INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

BLUE BOOK

VOLUME VI – FASCICLE VI.1

GENERAL RECOMMENDATIONS ON TELEPHONE SWITCHING AND SIGNALLING

FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN

SUPPLEMENTS

RECOMMENDATIONS Q.1-Q.118 bis

IXTH PLENARY ASSEMBLY
MELBOURNE, 14-25 NOVEMBER 1988

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REMARKS

1 The Recommendations in Volume VI of the *Blue Book* are in agreement with Series E of the CCITT Recommendations (Fascicles II.2 and II.3 of the *Blue Book* and with the provisions of the *Instructions for the International Telephone Service.*

2 The following expressions, which are in conformity with the CCITT *Terms and Definitions* have been used in Volume VI of the *Blue Book.*

a) *Semi-automatic service* (or working), to designate a "service in which the calling subscriber's booking is given to an operator in the outgoing exchange, who completes the call through automatic switches".

b) *Automatic service* (or working), to designate a "system in which the switching operations are performed without the intervention of operators, the calling subscriber dialling (or keying) the called subscriber direct". This expression must be used to the exclusion of all others, such as "fully automatic service".

If a recommendation applies to both automatic and semi-automatic working, this should be explicitly specified in each sentence, since the CCITT has not defined a general expression to cover both of these services.

However, it has been agreed that the expressions

"automatic circuit" and "automatic equipment"

should, unless otherwise stated, be taken to indicate circuits or equipment which may be used either for semi-automatic or for automatic working.

3 The strict observance of the specifications for standardized international signalling and switching equipment is of the utmost importance in the manufacture and operation of the equipment. Hence these specifications are obligatory except where it is explicitly stipulated to the contrary.

The values given in Fascicles VI.1 to VI.14 are imperative and must be met under normal service conditions.

4 The Questions entrusted to each Study Group for the Study Period 1989-1992 can be found in Contribution No. 1 to that Study Group.

5 In this Fascicle, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

PART I

Recommendations Q.1 and Q.2

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE

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Recommendation Q.1

SIGNAL RECEIVERS FOR MANUAL WORKING

In 1934 (CCIF *White Book*, Volume III, Xth Plenary Assembly, Budapest, 1934), a signalling current having a frequency of 500 Hz ± 2%, interrupted at a frequency of 20 Hz ± 2% was provisionally chosen for manually-operated international circuits.

500 Hz was chosen as the frequency to be transmitted, under normal conditions, by carrier terminal equipment and line repeaters. To avoid false operation due to speech currents, it was also considered desirable to interrupt the 500 Hz signalling current at low frequency. The use of a uniform interruption frequency of 20 Hz enables a high degree of selectivity to be obtained in signal receivers.

The effective power produced by the signalling current, when not interrupted, is fixed at 1 milliwatt at a zero relative level or an absolute power level of zero (with a tolerance of ± 1 decibel) which corresponds to an average power for the interrupted signalling current of 0.5 milliwatt, with a tolerance of ± 1 decibel.

The power levels specified above were chosen in 1954 (XVIIth CCIF Plenary Assembly, Geneva, 1954) on the basis of the limit imposed for the maximum energy which can be transmitted by signals during the busy hour; it must not exceed 2.5 microwatthours or 9000 microwattseconds at a zero relative level point. A reasonable value for the number of calls, or attempted calls, on a circuit during the busy hour was assumed and 2 seconds was assumed to be the sending duration of the signalling current to line by operation of the operator's ringing key.

On outgoing circuits from an international exchange, where the 500/20 Hz signals are liable to be sent over wideband carrier systems (coaxial carrier systems) it is desirable, to avoid overloading the repeaters, that the duration of the 500/20 Hz signals sent to line should not exceed 2 seconds and they should be limited to this value by automatic means.

Since, in general, the *Instructions for the International Telephone Service* (Article 32) [1] require the signalling current sent over an international circuit to have a duration of at least 2 seconds to avoid the risk of signals being undetected at the incoming end, the means for limiting the sending duration of the signalling current will generally consist of an arrangement which controls the sending duration independently of the time the ringing key is operated and which automatically fixes that duration at 2 seconds.

Note – In the case of short 2-wire circuits, it may be economical to use, by agreement between the Administrations concerned, a low-frequency signalling current (either between 16 and 25 Hz or 50 Hz).

ANNEX A

(to Recommendation Q.1)

Basic technical clauses of a model specification for the provision of 500/20-Hz voice-frequency signalling sets (signal transmitters and receivers) intended for manually-operated circuits

A.1 *Sending of signals*

Power – The signal transmitted shall supply a sinusoidal current at a frequency of 500 Hz ± 2% interrupted at a frequency of 20 Hz ± 2%.

The effective mean power of the 500/20-Hz current is fixed at 0.5 milliwatt or an absolute power level of −3 dBm (with a tolerance of ± 1 dB) at a zero relative level point.

Every precaution should be taken to avoid unbalance effects in the circuit during the transmission of a 500/20-Hz signalling current.

A.2 *Reception of signals*

Sensitivity – The signal receiver shall operate correctly when the 500/20-Hz current at the input to the signal receiver is within the following limits:

$$-8.5 + n \leqslant N \leqslant +2.5 + n \text{ dB}$$

where n is the relative power level at the point of the circuit at which the signal receiver is connected.

The limits take account of the tolerances indicated above for the transmitted power level and include a margin of ± 4.5 decibels on the nominal absolute power level of the 500/20 Hz current received at the input to the signal receiver. This margin allows for variations in transmission conditions on international circuits.

Tuning – Tuning should be such that the signal receiver operates only at a frequency of 500 Hz guaranteed to within ± 2% and at an interrupting frequency of 20 Hz guaranteed to within ± 2%.

Delay – The delay, i.e. the time which elapses between the application of the signalling voltage and the operation of the signal receiver, must be long enough for the signal receiver to remain insensitive to all speech currents which normally flow in the circuit to which it is connected. The duration of this delay must, however, be less than 1200 milliseconds. (In other words, 1200 milliseconds is the maximum signal recognition time within which a signal has to be recognized.)

Selectivity (resulting from the tuning of the resonant circuit and the delay mentioned above) – The receipt of a speech (or noise) current circulating in the circuit must not give rise to a current liable to cause the operation of the signalling equipment and, in consequence, to cause a wrong indication to be given on the international positions even though the speech (or noise) voltage reaches the maximum value likely to be met in practice. In particular, the signal receiver must not operate when a speech power not exceeding 6 milliwatts is applied at a zero relative level point.

Insertion loss – The insertion loss introduced by the signal receiver in the circuit with which the signalling set is associated must be less than 0.3 dB for any frequency effectively transmitted by the circuit.

Reference

[1] CCITT *Instructions for the international telephone service (1 October 1985)*, ITU, Geneva, 1985.

Recommendation Q.2

SIGNAL RECEIVERS FOR AUTOMATIC AND SEMI-AUTOMATIC WORKING, USED FOR MANUAL WORKING

The directives relating to 500/20-Hz signalling sets are provisional. An Administration intending to purchase new signalling sets for use on international circuits which for the time being are to be operated on a manual basis, may find it advantageous, by agreement with the Administrations interested in the operation of the circuits concerned, to use signal receivers and transmitters conforming to the specifications for international automatic equipment. This will permit a greater technical uniformity of installations and will avoid having to replace the signal receivers when, ultimately, these circuits are operated on an automatic or semi-automatic basis.

The signal receivers must therefore conform with the specifications for the applicable recommended CCITT systems.

Sending of signals

The frequency and power level of the signalling current must be in accordance with the specifications for international automatic equipment. If two-frequency signal receivers are concerned, the two frequencies (compound signal) must be transmitted simultaneously.

The nominal duration of a signal sent to line is fixed at 2 seconds so as to be the same as that specified for 500/20 Hz signalling.

Reception of signals

At the receiving end, provision must be made for a splitting arrangement conforming to the specifications for international automatic equipment. This splitting arrangement can be:

- either an integral part of the signal receivers, or
- placed at the end of the circuit after the signal receiver.

The signalling equipment (at the output of the signal receiver) which causes the lighting of the calling and clearing lamps shall have a signal recognition time of between 100 and 1200 milliseconds:

- the minimum duration of 100 ms has been chosen so as to avoid the recognition of false signals due to imitation by speech currents;
- the maximum duration of 1200 ms has been chosen so as to permit the partial use of 500/20-Hz signal-receiver equipment.

Note 1 – The characteristics of signal receivers of the types used for automatic or semi-automatic working could possibly also be used to provide signals and supplementary facilities for operators if the Administrations concerned consider that the operational advantages to be obtained justify the equipment modifications involved at the international exchanges.

Note 2 – The time quoted in this Recommendation for the signal length and the signal recognition times would also be appropriate for out-band signalling systems using discontinuous signals for a manual service.

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PART II

Recommendations Q.4 to Q.49

GENERAL RECOMMENDATIONS RELATING TO SIGNALLING AND SWITCHING IN THE AUTOMATIC AND SEMI-AUTOMATIC SERVICES

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SECTION 1

CCITT BASIC RECOMMENDATIONS ON INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING

Recommendation Q.4

AUTOMATIC SWITCHING FUNCTIONS FOR USE IN NATIONAL NETWORKS

1 Preamble

The CCITT,

considering

(1) that a large amount of switching equipment will be installed in the next few years, especially in areas of low subscriber density;

(2) the continuous rapid development of new switching techniques results in different generations of equipment having to co-exist;

(3) that some degree of compatibility in the installed switching equipment is required in the world-wide automatic network;

(4) that the introduction of newly developed switching systems presents Administrations with an ever increasing number of engineering, staff training, maintenance and other operational considerations,

and also considering

(5) that Recommendations originally intended for international application only are increasingly being applied to national networks, or could be so applied;

(6) that many current studies are aimed at producing Recommendations primarily applicable to national networks,

recommends

the following guidelines for use by Administrations establishing national switching standards or, if desired, for updating existing standards. Each Administration may select those guidelines it deems applicable to its own situation.

2 Automatic switching functions for use in national networks

Table 1/Q.4 lists the functional switching capabilities of an exchange which will, or may in some instances, according to the role of the exchange in a network, need to be technically specified in order that the Administration concerned can be assured that the exchange will satisfy existing and foreseen future needs of the network. For the required capabilities, references are given to CCITT texts which should be taken into account when decisions on national standards are taken; some make positive recommendations, others give guidelines or background information. Table 2/Q.4 provides full titles for those referenced texts, and for others applicable to national switching, in order to provide more specific information about the subject matter.

Some of the functions listed are required in all types of exchanges. Others may or may not be, according to the role of the exchange, e.g. local, combined local/transit, transit, international, etc.

It is not always necessary that a precise technical specification be given, e.g., in a tender specification, for each switching function. In some instances, it may be sufficient to state the requirements broadly, possibly including desired ranges of parameter values, and to invite a tenderer to make his own specific proposals for evaluation.

3 Requirements for ISDN

As Recommendations for the ISDN are being developed concurrently, it is difficult to reference them in this Recommendation. All Recommendations relevant to the ISDN will be published in a single volume at the end of this Study Period 1981-1984 (Fascicle III.5).

4 Requirements other than automatic switching functions

The technical specifications of the required automatic switching functions of an exchange do not, in themselves, consitute a complete specification. Other aspects possibly needing to be covered, which are particular to an exchange or to a group of exchanges and not included within the scope of automatic switching functions are:

- traffic (dimensioning and service performance);
- specifications dictated by the equipment environment (building constraints, power supplies, climatic conditions, etc.);
- installation, including testing, acceptance, post-acceptance technical support, etc.;
- training and documentation;
- support of system design and software, e.g., CCITT Recommendation Z.100 (SDL) series and CCITT Recommendation Z.200 (CHILL) series.

5 Technical cooperation possibilities

The CCITT Recommendations already established so far do not themselves suffice to cover all the points of a specification dealing with the functions to be performed by switching equipment. It is unavoidable, if national standards are to match the requirements and circumstances of a particular network, that the responsible Administration itself exercise a number of choices.

An Administration seeking advice or guidance beyond that indicated in CCITT texts may, by approaching the ITU Secretariat, obtain information on the standards adopted by other Administrations.

6 Definition of requirements in terms of services and facilities

6.1 Fundamental decisions as to range of service(s) and facilities to be provided must be made by the Administration. Descriptions and other information on the various services normally provided by a switching system may be found as indicated in the following:

- types of services (GAS 6, Chapter II, § 3; Chapter III, § 3.2),
- basic services (GAS 6, Chapter IV, § 1.2),
- supplementary services (GAS 6, Chapter IV, § 1.4); Recommendations E.130, E.132, E.151; Supplement No. 1 to Series E Recommendations.

6.2 A list of possible telephony subscriber services and facilities has been extracted from the GAS 6 Handbook, Chapter IX, § 1.3.2 and is shown in Annex A.

TABLE 1/Q.4

CCITT texts (Recommendations and GAS Handbooks) relevant to the technical specification of automatic switching functions of exchanges in national networks

Item	Reference
A. *Switching*	
Type of switch: analogue (2- or 4-wire)/digital, space or time division	GAS 6 II 1, VI 1.1 GAS 3 III, Annex 1 Recs. Q.501, Q.511
Type of control: distributed/centralized	GAS 6 VI 1.2
Subscriber classification	GAS 6 VI 1.2.1
B. *Routing and selection*	
Classification of exchange inlets and outlets: according to types of inter-exchange circuits to be connected: taking into account the line, inter-register, etc., signalling arrangements and the transmission, operating, testing, network management, etc., requirements	GAS 6 IV 5.6-7 VI 1.4.1 and 4 Recs. E.543 Q.7, Q.48, Q.49, Q.108, Q.110, Q.251-Q.300, Q.310-Q.331, Q.400-Q.480, Q.501-Q.507, Q.511-Q.517
Number analysis functions: required capacity and depth of analysis for routing, determination of number length, barring, digit insertion/deletion, charging, echo control, etc.	GAS 6 IV 6, VI 1.4.6 Recs. E.160, E.161, E.163 Q.103, Q.105, Q.106, Q.107, Q.107 *bis*, Q.115
Choice of outgoing circuit: search procedure, dual seizures, alternative routing, repeat attempts, etc.	GAS 6 VI 1.4.2, 3 and 5 Recs. E.170, E.171 Q.12, Q.263
Network management functions: circuit group denial, alternative routing cancellation, exchange load control, etc.	GAS 6 VI 1.4.7 Recs. E.170, E.410, E.411, E.412, E.413 Q.506, Q.516
C. *Charging*	
Methods: local, long-distance, international, non-chargeable, payphone, etc., calls	GAS 6 IV 7.1-2, VI 1.5.1 Recs. E.230-E.232
Charge determination: principles and parameters	GAS 6 IV 7.3, VI 1.5.2
D. *Transmission characteristics*	
Interfaces: specification of the transmission characteristics of the interfaces, or the identification of the standard interfaces, at which the exchange is to interconnect with external facilities and systems	GAS 3 III Recs. G.703, G.704, G.705, G.731-G.739, G.741-G.746, Q.502, Q.512
Exchange transmission performance: Limits for the levels of transmission impairments attributable to the exchange and for characteristics affecting performance, taking account of all possible types of connection through the exchange	GAS 6 VI 1.8 Recs. G.121, G.122, G.123 Q.45, Q.507, Q.517
E. *Synchronization and timing*	Recs. G.811, G.822 Q.502, Q.503, Q.512, Q.513
F. *Tones and recorded announcements*	
Scope and applications; tones; announcements	GAS 6 VI 1.7 Recs. E.180 (Q.35), E.181 (Q.36), E.182 Supplement No. 2 to Series E Recommendations Rec. Q.24

TABLE 1/Q.4 *(cont.)*

Item	Reference
G. *Subscriber line characteristics*	
1. *Analogue subscriber line*	
Subscriber line standards: limits for loop resistance, loop insulation, overall line attenuation, etc.	GAS 2 V 3.2, 3.3 GAS 6 VI 1.3.1 GAS 3 II 3.1 Recs. G.120-G.123
Subscriber line signals: supervision address information, ringing, metering, tones, etc.	GAS 2 V 6.2 GAS 6 IV 8, VI 1.3.2 Recs. E.131 Q.16, Q.23, Q.35 (E.180), Q.118
2. *Digital subscriber line*	
Exchange interfaces signalling for digital access	Recs. I.412 Q.512, Q.920, Q.921, Q.930, Q.931
H. *Inter-exchange signalling*	
Specification of required exchange functions by identification of existing and planned inter-exchange signalling arrangements	
Signalling philosophies and types of signalling	GAS 6 II 2, IV 8, VI 1.6 GAS 3 II 3.2 Recs. Q.7, Q.21 Supplement No. 3 to Series Q Recommendations
Signalling system specifications (channel associated and common channel, as appropriate)	Recs. Q.101-Q.103, Q.105-Q.118 *bis*, Q.251-Q.300, Q.310-Q.331, Q.400-Q.490, Q.701-Q.795
Interworking of signalling systems	Recs. Q.601-Q.685
I. *Operation*	
The specification of exchange features designed to facilitate the operation of the exchange with respect to the administrations of: – subscribers – routing – traffic – tariffs and charging – recording and billing – system control taking into account remote control possibilities	GAS 6 IV 7.4-7, 9.1-2 VI 1.5.3-4, 1.9 Recs. E.500 Q.505, Q.506, Q.515, Q.516 Z.331-Z.333
J. *Maintenance*	
The specification, with respect to maintenance, of: – subscriber lines – inter-exchange circuits – switching network – control system the specification of testing and maintenance features, taking into account the objectives of: – minimization of the fault rate – simplification of maintenance activities – adequate equipment repair facilities – maximization of immunity to failures – optimizing maintenance centralization	GAS 6 IV 9.1, 9.3, VI 1.10 Recs. G.231 M.565 O.22 (Q.49) Q.506, Q.516 Z.301, Z.331-Z.333
L. *Input/output devices for operation and maintenance*	GAS 6 VI 1.11 Recs. E.220, E.221 Z.301-Z.302, Z.311-Z.317, Z.321-Z.323

TABLE 2/Q.4

Titles of CCITT texts (Recommendations and GAS Handbooks) relevant to national switching applications

CCITT Manual *Local telephone networks*, ITU, Geneva, 1968 (Gas 2 Handbook).

CCITT Manual *Transmission planning of switched telephone networks*, ITU, Geneva, 1976 (Gas 3 Handbook).

CCITT Manual *Economic and technical aspects of the choice of telephone switching systems*, ITU, Geneva, 1981 (GAS 6 Handbook).

CCITT Manual *Economic and technical aspects of the transition from analogue to digital telecommunication networks*, ITU, Geneva, 1984 (GAS 9 Handbook).

CCITT Rec. E.130 *Choice of the most useful and desirable supplementary telephone services.*

CCITT Rec. E.131 *Subscriber control procedures for supplementary services.*

CCITT Rec. E.132 *Standardization of elements of control procedures for supplementary telephone services.*

CCITT Rec. E.151 *Conference calls.*

CCITT Rec. E.160 *Definitions relating to national and international numbering plans.*

CCITT Rec. E.161 *Arrangement of figures, letters and symbols on rotary dials and pushbutton telephone sets.*

CCITT Rec. E.163 *Numbering plan for the international telephone service.*

CCITT Rec. E.170 *Overflow – alternative routing – rerouting – automatic repeat attempt.*

CCITT Rec. E.171 *International routing plan.*

CCITT Rec. E.180 *Characteristics of the dial tone, ringing tone, busy tone, congestion tone, special information tone and warning tone.*

CCITT Rec. E.181 *Customer recognition of foreign tones.*

CCITT Rec. E.182 *Application of tones and recorded announcements in telephone services.*

CCITT Rec. E.211 *Numbering and dialling procedures for VHF/UHF and maritime mobile satellite services.*

CCITT Rec. E.220 *Ergonomic aspects of visual display terminals.*

CCITT Rec. E.221 *Human interface to visual display terminals.*

CCITT Recs. E.230-E.232 *Charging (determination of collection charges) in the international telephone service.*

CCITT Rec. E.500 *Measurement and recording of traffic.*

CCITT Rec. E.521 *Calculation of the number of circuits in a group carrying overflow traffic.*

CCITT Rec. E.543 *Grades of service in analogue/digital international telephone exchanges.*

CCITT Rec. E.410, E.411, E.412 and E.413 *Network management.*

CCITT Series E. Recommendations Supplement No. 1 *List of possible supplementary telephone services which may be offered to subscribers.*

CCITT Series E. Recommendations Supplement No. 2 *Various tones used in national networks.*

CCITT Recs. G.120-G.123 *General characteristics of national systems forming part of international connections.*

CCITT Rec. G.121 *Corrected reference equivalents (CREs) of national systems.*

CCITT Rec. G.122 *Influence of national networks on stability and echo losses in national systems.*

CCITT Rec. G.123 *Circuit noise in national networks.*

CCITT Rec. G.231 (2) *Use of standard components in transmission equipment.*

CCITT Rec. G.703 *General aspects of interfaces.*

CCITT Rec. G.704 *Functional characteristics of interfaces associated with network nodes.*

CCITT Rec. G.705 *Characteristics required to terminate digital paths on a digital exchange.*

CCITT Recs. G.731-G.739 *Principal characteristics of primary multiplex equipment.*

CCITT Recs. G.741-G.746 *Principal characteristics of second order multiplex equipments.*

CCITT Rec. G.811 *Performance of clocks suitable for plesiochronous operation of international digital links.*

CCITT Rec. G.822 *Controlled slip rate objectives on an international digital connection.*

CCITT Rec. I.412 *ISDN user-network interfaces-channel structures and access capabilities.*

CCITT Rec. M.565 *Access point for international telephone circuits.*

CCITT Rec. O.22 *Specification for the CCITT automatic transmission measuring and signalling testing equipment ATME No. 2.*

CCITT Rec. Q.7 *Signalling systems to be used for international automatic and semi-automatic telephone working.*

CCITT Rec. Q.12 *Overflow-alternative routing – rerouting – automatic repeat attempt.*

CCITT Rec. Q.14 *Means to control the number of satellite links in an international telephone connection.*

CCITT Rec. Q.15 *Nominal mean power during the busy hour.*

CCITT Rec. Q.16 *Maximum permissible value for the absolute power level of a signalling pulse.*

CCITT Rec. Q.21 *Systems recommended for out-band signalling.*

CCITT Rec. Q.23 *Technical features of push-button telephone sets.*

CCITT Rec. Q.24 *Multi-frequency push-button signal reception.*

CCITT Rec. Q.33 *Protection against the effects of faulty transmission on groups of circuits.*

CCITT Rec. Q.35 *Characteristics of the dial tone, ringing tone, busy tone, congestion tone, special information tone and warning tone.*

CCITT Rec. Q.45 *Transmission characteristics of an international exchange.*

CCITT Rec. Q.48 *Demand assignment signalling systems.*

CCITT Rec. Q.49 *Specification for the CCITT automatic transmission measuring and signalling testing equipment ATME No. 2.*

CCITT Recs. Q.101-Q.103, Q.105-Q.118 *bis Clauses applicable to CCITT standard systems.*

CCITT Rec. Q.103 *Numbering used.*

CCITT Rec. Q.105 *National (significant) number.*

CCITT Rec. Q.106 *The sending-finished signal.*

CCITT Rec. Q.107 *Standard sending sequence of forward address information.*

CCITT Rec. Q.107 *bis Analysis of forward address information for routing.*

CCITT Rec. Q.108 *One-way or both-way operation of international circuits.*

CCITT Rec. Q.110 *General aspects of the utilization of standardized CCITT signalling systems on PCM links.*

CCITT Rec. Q.115 *Control of echo suppressors.*

CCITT Recs. Q.118 *Special release arrangements.*

CCITT Recs. Q.251-Q.300 *Specifications of Signalling System No. 6.*

CCITT Rec. Q.263 *Double seizing with both-way operation.*

CCITT Recs. Q.310-Q.331 *Specifications of Signalling System R1.*

CCITT Recs. Q.400-Q.490 *Specifications of Signalling System R2.*

CCITT Recs. Q.500-Q.554 *Digital local, transit, combined and international exchanges in integrated digital networks and mixed analogue-digital networks.*

CCITT Recs. Q.601-Q.685 *Interworking of signalling systems.*

CCITT Recs. Q.701-Q.795 *Specifications of Signalling System No. 7.*

CCITT Rec. Q.920 *ISDN user-network interface data link layer – General aspects.*

CCITT Rec. Q.921 *ISDN user-network interface data link layer specification.*

CCITT Rec. Q.930 *ISDN user-network interface layer 3 – General aspects.*

CCITT Rec. Q.931 *ISDN user-network interface layer 3 specification for basic call control.*

CCITT Series Q. Recommendations Supplement No. 3 *Information received on national voice-frequency signalling systems.*

CCITT Rec. Z.100 Series *Functional specification and description language (SDL).*

CCITT Rec. Z.200 Series *CCITT high level language (CHILL).*

CCITT Rec. Z.300 Series *Man-machine language (MML).*

CCITT Recs. Z.301-Z.302 *General principles.*

CCITT Rec. Z.301 *Introduction to the CCITT man-machine language.*

CCITT Recs. Z.311-Z.317 *Basic syntax and dialogue procedures.*

CCITT Recs. Z.321-Z.323 *Extended MML for visual display terminals.*

CCITT Recs. Z.331-Z.333 *Specification of man-machine interface.*

ANNEX A

(to Recommendation Q.4)

List of possible subscriber services and facilities

Subscriber services

Basic services

- subscriber dialled local, long distance, and international calling with automatic charging
- PBX line hunting, night service, and direct dialling-in
- payphone
- access to operators for assistance and information
- access to community services (police, fire brigade, etc.)
- access to recorded announcements
- call barring
- malicious call trace
- interception of calls
- absent subscriber
- line observation

Supplementary services

- abbreviated dialling
- alarm call
- hot line
- outgoing service restriction
- call diversion
- call waiting
- do not disturb
- call completion to busy subscribers
- switching-in not permitted
- call charge indicator at subscriber's premises
- immediate call charge announcement
- priority line
- two party line
- multiparty line
- multifrequency push-button (MFPB) dialling
- mobile subscriber
- conference service
- Centrex services
- other services

Recommendation Q.5

ADVANTAGES OF SEMI-AUTOMATIC SERVICE IN THE INTERNATIONAL TELEPHONE SERVICE

(Geneva, 1954)

The CCITT,

considering

(a) the large economies in personnel that can result from the introduction of semi-automatic service at the incoming exchange;

(b) the very small number of faults due to the equipment used for the international semi-automatic service;

(c) the improvement in the "efficiency" (ratio of chargeable time to total holding time) of circuits using semi-automatic service compared with the efficiency of manual circuits operated on a demand basis;

(d) the improvement in the quality of the service given to users due to the reduction in the time of setting up a call;

(e) the fact that any type of call can be set up without difficulty over semi-automatic circuits, so that semi-automatic circuits can be used exclusively on an international relation;

draws the attention of Administrations

to the advantages of semi-automatic service from the point of view of economy and of the quality of service given to subscribers.

Recommendation Q.6

ADVANTAGES OF INTERNATIONAL AUTOMATIC WORKING

(New Delhi, 1960)

The CCITT,

considering

(a) that the advantages of semi-automatic working mentioned in Recommendation Q.5 apply as well to automatic working in respect of reliability, circuit efficiency and the satisfaction given to subscribers;

(b) that the advantages of automatic working are even greater as regards staff economy, since outgoing operators are dispensed with;

(c) that the changeover from semi-automatic to automatic working may be accomplished without any major modification to the international circuits or to the switching equipment at transit and incoming exchanges;

(d) that by 1960 the above advantages had been widely confirmed by experience on a number of international relations which had been using automatic service up to that time;

(e) that such experience has also shown that when a relation changes from demand working (manual or semi-automatic) to automatic working, there is a considerable increase in traffic;

(f) that the introduction of an international automatic service follows logically on the introduction of a national automatic service;

draws the attention of Administrations

to the additional advantages resulting from the introduction of an international automatic service.

SIGNALLING SYSTEMS TO BE USED FOR INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE WORKING

(Geneva, 1954 and 1964, Mar del Plata, 1968, Geneva, 1976 and 1980)

The CCITT,

considering

(a) that standardization of the signalling systems to be used for international automatic and semi-automatic telephone working is necessary to keep to a minimum the number of different types of equipment serving the various routes at any one exchange;

(b) that the following signalling systems have been standardized and are applicable for *general use* in international automatic and semi-automatic working:

- Signalling System No. 4, standardized by the CCIF in 1954;
- Signalling System No. 5, standardized by the CCITT in 1964;
- Signalling System No. 6, standardized by the CCITT in 1968;
- Signalling System No. 7, standardized by the CCITT in 1980;

(c) that the following signalling systems have been standardized and are applicable for *regional use* in international automatic and semi-automatic telephone working:

- Signalling System R1 (Regional Signalling System No. 1, formerly called the North American System), standardized by the CCITT in 1968;
- Signalling System R2 (Regional Signalling System No. 2, formerly called the MFC Bern System), standardized by the CCITT in 1968;

(d) that, under the conditions and subject to the reservations stated below, these signalling systems may be expected to give acceptable results for international automatic and semi-automatic telephone working;

desiring

that the CCITT Recommendation concerning the signalling systems for international automatic and semi-automatic telephone working be generally applied by all Administrations;

unanimously recommends

that, under the conditions and subject to the reservations stated below, Administrations should use, for international automatic and semi-automatic telephone working, one or more of the standard signalling systems mentioned in (b) and (c) above.

1 Criteria for selecting a signalling system

Many factors influence the selection of a given signalling system for a particular application. Factors that should be considered include:

1.1 *Satellite systems* because of long round-trip propagation delays (540 ± 40 ms)

The inclusion of one satellite link in a telephone connection requires subscribers to keep more discipline than usual during a conversation. If use is made of two satellite links in tandem, requirements are even more stringent. In addition, there is the question of what transmission objectives are attainable on such a connection.

According to Recommendation Q.13 the inclusion of two satellite links in a connection should be avoided in all but exceptional cases. To facilitate the observance of this Recommendation, it is advisable to inform the subsequent transit centres by means of signalling that a satellite link is already included in the connection. During the following routing process the transit centre(s) should select a terrestrial link.

1.2 *Echo suppressors*

Both long terrestrial telephone links and satellite links call for the insertion of echo suppressors. Recommendations G.131 [1] and Q.115 include basic requirements for the insertion of echo suppressors.

Therefore, signalling systems should be arranged to act in cooperation with switching equipment to achieve the goals covered by Recommendations G.131 [1] and Q.115. This would be facilitated where the signalling system to be used provides the possibility of controlling the inclusion of echo suppressors.

In the future, the use of echo cancellers may need to be considered (see Recommendation G.165 [2]).

1.3 *Speech interpolation systems (e.g. TASI)*

In the case of a transmission system with speech interpolation, it must be ensured that the signalling system to be used is compatible with speech interpolation.

2 Further criteria for selecting a signalling system

Once Administrations decide to establish a route, they will have to specify the general requirements to be met by the signalling system.

In the following, some questions are drawn up which may serve as a guideline:

a) Does the transmission system provide for sufficient bandwidth (e.g. for outband line signalling)?

b) Is the signal capacity sufficient to allow the setting-up of an ordinary connection?

c) Is an additional exchange of information required, e.g.:

- for echo suppressor control,
- to increase routing facilities,
- to obtain or to offer detailed information on congestion,
- to obtain or to offer information on the condition of the called subscriber line,
- to obtain or to offer information on the nature of the call:
  - i) for identification or
  - ii) for management purposes?

d) What requirements have to be set for the speed of the signalling system? What post-dialling and answering delays are to be tolerated?

e) Is there any interdependence between the minimum bundle size and signalling (e.g., as in the case of pilot interruption control of Signalling System R2)?

f) In the case of satellite systems, does the earth station require an extra interface between the terrestrial access circuits and the satellite links?

g) Is it necessary to introduce a new signalling system?

h) Is the signalling system suitable for application to the particular exchange type, e.g., electro-mechanical exchanges?

3 Characteristics of the standard CCITT Signalling Systems for general use

3.1 *Signalling System No. 4*

Described and specified in Fascicle VI.2.

Suitable for one-way operation.

Suitable for terminal and transit working; in the latter case two or three circuits equipped with Signalling System No. 4 may be switched in tandem.

Signalling System No. 4 is used in Europe and the Mediterranean Basin.

It makes use of a two-frequency code within the speech band.

A four-element binary code is employed for interregister signalling. Each of these elements consists of one of the two signal frequencies.

Each digit is acknowledged. In the case of long propagation times, these acknowledgements have an adverse effect because the propagation time is included twice in one signalling cycle. This disadvantage is more or less compensated for by the overlap mode of operation.

Signalling System No. 4 has a signal capacity of 16 codes for forward interregister signals and no register signals in the backward direction other than the acknowledgement signals.

One signal is provided for echo suppressor control on mutual agreement.

A signal is not provided to indicate whether the connection already includes a satellite link.

Not suitable for operation on transmission systems with speech interpolation.

3.2 *Signalling System No. 5*

Described and specified in Fascicle VI.2.

Suitable for both-way operation.

Suitable for terminal and transit working; in the latter case two or three circuits equipped with Signalling System No. 5 may be switched in tandem.

A multifrequency code (MFC: 2 out of 6) within the speech band is used for interregister signalling. The line signals consist of 1 or 2 frequencies within the speech band.

The entire address information is stored up to the last signal. It is then transmitted en bloc as a rapid sequence of pulsed multifrequency code signals.

The application of the en bloc mode of operation may result in an increased post-dialling delay, especially if the ST condition is determined by time out.

Signalling System No. 5 has a signal capacity of 15 codes for forward interregister signals and no backward interregister signals.

Signals are not provided either for echo suppressor control or for indicating whether the connection already includes a satellite link.

Suitable for operation on transmission systems with speech interpolation and on satellite links.

3.3 *Signalling System R1*

Described and specified in Fascicle VI.4.

Signalling System R1 is mainly used in North America.

Suitable for both-way operation.

Specified for terminal working.

A multifrequency code (MFC: 2 out of 6) within the speech band is used for interregister signalling.

In the analogue version of the Signalling System R1 line signalling, one frequency within the speech band is used. In the digital version of the Signalling System R1 line signalling, the two resultant signalling channels per speech circuit may be regarded as outband channels.

The following three modes of operation can be used to transmit the address information:

– en bloc,
– en bloc/overlap, or
– overlap.

The mode of operation selected influences:

- the seizing time of the next link, as well as
- the post-dialling delay.

The address information is transmitted as pulsed MFC signals.

Signalling System R1 has a signal capacity of 15 codes for forward interregister signals but no backward interregister signals.

Signals are not provided either for echo suppressor control or for indicating whether the connection already includes a satellite link.

Signalling System R1 can be used on satellite links. A variant of Signalling System R1 may be suitable for operation on transmission systems with digital speech interpolation, provided that the systems are designed and engineered to be transparent to pulsed interregister signals.

3.4 *Signalling System R2*

Described and specified in Fascicle VI.4.

Used for one-way operation on analogue transmission systems. Both-way operation is possible on digital transmission systems.

Suitable for terminal and transit working.

Signalling System R2 is used in both national and international telephone networks in several regions of the world.

A multifrequency code (MFC: 2 out of 6) within the speech band is used for interregister signalling. Since two different sets of six frequencies in separate bands are defined for forward and backward interregister signals, Signalling System R2 interregister signalling is suitable for use on 2-wire circuits as well as on 4-wire circuits.

For the analogue version of the Signalling System R2 line signalling, use is made of a low-level tone-on-idle method out of band. In addition, pilot interruption control is used.

The digital version of the line signalling uses two signalling channels to transmit the signalling information and for circuit supervision. For 2048 kbit/s PCM systems, the signalling information of the 30 speech circuits is transmitted in the Time Slot 16 (see Recommendation G.732 [3]).

It should be noted that the analogue version of the line signalling can be used on digital links; the signalling states are sent coded on one signalling channel. This use of the analogue version on digital links is not recommended on international circuits.

When a circuit is composed of both digital and analogue links, a conversion between the two versions of the line signalling can occur at the interface (see Recommendation Q.430).

Compelled signalling is used to transmit the address information in the overlap mode as multifrequency code signals, i.e., each forward interregister signal is acknowledged by a backward interregister signal. Considering that four times the propagation time is to be included in one signalling cycle, the exchange of signals is rather slow if the propagation time is long. This disadvantage is more or less compensated for by the overlap mode of operation.

Signalling System R2 has a higher signalling capacity than Signalling Systems No. 4, No. 5 and R1. The interregister signals allow, amongst others:

- improved routing,
- detailed information on congestion,
- information on:
  - i) the nature of call,
  - ii) the condition of the called subscriber line,
- no-charge calls, and
- address-complete information.

Signalling System R2 includes both forward and backward interregister signals for echo suppressor control.

In Signalling System R2, two signals are specified which indicate whether *or not* the connection already includes a satellite link.

Signalling System R2 may be suitable for use on satellite circuits, especially when it is already employed in the national or regional telephone networks concerned.

When Signalling System R2 is to be used on satellite links, the following must be borne in mind:

- In the case of analogue line signalling, intervals T1 and T2 have to be adapted.
- Pilot interruption control requires bundles comprising a multiple of 12 speech circuits.
- The register at the incoming end of a satellite link using Signalling System R2 shall be operated as an outgoing R2 register.
- The guard time for blocking and recognition of forward signals when pulsed signals are transmitted should be adapted to the propagation time on the satellite link.

Signalling System R2 may be suitable for operation on transmission systems with digital speech interpolation, provided the systems are designed and engineered to be transparent to pulsed interregister signals.

With 3 kHz spaced channels, the interregister signalling of Signalling System R2 may be used with the line signalling of Signalling System No. 4.

3.5 *Signalling System No. 6*

Fully described and specified in Fascicle VI.3.

Suitable for both-way operation.

Suitable for terminal and transit working.

During the period from 1970 to 1972 Signalling System No. 6 was tested internationally.

Some Administrations have introduced it for international telephone traffic. A variant of Signalling System No. 6 is employed in the national telephone network of the United States.

A common signalling link is used for signalling.

May be used in either an associated or quasi-associated mode of operation. Use in a quasi-associated mode may be more economic for small bundles of circuits.

Signalling is performed by means of signal units. Each unit is 28 bits in length, including 8 check bits. Transmission is at a speed of 2400 bit/s for the analogue version and 4 kbit/s (optionally 56 kbit/s) for the digital version.

Each signal unit within a block of 11 signal units is acknowledged and retransmitted in case of errors.

The address information can be transmitted en bloc and in the overlap mode. Because the transmission speed of Signalling System No. 6 is considerably higher than that of channel-associated signalling systems, the influence of the mode of operation on the post-dialling delay is reduced substantially.

The signal capacity (including the spare codes) of Signalling System No. 6 is much higher than that of Signalling Systems No. 4, No. 5, R1 and R2.

Signalling System No. 6 contains signals for echo suppressor control as well as signals indicating whether a satellite link is already included in the connection.

Signalling System No. 6 can be used for all types of telephone circuits including those with speech interpolation.

Signalling System No. 6 can be used on satellite links.

3.6 *Signalling System No. 7*

Fully described and specified in Fascicles VI.7, VI.8 and VI.9.

Suitable for both-way operation.

Suitable for terminal and transit working.

A common signalling link is used for signalling.

Signalling System No. 7 can be used in national and international telecommunication networks.

Signalling System No. 7 can be used for dedicated networks (e.g. data transmission, telephone) and within an integrated services digital network. It is the preferred signalling system between Integrated Digital Network (IDN) exchanges and within the Integrated Services Digital Network (ISDN).

Signalling System No. 7 may be used in either an associated or quasi-associated mode of operation. Use in a quasi-associated mode may be more economical for small bundles of circuits.

Variable length signal units with an integer number of octets are used of which 6 perform message transfer part functions. Signalling System No. 7 is optimized for a digital bearer with transmission speed of 64 kbit/s, but operation at lower speeds (e.g. 4.8 kbit/s) on analogue bearers is possible.

Two error control methods (basic and preventive cyclic retransmission) are specified, each with its own field of application. In the basic method each signal unit is acknowledged and retransmitted in case of errors while in the preventive cyclic retransmission method no negative acknowledgements occur and error correction is performed by retransmission during idle periods of not yet acknowledged signal units.

The address information can be transmitted en bloc and in the overlap mode. Because the transmission speed of Signalling System No. 7 is considerably higher than that of channel-associated signalling systems, the influence of the mode of operation on the post-dialling delay is reduced substantially.

The signal capacity (including the spare codes) of Signalling System No. 7 is much higher than that of Signalling Systems No. 4, No. 5, R1 and R2.

Signalling System No. 7 contains signals for echo suppressor control as well as signals indicating whether a satellite link is already included in the connection.

Signalling System No. 7 can be used for all types of telephone circuits including those with speech interpolation.

Signalling System No. 7 can be used on satellite links.

References

[1] CCITT Recommendation *Stability and echo*, Vol. III, Rec. G.131.

[2] CCITT Recommendation *Echo cancellers*, Vol. III, Rec. G.165.

[3] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Rec. G.732.

Recommendation Q.8

SIGNALLING SYSTEMS TO BE USED FOR INTERNATIONAL MANUAL AND AUTOMATIC WORKING ON ANALOGUE LEASED CIRCUITS

The CCITT,

considering

(a) that standardization of signalling systems to be used for international manual and automatic working on analogue leased circuits brings advantages to Administrations, manufacturers and users;

(b) that manual and automatic operation of international leased circuits require different technical arrangements;

(c) that the standard signalling systems set out in Recommendation Q.7 are primarily intended for the public service;

(d) that the national circuit sections of international leased circuits may need to conform to local regulations of the Administration(s) concerned;

(e) that the method of signalling will be affected by the type of transmission and vice versa;

(f) that the method of signalling will be affected by the characteristics of the service(s) carried on the circuit;

recommends

that Administrations should use for manual international analogue leased circuits the standard signalling system specified in § 1 below;

and *draws the attention* of Administrations

to the guidance clauses and related annexes concerning automatic signalling on international analogue leased circuits, as set out in § 2 below.

1 Signalling on manual international analogue leased circuits

1.1 Signalling shall take place by the transmission of a single frequency signalling current, analogous to the signalling method used in the international manual service and specified in Recommendations Q.1 and Q.2.

1.2 The signalling current shall have a nominal frequency of either 2280 Hz or 2600 Hz. One of these frequencies shall be chosen for both directions of transmission by bilateral agreement between the Administrations concerned. Failing such an agreement, each Administration shall determine which of the two frequencies it wishes to receive.

1.3 The duration of the transmitted tone shall be between 300 ms and 2 seconds. The upper limit of 2 seconds allows the partial use of signalling equipment designed for 500/20 Hz working according to Recommendation Q.1.

1.4 The signal recognition time shall be between 100 ms and 200 ms:

- The minimum duration of 100 ms has been chosen so as to avoid the recognition of false signals due to imitation by speech currents;
- The maximum duration of 200 ms has been chosen so as to allow a safe margin between this time and the minimum transmission time.

Exceptionally, a maximum signal recognition time of 1200 ms may be used where it is known that the transmitted signal has a 2 second duration. Such arrangements allow the partial use of signalling equipment designed for 500/20 Hz working according to Recommendation Q.1.

1.5 Other technical clauses for 2280 Hz signalling are set out in Annex A to this Recommendation.

1.6 Other technical clauses for 2600 Hz signalling are set out in Annex B to this Recommendation.

2 Signalling on automatic international analogue leased circuits

2.1 This section refers to international analogue leased circuits employing automatic signalling. Such circuits are considered to form part of a private network extending across international frontiers and linking exchanges carrying out the switching function in a private network. The exchanges may be Private Automatic Branch Exchanges (PABXs). Private tandem exchanges, or switching equipments provided by the Administration to carry out switching functions in a private network. Where the exchanges are privately owned, part of the signalling function may be provided by the Administration.

This Recommendation does not cover the case of international leased circuits directly connecting subscriber lines to remote switching equipment. However, most of the following text is equally applicable to this case. Annex D, § D.3 and Annex E give further information on such signalling.

2.2 Many Administrations have regulations concerning the use of signalling frequencies on leased circuits and these may apply to international leased circuits also. These regulations are intended to ensure non-interference between parts of the voice spectrum used for signalling and those available for use by subscriber apparatus. This does not create exceptional difficulties for manual working since the frequencies used (2280 Hz, 2600 Hz) can be converted to other acceptable frequencies at the Terminal International Centre. However, for automatic circuits it should be the aim to provide an uninterrupted path between the ends of the leased circuit.

Some World regions have existing or proposed signalling systems which meet the regulatory arrangements in those regions and a summary of two such systems are given in Annexes C and D to this Recommendation. Administrations are invited to note these existing systems that may meet their needs for automatic signalling on analogue leased circuits.

2.3 In order to reduce the cost of providing leased circuits some inter-regional leased circuits may be provided with various forms of bandwidth economizing systems, such as speech interpolation systems and digital voice compression. These systems usually have their own internal digital signalling capability and these are not covered by this Recommendation, except that the effect that speech interpolation equipment has on analogue signalling is discussed.

2.4 In the most general case, the choice of signalling and transmission in a private network will be determined by the availability of suitable equipment, and by the decisions of the network user and the Administrations concerned. The following sections give guidance on transmission factors which affect signalling, the important characteristics of signalling systems which could affect the choice of transmission medium, and the interaction between signalling and non-voice services.

2.5 *Transmission factors*

2.5.1 Recommendations for the transmission characteristics of leased circuits forming part of a private telephone network are given in Recommendation G.171.

2.5.2 Where large groups of circuits are concerned and the transmission multiplex equipment is on the renter's premises, it is advisable to protect against the effects of faulty transmission on groups of circuits. Recommendation Q.33 gives details of such measures.

2.5.3 *Satellite systems*

- i) Some signalling systems will not function correctly over satellite links since the long propagation delay (270 ± 20 ms one way) exceeds that assumed by the line signalling specification. Amongst the standard systems for public telephony, Signalling System R2 incorporates special precautions because of this delay. In addition the speed of multi-frequency compelled interregister signalling is affected, which may cause undesirable post-dialling delay. If signalling systems based on R2 are used in private networks then reference should be made to information contained in Recommendations Q.7 and Q.400 to Q.490.
- ii) Consideration should be given to the possibility that two satellite links may, in some cases, need to be connected in tandem. Means to prevent this may also need to be considered. (Further information is contained in Recommendations E.171, G.131, Q.14 and Q.115.)
- iii) If satellite links via Time Division Multiple Access Systems with Digital Speech Interpolation (TDMA/DSI) are used, then guidance on circuit supervision signalling arrangements can be found in Recommendation Q.33. However, Digital Non-Interpolated (DNI) channels are usually assigned for leased circuits and these exhibit fewer problems for signalling.
- iv) If satellite links via Single Channel Per Carrier (SCPC) systems are used, then it should be noted that these systems employ voice activated carriers for telephony type circuits. On transmission systems of this type, the use of tone-on-idle signalling systems should be avoided, since such signalling systems would override the voice activation feature of SCPC systems.

2.5.4 *Echo control*

Paragraph 9 of Recommendation G.171 should be observed concerning the location of echo control devices where these are required. All analogue channel associated signalling systems operate more effectively if the line signal receiver, and often the line signal sender also, are located on the line side of any echo control device. In addition, some signalling systems require echo control devices to be locally disabled during interregister signalling. For these reasons, the echo control device should be located at the private renter's premises and not the terminal international centre.

2.5.5 *Speech interpolation*

Some signalling systems may not be compatible with speech interpolation systems for the following reasons:

- i) Signalling systems employing continuous state tone signalling will cause permanent operation of the speech detectors and thus permanent trunk to channel association. This prevents the correct operation of the interpolation process.
- ii) The speech interpolation equipment may not be transparent to out-band signalling.

iii) The speech interpolation equipment may cause excessive clipping of pulse signals resulting in their non-recognition by the distant signalling equipment.

iv) The speech interpolation equipment may not provide sufficient speech detector hangover to allow the successful transmission of some signals, e.g. en bloc multi-frequency signals.

Information on the characteristics of some speech interpolation systems is given in Supplement No. 2 of Fascicle V1.1, though different systems may also be used on leased circuits.

In the case of continuous state tone signalling, compatibility with speech interpolation systems can be achieved by converting the tone signalling to interface with any in-built signalling capability the system may provide. If the transmission difficulty only exists in the interregister signalling phase, then this can be obviated by the simultaneous transmission of a speech interpolation locking tone, e.g. 2800 Hz.

Note that fully compelled signalling techniques are compatible with speech interpolation systems.

2.6 *Characteristics of signalling systems*

2.6.1 *Line signalling systems*

Analogue line signalling systems can be divided into in-band and out-band systems. In addition, two signalling techniques may be employed: pulse signalling or continuous signalling.

Information on the comparative advantages of in-band and out-band systems can be found in Recommendation Q.20. General requirements for signalling equipment are contained in Recommendations Q.112 to Q.114.

i) *In-band systems*

According to Recommendation Q.22, signalling frequencies above 2000 Hz should be used (but see also §§ 2.7.1 and 2.7.2 below).

The preferred power level for in-band signalling is −9 dBm0 for pulsed signals and −20 dBm0 for continuous signals (also see Recommendation Q.16).

In-band systems require the use of a guarding characteristic to prevent false operation of the signalling equipment by speech currents. Even so, occasional receiver misoperation by speech can occur, and thus in the speech phase a suitable minimum signal recognition time should be chosen.

In-band systems require the use of splitting techniques in order to confine the signalling frequencies to the link concerned, and this has an impact on minimum signal recognition times. Further information can be found in Recommendation Q.25.

If the leased circuit contains a digital transmission system in the terminal national section and this connects directly to a renter's digital PABX using a first order PCM system, then the detection of in-band signalling requires digital filtering techniques.

ii) *Out-band systems*

Recommendation G.171 does not provide for the use of out-band signalling on leased circuits. Because of the frequencies used, out-band signalling requires the use of a transparent 4 kHz bandwidth between the two signalling equipments. Part of the signalling equipment is usually provided within the transmission equipment.

Nevertheless, where the required transmission facilities can be assured, out-band signalling may provide a useful alternative to in-band signalling. Preferred signalling frequencies and power levels for out-band signalling are set out in Recommendation Q.21.

iii) *Pulsed signalling*

Pulsed signalling allows a greater signal repertoire than continous signalling, but requires more complex signal recognition arrangements. In general, the signalling tone is recognized by the signal receiver but requires persistence checking and correlation with the circuit state before the signal is validated.

iv) *Continuous signalling*

Usually continous signalling is arranged to operate with "*tone-on-idle*". Such systems have the inherent advantage of allowing immediate identification of circuit availability.

Since only two signal states are available in each direction, the possible signal repertoire is lower than pulsed systems, but recognition arrangements are simpler. A single persistence timing is usually provided to validate changes of signalling state.

Where continuous in-band signalling uses the "*tone-on*" condition after the interregister signalling phase, means must be provided to prevent the calling or called parties from hearing the signalling tone without undue interference to the transmission of speech currents and tones. A band stop filter as used in Signalling System R1 (see Recommendation Q.313, § 2.3.4) may be suitable. Alternatively, to obviate these difficulties, pulsed signalling could be used in the speech phase.

2.6.2 *Interregister signalling*

The following types of interregister signalling may be suitable for use on leased circuits:

i) *Decadic signalling*

Signalling takes place using the same frequency and sender/receiver equipment as the line signalling. Forward signals are composed of a sequence of tone pulses analogous to subscriber line signalling employing rotary dials. Backward signals may not always be provided, but *proceed-to-send* and *address complete* signals can be used to advantage.

ii) *Multi-frequency signalling*

Multi-frequency (MF) signalling has the advantage of greater speed and signal repertoire than decadic systems. To provide both an adequate repertoire and signalling reliability, signals are composed of two frequencies from a set of 4, 5, 6 or 8 frequencies. Different frequencies may be used for signalling in the backward direction. The frequencies used for MF signalling should lie below 2000 Hz in order that they do not interfere with in-band line signalling.

MF systems may transmit signals in pulse form, or in a compelled sequence with signals in the opposite direction. The preferred signal power level is -9 dBm0 for each constituent tone.

Three existing MF systems may be suitable as the basis for signalling on leased circuits. These are:

1) The dual tone multi-frequency system as specified in Recommendation Q.23 and modified to act as an interregister signalling system. (See also Recommendation Q.24.)

2) Signalling System R1. See Recommendations Q.7 and Q.310 to Q.331.

3) Signalling System R2. See Recommendations Q.7 and Q.400 to Q.490.

2.6.3 *Overall signalling repertoire*

Consideration should be given to providing a set of signals capable of being adapted for different situations to provide a signal capability for extending the scope of PABX supplementary services to encompass the private network as a whole, and to provide other network facilities. This is best achieved by the inclusion in the signalling repertoire of a set of auxiliary signals that are separate from the basic call set-up and supervisory signals and can therefore be allocated in a flexible manner to the required function.

2.6.4 *Position of signalling equipment*

Normally all signalling equipment for automatic leased circuits will be located at the renter's premises. Some Administrations may wish or may be able to provide part of the signalling equipment at the Terminal National Centre or the Terminal International Centre. In these cases, suitable signalling arrangements need to be made to interconnect the exchange at the renter's premises with the remote elements of the signalling equipment. This will be determined by the Administration concerned. Any echo control device could in this case also be remote, but see Recommendation G.171, § 9.2.

2.7 *Interaction between signalling and non-voice services*

As well as normal speech transmission, leased circuits can be used to provide for other types of service (see Recommendation M.1015).

The most common types are:

- Voice-frequency telegraphy,
- Data transmission,
- Facsimile,
- Phototelegraphy.

Since these services use in-band frequencies, there is a possibility of interaction with signalling, and the following general guidance is given below.

2.7.1 *Voice-frequency telegraphy*

Where voice-frequency telegraphy is carried on a telephone-type leased circuit it will be by one of two methods:

- *Alternate use* (see Recommendation M.1015). The circuit is switched at both ends between the telephone equipment and the photo-telegraph equipment.
- Subdivision of the frequency band between telephone and telegraph services. (See Recommendation H.34.)

In the former case, the signalling equipment is disconnected during telegraph use and no interaction can take place. (Outgoing telephone circuits should be removed from service and blocked prior to service switching).

In the latter case, the in-band telephone signalling must be confined to frequencies below 2500 Hz since the attenuation at higher frequencies due to the separation filter cannot provide a reliable signalling path.

2.7.2 *Data transmission*

Data transmission systems for use over leased circuits are specified in Recommendations V.16, V.19 to V.23, V.26 and V.27. These systems do not interact with the Standard Systems for the following reasons:

i) In most cases, the data carriers lie below 2000 Hz and thus below the range for voice frequency line signalling. However, when the carrier is modulated, energy may be present in the signalling band but false receiver operation is prevented by there being at all times a greater energy in the pass-band of the guard circuit.

ii) In some cases, the carriers do lie in the signalling band above 2000 Hz, but with constant phase modulation the guard circuit will operate as outlined in i) above. In the case of 1200 bits/sec duplex transmission according to Recommendation V.22, a guard tone of 1800 Hz is required in order to ensure guard circuit operation.

For signalling systems on automatic leased circuits therefore, providing the signalling frequency is above 2000 Hz and that a guard circuit with a pass-band covering the common data carrier frequencies is used, no problems are foreseen with interaction.

In order that duplex data transmission can take place on circuits equipped with echo control devices, the data set will transmit a tone disabling signal with the following characteristics (see also Recommendation G.164).

2100 $\pm$ 15 Hz at a level of -12 ± 6 dBm0

Duration greater than 400 ms

In order that false operation of signalling equipment does not take place, it is essential that the lowest possible operating frequency of the signalling receiver be above the highest possible tone disabling frequency. This requires that the lowest usable signalling frequency be higher than the 2000 Hz referred to above in § 2.6.1.

For example:

Highest tone disabling frequency		=	2115 Hz
Allowance for frequency deviation in channel		=	5 Hz
Margin of safety		=	30 Hz
Typical maximum receiver deviation for operation		=	75 Hz
	Giving		2225 Hz

Thus on the basis of this example, frequencies above 2225 Hz should be suitable for signalling.

Since the tone disabling circuit of echo control devices may respond in the range 1900-2350 Hz, the unintentional disabling of echo control devices may occur during signalling if this frequency range is used. However, this is not considered detrimental since the echo control device serves no essential function during the time when signalling tones are present on the circuit.

2.7.3 *Facsimile*

Facsimile apparatus for use on telephone circuits are specified in Recommendations T.2, T.3, T.4 and T.10.

i) *Group 1 apparatus* (Recommendation T.2)

Since leased circuits in an automatic private network form part of a switched connection, the centre frequency f_o should be 1700 Hz as used on the public switched network. This implies, for frequency modulation, a transmitted frequency between 1300 Hz (white) and 2100 Hz (black). With a maximum frequency deviation of 32 Hz, and by analogy with the calculations in § 2.7.2 above, frequencies above 2242 Hz should be suitable for signalling. This must be carefully observed since facsimile transmission may result in a single tone for a significant period, and without energy in the pass-band of the guard circuit.

ii) *Group 2 apparatus* (Recommendation T.3)

The transmission method for Group 2 machines uses vestigal sideband amplitude modulation. The 2100 Hz carrier frequency is permanently modulated and the effect of this and the vestigial sideband filter is such that the energy spectrum of the transmitted signal is biased towards frequencies in the pass-band of the guard circuit and receiver misoperation should not occur.

iii) *Group 3 apparatus* (Recommendation T.4)

The transmission method for Group 3 machines uses the data transmission method of Recommendation V.27 *ter* or V.29. False operation should not occur for the reasons described in § 2.7.2 above.

2.7.4 *Phototelegraphy*

For Phototelegraphy on leased circuits, Recommendations T.1 and T.11 apply.

The transmitted centre frequency is 1900 Hz with deviation (in the case of frequency modulation) from 1500 Hz (white) to 2300 Hz (black). For amplitude modulated systems the carrier may be between 1300 and 1900 Hz.

In many cases a phototelegraph circuit is derived by *alternate use* where the telephone signalling equipment is disconnected. However, where automatic switching of phototelegraph circuits is required, the guidance of Recommendation T.11, § 3.2 applies; that is, a guard tone (*blocking signal*) should be transmitted in order to prevent false receiver operation on single-frequency signalling systems.

2.7.5 *Interference of service signals*

With the systems referred to in §§ 2.7.1-2.7.4 above, the precautions included to prevent false recognition of service signals will usually be reliable. However, where the precautions are dependent on the statistical probability of the transmitted power spectrum operating the guard circuit, there is always a small risk of receiver operation for very short periods (in a similar fashion to the occasional false operation by speech). It should be noted that if such operation persists long enough, then the receiver splitting function will operate and thus cause a discontinuity in the service signal. This should be borne in mind when deciding the minimum receiver splitting time. In the call connected phase it is advisable that the minimum tone recognition time for a valid signal should be chosen such that occasional short receiver operation does not cause a change of signalling state.

ANNEX A

(to Recommendation Q.8)

Technical clauses for 2280 Hz signalling on manual circuits

A.1 *Signal sender*

A.1.1 *Signalling frequency*

2280 ± 5 Hz.

A.1.2 *Transmitted signal level*

-13 ± 1 dBm0.

The permissible noise level measured at the output of the signal sender shall be as low as practicable, but in any event at least 35 dB below signal level.

The level of leak current transmitted to line should be at least 50 dB below signal level.

A.2 *Signal receiver*

A.2.1 *Operating limits*

The signal receiver must operate satisfactorily if a signal is received satisfying the following conditions:

a) the frequency received is within 2280 ± 15 Hz;

b) the absolute power level N of each unmodulated signal shall be within the limits $(-19 + n \leqslant N \leqslant -7 + n)$ dBm where n is the relative power level at the receiver input.

The limits give a margin of ± 6 dB on the nominal absolute power level of the 2280 Hz signal received at the receiver input, to allow for variations in transmission conditions on the international circuits.

A.2.2 *Non-operate conditions*

a) *Selectivity*

The signal receiver shall not operate on a signal having an absolute power level at the receiving end within the limits specified in § 2.1 b) when the frequency is outside: 2280 ± 75 Hz.

b) *Maximum sensitivity of the signal receiver*

The signal receiver shall not operate on a signal in the range 2280 ± 15 Hz whose absolute power level at the point of connection of the receiver is $(-29 - 13 + n)$ dBm, n being the relative power level at this point.

A.2.3 *Guard circuit*

A.2.3.1 *Efficiency of the guard circuit*

The signal receiver must be protected by a guard circuit against false operation due to speech currents, circuit noise, or other currents of miscellaneous origin circulating in the line.

The purpose of the guard circuit is to prevent signal imitation, and operation of the splitting device by interfering speech.

To minimize signal imitation by speech current it is advisable that the guard circuit be tuned as follows:

To minimize signal interference by low-frequency noise it is advisable that the response of the guard circuit falls off towards the lower frequencies and that the sensitivity of the guard circuit at 200 Hz is at least 10 dB less than at 1000 Hz.

An indication of the efficiency of the guard circuit is given by the following:

a) during 10 hours of speech, normal speech currents should not, on average, cause more than one false operation of the receiver lasting more than the minimum recognition time of the signal;

b) the number of false splits of the speech path caused by speech currents should not cause an appreciable reduction in the transmission quality of the circuit.

A.2.3.2 *Guard circuit limits*

Considering:

a) that unweighted noise of a level −40 dBm0 and uniform spectrum energy may arise on the longest international circuit;

b) that an oversensitive guard circuit might give rise to signalling difficulties.

It is recommended that, the guard circuit shall not operate in the presence of noise at a level of less than −35 dBm0 and uniform spectral energy over the frequency range 300-3400 Hz.

A.3 *Splitting arrangements*

Sending and receiving line splitting shall be provided.

A.3.1 *Sending line split*

a) the sending line transmission path of the signalling termination shall be disconnected 30-50 ms before a voice-frequency signal is sent over the circuit;

b) the sending line transmission path of the signalling termination will not be reconnected for 30-50 ms following the end of the sending of a voice-frequency signal over the circuit.

A.3.2 *Receiving line split*

a) the receiving line transmission path of the signalling termination shall be split when the 2280 Hz signal is received. The splitting time should be less than 20 ms;

b) the split must be maintained for the duration of the signal but must cease within 25 ms of the cessation of the 2280 Hz signal;

c) the splitting device may be any suitable arrangement for example, physical line disconnection, insertion of a bandstop filter, etc. The level of leak current transmitted to the subsequent circuit should be at least 40 dB below the received signal level.

ANNEX B

(to Recommendation Q.8)

Technical clauses for 2600 Hz signalling on manual circuits

B.1 *Signalling sender*

B.1.1 *Signalling frequency*

2600 ± 5 Hz.

B.1.2 *Transmitted signal level*

The transmitted signal level shall be −8 ± 1 dBm0 for the duration of the signal or for a minimum of 300 ms (whichever is shorter) and for a maximum of 550 ms after which the level of the signal shall be reduced to −20 ± 1 dBm0.

B.1.3 *Signal frequency leak*

The level of signal frequency leak power transmitted to the line should not exceed −70 dBm0, during the tone-off condition.

B.1.4 *Extraneous frequency components*

The total extraneous frequency components accompanying a tone signal should be at least 35 dB below the fundamental signal power.

B.1.5 *Sending line split*

The following splitting arrangements are required when transmitting line signals to prevent incorrect operation of the receiving equipment:

a) when a tone-on signal is to be transmitted, the sending line transmission path shall be split, within an interval from 20 ms before, to 5 ms after tone is applied to the line, and remain split for a minimum of 350 ms and a maximum of 750 ms;

b) when a tone-off signal is to be transmitted, the sending line transmission path shall be split, within an interval from 20 ms before, to 5 ms after tone is removed from the line, and remain split for a minimum of 75 ms and a maximum of 160 ms after the tone is removed.

Further details are given in § 2.2.6 of Recommendation Q.312.

B.2 *Signal receiver*

B.2.1 *Operating limits*

The receiving equipment shall operate on a received tone signal that meets the conditions listed below:

a) 2600 ± 15 Hz;

b) to ensure proper operation in the presence of noise, the signal level of the initial portion of each tone-on signal is augmented by 12 dB. The absolute power level of the signal shall be within the limits $(-27 + n \leqslant N \leqslant -1 + n)$ dBm where n is the relative power level at the input to the receiving equipment.

B.2.2 *Non-operate limits*

a) The receiving equipment shall neither operate on signals originating from subscriber stations (or other sources) if the total power in the band from 800 Hz to 2450 Hz equals or exceeds the total power present at the same time in the band from 2450 Hz to 2750 Hz as measured at the station, nor degrade these signals.

b) The receiving equipment shall not operate on any tone or signal whose absolute power level at the point of connection of the receiving equipment is $(-17 -20 + n)$ dBm or less, n being the relative power level at this point.

On average during 10 hours of speech, normal speech currents should not cause more than one operation lasting more than 50 ms.

B.2.3 *Receiving line split*

To prevent line signals of the signalling system from causing disturbances to signalling systems on subsequent circuit sections, the receiving line transmission path should be split when the signal frequency is received to ensure that no portion of any signal exceeding 20 ms duration may pass out of the circuit section.

This should be achieved by use of a bandstop filter in which case the level of signal leak current transmitted to the subsequent circuit section with the bandstop filter inserted should be at least 35 dB below the received signal level. In addition, the bandstop filter must not introduce more than 5 dB loss at frequencies 200 Hz or more above or below the midband frequency nor more than 0.5 dB loss at frequencies 400 Hz or more above or below the midband frequency.

The receiving line split must be maintained for the duration of the incoming tone signal, but must cease within 300 ms of tone removal.

Note – In some existing designs, the initial cut may be a physical line disconnection but the filter must be inserted within 100 ms of tone reception.

ANNEX C

(to Recommendation Q.8)

The standard European inter-PABX signalling system

C.1 *Introduction*

Recognizing the increasing use of leased lines between private automatic branch exchanges (PABXs) in the European telecommunication networks, a specification has been developed covering the need for signalling on such lines. The system emerged is called Signalling System L1. Distinction is made between line signalling (call supervisory signals) and interregister signalling (set-up including routing and additional service control). Taking into account different applications, existing interregister signalling techniques have been adopted for use with the basic line signalling as follows:

- decadic pulsing (DP);
- multi-frequency push-button (MFPB) type signalling;
- System R2 multi-frequency code (MFC) type signalling.

C.2 *Principles and field of application*

C.2.1 The line signalling system is to provide automatic and semi-automatic working between PABXs in different countries.

C.2.2 The signalling system is a single voice frequency (1 vf) tone-on-idle line signalling system using a signalling frequency of 2280 Hz. The use of voice frequency signals renders the system suitable for all voice transmission media, except those using speech interpolation.

C.2.3 The system is intended for use on bothway inter-PABX circuits, with first party clearing.

C.2.4 Either decadic pulsing or multi-frequency interregister signalling may be used with the line signalling system. The provision of particular line signals will depend upon the requirements of the associated interregister signalling system.

C.2.5 The system operates on a four-wire basis, forward and backward signals being segregated by utilizing the four-wire circuits as two separate signalling paths.

C.2.6 In addition to the application or removal of signalling frequency (tone-on and tone-off) in continuous form, the transmission of pulses of signalling frequency is applied.

C.2.7 When in the idle condition, the signalling frequency applied to the line is reduced in power level to conform to the transmission loading requirements of Recommendation Q.15.

C.2.8 The line signalling operates on a link-by-link basis and may be used to establish a multi-link tandem connection using one or more private automatic exchange(s) as a transit switch. In accordance with Recommendation Q.25 sending line and receiving line splitting arrangements are provided so that signals are contained within the appropriate link and are not allowed to spill over into subsequent or preceding links.

C.3 *Line signal conditions and signalling codes*

C.3.1 The line signal conditions and the signalling codes shall be as shown in Table C-1/Q.8. Signal sending and detection requirements are given in §§ C.3.2 and C.3.3.

C.3.2 A continuous tone-on condition shall be the application of the signalling frequency to the send signalling path for a period exceeding 300 ms.

A tone-on pulse signal shall be the application of the signalling frequency to the send signalling path for a period of 45-135 ms. A continuous tone-off condition shall exist when any signalling frequency is absent from the send signalling path for a period exceeding 80 ms.

TABLE C-1/Q.8

Line signal conditions and signalling codes

Signal	From outgoing PABX	From incoming PABX
Idle	Continuous tone-on	Continuous tone-on
Seizing	Continuous tone-off	Continuous tone-on
Seizing-acknowledgement or proceed-to-send	Continuous tone-off	Continuous tone-off
Answer	Continuous tone-off	Single tone-on pulse
Clear-forward	Continuous tone-on	Continuous tone-on or tone-off
Clear-back	Continuous tone-off	Continuous tone-on

C.3.3 A tone-on condition applied to the receive signalling path PABX termination may be recognized as a continuous tone-on condition for signalling when it has persisted for 150 ms, while for a tone-off condition a value of 40 ms has to be taken into account.

A tone-on condition applied to the receive signalling path PABX termination and persisting for 35-150 ms, followed by a tone-off condition longer than 200 ms, may be recognized as a pulse tone-on signal.

C.4 *Line signalling transmission requirements*

C.4.1 *Signal sender*

C.4.1.1 The signalling tone shall be at a frequency of 2280 $\pm$ 5 Hz.

C.4.1.2 The tone-on condition shall have two power levels: a high level and a low level.

A high level tone shall be sent for the duration of the signal or for a minimum of 300 ms (whichever is shorter) and for a maximum of 550 ms after which it must be reduced to low level.

a) A high level tone-on condition shall be a signalling tone transmitted at a level of -10 dBm0 $\pm$ 1 dB.

b) A low level tone-on condition shall be a signalling tone transmitted at a level of -20 dBm0 $\pm$ 1 dB.

C.4.2 *Signal receiver*

C.4.2.1 A frequency within the range 2280 $\pm$ 15 Hz at an absolute level N, within the range $(-30 + n \leq N \leq -4 + n)$ dBm, shall be recognized as a tone-on condition; where n is the relative power level at the receive signalling path PABX termination (see Recommendation G.171).

C.4.2.2 Any frequency or combination of frequencies having a total absolute power level or less than $(-40 + n)$ dBm shall be recognized as a tone-off condition; where n is the relative power level at the receive signalling path PABX termination as in § C.4.2.1.

C.5 *General line signal transfer procedures*

C.5.1 Depending upon the capabilities of the incoming PABX, recognition of the seizing signal will initiate either proceed-to-send or seizing acknowledgement. The sending of the latter signal does not imply that the incoming PABX is ready to receive address information.

C.5.2 Some PABXs do not use the answer signal, others require it for correct operation. Therefore the answer signal is optional and subject to mutual agreement.

C.5.3 A continuous tone-on signal shall be applied when, after recognition of a seizing signal, no address or incomplete address information is received and the incoming PABX times-out.

A continuous tone-on signal may be applied when an incoming PABX encounters congestion or an engaged extension.

C.6 *Decadic pulsing*

For decadic pulsing interregister signalling the 2280 Hz line signalling is used. Some characteristics are given below.

C.6.1 The break periods of dial pulses shall be applied to the send signalling path as pulses of tone-on condition within the following limits.

SPEED (pulses per sec.) BREAK PULSE	7		9		11		12	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
DURATION (ms)	45	112	45	81	45	61	45	52

C.6.2 Pulses of tone-on condition applied to the receive signalling path PABX termination and consistent with the following speed and duration limits, are break periods of dial pulses (address signal).

SPEED (pulses per sec.) BREAK PULSE	7		9		11		12	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
DURATION (ms)	35	122	35	91	35	71	35	62

ANNEX D

(to Recommendation Q.8)

A typical North American private analogue network signalling system

D.1 *Introduction*

D.1.1 A Private Switched Network is a common control switching arrangement which provides interconnections of subscriber locations via dedicated access lines and inter-exchange circuits and shared common control switching with the Public Switched Telephone Network. The Private Switched Networks are terminated at the subscriber location by directly-homed telephone sets, multi-line telephone systems or by main PBX or PABXs. This annex describes the signalling on a typical North American switched private network.

D.2 *General signalling applications*

D.2.1 The line signalling system provides for semi-automatic and automatic working between subscribers on the private network and the ability to go off network to the Public Switched Network.

D.2.2 In general, four-wire transmission links employing an in-band single frequency of 2600 Hz, tone-on-idle, are used on the inter-exchange circuits, directly-homed stations and PBX access lines.

D.2.3 Signalling on an inter-exchange circuit is in accordance with Recommendations Q.310 to Q.331 – System R1 signalling.

D.2.4 Either decadic pulsing (DP) or multi-frequency pushbutton is used for address signalling on access lines.

D.2.5 Multi-frequency pushbutton signalling is in accordance with Recommendation Q.23. (See also Recommendation Q.24.)

D.2.6 Address signalling on inter-exchange circuits is multi-frequency (MF) using a combination of two out of six frequencies in accordance with Recommendations Q.320 to Q.326.

D.2.7 Interregister signalling techniques are used for controlling outpulsing to accommodate different equipment designs and to improve register usage.

D.3 *Signalling on access lines*

D.3.1 Either decadic pulsing (DP) or multi-frequency push-button (MFPB) is used on access lines for address signalling.

D.3.2 Supervisory signalling may use either the single frequency 2600 Hz or direct current loop.

D.3.3 Called party ringing is controlled by the terminating exchange or PABX in a conventional manner.

D.4 *Signalling on inter-exchange trunks*

D.4.1 Supervisory signalling is single frequency 2600 Hz in accordance with Recommendations Q.310 to Q.313, Q.317 and Q.318.

D.4.2 Register signalling uses multi-frequency (MF) signals consisting of two out of six frequencies in accordance with Recommendation Q.320.

D.5 *Decadic pulsing*

The decadic pulsing represents the numeric value of each digit by the number of on-hook intervals in a train of pulses.

D.5.1 The general characteristics of decadic pulsing are shown below:

Equipment	*Pulsing Speed (PPS)*	*Percent Break (BK)*
Customer Dial	8-11 PPS	58-64 BK
10-PPS PBX	10 ± 0.3 PPS	62-66 BK
Sender Pulsing	10 ± 1 PPS	57-64 BK

D.6 *Multi-frequency pushbutton*

See Recommendations Q.11, Q.23 and Q.24. Signal combinations A-D are not usually used in North American private switched networks.

ANNEX E

(to Recommendation Q.8)

The standard European signalling system for leased circuits connecting subscribers to remote PABXs and public exchanges

E.1 *Introduction*

Recognizing the increasing use of leased lines for interconnection of telephone instruments and public exchanges or private automatic branch exchanges (PABXs) in the European telecommunication networks, a specification has been developed covering the need for signalling on such lines. The system emerged is called Signalling System L2. Distinction is made between line signalling (call supervisory signals) and interregister signalling (set-up including routing and additional service control). Taking into account different applications, existing interregister signalling techniques have been adopted for use with the basic line signalling as follows:

- decadic pulsing (DP);
- multi-frequency pushbutton (MFPB) type signalling.

E.2 *Principles and fields of application*

E.2.1 The line signalling system is to provide supervisory signals (e.g. loop signalling in one direction and ringing in the other) between a telephone instrument or its equivalent and a public exchange or PABX in different countries, via an extra long line.

E.2.2 For the purpose of description, this specification refers to an instrument signalling unit (ISU) and an exchange signalling unit (ESU).

E.2.3 The system is intended for use over four-wire circuits but, as an option for national use, it may be used over two-wire circuits. In the four-wire case, forward and backward signals are segregated by utilizing the four-wire circuit as two separate signalling paths.

E.2.4 The system is a single voice frequency (1 vf) line signalling system using a signalling frequency of:

- 2280 Hz in both directions on four-wire circuits;
- 2280 Hz in the direction ISU to ESU and 2400 Hz in the direction ESU to ISU on two-wire circuits (national).

The use of voice frequency signals renders the system suitable for all voice transmission media, except those using speech interpolation.

E.2.5 In addition to the application or removal of signalling frequency (tone-on and tone-off) in continuous form, the transmission of pulses of signalling frequency is applied.

E.2.6 When in the idle condition, the signalling frequency applied to the line by the ISU is reduced in power level to conform to the transmission loading requirements of Recommendation Q.15.

E.2.7 In accordance with Recommendation Q.25, sending and receiving line splitting arrangements are provided so that signals are contained within the ISU-ESU link and not allowed to spill over into the next link.

E.2.8 When making an outgoing call, a through speech path shall be provided in the direction ESU-ISU prior to the answered state.

E.2.9 Signals may be passed in the direction ISU to ESU while speech or audible indications are being received in the direction ESU to ISU.

E.3 *Line signal conditions and signalling codes*

E.3.1 The line signal conditions and the signalling codes shall be as shown in Tables E-1/Q.8 and E-2/Q.8. Signal sending and detection requirements are given in §§ E.3.2 and E.3.3.

TABLE E-1/Q.8

Calls originated by the telephone instrument

Signal	Conditions from ISU	Conditions from ESU
Idle	Continuous tone-on	Continuous tone-off
Seizing	Continuous tone-off	Continuous tone-off
Answer	Continuous tone-off	Tone-on pulse
Recall	Recall tone-on pulse	Continuous tone-off
Clear	Continuous tone-on	Continuous tone-off

TABLE E-2/Q.8

Calls from the exchange

Signal	Conditions from ESU	Conditions from ISU
Idle	Continuous tone-off	Continuous tone-on
Calling	Calling tone-on-pulse	Continuous tone-on
Answer	Continuous tone-off	Continuous tone-off
Recall	Continuous tone-off	Recall tone-on pulse
Clear	Continuous tone-off	Continuous tone-on

E.3.2 A continuous tone-on condition shall be the application of the signalling frequency to the send signalling path for a period exceeding 350 ms. A tone-on pulse signal shall be the application of the signalling frequency to the send signalling path for a period of 45-135 ms or 210-240 ms (see § E.5.2).

A continuous tone-off condition shall exist when any signalling frequency is absent from the send signalling path for a period exceeding 80 ms.

E.3.3 A tone-on condition applied to the receive signalling path line termination may be recognized as a continuous tone-on condition for signalling, when it has persisted for 250 ms, while for a tone-off condition a value of 40 ms has to be taken into account.

A tone-on condition applied to the receive signalling path line termination, and persisting for a period of 35-150 ms or 200-250 ms (see § E.5.2) may be recognized as a tone-on pulse signal.

E.4 *Line signalling transmission requirements*

E.4.1 *Signal sender*

E.4.1.1 The signalling tone shall be at a frequency of 2280 (2400 Hz in the ESU for two-wire working) ± 5 Hz.

E.4.1.2 The tone-on condition shall have two power levels: a high level and a low level.

A high level tone shall be sent for the duration of the signal or for a minimum of 300 ms (whichever is shorter), and for a maximum of 550 ms after which it must be reduced to low level.

a) A high level tone-on condition shall be a signalling tone transmitted at a level of -10 dBm0 ± 1 dB.

b) A low level tone-on condition shall be a signalling tone transmitted at a level of -20 dBm0 ± 1 dB.

E.4.2 *Signal receiver*

E.4.2.1 A frequency within the range 2280 (2400 Hz in the ISU for two-wire working) ± 15 Hz at an absolute level N, within the range $(-30 + n \leqslant N \leqslant -4 + n)$ dBm shall be recognized as a tone-on condition; where n is the relative power level at the receive signalling path line termination (see Recommendation G.171).

E.4.2.2 Any frequency or combination of frequencies having a total absolute power level of less than $(-40 + n)$ dBm shall be recognized as a tone-off condition; where n is the relative power level at the receive signalling path line termination as in § E.4.2.1.

E.5 *General line signal transfer procedures*

E.5.1 The calling signal is a series of tone-on pulses with a duration of each pulse according to the length of the original ringing pulse and in step with the period of the ringing signal.

E.5.2 As an option and subject to mutual agreement by the parties involved, the ISU applies a recall signal in the form of a tone-on pulse to the signalling path.

The length of tone-on pulse applied by the ISU depends upon the type of recall employed by the associated telephone, e.g. timed break or earthed loop.

E.5.3 As an option and subject to mutual agreement by the parties involved, the answer signal is sent by the ESU.

E.6 *Decadic pulsing*

For decadic pulsing interregister signalling, the 2280 Hz line signalling is used. Some characteristics are given below.

E.6.1 The break periods of decadic pulses shall be applied to the send signalling path of the ISU, as pulses of tone-on condition within the following limits.

SPEED (pulses per sec.) BREAK PULSE	7		9		11		12	
DURATION (ms)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
	45	112	45	81	45	61	45	52

E.6.2 Pulses of tone-on condition applied to the receive signalling path line termination of the ESU, consistent with the following speed and duration limits, are break periods of dial pulses (address signal).

SPEED (pulses per sec.) BREAK PULSE	7		9		11		12	
DURATION (ms)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
	35	122	35	91	35	71	35	62

Recommendation Q.9

VOCABULARY OF SWITCHING AND SIGNALLING TERMS

(Geneva, 1980; modified at Malaga-Torremolinos, 1984; Melbourne 1988)

1 This Recommendation provides a vocabulary of terms and definitions which have been studied for application in documentation on switching and signalling. The possible evolution toward integrated digital networks and integrated services digital networks has been taken into account.

2 The terms are grouped in sections and within each section terms belonging to the same area of concepts are assembled. While such grouping in logical order may ease overview, it was not established according to firm principles and arbitrary placing of certain terms was accepted.

3 Part of the terms and definitions in this Recommendation also are contained in specialized glossaries which are attached to certain Recommendations of the G, Q and Z Series. Care has been taken then that identical texts appear in both the Recommendation and the glossary.

CONTENTS

According to the conventions applied in the lists, indications in round brackets are qualifiers or alternative terms in general use in addition to the principal term.

Examples: **call** (in software)

exchange (switching exchange, switching centre)

Terms in square brackets are deprecated.

The indication *(USA)* after a term in English means that the term is used in the United States, and is different from that current in the United Kingdom. The indication *(UK)* means the reverse.

A number (1) or (2) after a term indicates that more than one definition is given (when the term acquires another meaning depending on the context).

Cross-references to the sources in §§ 1 to 9 are given, where of interest, at the right-hand side of the line following the end of a definition.

Sources quoted are ISO, Recommendation G.701 [1] and Recommendation I.112 [7], *List of Essential Telecommunication Terms* [2], the International Electrotechnical Vocabulary (IEV), Recommendations E.100 and E.600 [3]. The name of ISO and Recommendations are mentioned along with a number; the terms derived from the "List of Essential Telecommunications Terms" give only a four digit number. The four digit number from E Recommendations [3] is preceded by the designation "Study Group II". Numbers beginning with 714 refer to Chapter 714 (Switching), those with 716 to Chapter 716 (ISDN) of IEV.

0 General terms

General terms and definitions as shown in § 0 have in many cases not been elaborated by Study Group XI. However, they need to be used in certain definitions for which the Study Group is responsible. A cross-reference to the source is given wherever possible. If no cross-reference is given, the term is quoted with the provisional meaning that Study Group XI adopted for it. Such definitions will be substituted by the definition of the competent body when available. It should be noted that the terms concerned will not necessarily be classified by the responsible body as "general" in the sense applied to § 0.

0001 **communication** (1)

F: communication (1)

S: comunicación (1)

Information transfer according to agreed conventions.

Note 1 – In the context of the present vocabulary, the ordinary dictionary meaning of the term is appropriate and sufficient.

Note 2 – The French term "communication" and the Spanish term "comunicación" have the current meaning given in this definition, but they also acquire a more specific meaning in telecommunication (see 0009, 0010 and 0011).

0002 **telecommunication**

F: télécommunication

S: telecomunicación

Any process that enables a correspondent to pass to one or more given correspondents (telegraphy or telephony), or possible correspondents (broadcasting), information of any nature delivered in any usable form (written or printed matter, fixed or moving pictures, words, music, visible or audible signals, signals controlling the functioning of mechanisms, etc.) by means of any electromagnetic system (electrical transmission by wire, radio transmission, optical transmission, etc., or a combination of such systems).

01.01

0003 **network, telecommunication network**

F: réseau, réseau de télécommunications

S: red, red de telecomunicaciones

A set of nodes and links that provides connections between two or more defined points to accommodate telecommunication between them.

0004 **integrated digital network**

F: réseau numérique intégré

S: red digital integrada

A network in which connections established by digital switching are used for the transmission of digital signals.

0005 **integrated digital network, digital network**

F: réseau numérique intégré, réseau numérique

S: red digital integrada, red digital

A combination of digital switching nodes and digital links that uses integrated digital transmission, digital switching and common channel signalling to provide digital connections between two or more points to facilitate telecommunication and possibly other functions.

0007 **channel; transmission channel**

F: voie; voie de transmission

S: canal; canal de transmisión

A means of unidirectional communication.

Note – Several channels may share a common path as in frequency division and time division systems; in these cases, each channel is allotted a particular frequency band or a particular time slot which is reserved for it.

0008 **access channel** [channel]

F: voie d'accès [voie]

S: canal de acceso [canal]

A designated part of the information transfer capability, having specified characteristics, provided at the user-network interface.

Note 1 – The term "transmission channel" is well understood to imply uni-directional working only, and then is commonly abbreviated to "channel". To avoid confusion with this usage, the term "access channel", which encompasses bi-directional working through the user-network interface, must not be abbreviated to "channel".

Note 2 – The term "access channel" may be qualified, for example, by H, B, or D in which case it is appropriate to abbreviate the term to "H-channel", "B-channel" or "D-channel".

716.0402

0009 **call** (1)

F: appel (1)

S: llamada (1)

In an automatic system, the action performed by a calling party in order to obtain communication with the wanted terminal equipment and by extension, the operations controlled by the action performed.

call (2)

F: communication (2)

S: comunicación (2)

The use, or the possible use, of a complete connection set up between a calling party and the called party or service (see Note 2 of 0001).

0010 **(complete) connection in telecommunication**

F: chaîne de connexion complète, (chemin de) communication

S: conexión completa; cadena de conexión completa (en telecomunicaciones)

An association of transmission channels or circuits, switching and other functional units set up to provide means for a transfer of information between terminals in a telecommunication network.

Note 1 – A connection is the result of a switching operation.

Note 2 – A connection which allows an end-to-end communication, e.g. a conversation, may be called a "complete connection".

Note 3 – The connection makes a communication possible but is not a communication.

0011 **connection**

F: chaîne de connexion

S: conexión; cadena de conexión

An association of transmission channels or circuits, switching and other functional units set up to provide a means for a transfer of information between two or more points in a telecommunication network.

0012 **call attempt** (1) (of a user)

F: (tentative d')appel (d'un usager) (1)

S: tentativa de llamada (de un usuario) (1)

The sequence of operations made by a user of a telecommunication network to obtain another party or a service.

Note – Several call attempts may be required to establish a call.

0013 **circuit, telecommunication circuit**

F: circuit, circuit de télécommunications

S: circuito, circuito de telecomunicaciones

A combination of two transmission channels permitting bidirectional telecommunication between two points, to support a single call.

Note 1 – If the telecommunication is by nature unilateral, for example: long distance television transmission, the term "circuit" is sometimes used to designate the single channel providing the facility.

Note 2 – In telephony, use of the term "circuit" is generally limited to a telecommunication circuit with associated terminating equipment directly connecting two switching devices or exchanges.

Note 3 – A telecommunication circuit does not necessarily permit simultaneous transmission in both directions.

Note 4 – The "go" and "return" channels may be permanently associated together or may be selected from separate sets for association together throughout a call.

Note 5 – The term circuit may be preceded by other qualifiers than telecommunication, e.g., telephone, digital, etc.

0015 **telephone circuit**

F: circuit téléphonique

S: circuito telefónico

A permanent electrical connection permitting the establishment of a telephone communication in both directions between two telephone exchanges.

02.06

0016 **hypothetical reference circuit (nominal maximum circuit)**

F: circuit fictif de référence

S: circuito ficticio de referencia (circuito máximo nominal)

A hypothetical circuit having a defined length and a defined amount of terminal and intermediate equipment, these quantities being reasonably large but not extreme. Such a conception is of value in the study of certain characteristics (noise, for example) of long-distance circuits.

02.08

0017 **virtual circuit**

F: circuit virtuel

S: circuito virtual

A capability in the network between two users that is available to them for exchanging packets of data.

0018 **permanent virtual circuit**

F: circuit virtuel permanent

S: circuito virtual permanente

A capability in the network between two users that is continuously available to them for exchanging packets of data.

0019 **(electric) circuit**

F: circuit (électrique)

S: circuito (eléctrico)

A region of electrical action where such action takes place essentially along a path and can be uniquely specified in terms of time and a single dimension.

Note – In contradistinction, an "electric field" implies action which can only be specified uniquely in terms of time and two or three dimensions.

02.01 a)

0020 **. . . circuit** (specific function)

F: circuit de . . .

S: circuito de . . .

Part of an installation forming (or able to form part of) an electric circuit traversed by a current having a definite function, specified in each case, (example: calling, speaking, feeding, etc.).

02.01 b)

0022 **circuit group**

F: faisceau de circuits

S: haz de circuitos

A group of circuits which are traffic-engineered as a unit.

0023 **circuit sub-group**

F: sous-faisceau de circuits

S: subhaz de circuitos

A number of circuits with similar characteristics (e.g. type of signalling, type of transmission path, etc.).

It is not engineered as a unit, but as a part of a circuit group. Circuit sub-groups are provided for reasons of service, protection, equipment limitation, maintenance, etc.

0026 **path, telecommunication path**

F: itinéraire, itinéraire de télécommunications

S: trayecto, trayecto de telecomunicación

The continuous course taken by a transmission signal between two points.

Note 1 – This may be a physical transmission medium, a frequency band in a frequency multiplex, a time slot in a time division multiplex, etc.

Note 2 – The path includes the transmission media and the means used for connecting them together.

0031 **link**

F: liaison

S: enlace

A telecommunication path with specified characteristics between two points.

Note – The nature of the specified characteristics may be added in the form of a qualifier, e.g., digital link, co-axial link, radio link.

0040 **signal** (general sense)

F: signal (sens général)

S: señal (sentido general)

Aggregate of waves propaged along a transmission channel and intended to act on a receiving unit.

Note – "General sense" applies only to the area of telecommunications. The ordinary dictionary sense is still wider, viz: "A preconcerted or intelligible sign conveying information or direction at a distance, a physical phenomenon or characteristic quantity of such a phenomenon whose time variations represent information, etc."

0041 **signal** (in signalling applications)

F: signal (applications concernant la signalisation)

S: señal (en aplicaciones de señalización)

A transferable element of information relating to a particular circuit, a particular transaction or to the network management.

Note 1 – A signal as defined above may be generated by a change of state.

Note 2 – A qualification may precede the term, e.g. "answer signal". The qualification represents the name of the signal and generally refers to the kind of information the signal conveys or its main function. A great many of such qualifications are defined in standard signalling system's specifications.

0042 **forward signal**

F: signal en avant

S: señal hacia adelante

A signal, used for the establishment, release or other control of a connection sent in the same direction as call set-up.

0046 **backward signal**

F: signal en arrière

S: señal hacia atrás

A signal, used for the establishment, release or other control of a connection, sent in the opposite direction to call set-up.

0050 **subscriber's line**

F: ligne d'abonné

S: línea de abonado

The telephone line connecting the subscriber's equipment to the exchange.

0060 **process** (in a data processing system)

F: processus (dans un traitement de l'information)

S: proceso (en un sistema de procesamiento de datos)

A course of events occurring according to an intended purpose or effect.

(10.01.03 in ISO/TC97/SC1/515, Nov. 1975)

0063 **bidirectional**

F: bidirectionnel

S: bidireccional

A qualification which implies that the transmission of information occurs in both directions.

0064 **unidirectional**

F: unidirectionnel

S: unidireccional

A qualification which implies that the transmission of information always occurs in one direction.

0066 **space division**

F: répartition dans l'espace, répartition spatiale

S: división en el espacio; división espacial

The separation in the space domain of a plurality of transmission channels between two points.

0067 **time division**

F: répartition dans le temps, répartition temporelle

S: división en el tiempo; división temporal

The separation in the time domain of a plurality of transmission channels between two points.

0068 **frequency division**

F: répartition en fréquence, répartition fréquentielle

S: división de frecuencia

The separation in the frequency domain of a plurality of transmission channels between two points.

0069 **code division**

F: répartition en code

S: división por código

The separation of a plurality of transmission channels by using specific values of codes belonging to the same set.

0075 **flag**

F: fanion

S: bandera

The unique pattern on the signalling data link used to delimit a signal unit.

0080 **packet switched data transmission service**

F: service de transmission de données à commutation par paquets

S: servicio de transmissión de datos con conmutación de paquetes

A service involving the transmission and, if necessary, the assembly and disassembly of data in the form of packets.

0081 **user packet**

F: paquet d'usager

S: paquete de usuario

A data packet exchanged between users.

0083 **packet switching**

F: commutation par paquets

S: conmutación de paquetes

The function of handling, routing, supervising and controlling user packet data, as required, by an exchange.

0085 **packet handling**

F: traitement des paquets

S: manejo (tratamiento) de paquetes

The function of receiving and transmitting user packets between a user and a packet switching function.

0086 **packet mode operation**

F: fonctionnement en mode paquet

S: funcionamiento (operación) en modo paquete

The transmission of data by means of addressed packets whereby a transmission channel is occupied for the duration of the transmission of the packet only. The channel is then available for use by packets being transferred between different data terminal equipments.

0087 **packet mode operation** (in switching applications)

F: fonctionnement en mode paquet (dans les applications de commutation)

S: funcionamiento (operación) en modo paquete (en aplicaciones de conmutación)

The function of handling user packets is an exchange.

0105 **functional unit**

F: unité fonctionnelle

S: unidad funcional

An entity of hardware or software, or both, capable of accomplishing a special purpose.

ISO 10.01.01

0108 **traffic-carrying device**

F: organe de trafic

S: dispositivo de curso de tráfico

Functional unit used directly or indirectly during the establishment and sustaining of a connection.

0112 **(network) resource(s)**

F: ressource(s) (du réseau)

S: recurso(s) (de la red); órgano de la red

Means of supplying a want or a stock that can be drawn on. In context with the telecommunication network, in particular switching devices, circuit groups, echo and loss control devices, devices for sending recorded announcements, traffic service positions, network integrated data banks, etc.

0115 **software**

F: logiciel

S: soporte lógico (software)

Computer programs, procedures, rules and any associated documentation concerned with the operation of a system.

0120 **processor**

F: processeur

S: procesador

A device capable of performing systematic execution of operations upon data. In telecommunication applications, the operations include control of the resources required to provide services.

0124 **operation and maintenance centre processor**

F: processeur de centre d'exploitation et de maintenance

S: procesador de centro de operación y mantenimiento

A centralized *processor* for operation and maintenance purposes which serves one or more switching centres.

0150 **route**

F: route

S: ruta

a) the means of transmission (paths, links via wire, cable, radio) used or to be used for the set-up of permanent or switched connections between two locations;

b) the way within a network followed or to be followed for the transmission of a message or the set-up of a call between two locations.

Note – Two or more routes may be used in tandem. The whole way between the end points then again is called route.

0151 **routing**

F: acheminement

S: encaminamiento

a) the process of determining and using, in accordance with a set of rules, the route for the transmission of a message or the set-up of a call. The process ends when the message or the call has reached the destination location;

b) a qualification implying the above process, e.g.:
   - call routing;
   - message routing;
   - traffic routing.

0205 **seizure**

F: prise

S: toma

A successful bid.

With "bid": a single attempt to obtain the service of a resource.

0208 **busy**

F: occupation

S: ocupado

Condition of a resource which is in use, following its seizure for the time until it is released.

0209 **engaged test** (UK); **busy test** (USA)

F: test d'occupation

S: prueba de ocupación

An engaged test is a test made to find out whether or not certain facilities which may be desired, such as a subscriber's line or trunk, are available for use.

17.66

busy test

F: test d'occupation

S: prueba de ocupación

A procedure for determining whether a traffic carrying device is free and available for use.

0212 **release**

F: libération

S: liberación

The sequence of events which brings about the end of a busy state.

0215 **one-way**

F: à sens unique

S: en un solo sentido

A qualification applying to traffic which implies that call set-ups always occur in one direction.

0216 **both-way**

F: à double sens

S: en ambos sentidos

A qualification applying to traffic which implies that call set-ups occur in both directions.

Note – The amount of traffic flowing in the two directions is not necessarily equal either in the short term or in the long term.

0221 **random errors**

F: erreurs aléatoires

S: errores aleatorios

Errors distributed over the digital signal so that they can be considered statistically independent from each other.

0222 **error burst**

F: paquet d'erreurs

S: ráfaga de errores

A group of bits in which two successive erroneous bits are always separated by less than a given number (x) of correct bits. The number x should be specified when describing an error burst.

Note – The last erroneous bit in a burst and the first erroneous bit in the following burst are accordingly separated by x correct bits or more.

0225 **bit error ratio**

F: taux d'erreur sur les bits

S: tasa de errores en los bits; tasa de error en los bits

The ratio of the number of digital errors received in a specified period to the total number of digits received in the same period.

Note 1 – Numerical values of error ratio should be expressed in the form

$$n \cdot 10^{-p}$$

where p is a positive integer.

Note 2 – Error ratio may be qualified, for example by the term "bit" or "block".

0226 **cyclic redundancy check (or procedure)**

F: contrôle (ou procedure) de redondance cyclique

S: verificación por redundancia cíclica (procedimiento de)

The monitoring of a digital bit stream to detect deviations from the expected bit patterns.

0230 **delay distortion**

F: distorsion de temps de propagation

S: distorsión por retardo

Deviation in delay from a reference or an expected value for signals of various frequencies.

0231 **group delay**

F: temps de propagation de groupe

S: retardo de grupo

The time of propagation between two points of a certain point (for example the crest) of the envalope of a wave.

For a given frequency it is equal to the first derivative of the phase shift measured in radians, between these points, with reference to the angular frequency measured in radians per second.

0232 **crosstalk**

F: diaphonie

S: diafonía

Electrical interference between non-connected components.

0301 **first-order digital transmission hierarchy**

F: hiérarchie de transmission numérique du premier ordre

S: jerarquía de transmisión digital de primera orden

Digital signals multiplexed to the 1544 or 2048 kbit/s level (Primary level) for digital transmission.

0302 **second-order digital transmission hierarchy**

F: hiérarchie de transmission numérique du deuxième ordre

S: jerarquía de transmisión digital de segundo orden

Digital signals multiplexed to the 6312 or 8448 kbit/s level for digital transmission.

0311 **first-order multiplexes** (Suggest that term should be, "First-order multiplexed signals")

F: multiplex du premier ordre

S: múltiplex de primer orden

Digital signals that have been multiplexed into 1544 or 2048 kbit/s bit streams.

0312 **second-order multiplexes** (Same comment as above)

F: multiplex du deuxième ordre

S: múltiplex de segundo orden

Digital signals that have been multiplexed into 6312 or 8448 kbit/s bit streams.

0400 **pilot**

F: onde pilote

S: piloto

Sinusoidal signal transmitted over analogue FDM links for regulation and supervision purposes.

1 Switching functions and techniques

1001 **exchange (switching exchange, switching centre)**

F: centre – central (centre ou central de commutation)

S: central (central de conmutación, centro de conmutación)

An aggregate of traffic carrying devices, switching stages, controlling and signalling means at a network node that enables subscriber lines and/or other telecommunication circuits to be interconnected as required by individual users. (See Figure 1/Q.9.)

1002 **local exchange** [local central office]

F: central urbain

S: central local

An exchange in which subscribers' lines terminate. (See Figure 1/Q.9.)

15.02

1003 **transit exchange** [tandem exchange, tandem central office, tandem office]

F: centre de transit

S: central de tránsito

An exchange used primarily as a switching point for traffic between other exchanges. (See Figure 1/Q.9.)

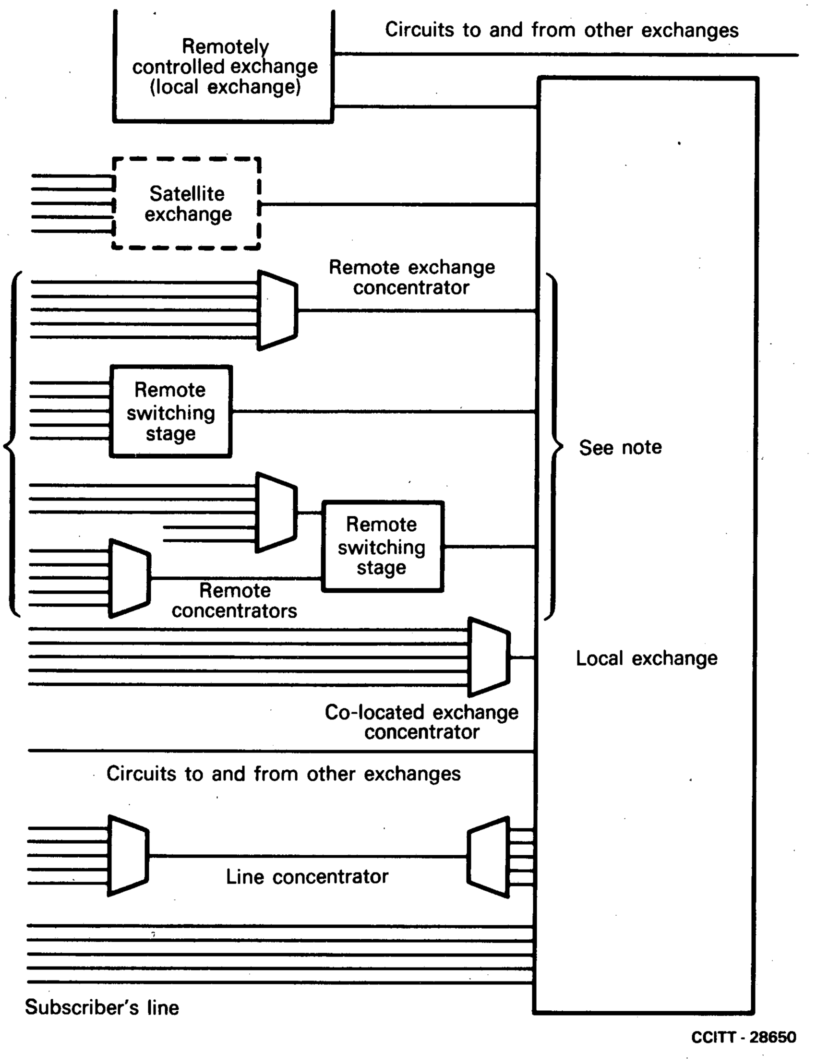
15.04

1004 **combined local/transit exchange**

F: centre mixte urbain et de transit

S: central combinada local/de tránsito

An exchange in which subscribers' lines terminate that also is used as a switching point for traffic between other exchanges. (See Figure 1/Q.9.)



Note – The brackets comprise the component parts of a geographically distributed exchange.

FIGURE 1/Q.9

Exchange and related terms

1005 **international exchange**

F: centre international

S: central internacional

A transit exchange where international circuits and, in general, national circuits terminate.

1007 **geographically distributed exchange** [geographically dispersed exchange]

F: centre géographiquement dispersé

S: central geográficamente distribuida

An exchange where not all sub-systems such as switching stages and control means are at the same location. (See Figure 1/Q.9.)

1008 **remotely controlled exchange**

F: centre télécommandé

S: central controlada a distancia; central telecontrolada

An exchange whose switching functions are wholly or partially controlled by a control unit or a processor in another location. (See Figure 1/Q.9.)

1010 **digital exchange**

F: centre numérique

S: central digital

An exchange that switches information in digital form through its switching devices.

1011 **integrated services exchange**

F: central avec intégration des services

S: central de servicios integrados

An exchange arranged to handle multiple services such as telephone and data using all or part of the switching, signalling and control devices in common.

1013 **satellite exchange**

F: centre satellite

S: central satélite

A local exchange on a low level of the network hierarchy which is associated to another exchange and with no route switching functions except those towards the associated higher level local exchange. A satellite exchange has normally the capability to connect locally subscribers' lines terminating in it. (See Figure 1/Q.9.)

1015 **switching stage**

F: étage de commutation

S: etapa de conmutación

An aggregate of switching devices constituting a subset of the switching network in an exchange and designed to operate as a single unit from a traffic handling point of view. (See Figure 1/Q.9.)

1016 **remote switching stage**

F: étage de commutation distant

S: etapa de conmutación distante

A switching stage associated with and controlled by an exchange in a different location. (See Figure 1/Q.9.)

1018 **exchange concentrator**

F: concentrateur de central

S: concentrador de central

A switching stage wherein a number of subscriber lines or inter-exchange circuits carrying relatively low traffic volumes can be through-connected to a few number of circuits carrying higher traffic volumes. (See Figure 1/Q.9.)

1019 **co-located exchange concentrator**

F: concentrateur de central local

S: concentrador de central local

A concentrator in the same location as the exchange that controls it and to which its higher traffic volume circuits are connected. (See Figure 1/Q.9.)

1020 **remote exchange concentrator**

F: concentrateur de central distant

S: concentrador de central distante

A concentrator located remotely from the exchange that controls it and to which its higher traffic volume circuits are connected. The switching stages comprised normally have no capability to directly interconnect subscriber lines terminating in that concentrator. (See Figure 1/Q.9.)

1025 **line concentrator (stand-alone concentrator)**

F: concentrateur de lignes (concentrateur autonome)

S: concentrador de líneas (concentrador autónomo)

A switching device which concentrates traffic from a number of circuits or subscribers' lines onto a smaller number of circuits to a parent local exchange, where a similar switching device deconcentrates the traffic to the original number of lines. In the case of subscribers' lines, the correspondence of the lines before concentration and after deconcentration must be maintained. The system is both-way working, i.e., traffic from the exchange is concentrated onto the same circuits and deconcentrated to the subscribers as well. (See Figure 1/Q.9.)

1030 **semi-automatic system**

F: système semi-automatique

S: sistema semiautomático

A system in which the calling subscriber's order is given to an operator who completes the call through automatic switches.

16.19

1031 **automatic system**

F: système automatique

S: sistema automático

A system in which the *switching* operations are performed by electrically controlled devices without the intervention of operators.

16.20

1105 **inlet**

F: accès d'arrivée

S: entrada (en conmutación); acceso de entrada

Point through which the incoming traffic flow enters a switching stage.

1106 **outlet**

F: accès de départ

S: salida (en conmutación); acceso de salida

Point through which the outgoing traffic flow leaves a switching stage, or device.

1110 **switching**

F: commutation

S: conmutación

(1) The establishing, on demand, of an individual connection from a desired inlet to a desired outlet within a set of inlets and outlets for as long as is required for the transfer of information.

(2) A qualification implying the action as defined above, e.g.:

switching centre	switching network
switching delay	switching node
switching device	switching point
switching equipment	switching system
switching exchange	switching unit
switching matrix	

1111 **switching node**

F: nœud de commutation

S: nodo de conmutación

An interstitial point in a telecommunication network where temporary interconnection of inlets and outlets may be undertaken as required.

1112 **switching network**

F: réseau de commutation

S: red de conmutación

The switching stages of a telecommunication exchange taken collectively.

1113 **switching matrix**

F: matrice de commutation

S: matriz de conmutación

An array of crosspoints in a space division exchange which, from a traffic point of view, operates as a switch.

1115 **selection stage**

F: étage de sélection

S: etapa de selección

An aggregate of switches enabling an inlet to access one of a plurality of outlets and designed to operate as a single unit from a traffic handling point of view.

1117 **concentration** (in a switching stage)

F: concentration

S: concentración

A configuration wherein the number of inlets into the switching stage is larger than the number of outlets.

1118 **expansion** (in a switching stage)

F: expansion

S: expansión

A configuration wherein the number of inlets into the switching stage is smaller than the number of outlets.

1120 **digital switching**

F: commutation numérique

S: conmutación digital

A process in which connections are established by operations on digital signals without converting them to analogue signals.

1121 **digital node, digital switching node**

F: point nodal numérique, point nodal de commutation numérique

S: nodo digital, nodo de conmutación digital

A point at which digital switching occurs.

1122 **digital circuit**

F: circuit numérique

S: circuito digital

A circuit which transmits information signals in digital form between two exchanges. It includes termination equipment but not switching stages.

1123 **digital link**

F: liaison numérique

S: enlace digital

A means of digital transmission between two points.

1125 **circuit switching**

F: commutation de circuits

S: conmutación de circuitos

The switching together of circuits to form a connection which is used for the duration of a call.

1126 **space division switching**

F: commutation par répartition dans l'espace (commutation spatiale)

S: conmutación por división en el espacio; conmutación espacial

The switching of inlets to outlets using space division techniques.

1127 **time division switching**

F: commutation par répartition dans le temps (commutation temporelle)

S: conmutación por división en el tiempo; conmutación temporal

The switching of inlets to outlets using time division (multiplexing) techniques.

1128 **frequency division switching**

F: commutation par répartition en fréquence

S: conmutación por división de frecuencia

The switching of inlets to outlets using frequency division (multiplexing) techniques.

1129 **channel switching**

F: commutation de voies

S: conmutación de canales

The switching together of single channels to form a connection which is used for the duration of a call.

1130 **message switching; store-and-forward switching**

F: commutation de messages; commutation avec enregistrement et retransmission

S: conmutación de mensajes; conmutación con almacenamiento y reenvío

The process of routing messages comprising, in certain nodes of the network, a receiving, storing as necessary, and forwarding of messages within a telecommunication network so as to minimize queue and idle times of traffic carrying devices.

1132 **integrated digital transmission and switching**

F: transmission et commutation numériques intégrées

S: transmisión y conmutación digitales integradas

The direct (digital) concatenation of digital transmission and digital switching, that maintains a continuous digital telecommunication path.

1134 **exchange connection**

F: connexion de commutateur

S: conexión de central

A connection that is established through an exchange, between the terminations on that exchange, of two or more circuits or channels.

1135 **digital connection**

F: connexion numérique

S: conexión digital

An association of digital circuits, digital switches and other functional units providing means for the transfer of digitally encoded information signals between two terminal points.

1136 **multislot connection**

F: connexion à intervalles de temps multiples

S: conexión multiintervalo

Time slots associated with two or more digital circuits switched in parallel through a digital exchange for use on the same call to provide a wideband service.

1137 **trombone (loop) connection**

F: connexion en boucle

S: conexión en bucle

The use for a single call of two circuits in tandem between a remote switching stage and its controlling entity.

1138 **semi-permanent connection**

F: connexion semi-permanente

S: conexión semipermanente

A connection established part-time and on a scheduled basis for the use of one user. At other times the connection may be released and available for use in handling traffic of the switched network.

1139 **transit connection**

F: connexion de transit

S: conexión de tránsito

An exchange connection for a call incoming from one interexchange circuit and outgoing on another.

1140 **originating connection**

F: connexion de départ

S: conexión de origen

An exchange connection for a call originating on a subscriber line or access channel outgoing to an interexchange circuit.

1141 **terminating connection**

F: connexion d'arrivée

S: conexión de destino; conexión de terminación

An exchange connection for a call incoming from an interexchange circuit and terminating on a subscriber line or channel.

1142 **internal connection**

F: connexion interne

S: conexión interna

An exchange connection for a call between subscriber lines or channels on the same exchange.

1143 **through connection**

F: transfert

S: transconexión

The processes performed by control and switching equipment in order to establish an exchange connection.

1144 **asymmetrical through connection**

F: transfert asymétrique

S: transconexión asimétrica

The through connection of only one direction of transmission on a potential both-ways through connection.

1145 **symmetrical through connection**

F: transfert symétrique

S: transconexión simétrica

The through connection of both directions of transmission simultaneously.

1147 **input connection**

F: connexion d'entrée

S: conexión de entrada

An unidirectional path from an interface of a digital exchange to an exchange test point.

1148 **output connection**

F: connexion de sortie

S: conexión de salida

An unidirectional path from an exchange test point to an interface of a digital exchange.

1149 **half connection**

F: demi-connexion

S: semiconexión

A bi-directional path comprised of an input connection and an output connection, both having the same exchange interface.

Note 1 – These terms may be qualified by the words analogue or digital, the qualification signifying the property of the exchange interface.

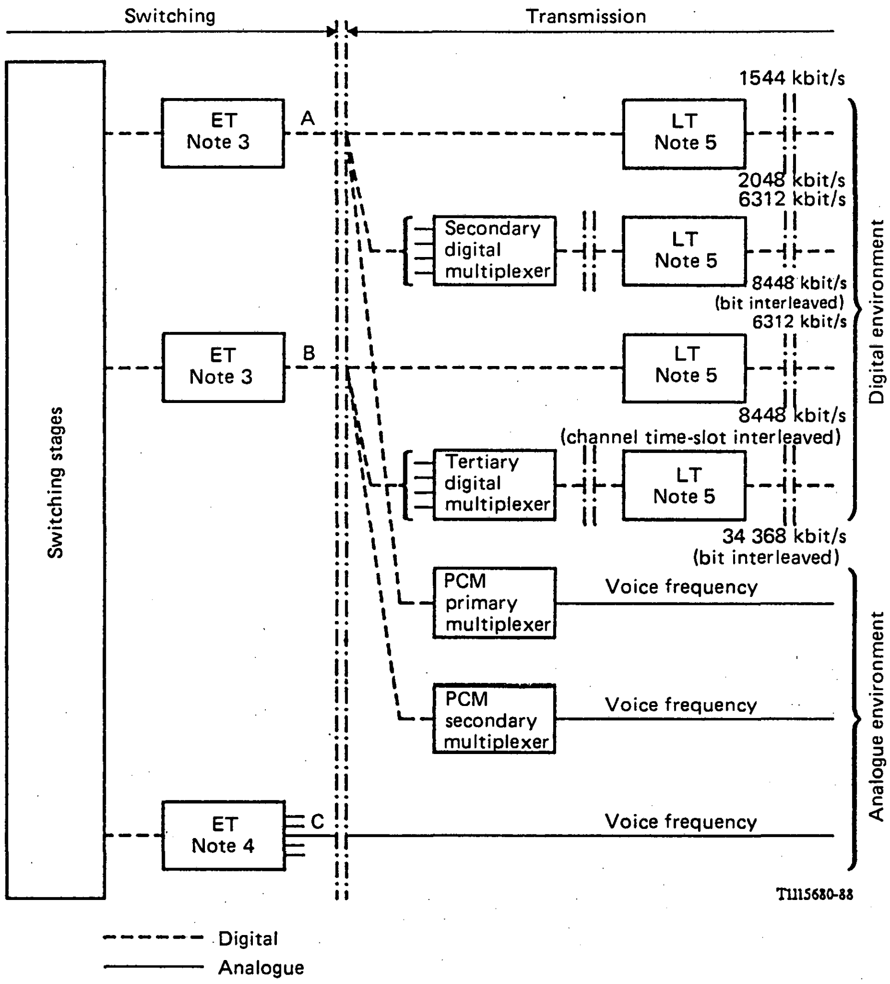
Note 2 – An analogue input (output) (half) connection may be further qualified by the words 2-wire or 4-wire.

1160 **exchange termination (ET)**

F: terminaison de commutateur (TC)

S: terminación de central (TC)

The unit or function on the exchange side of the switching/transmission interface. See Figure 2/Q.9.



Note 1 — The G and Q Series CCITT Recommendations applicable to each interface are detailed in the text.

Note 2 — Other configurations, such as series connection of secondary, tertiary or higher order muldex, may be used.

Note 3 — Examples of functions of Exchange Termination (ET) – interfaces A & B:
- Signalling insertion and extraction
- Code conversion
- Frame alignment
- Alarms and fault indication.

Note 4 — Examples of functions of Exchange Termination (ET) – interface C:
- A/D conversion
- Signalling insertion and extraction
- Multiplexing
- 2-wire/4-wire conversion.

Note 5 — Examples of functions of Line Termination (LT):
- Power feed
- Fault location
- Regeneration
- Code conversion.

Note 6 — Not all interfaces will necessarily exist in every implementation.

FIGURE 2/Q.9

Interfaces towards other exchanges (Q.511)

1161 **line termination (LT)**

F: terminaison de ligne (TL)

S: terminación de línea (TL)

Group or functional block containing at least the transmit and receive functions terminating one end of a digital transmission system. See Figure 2/Q.9.

1163 **interface units**

F: unités d'interface

S: unidades de interfaz

Units of an exchange on which lines and/or interexchange circuits are terminated, and which are involved in the processing of traffic to/from those lines and/or circuits.

1165 **mediation device**

F: dispositif de médiation

S: dispositivo de mediación

A unit or function that is situated between a Network Element and an Operations System in the Telecommunications Management Network that translates the information flow between the two entities as required, provides multiplexing, etc.

1166 **muldex**

F: muldex

S: múldex

A contraction of multiplexer-demultiplexer. The term may be used when the multiplexer and demultiplexer are associated in the same equipment.

Note – When used to describe an equipment, the function of the equipment should qualify the title, e.g., PCM muldex, data muldex, digital muldex.

1167 **primary muldex**

F: muldex primaire

S: múldex primario

A digital multiplexer-demultiplexer that converts signals between 64 kbit/s and 1544 or 2048 kbit/s bit streams. See Figure 2/Q.9.

1168 **tertiary digital muldex**

F: muldex numérique tertiaire

S: múldex digital terciario

A digital multiplexer-demultiplexer that converts signals between 64 kbit/s and 34 368 kbit/s bit streams. See Figure 2/Q.9.

1169 **static multiplex**

F: multiplex statique

S: múltiplex estático

Digital bit streams between reference points into which lower bit rate channels have been combined, each into an assigned channel or slot.

1170 **two-wire switching**

F: commutation à deux fils

S: conmutación a dos hilos

Switching using the same path, frequency band or time interval for both directions of transmission.

1171 **four-wire switching**

F: commutation à quatre fils

S: conmutación a cuatro hilos

Switching using a separate path, frequency band or time interval for each direction of transmission.

1176 **reentrant trunking**

F: jonction réentrante

S: enlace reentrante

The routing of a circuit from outlet to inlet in a switching stage in order to access equipment associated with special services such as operators, auxiliary equipment, etc.

Note – Not to be confused with the action of mutual help where the purpose of re-entering the call is to attempt to reduce the probability of switching congestion on a given call by allowing a new possibility of choice of path from the new inlet to a trunk in the desired route.

1178 **multiple**

F: multiplage

S: múltiple

Interconnection of several inlets or outlets in a switching stage to the same traffic carrying device (e.g., other switching stage or circuit).

1205 **crossbar system**

F: système automatique "crossbar"

S: sistema de barras cruzadas

An automatic switching system in which the selecting mechanisms are *crossbar switches.*

16.26

1206 **junctor** (in the crossbar system)

F: joncteur

S: conector

In crossbar systems, a junctor is a circuit extending between frames of a switching unit and terminating in a switching device on each frame.

15.68

1207 **link** (in the crossbar system)

F: maillon

S: enlace

A link is a circuit extending between the primary and secondary selectors of a selection stage.

15.69

1210 **register**

F: enregistreur

S: registrador

The apparatus, in an automatic system, which receives the dialled impulses and controls the subsequent switching operations.

15.56

1212 **translation**

F: traduction

S: traducción

In automatic telephony: the retransmission of received trains of impulses after changing the number of impulses in each train and/or changing the number of trains.

15.58

1213 **translator**

F: traducteur

S: traductor

In automatic telephony: a device used for the *translation* of trains of impulses.

15.57

1305 **(time division) highway** (in switching); **bus** (USA)

F: canal (à multiplexage dans le temps)

S: arteria; canal principal (por división en el tiempo) (en conmutación)

A common path within an apparatus or station over which signals from a plurality of channels pass, separated by time division.

1310 **character signal**

F: signal de caractère

S: señal de carácter

A set of signal elements representing a character, or in PCM representing the quantized value of a sample.

Note – In PCM, the term "PCM word" may be used in this sense.

1314 **quiet code**

F: code silencieux

S: código de calma

A digital signal used for transmission test purposes.

1315 **cross-exchange check (cross-office)**

F: vérification du trajet dans le central

S: verificación a través de la central

A check made across the exchange to verify that a speech path exists.

1319 **in-call rearrangement**

F: remaniement des liaisons pendant la communication

S: reestructuración en comunicación

Reassignment of the switched path during the call.

1330 **channel gate**

F: porte de voie

S: puerta de canal

A device for connecting a channel to a highway, or a highway to a channel, at specified times.

1331 **primary block; digroup** (USA)

F: bloc primaire

S: bloque primario

A basic group of PCM channels assembled by time division multiplexing.

Note – The following conventions could be useful:

Primary block μ – a basic group of PCM channels derived from 1544 kbit/s PCM multiplex equipment.

Primary block A – a basic group of PCM channels derived from 2048 kbit/s PCM multiplex equipment.

1332 **frame**

F: trame

S: trama

A set of consecutive digit time slots in which the position of each digit time slot can be identified by reference to a frame alignment signal.

The frame alignment signal does not necessarily occur, in whole or in part, in each frame.

1333 **multiframe**

F: multitrame

S: multitrama

A set of consecutive frames in which the position of each frame can be identified by reference to a multiframe alignment signal.

The multiframe alignment signal does not necessarily occur, in whole or in part, in each multiframe.

1334 **subframe**

F: secteur de trame – sous-trame

S: subtrama

A sequence of noncontiguous sets of digits assembled within a frame, each set occurring at n times the frame repetition rate where n is an integer > 1.

1335 **parallel to serial converter; serializer** (USA) [dynamicizer]

F: convertisseur parallèle/série

S: convertidor paralelo/serie

A device that converts a group of digits, all of which are presented simultaneously, into a corresponding sequence of signal elements.

1336 **serial to parallel converter; deserializer** (USA) [staticizer]

F: convertisseur série/parallèle

S: convertidor serie/paralelo

A device which converts a sequence of signal elements into a corresponding group of digits, all of which are presented simultaneously.

1337 **μ/A law converter**

F: convertiseur loi μ/loi A

S: convertidor de ley μ/A

A unit or a function that changes digital signals encoded using either μ or A-law encoding into the corresponding signal for the other.

1405 **frame alignment**

F: verrouillage de trame

S: alineación de trama

The state in which the frame of the receiving equipment is correctly phased with respect to that of the received signal.

1406 **frame alignment signal**

F: signal de verrouillage de trame

S: señal de alineación de trama

The distinctive signal used to secure frame alignment; this signal does not necessarily occur, in whole or in part, in each frame.

1407 **bunched frame alignment signal**

F: signal de verrouillage de trame concentré

S: señal de alineación de trama concentrada

A frame alignment signal in which the signal elements occupy consecutive digit time slots.

1408 **distributed frame alignment signal**

F: signal de verrouillage de trame réparti

S: señal de alineación de trama distribuida

A frame alignment signal in which the signal elements occupy non-consecutive digit time slots.

1409 **frame alignment recovery time**

F: temps de reprise du verrouillage de trame

S: tiempo de recuperación de la alineación de trama

The time that elapses between a valid frame alignment signal being available at the receive terminal equipment and frame alignment being established.

Note – The frame alignment recovery time includes the time required for replicated verification of the validity of the frame alignment signal.

1410 **out-of-frame alignment time**

F: durée de perte du verrouillage de trame

S: duración de la pérdida de alineación de trama

The time during which frame alignment is effectively lost. That time will include the time to detect loss of frame alignment and the alignment recovery time.

1414 **time slot**

F: intervalle de temps

S: intervalo de tiempo

Any cyclic time interval that can be recognized and defined uniquely.

1415 **channel time slot**

F: intervalle de temps de voie

S: intervalo de tiempo de canal

A time slot starting at a particular phase in a frame and allocated to a channel for transmitting a character signal and possibly in-slot signalling or other information.

Note – Where appropriate a description may be added, for example “telephone channel time slot”.

1416 **signalling time slot**

F: intervalle de temps de signalisation

S: intervalo de tiempo de señalización

A time slot starting at a particular phase in each frame and allocated to the transmission of signalling.

1417 **frame alignment time slot**

F: intervalle de temps de verrouillage de trame

S: intervalo de tiempo de alineación de trama

A time slot starting at a particular phase in each frame and allocated to the transmission of a frame alignment signal.

1418 **digit time slot**

F: intervalle de temps pour élément numérique

S: intervalo de tiempo de dígito

A time slot allocated to a single digit.

1419 **bit integrity**

F: integrité des bits

S: integridad de los bits; integridad de la secuencia de bits

Exists when the values of the bits in each octet of a digital bit stream at the output of a device or system are unchanged from those at the input.

Note – Digital processing devices such as A/μ law converters, echo suppressors and digital pads must be disabled to provide bit integrity.

1420 **octet sequence integrity**

F: integrité de la suite des octets

S: integridad de la secuencia de octetos

The property of a digital transmission channel, telecommunication circuit or connection that permits a digital signal to be conveyed over it without change to the order of any octets.

1421 **time slot sequence integrity**

F: intégrité de la séquence des intervalles de temps

S: integridad de la secuencia de intervalos de tiempo

The assurance that the digital information contained in the *n* time slots of a multislot connection arrives at the output (or terminal) in the same sequence as it was introduced.

1422 **time slot interchange**

F: échange entre intervalles de temps

S: intercambio de intervalos de tiempo

The transfer of information from one time slot to another between incoming and outgoing time division highways.

1425 **retiming**

F: réajustement du rythme

S: reajuste de la temporización

Adjustment of the intervals between corresponding significant instants of a digital signal, by reference to a timing signal.

1426 **timing recovery (timing extraction)**

F: récupération du rythme

S: recuperación de la temporización (extracción de la temporización)

The derivation of a timing signal from a received signal.

1428 **bit timing**

F: rythme des bits

S: temporización de los bits

Timing information sent from the Exchange Termination used by the Line Termination to recover information from the digital bit stream.

1430 **synchronous**

F: synchrone

S: síncrono

Signals[1)] are synchronous if their corresponding significant instants have a desired phase relationship with each other.

1431 **synchronization**

F: synchronisation

S: sincronización

The process of adjusting the corresponding significant instants of signals[1)] to make them synchronous.

1434 **plesiochronous**

F: plésiochrone

S: plesiócrono

Signals[1)] are plesiochronous if their corresponding significant instants occur at nominally the same rate, any variation in rate being constrained within specified limits.

Note 1 – Two signals having the same nominal digit rate, but not stemming from the same clock[2)] or homochronous clocks, are usually plesiochronous.

Note 2 – There is no limit to the phase relationship between corresponding significant instants.

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1) In the definitions, "signal" is taken with the general meaning of Definition 02.27. For information, Definition 02.27 is reproduced below:

02.27 **signal** (general sense)

Aggregate of waves propagated along a transmission channel and intended to act on a receiving unit.

2) In these definitions "clock" is taken with the general meaning of Definition 51.10 and it is assumed that where replicated sources are used for security reasons, the assembly of these is regarded as being a single clock.
For information, Definition 51.10 is reproduced below:

51.10 **clock**

Equipment providing a time base used in a transmission system to control the timing of certain functions such as the control of the duration of signal elements, the sampling, etc.

1446 **synchronized network** [synchronous network]

F: réseau synchronisé [réseau synchrone]

S: red sincronizada [red síncrona]

A network in which the corresponding significant instants of nominated signals are adjusted to make them synchronous.

Note – Ideally the signals are synchronous, but they may be mesochronous in practice. By common usage such mesochronous networks are frequently described as synchronized.

1447 **nonsynchronized network**

F: réseau non synchronisé

S: red no sincronizada

A network in which the corresponding significant instants of signals need not be synchronized or mesochronous.

1450 **hierarchic (mutually synchronized) network**

F: réseau hiérarchisé (à synchronisation mutuelle)

S: red jerárquica (mutuamente sincronizada)

A mutually synchronized system in which some clocks[3] exert more control than others, the network operating frequency being a weighted mean of the natural frequencies of the population of clocks.

1505 **transmission delay** (through a digital exchange)

F: temps de transmission (dans un central numérique)

S: tiempo de transmisión (a través de una central digital)

The sum of the times necessary for an octet to pass in both directions on a connection through a digital exchange due to buffering, frame alignment and time-slot interchange functions for digital-to-digital connections and in addition, for analogue-to-analogue connections, to the A/D conversions.

1506 **switching delay (processing (handling) time)**

F: temps de commutation (temps de traitement)

S: tiempo de conmutación (tiempo de proceso (tratamiento))

The interval of time attributable to the functions performed in a switching exchange in the process of setting up a call.

1507 **incoming response delay**

F: temps de réponse à la prise d'un circuit d'arrivée

S: duración de la preselección

A characteristic that is applicable where channel associated signalling is used. It is defined as the interval from the instant an incoming circuit seizure signal is recognizable until a proceed-to-send signal is sent backwards by the exchange.

---

[3] In these definitions "clock" is taken with the general meaning of Definition 51.10 and it is assumed that where replicated sources are used for security reasons, the assembly of these is regarded as being a single clock.
For information, Definition 51.10 is reproduced below:

51.10 **clock**

Equipment providing a time base used in a transmission system to control the timing of certain functions such as the control of the duration of signal elements, the sampling, etc.

1508 **exchange call set-up delay**

F: temps d'établissement de la communication dans le central

S: tiempo de establecimiento de la comunicación por una central

The interval from the instant when the digits required for setting up a call are available in the exchange or the address information is received at the incoming signalling data transmission control of the exchange to the instant when the seizing signal is sent to the subsequent exchange or the corresponding address information is sent from the outgoing signalling data transmission control.

1510 **through-connection delay**

F: temps de transfert

S: demora de transconexión; tiempo de transferencia de la central

The interval from the instant at which the information required for setting up a through-connection in an exchange is available for processing in the exchange to the instant that the switching network through-connection is established and available for carrying traffic between the incoming and outgoing 64-kbit/s circuits.

1512 **exchange call-release delay**

F: temps de libération de la communication par le central

S: tiempo de liberación de la comunicación (llamada) por una central

Exchange call release delay is the interval from the instant at which the last information required for releasing a call in an exchange is available for processing in the exchange to the instant that the switching network through-connection is no longer available between the incoming and outgoing 64-kbit/s circuits and the disconnection signal is sent to the subsequent exchange. This interval does not include the time taken to detect the release signal, which might become significant during certain failure conditions, e.g. transmission system failures.

1514 **post-dialling delay**

F: délai d'attente après numérotation

S: periodo de espera después de marcar

Time interval between the end of dialling by the subscriber and the reception by him of the appropriate tone or recorded announcement, or the abandon of the call without tone.

1517 **engineered exchange capacity**

F: capacité dimensionnée de commutateur

S: capacidad de la central establecida en el diseño

The maximum traffic load that an exchange can handle while meeting specified performance requirements, and performing all normal operational and administrative functions, without entering into an overload condition.

1520 **overload**

F: surcharge

S: sobrecarga

That part of the total load offered to an exchange in excess of the engineered exchange capacity.

1551 **basic access (ISDN basic access)**

F: accès de base (accès de base RNIS)

S: acceso básico (acceso básico RDSI)

A user-network access arrangement that corresponds to the interface structure composed of two B-channels and one D-channel. The bit rate of the D-channel for this type of access is 16 kbit/s.

1552 **primary rate access**

F: accès au débit primaire

S: acceso a velocidad primaria

A user-network access arrangement that corresponds to the primary rates of 1544 kbit/s and 2048 kbit/s. The bit rate of the D-channel for this type of access is 64 kbit/s.

1560 **reference point**

F: point de référence

S: punto de referencia

A conceptual point at the conjunction of two non-overlapping functional groups.

Note – Each reference point is assigned a prefix letter, for example: T reference point.

1561 **V-interface**

F: interface V

S: interfaz V

A digtal exchange interface for subscriber access which coincides with the V reference point.

Note 1 – A specific V interface is denoted by a suffix number.

Note 2 – The V interfaces are internal network interfaces.

2 Signalling functions and techniques

2.0 *Basic signalling terms and techniques*

2001 **signalling**

F: signalisation

S: señalización

a) The exchange of information (other than by speech) specifically concerned with the establishment, release and other control of calls, and network management, in automatic telecommunications operation.

b) A qualification implying an action as defined above, e.g.:

signalling channel	signalling procedure
signalling equipment	signalling relation
signalling information	signalling route
signalling link	signalling system
signalling message	signalling time slot

2004 **speech digit signalling**

F: signalisation par éléments numériques vocaux

S: señalización por dígitos de conversación

A type of channel-associated signalling in which digit time slots primarily used for the transmission of encoded speech are periodically used for signalling.

2005 **in-slot signalling**

F: signalisation dans l'intervalle de temps

S: señalización dentro del intervalo

Signalling associated with a channel and transmitted in a digit time slot permanently (or periodically) allocated in the channel time slot.

2006 **out-slot signalling**

F: signalisation hors intervalle de temps

S: señalización fuera del intervalo

Signalling associated with a channel but transmitted in one or more separate digit time slots not within the channel time slot.

2008 **common channel signalling**

F: signalisation sur voie commune (signalisation par canal sémaphore)

S: señalización por canal común

A signalling technique in which signalling information relating to a multiplicity of circuits, and other information such as that used for network management, is conveyed over a single channel by addressed messages.

2009 **channel associated signalling**

F: signalisation voie par voie

S: señalización asociada al canal

A signalling method in which the signals necessary for the traffic carried by a single channel are transmitted in the channel itself or in a signalling channel permanently dedicated to it.

2010 **in-band signalling**

F: signalisation dans la bande

S: señalización dentro de banda

A signalling method in which signals are sent over the same transmission channel or circuit as the user's communication and in the same frequency band as that provided for the users.

2011 **out-band signalling**

F: signalisation hors bande

S: señalización fuera de banda

A signalling method in which signals are sent over the same transmission channel or circuit as the user's communication but in a different frequency band from that provided for the users.

2012 **line signalling**

F: signalisation de ligne

S: señalización de línea

A signalling method in which signals are transmitted between equipments which terminate and continuously monitor part or all of the traffic circuit.

2013 **register signalling** (Signalling System R1)

F: signalisation entre enregistreurs

S: señalización entre registradores

Link-by-link multifrequency (MF) in-band pulse signalling is used for the transmission of address information. The signalling frequencies are 700 Hz to 1700 Hz, in 200 Hz steps, and combinations of two, and two only, determine the signal. The address information is preceded by a KP signal (start-of-pulsing) and terminated by an ST signal (end-of-pulsing). Either en bloc, or en bloc overlap, or overlap sending may apply. This register signalling arrangement is used extensively with other in-band and out-band line signalling systems.

2014 **link-by-link signalling**

F: signalisation section par section

S: señalización enlace por enlace

A signalling method in which signals are transmitted one link at a time in a multi-link connection and requiring processing at each intermediate switching point for subsequent transmission.

2015 **link-by-link signalling**

F: signalisation section par section

S: señalización enlace por enlace

A procedure for the exchange of signalling information directly between two signalling points that are either directly connected or via signalling transfer points.

2017 **end-to-end signalling** (general sense)

F: signalisation de bout en bout (sens général)

S: señalización de extremo a extremo (sentido general)

A signalling method in which signals are transmitted from one end of a multi-link connection to the other end where processing of these signals is required.

2018 **end-to-end signalling**

F: signalisation de bout en bout

S: señalización de extremo a extremo

The capability to transfer signalling information of end point significance directly between signalling end points in order to provide a requesting user with a basic or supplementary service.

2019 **end-to-end signalling**

F: signalisation de bout en bout

S: señalización de extremo a extremo

A procedure for the exchange of signalling information directly between signalling entities in an originating exchange and a destination exchange for purposes of supporting certain user services.

2020 **pass along method**

F: méthode du "faire passer"

S: método de paso de largo

A method for transporting signalling messages, whereby the signalling information is sent along the signalling path of a previously established physical connection.

2021 **signalling system**

F: système de signalisation

S: sistema de señalización

The procedures for the interpretation and use of a repertoire of signals together with the hardware and/or software needed for the generation, transmission, and reception of these signals.

2022 **en-bloc signalling**

F: signalisation "en bloc"

S: señalización en bloque

A signalling method in which the address digits are assembled into one block for onward transmission, the block containing all of the address information necessary to route the call to its destination.

2023 **compelled signalling** (general sense)

F: signalisation asservie (sens général)

S: señalización de secuencia obligada (sentido general)

A signalling method in which, after one signal (or message) has been sent, the sending of any further signals (or messages) in the same direction is inhibited until the signal sent has been acknowledged in the opposite direction by the receiving terminal and the acknowledgement has been received.

2024 **compelled signalling (fully compelled; continuous compelled)**

F: signalisation asservie (entièrement asservie; continuellement asservie)

S: señalización de secuencia obligada (totalmente obligada; continuamente obligada)

A signalling method in which the signal to be transmitted as applied continuously until acknowledged or until a timeout occurs. Upon recognition of the initial signal, the acknowledgement signal is applied continuously until the cessation of the initial signal or until a timeout occurs. The cessation of the aknowledgement signal may provoke the beginning of the next subsequent compelled cycle. In addition to the acknowledgement, the acknowledgement signal may carry other signalling information (e.g. concerning the next cycle).

2025 **overlap address signalling**

F: signalisation d'adresse à recouvrement

S: señalización de dirección con superposición

A signalling method in which the onward transmission of address signals from a switching centre may commence before the reception of all the address signals over the preceding link has been completed.

2026 **overlap line signalling**

F: signalisation de ligne à recouvrement

S: señalización de línea con superposición

A signalling method in which the onward transmission of a line signal from a switching centre may commence before the recognition time of the line signal being received expires.

2030 **direct current signalling (d.c. signalling)**

F: signalisation en courant continu

S: señalización en corriente continua (señalización en c.c.)

A signalling method in which the signalling information may be represented by controlling the direct current magnitude, polarity, and duration or a combination thereof.

2031 **loop/disconnect signalling**

F: signalisation par ouverture de boucle

S: señalización por interrupción del bucle

A direct current signalling method in which the signals are represented by the breaking of a loop circuit.

2032 **alternating current signalling (a.c. signalling)**

F: signalisation en courant alternatif

S: señalización en corriente alterna (señalización en c.a.)

A signalling method in which the signalling information is represented by means of pulsed alternating current having a frequency below the telephone speech band.

2033 **voice-frequency signalling (VF signalling)**

F: signalisation à fréquences vocales

S: señalización en frecuencia vocal (señalización FV)

A signalling method in which the signalling information is based on the use of currents which have frequencies within the telephone speech band.

2034 **multi-frequency code signalling (MFC signalling)**

F: signalisation multifréquences (signalisation MF)

S: señalización en código multifrecuencia (señalización CMF)

A voice-frequency signalling method in which the signalling information is represented by compound signals, each consisting of *n* frequencies from a set of *m* frequencies.

2038 **dual seizure**

F: prise simultanée

S: doble toma; toma simultánea

The condition which occurs when in bothway operation two exchanges attempt to seize the same circuit at approximately the same time.

2039 **interruption control**

F: contrôle d'interruption

S: protección contra las interrupciones

A system which monitors a pilot for interruptions on FDM systems and which transmits an indication to the swiching equipment.

2040 **signal spillover** (in VF signalling)

F: partie débordante d'un signal (dans un système de signalisation à fréquences vocales)

S: rebasamiento de señal (en señalización FV)

That part of a VF signal which passes in band from one link to the other in a multi-link connection before the connection between the links has been split at the incoming end.

2041 **signal imitation** (in VF signalling)

F: imitation de signaux (dans un système de signalisation à fréquences vocales)

S: imitación de señal (en señalización FV)

An unwanted signal produced within the signalling band by speech or other currents which are not genuine signals causing the response of a signal receiver.

2042 **guarding** (in VF signalling)

F: protection (dans un système de signalisation à fréquences vocales)

S: guarda (en señalización FV)

Rendering ineffective the signal imitation by recognizing the simultaneous presence of frequencies outside the signalling band.

2043 **splitting** (in VF signalling)

F: coupure (dans un système de signalisation à fréquences vocales)

S: desprendimiento (en señalización FV)

A switching function which provides disconnection or isolation of that part of a channel which:

– preceeds the point where the signalling frequency(ies) is(are) injected;

– succeeds the point where the signal receiver is connected.

Splitting when receiving a signal prevents false operation of signalling equipment by signal reflections and signal spill-over.

Splitting when sending a signal prevents interference from a preceding circuit or near-end equipment.

2050 **signalling information**

F: information de signalisation

S: información de señalización

The information content of a signal or a signalling message.

2051 **address**

F: adresse

S: dirección

A name which indicates the source or destination of an intended instance of communication.

2052 **band number**

F: numéro de bande

S: número de banda

A subdivision of the address label, containing the most significant bits, used for routing the signal message and possibly for identifying the circuit group containing the traffic circuit concerned.

2053 **address signal**

F: signal d'adresse

S: señal de dirección

A signal containing one element of the part of the selection signals which indicate the destination of a call initiated by a customer, network facility, etc.

2054 **address signal complete**

F: signal d'adresse complet

S: señal de dirección completa

A signal sent in the backward direction indicating that signals required for routing the call to the called party have been received and that no called party's line condition signals will be sent.

2055 **address-incomplete signal**

F: signal d'adresse incomplet

S: señal de dirección incompleta

A signal sent in the backward direction indicating that the number of address signals received is not sufficient for setting up the call.

2056 **end-of-pulsing (ST) signal**

F: signal de fin de numérotation

S: señal de fin de numeración (SFN)

An address signal sent in the forward direction indicating that there are no more address signals to follow.

2057 **call-failure signal**

F: signal d'échec de l'appel

S: señal de llamada infructuosa

A signal sent in the backward direction indicating the failure of a call set-up attempt due to the lapse of a time-out or a fault not covered by specific signals.

2058 **ringing tone; ringback tone** (USA)

F: tonalité de retour d'appel

S: tono de llamada

A tone which indicates that the ringing function is being applied at the called end.

2059 **release-guard signal**

F: signal de libération de garde

S: señal de liberación de guarda

A signal sent in the backward direction in response to the clear-forward signal when the circuit concerned is brought into the idle condition.

2060 **clear-forward signal**

F: signal de fin

S: señal de fin (desconexión)

A signal sent in the forward direction to terminate the call or call attempt and release the circuit concerned. This signal is normally sent when the calling party clears.

2061 **clear-back signal**

F: signal de raccrochage

S: señal de colgar

A signal sent in the backward direction indicating that the called party has cleared.

2062 **confusion signal**

F: signal de confusion

S: señal de confusión

A signal sent in the backward direction indicating that an exchange is unable to act upon a message received from the preceding exchange because the message is considered unreasonable.

2070 **message**

F: message

S: mensaje

An assembly of information within a protocol transferred as an entity in a telecommunication process.

Note – Specific qualifiers may be used to indicate a particular application, e.g., alarm, message.

2071 **signalling message**

F: message (de signalisation)

S: mensaje de señalización

An assembly of signalling information pertaining to a call, management transaction, etc., comprising also elements for delimitation, sequencing and error control, that is transferred as an entity.

2074 **optional part**

F: partie facultative

S: parte facultativa; parte opcional

Part of a message that contains parameters that may not occur in any particular message type.

Note – Other qualifiers may be used in specific applications, for example, mandatory part.

2080 **initial address message (IAM)**

F: message initial d'adresse (MIA)

S: mensaje inicial de dirección (MID)

A type of message sent in the forward direction at call set-up. It contains address information and other information relating to the routing and handling of the call.

initial address message with additional information (IAI)

F: message initial d'adresse avec informations supplémentaires (IAI)

S: mensaje inicial de dirección con información adicional (MII)

A type of message sent first in the forward direction at call set-up. It contains address, routing and handling information, such as charging and supplementary services information to be used in the call set-up procedures.

2081 **subsequent address message (SAM)**

F: message subséquent d'adresse (MSA)

S: mensaje subsiguiente de dirección (MSD)

A type of message sent in the forward direction subsequent to the initial address message and containing further address information.

2082 **subsequent address message with one signal**

F: message subséquent d'adresse à un seul signal

S: mensaje subsiguiente de dirección con una señal

A type of message sent in the forward direction subsequent to the initial address message or to the subsequent address message and containing only one address signal.

2083 **NSAP address (OSI-)**

F: adresse NSAP (OSI)

S: dirección PASR (de la ISA)

A global address as defined for OSI which is understandable over any network and can be used to address between networks.

2084 **address complete (network)**

F: adresse complète (réseau)

S: dirección completa (red)

A message sent in the backward direction indicating that all the address (number) signals required by the network for routing the call to the called party have been received.

2085 **address complete (alerting)**

F: adresse complète (alerte)

S: dirección completa (aviso)

A message sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received and that the called party is being alerted.

2086 **connect message**

F: message de connexion

S: mensaje de conexión

A message sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received, and that the called party has answered.

2087 **continuity check message**

F: message de contrôle de continuité

S: mensaje de prueba de continuidad

A type of message containing a continuity signal or a continuity-failure signal.

2088 **end-of-selection signal**

F: signal de fin de sélection

S: señal de fin de selección

A signal sent in the backward direction indicating the successful completion or unsuccessful termination of the call set-up process, and which may contain information or the called party's line condition.

Note – The functions of this signal in Signalling System No. 7 are provided by the Address Complete message, and the Unsuccessful Call Set-up message.

2089 **delayed release message (DRS)**

F: message de libération retardée (MLR)

S: mensaje de liberación diferida (LID)

A message sent in either direction, generated by the network, in response to a request to release a call, if the network is applying a hold condition to the connection.

2090 **message sequencing**

F: mise en séquence des messages

S: secuenciación de mensajes

The procedures for ensuring that received messages are processed in the correct order.

2091 **unreasonable message**

F: message inattendu

S: mensaje irrazonable (o irracional)

A message with an inappropriate signal content, an incorrect signal direction, or an inappropriate place in the message sequence.

2092 **reasonableness check**

F: contrôle de vraisemblance

S: prueba de racionabilidad (o de racionalidad)

A procedure for verfifying whether the signalling information of a received signal message is reasonable in relation to the sequence of previously received signal messages for that circuit.

2093 **call spill-over**

F: empiétement de communications

S: rebasamiento de llamada

Receipt of an abnormally delayed signalling message from a previous call at a switching centre whilst a new call is being set up on that circuit.

2094 **transaction** (in signalling applications)

F: transaction (dans les applications de signalisation)

S: transacción (en aplicaciones de señalización)

An interchange of enquiry and response messages between signalling points that transfers information.

2095 **enquiry** (in a transaction)

F: demande (dans une transaction)

S: averiguación; indagación (en una transacción)

A signal or signals (possibly sent as a sequence of messages) requesting specific information.

2096 **response** (in a transaction)

F: réponse (dans une transaction)

S: respuesta (en una transacción)

A signal or signals (possibly sent as a sequence of messages) containing information requested by an enquiry.

2.1 *Structure and generic applications*

2101 **message transfer part**

F: sous-système Transport de Messages

S: parte (de) transferencia de mensajes

The functional part of a common channel signalling system which transfers signal messages as required by all the users, and which performs the necessary subsidiary functions, for example error control and signalling security.

2102 **user part**

F: sous-système Utilisateur

S: parte (de) usuario

A functional part of the common channel signalling system which transfers signalling messages via the message transfer part. Different types of user parts exist (e.g. for telephone and data services), each of which is specific to a particular use of the signalling system.

2103 **signalling network**

F: réseau de signalisation

S: red de señalización

A network used for signalling and consisting of signalling points and connecting signalling links.

2104 **signalling network**

F: réseau sémaphore

S: red de señalización

A network used for transfer of signalling messages and consisting of signalling points and connecting common channel signalling links.

2106 **signalling point**

F: point sémaphore

S: punto de señalización

A node in a signalling network which either originates and receives signal messages, or transfers signal messages from one signalling link to another, or both.

Note – Signalling point may be qualified by a prefix, such as International, to denote a specific application.

2107 **(signalling) originating point**

F: point sémaphore d'origine

S: punto de origen (de la señalización)

A signalling point in which a message is generated.

2109 **(signalling) destination point**

F: point sémaphore de destination

S: punto de destino (de la señalización)

A signalling point to which a message is destined.

2110 **adjacent signalling points**

F: points sémaphores adjacents

S: puntos de señalización adyacentes

Two signalling points that are directly interconnected by one or more signalling links.

2111 **connection end-point**

F: point terminal de connexion

S: punto extremo de conexión

A signalling point which may be either originating or destination.

2112 **signalling point numbering plan**

F: plan de numérotage des points sémaphores

S: plan de numeración de puntos de señalización

A formal description of the method of translating end-user provided address information into an address understandable by the signalling network.

2113 **signalling point restart**

F: redémarrage d'un point sémaphore

S: rearranque de punto de señalización

A procedure that allows a graceful increase of traffic to a restarting node.

2114 **signalling point code**

F: code d'un point sémaphore

S: código de punto de señalización

A binary code uniquely identifying a signalling point in a signalling network. This code is used, according to its position in the label, either as destination point code or as originating point code.

2116 **signalling link**

F: canal sémaphore (liaison de signalisation)

S: enlace de señalización

A transmission means which consists of a signalling data link and its transfer control functions, used for reliable transfer of signalling messages.

2117 **unavailable signalling link**

F: canal sémaphore indisponible

S: enlace de señalización indisponible

A signalling link which has been deactivated and cannot therefore carry signalling traffic.

2118 **data channel**

F: voie de données

S: canal de datos

A unidirectional transmission path for data, with transmission terminal equipment at both ends.

2119 **signalling link group**

F: faisceau de canaux sémaphores (faisceau de liaisons de signalisation)

S: haz de enlaces de señalización

A set of signalling link(s) directly connecting two signalling points, and having the same physical characteristics (e.g., bit rate, propagation delay, etc.).

2120 **regular signalling link**

F: canal sémaphore normal (liaison de signalisation régulière)

S: enlace de señalización regular

The signalling link which normally carries some particular parcel of signalling traffic.

2121 **reserve signalling link**

F: canal sémaphore de secours (liaison de signalisation de réserve)

S: enlace de señalización de reserva

The signalling link which can be used to carry all, or part of, the signalling traffic of a regular signalling link when the latter has failed or has been withdrawn from service.

2122 **signalling channel** (Signalling System No. 6)

F: voie de signalisation

S: canal de señalización

A data channel in combination with the associated signalling terminal equipment at each end.

2123 **signalling data link**

F: liaison sémaphore de données (liaison de données de signalisation)

S: enlace de datos de señalización

A combination of two data channels operating together in a single signalling system. The data channels operate in opposite directions and at the same data rate.

2124 **analogue signalling data link**

F: liaison sémaphore de données analogique

S: enlace de datos de señalización analógico

A data link that provides an interface to signalling terminals and is made up of voice-frequency analogue transmission channels and modems.

2125 **hypothetical signalling reference connection**

F: communication fictive de référence pour la signalisation

S: conexión ficticia de referencia de señalización

A hypothetical reference model of a connection in a signalling network.

2126 **transmission buffer**

F: tampon d'émission

S: memoria tampón de transmisión

Storage in the signalling link control for message signal units not yet transmitted.

2127 **data link**

F: liaison de données

S: enlace de datos

This is an ensemble of terminal installations and the interconnecting network operating in a particular mode that permits information to be exchanged between terminal installations.

A bidirectional transmission path for data, comprising two data channels in opposite directions which operate together at the same data rate.

2130 **changeover**

F: passage sur canal sémaphore de secours (passage sur liaison de réserve)

S: paso a enlace de reserva

The procedure of transferring signalling traffic from one signalling link to one or more different signalling links, when the link in use fails or is required to be cleared of traffic.

2131 **changeback**

F: retour sur canal sémaphore normal (retour sur la liaison normale)

S: retorno al enlace de servicio

The procedure of transferring signalling traffic from one or more alternative signalling links to a signalling link which has become available.

2132 **signalling relation**

F: relation sémaphore

S: relación de señalización

A relation formed by two signalling points involving the possibility of information interchange between corresponding user part functions.

2134 **signalling route**

F: route sémaphore

S: ruta de señalización

A predetermined path described by a succession of signalling points that may be transversed by signalling messages directed by a signalling point towards a specific destination point.

2135 **signalling route set**

F: faisceau de routes sémaphores

S: conjunto de rutas de señalización

The combination of all the permitted signalling routes that may be used to pass signalling messages from a signalling point to a specific destination.

2136 **signalling routing**

F: acheminement de la signalisation

S: encaminamiento de señalización

Procedures for directing the choice and allocation of signalling paths.

2137 **(signalling) message route**

F: route de message (de signalisation)

S: ruta de mensajes (de señalización)

The signalling link or consecutive links connected in tandem that are used to convey a signalling message from an originating point to its destination point.

2140 **associated mode (of signalling)**

F: mode (de signalisation) associé

S: modo (de señalización) asociado

The mode where messages for a signalling relation involving two adjacent signalling points are conveyed over a directly interconnecting signalling link.

2141 **non-associated mode (of signalling)**

F: mode (de signalisation) non associé

S: modo (de señalización) no asociado

The mode where messages for a signalling relation involving two (non-adjacent) signalling points are conveyed, between those signalling points, over two or more signalling links in tandem passing through one or more signalling transfer points.

2142 **quasi-associated mode (of signalling)**

F: mode (de signalisation) quasi associé

S: modo (de señalización) cuasiasociado

A non-associated mode (of signalling) in which the (signalling) message route is determined basically, for each signalling message, by information contained in this message (namely in its routing label) and is fixed in normal operation.

2145 **block (data)**

F: bloc (de données)

S: bloque (de datos)

A group of bits, or *n*-ary digits, transmitted as a unit over which an encoding procedure is generally applied for error-control purposes.

2146 **block** (Signalling System No. 6)

F: bloc

S: bloque

A group of 12 signal units on the signalling channel.

2147 **signal units**

F: trame sémaphore

S: unidad de señalización

A group of bits forming a separately transferable entity used to convey information on a signalling link.

2150 **protocol**

F: protocole

S: protocolo

A set of rules and formats which govern the exchange of information between two peer entities, for purposes of information (signalling or data) transfer.

2151 **(signalling) protocol**

F: protocole (de signalisation)

S: protocolo (de señalización)

A protocol used for effecting the exchange of signalling information between network service users, or between exchanges and/or other network entities.

2152 **invoke**

F: lancement

S: invocar; invocación

A type of component (in a protocol) used to specify particular operations to be carried out between groups of messages having similar functions.

2155 **application**

F: application

S: aplicación

The set of a user's requirements.

2156 **application entity**

F: entité d'application

S: entidad de aplicación

A set of Application Service Elements which together perform all or part of the communications aspects of an application process. The Application Entity is addressed througn an SCCP subsystem number.

2157 **application process**

F: processus d'application

S: proceso de aplicación

An element which performs the information processing for a particular application.

2158 **application service element**

F: élement du service d'application

S: elemento de servicio de aplicación

A coherent set of integrated functions within an application entity which provides an OSI environment capability, using underlying services where appropriate.

2160 **layer**

F: couche

S: capa

A group of one or more entities contained within an upper and lower logical boundary. Layer (N) has boundaries to the layer ($N + 1$) and to the layer ($N - 1$).

2161 **layer interface**

F: interface entre couches

S: interfaz de capa

The boundary between two adjacent layers of the model.

2162 **(layer) service**

F: service (de couche)

S: servicio (de capa)

A set of functions offered or performed by an entity at one layer in a protocol on behalf of an entity at another layer.

2163 **layer service**

F: service de couche

S: servicio de capa

A capability of the (N) layer and the layers beneath it, which is provided to (N + 1) entities, at the boundary between the (N) layer and the (N + 1) layer.

2164 **layer service element**

F: elément du service de couche

S: elemento de servicio de capa

An indivisible component of the layer service made visible to the service user via layer service primitives.

2165 **layer service primitives**

F: primitives du service de couche

S: primitivas de servicio de capa

A means for specifying in detail the adjacent layer interactions.

2166 **peer entities**

F: entités homologues

S: entidades pares

Entities in the same layer but in different systems (nodes) which must exchange information to achieve a common objective.

2167 **peer control**

F: commande homologue

S: control entre (entidades) pares

A formal language used by peer entities to exchange information.

2.2 *Service processing*

2201 **call** (in signalling)

F: appel (en signalisation)

S: llamada (en señalización)

An association between two or more users, or between a user and a network entity, that is established by use of network capabilities. This association may have zero or multiple information exchange mechanisms established within this call, for example in connection-oriented or in connectionless modes.

2202 **connection-oriented network service**

F: service de réseau en mode connexion

S: servicio de red con conexión

A network service that establishes logical connections between end users before transferring information.

2203 **connectionless** (service)

F: sans connexion (service)

S: sin conexión (servicio)

A mode of transferring information across a network, between users, without establishing a logical connection or a virtual circuit.

2205 **user (of a signalling system)**

F: utilisateur d'un système de signalisation

S: usuario (de un sistema de señalización)

A functional reply, typically a telecommunication service, which uses a signalling network to transfer information.

2206 **call clear-down (connection release)**

F: libération de la communication (libération de la connexion)

S: liberación de la llamada

A sequence of events that follows initiation of a release condition by one or more of the parties or entities involved in a call, which leads to the disconnection of communication paths used for that call.

2207 **call establishment (connection establishment)**

F: établissement de l'appel (établissement de connexion)

S: establecimiento de llamada; compleción de llamada; establecimiento de conexión

The sequence of events in an exchange and/or signalling system necessary to establishing a call, in reponse to a call attempt generated by a user.

2208 **call set-up**

F: établissement de la communication

S: establecimiento de la comunicación

The state reached in establishing a communications path between the calling and called parties, and/or network entities, when information can be passed.

2220 **service indicator**

F: indicateur de service

S: indicador de servicio

Information within a signalling message identifying the user to which the message belongs.

2221 **country-code indicator**

F: indicateur d'indicatif de pays

S: indicador de indicativo de país

Information sent in the forward direction indicating whether or not the country code is included in the address information.

2222 **calling party's category indicator**

F: indicateur de catégorie du demandeur

S: indicador de la categoría del abonado llamante

Information sent in the forward direction denoting the category of the calling party which is used together with other call set-up information to select the appropriate call treatment.

2223 **address separator**

F: séparateur d'adresse

S: separador de dirección

The character which separates the different addresses in the selection signals.

2224 **label**

F: étiquette

S: etiqueta

Information within a signalling message used to identify typically the particular circuit, call or management transaction to which the message is related.

2.3 *Interworking (of signalling)*

(No terms yet defined.)

2.4 *Operation, maintenance and performance*

2420 **continuity check**

F: contrôle de continuité

S: prueba de continuidad

A check made to a circuit in a connection to verify that an acceptable path (for transmission of data, speech, etc.) exists.

2421 **check bit**

F: bit de contrôle

S: bit de control

A bit associated with a character or block for the purpose of checking the absence of error within the character or block.

2422 **check loop**

F: boucle pour contrôle de continuité

S: bucle de pruebas de continuidad

A device which is attached to interconnect the Go and Return paths of a circuit at the incoming end of a circuit to permit the outgoing end to make a continuity check on a loop basis.

2423 **cross-office check**

F: contrôle de continuité à travers un commutateur

S: prueba (verificación) de continuidad a través de la central

A check made of a circuit across an exchange to verify that a transmission path exists.

2425 **continuity check transponder**

F: répondeur pour contrôle de continuité

S: transpondedor (transmisor-respondedor) para pruebas de continuidad

A device which is used to interconnec the Go and Return paths of a circuit at the incoming and which on detection of a check tone, returns another check tone to the originating end to permit a continuity checking of a 2-wire circuit.

2426 **transceiver**

F: émetteur-récepteur

S: transceptor (transmisor-receptor)

A tone device inserted in the outgoing end of a circuit which performs the transmitter and receiver check test through a check loop.

2430 **processor outage**

F: processeur hors service

S: interrupción del procesador

A situation in which a signalling link becomes unavailable, due to factors at a functional level higher than level 2. This may be because of, of example, a central processor failure.

2435 **forced retransmission (procedure)**

F: retransmission forcée (procédure de)

S: retransmisión forzada (procedimiento de)

An error correction procedure used to complement the preventive cyclic retransmission procedure.

2440 **message routing**

F: acheminement des messages

S: encaminamiento de mensajes

The process for selecting, for each signalling message to be sent, the signalling link to be used.

2441 **normal routing (of signalling)**

F: acheminement normal (de signalisation)

S: encaminamiento normal (de señalización)

The routing of a given signalling traffic flow in normal conditions (i.e., in the absence of failures).

2442 **alternative routing (of signalling)**

F: acheminement (de signalisation) de secours

S: encaminamiento alternativo (de señalización)

The routing of a given signalling traffic flow in case of failures affecting the signalling links, or routes, involved in the normal routing of that signalling traffic flow.

2443 **circular routing**

F: acheminement circulaire

S: encaminamiento circular

A situation where signal units destined to a particular signalling point (SP) are transferred in a never-ending loop.

2444 **controlled rerouting**

F: retour sous contrôle sur route normale

S: reencaminamiento controlado

A procedure of transferring in a controlled way, signalling traffic from an alternative signalling route to the normal signalling route, when this has become available.

2445 **forced rerouting**

F: passage sous contrainte sur route de secours

S: reencaminamiento forzado

A procedure of transferring signalling traffic from one signalling route to another, when the signalling route in use fails or is required to be cleared of traffic.

2449 **load sharing** (general)

F: partage de la charge (en général)

S: compartición de carga (en general)

A process by which signalling traffic is distributed over two or more signalling or message routes, in view of traffic equalization or security.

2450 **signalling route management functions**

F: fonctions de gestion des routes sémaphores

S: funciones de gestión de rutas de señalización

Functions that transfer information about changes in the availability of signalling routes in the signalling network.

2451 **signalling route-set-test procedure**

F: procédure de test de faisceau de routes sémaphores

S: procedimiento de prueba de conjunto de rutas de señalización

A procedure, included in the signalling route management which is used to test the availability of a given signalling route, previously declared unavailable.

2452 **signalling traffic management functions**

F: fonctions de gestion du trafic sémaphore

S: funciones de gestión del tráfico de señalización

Functions that control and, when required, modify routing information used by the Message routing function and control the transfer of signalling traffic in a manner that avoids irregularities in message flow.

2453 **transfer-allowed (procedure)**

F: transfert autorisé (procédure de)

S: autorización de transferencia (o transferencia autorizada) (procedimiento de)

A procedure, included in the signalling route management, which is used to inform a signalling point that a signalling route has become available.

2454 **transfer-controlled (procedure)**

F: transfert sous contrôle (procédure de)

S: control de transferencia (o transferencia controlada) (procedimiento de)

A procedure included in signalling route management which does inform a signalling point of the congestion status of a signalling route.

2455 **transfer-restricted (procedure)**

F: transfer restreint (procédure de)

S: restricción de transferencia (o transferencia restringida) (procedimiento de)

A procedure, included in the signalling route management, which is used to inform a signalling point that a signalling route is not optimal and should be avoided where possible (national option).

2456 **transfer-prohibited (procedure)**

F: transfert interdit (procédure de)

S: prohibición de transferencia (o transferencia prohibida) (procedimiento de)

A procedure, included in the signalling route management, which is used to inform a signalling point of the unavailability of a signalling route.

2460 **signalling network management functions**

F: fonctions de gestion du réseau sémaphore

S: funciones de gestión de la red de señalización

Functions that, on the basis of predetermined data and information about the status of the signalling network, control the current message routing and configuration of signalling network facilities.

2461 **flow control**

F: contrôle de flux

S: control de flujo

A function in a protocol used to control the flow of signalling messages between adjacent layers of a protocol, or between peer entities. The function permits, for example, a receiving entity to control signalling message flow from a sending entity (or between or within different users, and the MTP).

2462 **(signalling) traffic flow control**

F: contrôle de flux de trafic (sémaphore)

S: control del flujo del tráfico (de señalización)

Actions and procedures intended to limit signalling traffic at its source in the case when the signalling network is not capable of transferring all signalling traffic offered by the User Parts, because of network failures or overload situations.

2470 **signalling message transfer delay**

F: temps de transfert d'un message sémaphore

S: tiempo de transferencia de mensaje de señalización

The time a message will take to pass through the signalling network.

2471 **cross-office (transit) delay**

F: temps (de transit) dans le commutateur

S: tiempo (de tránsito) a través de la central

The time a signalling message will take to pass through an exchange.

2472 **data channel propagation time**

F: temps de propagation sur la voie de données

S: tiempo de propagación de un canal de datos

The period which starts when the last bit of the signal unit has entered the data channel at the sending side and ends when the last bit of the signal unit leaves the data channel at the receiving end, irrespective of whether the signal unit is disturbed or not.

3 Control functions

3.0 *General*

3000 **stored program control (SPC)**

F: commande par programme enregistré (SPC)

S: control por programa almacenado (CPA)

The control of an exchange by means of a set of instructions which are stored and can be modified.

3001 **exchange control system**

F: système de commande du commutateur

S: sistema de control de la central

The central control *system* of a stored program controlled switching *system.* It may consist of one or more *processors.*

3002 **multi-processor exchange**

F: commutateur à plusieurs processeurs

S: central multiprocesadora

An exchange design that uses two or more processors to perform call processing functions.

3004 **central processing unit**

F: unité centrale de traitement

S: unidad central de procesamiento

A processor which controls and coordinates the processing of traffic in an exchange.

3007 **utility processor**

F: processeur utilitaire

S: procesador utilitario

A processor in multi-processor exchange design that is used to perform administrative tasks (e.g., processing and storing billing data).

3010 **operations system**

F: système d'exploitation

S: sistema de operaciones

A system whose function it is to receive operational data from network elements and to analyze such data to provide information and/or commands to facilitate the operation, administration and/or engineering of the network.

3012 **operations and maintenance centre (OMC)**

F: centre d'exploitation et de maintenance (CEM)

S: centro de operaciones y mantenimiento (COM)

A control location for an operations sytem, usually attended by operations personnel.

3.1 *Input/output*

3100 **human-machine interface**

F: interface homme-machine

S: interfaz hombre-máquina; interfaz persona-máquina

The interface between a person and a system (e.g., video display unit used for interacting with an operations system).

3101 **input/output devices (I/O devices)**

F: dispositif d'entrée/sortie (dispositif E/S)

S: dispositivos de entrada/salida (dispositivos E/S)

Memory and keyboard devices for entering or receiving data to or from the *system.* Can be controlled manually for entering or receiving data.

3102 **CCITT MML**

F: langage homme-machine du CCITT

S: LHM del CCITT

The man-machine language (MML) for stored program controlled switching systems developed by the International Telegraph and Telephone Consultative Committee (CCITT).

3103 **system** (in MML)

F: système

S: sistema

Refers to a stored program controlled switching *system* and also to its man-machine communication facility.

3105 **command** (in MML)

F: commande

S: instrucción; orden; comando

A specification of an expected action or function by the system.

3110 **control character** (in MML)

F: caractère de commande

S: carácter de control

A character whose occurrence in a particular context initiates, modifies, or stops an action that affects the recording, processing or interpretation of data.

3115 **function** (in MML)

F: fonction

S: función

A function is an action which various groups of staff wish to carry out, e.g., add subscriber's line, initiate a testing routine, read a subscriber's class of service. To carry out one function, one or more *commands* may be necessary. The function is characterized by the *command code(s).*

3.2 *Techniques*

3210 **processing capacity**

F: capacité de traitement

S: capacidad de procesamiento

The total capacity of a unit available for performing processing functions.

3213 **fixed overhead**

F: servitude fixe

S: taza fija (elementos auxiliares fijos)

Capacity used for performing functions other than, and in addition to, traffic handling that are always required.

3215 **call processing tasks**

F: tâches de traitement des appels

S: tareas de procesamiento de llamada

Functions performed in handling traffic.

3217 **base level tasks**

F: tâches au niveau de base

S: tareas de nivel de base

Deferrable tasks that are performed when capacity is available (e.g., routine maintenance functions.)

3220 **register function**

F: fonction d'enregistreur

S: función de registrador; función de registro

The functions of receiving, storing, analyzing and possibly translating and transmitting address and other information for the purpose of controlling the setting up of a call.

3223 **service control point**

F: point de commande du service

S: punto de control de servicio

A function or entity in the telecommunications network which has access to data and logic for controlling the processing of a call in order to provide a supplementary service.

3226 **hold**

F: maintien

S: retención

The function of not releasing a resource or call but retaining it for possible reconnection.

4 Interfaces and interface functions (machine-machine)

4001 **interface**

F: jonction, interface

S: interfaz

A shared boundary, for example, the boundary between two subsystems or two devices.

Note 1 – An interface is used to specify once the interconnection between the two sides of it. The specification includes the type, quantity and function of the interconnecting means and the type, form and sequencing order of the signals to be interchanged via those means.

Note 2 – Recommendation G.703, as an example, refers to physical, functional and electrical characteristics of interfaces that are necessary to interconnect digital network components to form a digital path or connection.

4002 **physical interface**

F: interface physique

S: interfaz físico

The interface between two equipments.

4003 **interface specification**

F: spécification d'interface

S: especificación de interfaz

A formal statement of the type, quantity, form and order of the interconnections and interactions between two associated systems, at their interface.

4004 **physical interface specification (physical interface)**

F: spécification d'interface physique

S: especificación de interfaz físico (interfaz físico)

A formal statement of the mechanical, electrical, electromagnetic and optical characteristics of the interconnections and interactions between two associated equipments, at their interface.

4006 **codirectional interfaces**

F: jonction codirectionnelle

S: interfaz codireccional

An interface across with the information and its associated timing signal are transmitted in the same direction (see Figure 3/Q.9).

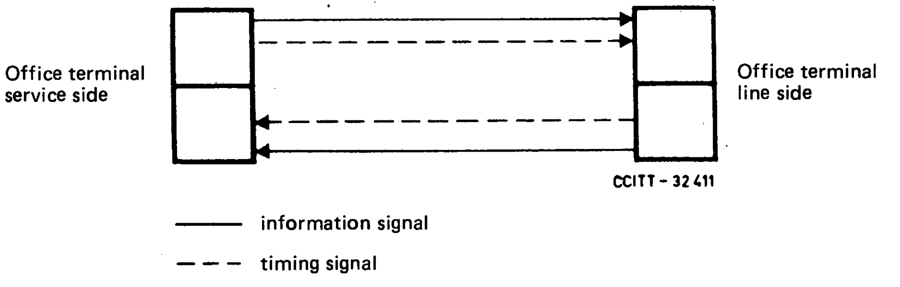

FIGURE 3/Q.9

Codirectional interface (G.703)

4007 **centralized clock interface**

F: jonction à horloge centrale

S: interfaz de reloj centralizado

An interface wherein for both directions of transmission of the information signal, the associated timing signals of both the exchange terminal on the line side and the exchange terminal on the service side are supplied from a centralized clock, which may be derived for example from certain incoming line signals (see Figure 4/Q.9).

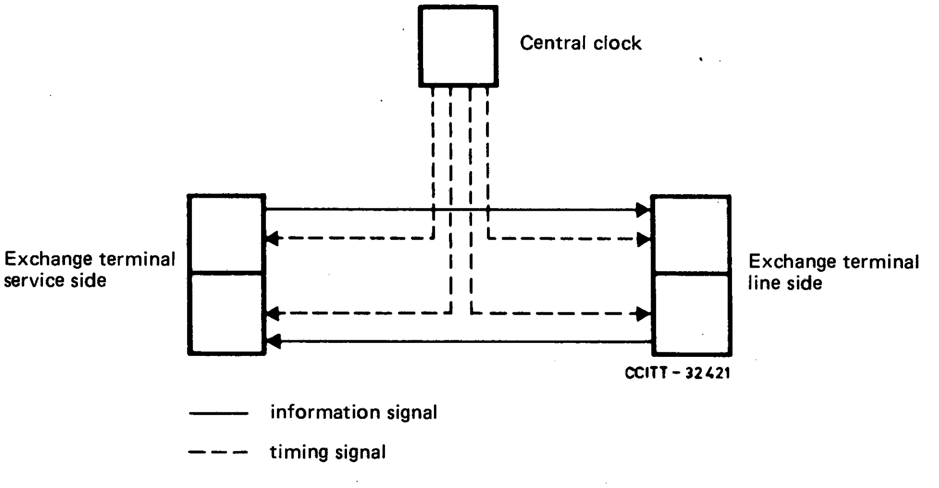

FIGURE 4/Q.9

Centralized clock interface (G.703)

4008 **contradirectional interface**

F: jonction contradirectionnelle

S: interfaz contradireccional

An interface across which the timing signals associated with both directions of transmission are directed towards the service side (e.g., data or signalling) of the interface (see Figure 5/Q.9).

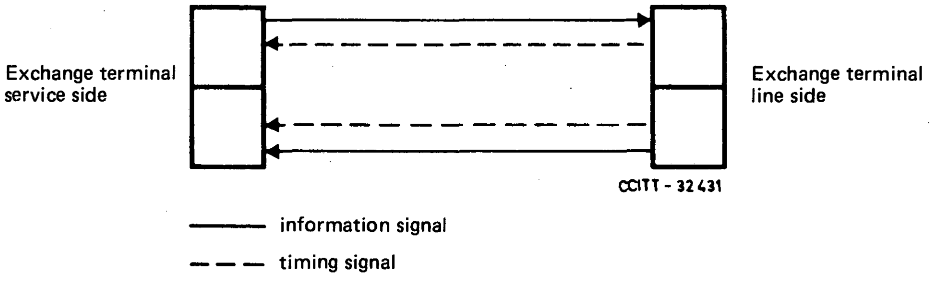

FIGURE 5/Q.9

Contradirectional interface (G.703)

4020 **protocol**

F: protocole

S: protocolo

A formal statement of the procedures that are adopted to accommodate communication between two or more functions within the same layer of a hierarchy of functions.

4022 **access protocol**

F: protocole d'accès

S: protocolo de acceso

A defined set of procedures that is adopted at an interface at a specified reference point between a user and a network to enable the user to employ the services and/or facilities of that network.

4025 **user-user protocol**

F: protocole usager-usager

S: protocolo usuario-usuario

A protocol that is adopted between two or more network users in order to accommodate communication between them.

5 Equipment and hardware

5001 **automatic switching equipment**

F: commutateur automatique

S: equipo de conmutación automática

Equipment in which *switching* operations are performed by electrically controlled apparatus without the intervention of operators.

15.12

5004 **distribution frame**

F: répartiteur

S: repartidor

A structure for terminating wires and connecting them together in any desired order.

15.20

5005 **main distribution frame**

F: répartiteur d'entrée

S: repartidor principal

A *distribution frame* to which are connected on one side the lines exterior to the exchange, and on the other side the internal cabling of the exchange.

15.21

5006 **intermediate distribution frame**

F: répartiteur intermédiaire

S: repartidor intermedio

A *distribution frame* intermediate between the main distribution frame and the switchboard, or the switching apparatus or intermediate between two ranks of switches in an automatic exchange.

15.22

5012 **crossbar switch**

F: commutateur crossbar

S: conmutador de barras cruzadas

A *switch* having a plurality of vertical paths, a plurality of horizontal paths, and electromagnetically-operated mechanical means for interconnecting any one of the vertical paths with any of the horizontal paths.

15.45

6 Executive software

6.1 *Basic software concepts*

6102 **algorithm**

F: algorithme

S: algoritmo

A prescribed finite set of well-defined rules or processes for the solution of a problem in a finite number of steps.

ISO 01.04.10

6103 **real-time** (adjective)

F: en temps réel

S: en tiempo real

Pertaining to the processing of data by a computer in connection with another process outside the computer according to time requirements imposed by the outside process.

ISO 10.03.04

6104 **file**

F: fichier

S: fichero

A set of related records treated as a unit.

ISO 04.11.05

6105 **record**

F: enregistrement

S: registro

A set of related data or words treated as a unit.

ISO 04.11.03

6106 **field**

F: zone

S: campo

In a record, a specified area used for a particular category of data.

ISO 04.11.11

6107 **key (tag) (label)**

F: clé (étiquette) (label)

S: clave (rótulo) (etiqueta)

One or more characters within or attached to a set of data, that contains information about the set, including its identification.

ISO 04.12.04

6108 **identifier**

F: identificateur

S: identificador

A character, or group of characters, used to identify or name an item of data and possibly to indicate certain properties of that data.

ISO 07.04.01

6109 **parameter**

F: paramètre

S: parámetro

A variable that is given a constant value for a specified application and that may denote the application.

ISO 02.02.04

6110 **call** (in software), **procedure call**

F: appel (en logiciel)*; appel de procédure*

S: llamada (en soporte lógico)*; llamada de procedimiento*

The use of a procedure name in an expression or statement which causes the execution of the procedure when encountered.

6111 **address**

F: adresse

S: dirección

A character or group of characters that identifies a storage or a device without the use of any intermediate reference.

ISO 07.01.11

6112 **absolute address**

F: adresse absolue

S: dirección absoluta

An address in a computer language that identifies a storage or a device without the use of any intermediate reference.

ISO 07.19.03

6113 **indirect address**

F: adresse indirecte

S: dirección indirecta

An address that designates the storage location of an item of data to be treated as the address of an operand but not necessarily as its direct address.

ISO 07.19.11

6114 **direct address**

F: adresse directe

S: dirección directa

An address that designates a storage location of an item of data to be treated as an operand.

ISO 07.19.10

6115 **base address**

F: adresse de base; adresse base

S: dirección de base

A numeric value that is used as a reference in the calculation of addresses in the execution of a computer program.

ISO 07.19.05

6116 **relocatable address**

F: adresse translatable

S: dirección reubicable

An address that is adjusted when the computer program containing it is relocated.

ISO 07.19.08

6117 **monitor**

F: moniteur

S: monitor

A functional unit that observes and records selected activities within a system for analysis.

ISO 11.03.02 mod

6118 **direct access** [random access]

F: accès sélectif

S: acceso directo

The facility to obtain data from a storage device or to enter data into a storage device in such a way that the process depends only on a reference to data previously accessed.

ISO 12.05.03

6.2 *Software organization*

6201 **operating system**

F: système d'exploitation

S: sistema operativo

Software that controls the management and the execution of programs.

ISO 01.04.07 mod

6202 **conversational mode**

F: mode dialogué

S: modo conversacional

A mode of operation of a data processing system in which a sequence of alternating entries and responses between a user and the system takes place in a manner similar to a dialogue between two persons.

ISO 10.03.03 mod

6203 **time sharing** [time slicing]

F: partage de temps

S: tiempo compartido

A mode of operation of a data processing system that provides for the interleaving in time of two or more processes in one processor.

ISO 10.04.05 mod

6204 **time slicing** [time sharing]

F: découpage de temps

S: segmentación de tiempo

A mode of operation in which two or more processes are assigned quanta of time on the same processor.

ISO 10.04.04

6205 **to pack**

F: condenser

S: compactar

To store data in a compact form in a storage medium by taking advantage of known characteristics of the data and of the storage medium, in such a way that the original form of the data can be recovered.

Example: To make use of bit or byte locations that would otherwise go unused.

ISO 06.03.12

6206 **to map (over)**

F: appliquer

S: hacer corresponder

To establish a set of values having a defined correspondence with the quantities or values of another set.

ISO 02.04.04

6207 **to relocate**

F: translater

S: reubicar

To move a computer program or part of a computer program, and to adjust the necessary address references so that the computer program can be executed after being moved.

ISO 07.12.03

6208 **chaining search**

F: recherche en chaîne

S: búsqueda en cadena

A search in which each item contains means for locating the next item to be considered in the search.

ISO 06.04.08

6209 **dichotomizing search**

F: recherche dichotomique

S: búsqueda dicotómica

A search in which an ordered set of items is partitioned into two parts, one of which is rejected, the process being repeated on the accepted part until the search is completed.

ISO 06.04.04

6210 **interrupt; interruption**

F: interruption

S: interrupción

A suspension of a process, such as the execution of a computer program, caused by an event external to that process and performed in such a way that the process can be resumed.

ISO 10.01.09

6211 **to dump**

F: vider

S: vaciar

To write the contents of a storage, or part of a storage, usually from an internal storage, on to an external medium for a specific purpose such as to allow other use of the storage, as a safeguard against faults or errors, or in connection with debugging.

ISO 07.14.01

6212 **to patch**

F: rapiécer

S: parchear

To make an improvized modification.

ISO 07.15.06

6.3 *Programming*

6301 **to assemble**

F: assembler

S: ensamblar

To translate a program expressed in an assembly language and perhaps to link subroutines.

ISO 07.03.04

6302 **assembler; assembly program**

F: assembleur; programme d'assemblage

S: ensamblador; programa de ensamblaje

A program used to assemble.

ISO 07.03.05 mod

6303 **to compile**

F: compiler

S: compilar

To translate a program expressed in a high level language into a program expressed in a computer language.

ISO 07.03.06 mod

6304 **compiler; compiling program**

F: compilateur

S: compilador; programa compilador

A program used to compile.

ISO 07.03.07 mod

6305 **link** (in programming)

F: lien

S: enlace (vinculación)

A part of a program that passes control and parameters between separate portions of the program.

ISO 07.09.09 mod

6306 **to link** (in programming)

F: relier

S: enlazar (vincular)

To provide a link.

ISO 07.09.10

6307 **programming system**

F: système de programmation

S: sistema de programación

One or more programming languages and the necessary software for using these languages with particular automatic data processing equipment.

ISO 07.01.01

6308 **routine**

F: routine

S: rutina

An ordered set of instructions that may have some general or frequent use.

ISO 01.04.08 mod

6309 **subroutine**

F: sous-programme

S: subrutina

A sequence set of statements which taken as an entity may be used in one or more programs and at one or more points in a program, as required for repetitive occurrence of the same task.

ISO 07.08.01 mod

6310 **executive program; supervisory program; supervisor**

F: (programme) superviseur

S: programa ejecutivo; programa supervisor; supervisor

A program, usually part of an operating system, that controls the execution of other programs and regulates the flow of work in a data processing system.

ISO 07.06.01 mod

6311 **reusable program (routine)**

F: programme (routine) réutilisable

S: programa (rutina) reutilizable

A program (A routine) that may be loaded once and executed repeatedly subject to the requirements that any instructions that are modified during its execution are returned to their states and that its external program parameters are preserved unchanged.

ISO 07.08.05 mod

6312 **reentrant program (routine) (subroutine); reenterable program (routine) (subroutine)**

F: programme (routine); (sous-programme) rentrant

S: programa (rutina) (subrutina) reentrante; programa (rutina) (subrutina) reintroducible

A program (A routine) (A subroutine) that may be entered repeatedly and may be entered before prior executions of the same program (routine) (subroutine) have been completed, subject to the requirement that neither its external program parameters nor any instructions are modified during its execution.

Note – A reentrant program, routine or subroutine may be used by more than one computer program simultaneously.

ISO 07.08.06

6313 **target program; object program**

F: programme résultant; programme-objet

S: programa objeto; programa resultante

A program in a target language that has been translated from a source language.

ISO 07.03.02 mod

6314 **microinstruction**

F: micro-instruction

S: microinstrucción

An instruction of a microprogram.

ISO 07.16.13

6315 **microprogram**

F: microprogramme

S: microprograma

A sequence of elementary instruction that corresponds to a specific computer operation, maintained in special storage, whose execution is initiated by the instruction register of a computer.

ISO 07.01.13

6316 **to debug** (in programming)

F: mettre au point

S: depurar

To detect, to trace, to eliminate mistakes in programs or in other software.

ISO 07.15.01

6.4 *Languages*

6401 **computer language; machine language**

F: langage-machine

S: lenguaje de computador; lenguaje de máquina

A low level language whose instructions consist only of computer instructions.

ISO 07.02.15 mod

6402 **macroinstruction; macro (instruction)**

F: macro-instruction

S: macroinstrucción

An instruction in a source language that is to be replaced by a defined sequence of instructions in the same source language.

Note – The macroinstruction may also specify values for parameters in the instructions that are to replace it.

ISO 07.16.05

6403 **command language**

F: langage de commande

S: lenguaje de instrucciones; lenguaje de órdenes

A source language consisting primarily of procedural operators that indicate the functions to be performed by an operating system.

ISO 10.02.09 mod

6404 **assembly language**

F: langage d'assemblage

S: lenguaje de ensamblaje

A low level language whose instructions are usually in one-to-one correspondence with computer instructions and that may provide facilities such as the use of macroinstructions.

ISO 07.02.16 mod

6405 **syntax**

F: syntaxe

S: sintaxis

The relationships among characters or groups of characters, independent of their meanings or the manner of their interpretation and use.

ISO 07.02.04

6406 **object language; target language**

F: langage résultant; langage-objet

S: lenguaje objeto; lenguaje resultante

A language into which statements are translated.

ISO 07.02.11

6407 **source language**

F: langage d'origine; langage-source

S: lenguaje fuente

A language from which statements are translated.

ISO 07.02.10

6408 **high level language (HLL)**

F: langage évolué

S: lenguaje de alto nivel

A programming language that does not reflect the structure of any given computer or any given class of computers.

ISO 07.02.17

6409 **low level language**

F: langage lié au calculateur

S: lenguaje de bajo nivel

A programming language that reflects the structure of a computer or that of a given class of computers.

ISO 07.02.14

6410 **man-machine language (MML)**

F: langage homme-machine (LHM)

S: lenguaje hombre-máquina (LHM)

A language designed to facilitate direct user control of a computer.

6411 **mnemonic (abbreviation)**

F: (abréviation) mnémonique

S: (abreviatura) nemotécnica; (abreviatura) nemónica

A representation of an entity by one or more characters, so chosen that the character representation has a relationship to normal language usage such that the name of the entity serves as an aid to the memory of a human operator in remembering the appropriate coded representation used.

6501 **CHILL**

F: CHILL

S: CHILL

A high-level programming language for programming SPC telephone exchanges, developed by CCITT and fully described in Recommendation Z.200 [4].

Note – For details of the individual terms and definitions used in CHILL see Appendix 6 to Recommendation Z.200 [4].

6901 **comment** (in MML)

F: commentaire

S: comentario

A character string enclosed between the separator strings /* (solidus asterisk) and */ (asterisk solidus). Has no MML syntactical or semantical meaning.

6902 **format**

F: format

S: formato

The arrangement or layout of data on a data medium.

6903 **header**

F: en-tête

S: encabezamiento

The header provides general information which could comprise identification information, date and time, etc.

6904 **identifier** (in MML)

F: identificateur

S: identificador

An identifier is a representation of an entity, typically consisting of one or more *characters.* It is used to identify or name a unique item of data. In the *man-machine language*, the first character is a letter.

6905 **mnemonic abbreviation**

F: abréviation mnémonique

S: abreviatura nemotécnica

A representation of an entity typically consisting of one or more *characters* chosen to assist the human memory.

6906 **arithmetic expression** (in MML)

F: expression arithmétique

S: expresión aritmética

A combination of *arithmetic delimeters, numerals (decimal, hexadecimal, octal* or *binary*) and *identifiers* enclosed by parentheses.

6907 **binary numeral**

F: nombre binaire

S: numeral binario

A *numeral* in the binary (base 2) *numbering system,* represented by the characters 0 (zero), 1 (one) and optionally preceded by B' (B apostrophe).

6908 **character**

F: caractère

S: carácter

A member of the *character set* which is used for the organization, control or representation of data.

6910 **character set** (in MML)

F: ensemble de caractères

S: juego de caracteres; conjunto de caracteres

The finite set of different characters used in *CCITT MML.*

6911 **decimal numeral**

F: nombre décimal

S: numeral decimal

A *numeral* in the decimal (base 10) *numbering system,* represented by the *characters* 0 (zero), 1, 2, 3, 4, 5, 6, 7, 8, 9 optionally preceded by D' (D apostrophe).

6912 **digit**

F: chiffre

S: cifra; dígito

A *character* of the *character set* representing an integer, listed in Table 1/Z.314 [5], column 3, positions 0 (zero) to 9.

6913 **flow line** (in MML)

F: ligne de liaison

S: línea de flujo

A line representing a connection path between *symbols* in a *syntax diagram.*

6914 **graphic characters**

F: caractères graphiques

S: caracteres gráficos

Graphic characters are a collection of *characters* with the *characters set* used to improve readability of *output.*

6915 **hexadecimal numeral**

F: nombre hexadécimal

S: numeral hexadecimal

A *numeral* in the hexadecimal (base 16) *numbering system,* represented by the *characters* 0 (zero), 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, optionally preceded by H' (H apostrophe).

6916 **input** (in MML)

F: entrée

S: entrada

The process that constitutes the introduction of data into a data processing system or any part of it.

6917 **letter**

F: lettre

S: letra

A *character* of the *character set* representing the alphabet, listed in Table 1/Z.314 [5], columns 4, 5, 6 and 7 excluding table positions 5/15 and 7/15.

6918 **metalanguage** (in MML)

F: métalangage

S: metalenguaje

A symbolic method for defining *MML input* and *output syntax.*

6919 **octal numeral**

F: nombre octal

S: número octal

A *numeral* in the octal (base 8) *numbering system,* represented by the *characters* 0, 1, 2, 3, 4, 5, 6, 7, optionally preceded by O' (letter O apostrophe).

6920 **output** (in MML)

F: sortie

S: salida

The process that consists of the delivery of data from a data processing system or from any part of it.

6921 **parameter** (in MML)

F: paramètre

S: parámetro

A parameter identifies and contains a piece of necessary information to execute a *command.*

6922 **separator** (in MML)

F: séparateur

S: separador

A *character* used to delimit *syntax* elements.

6923 **symbol**

F: symbole

S: símbolo

A conventional representation of a concept or a representation of a concept upon which agreement has been reached.

6924 **syntax diagram**

F: diagramme syntaxique

S: diagrama sintáctico

The syntax diagrams are a method of defining the *syntax* of the *input* and *output* language by pictorial representation.

6925 **comment** (in SDL)

F: commentaire

S: comentario

Information which is in addition to or clarifies an SDL diagram. Comments may be attached by a single square bracket connected by a dashed line to a *symbol* or *flow line.* (Recommendation Z.100, § 2.2.6 [6].)

6926 **connector** (in SDL)

F: connecteur

S: conector

A connector (○) is either an *in-connector* or an *out-connector.* A *flow line* may be broken by a pair of *associated connectors,* with the flow assumed to be from the *out-connector* to its associated *in-connector.* (Recommendation Z.100, § 2.6.6 [6].)

6927 **decision** (in SDL)

F: décision

S: decisión

A decision is an *action* within a *transition* which asks a question to which the answer can be obtained at that instant and chooses one of several paths to continue the *transition.* (Recommendation Z.100, § 2.7.5 [6].)

6928 **description** (in SDL)

F: description

S: descripción

The implementation of the requirements of a system is described in a description of the system. Descriptions consist of *general parameters* of the system as implemented and the *functional description (FD)* of its actual behaviour. (Recommendation Z.100, § 1.1 [6].)

6929 **flow line** (in SDL)

F: ligne de liaison

S: línea de flujo

A flow line (——— or ———→) connects every *symbol* to the symbol(s) it follows. (Recommendation Z.100, § 2.2.4 [6].)

6930 **functional block** (in SDL)

F: bloc fonctionnel

S: bloque funcional

A functional block is an object of manageable size and relevant internal relationship, containing one or more *processes.*

6931 **functional description (FD)** (in SDL)

F: description fonctionnelle (DF)

S: descripción funcional (DF)

The functional description (FD) of a system describes the actual behaviour of the implementation of the functional requirements of the system in terms of the internal structure and logic processes within the system.

6932 **functional specification (FS)** (in SDL)

S: spécification fonctionnelle (SF)

F: especificación funcional (EF)

The functional specification (FS) of a system is a specification of the total functional requirements of that system from all significant points of view.

6933 **general parameters** (in SDL)

F: caractéristiques générales

S: parámetros generales

The general parameters in both a *specification* and a *description* of a system relate to such matters as temperature limits, construction, exchange capacity, grade of service, etc. (Recommendation Z.100, § 1.1 [6].)

6934 **input** (in SDL)

F: entrée

S: entrada

An input is an incoming *signal* which is *recognized* by a *process.* (Recommendation Z.100, § 2.6.4 [6].)

6935 **output** (in SDL)

F: sortie

S: salida

An output in an *action* within a *transition* which generates a *signal* which in turn acts as an *input* elsewhere. (Recommendation Z.100, § 2.7.4 [6].)

6936 **pictorial element (PE)**

F: élément graphique (EG)

S: elemento pictográfico (EP)

One of a number of standardized graphical entities used within *state pictures* to represent switching system concepts. (Annex E to Recommendation Z.100 [6].)

6937 **process** (in SDL)

F: processus

S: proceso

A process performs a logic function that requires a series of information items to proceed, where these items become available at different points in time. In the context of SDL, a process is an object that either is in a *state* awaiting an *input* or in a *transition.*

6938 **save** (in SDL)

F: mise en réserve

S: conservación (salvaguarda)

A save is the postponement of *recognition of a signal* when a *process* is in a *state* in which *recognition of that signal* does not occur. (Recommendation Z.100, § 2.6.5 [6].)

6939 **signal** (in SDL)

F: signal

S: señal

A signal is a flow of data conveying information to a *process.* (Recommendation Z.100, § 2.5.4 [6].)

6940 **specification** (in SDL)

F: spécification

S: especificación

The requirements of a system are defined in a specification of that system. A specification consists of *general parameters* required of the system and the *functional specification (FS)* of its required behaviour. (Recommendation Z.100, §§ 1.1 [6].)

6941 **specification and description language (SDL)**

F: langage de spécification et de description (LDS)

S: lenguaje de especificación y descripción (LED)

The CCITT language used in the presentation of the *functional specification* and *functional description* of the internal logic processes in stored programmed control (SPC) switching systems.

6942 **state** (in SDL)

F: état

S: estado

A state is a condition in which the action of a *process* is *suspended* awaiting an *input.* (Recommendation Z.100, § 2.6.3 [7].)

6943 **symbol** (in SDL)

F: symbole

S: símbolo

In the context of SDL, a symbol is a representation of the concept of either a *state, input, task, output, decision* or *save.*

6944 **task** (in SDL)

F: tâche

S: tarea

A task is any action within a *transition* which is neither a *decision* nor an *output.* (Recommendation Z.100, § 2.7.1 [7].)

6945 **transition** (in SDL)

F: transition

S: transición

A transition is a sequence of *actions* which occurs when a *process* changes from one *state* to another in reponse to an *input.* (Recommendation Z.100, § 2.6.7 [7].)

7 Functions for basic and supplementary services

7011 **service, telecommunication service**

F: service, service de télécommunications

S: servicio, servicio de telecomunicación

That which is offered by an Administration or RPOA to its customers in order to satisfy a specific telecommunication requirement.

Note – Bearer service and teleservice are types of telecommunication service. Other types of telecommunication service may be identified in the future.

7012 **bearer service**

F: service support

S: servicio portador

A type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

Note – The ISDN connection type used to support a bearer service may be identical to that used to support other types of telecommunication service.

7015 **teleservice** [telecommunication service]

F: téléservice

S: teleservicio; servicio final

A type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between Administrations and/or RPOAs.

7018 **basic service**

F: service de base

S: servicio básico

The fundamental type of service, or the most commonly provided service in a telecommunications network. It forms the basis upon which supplementary services may be added.

7019 **supplementary service**

F: service supplémentaire

S: servicio suplementario

Any service provided by a network in addition to its basic service or services.

7110 **entity**

F: entité

S: entidad

A part, device, subsystem, functional unit, equipment or system that can be individually considered. In ISDN the term is used to refer to a particular system or subsystem such as a user terminal or a digital exchange. It is also used to refer to a set of functions of a particular system at a location, e.g., the Layer 2 functions of a signalling system at a user terminal.

7112 **functional entity**

F: entité fonctionnelle

S: entidad funcional

An entity that comprises a specific set of functions at a given location.

7113 **functional entity** (in telecommunication service provision applications)

F: entité fonctionnelle (dans les applications de prestation de services de télécommunications)

S: entidad funcional (en aplicaciones de prestación de servicios de telecomunicación)

A grouping of service-providing functions in a single location and subset of the total set of functions required to provide the service.

7114 **network element**

F: élément de réseau

S: elemento de red

An entity in the telecommunications network.

7115 **exchange function**

F: fonction de commutateur

S: función de central

A process which performs a specific action in support of a telecommunications service or network operation in exchanges or at other network-associated locations such as STPs or a data base.

7116 **exchange function set**

F: ensemble de fonction de commutateur

S: conjunto de funciones de central

An organized assembly of exchange functions in a given location. Usually an exchange function set is associated to one or more phase(s) in call handling or other network operations.

7120 **information flow**

F: flux d'information

S: flujo de información

An interaction between a communicating pair of functional entities. The relationship between any pair of functional entities is the complete set of information flows between them.

8 Mobile station networks

8.0 *Public land mobile network structure*

8003 **public land mobile services**

F: services mobiles terrestres publics

S: servicios móviles terrestres públicos

Telecommunication services provided to moving subscribers (terrestrial applications).

8010 **base station (BS)**

F: station de base (SB)

S: estación de base (EB)

The common name for all radio equipment located at one and the same place used for serving one or several *cells.*

8011 **base station area**

F: zone de la station de base

S: zona de estación de base

The area covered by all the *cells* served by a base station.

8012 **cell**

F: cellule

S: célula (o celda)

The area covered by a base station, or by a sub-system (sector antenna) of that base station corresponding to a specific logical identification on the radio path, whichever is smaller.

Every mobile station in a cell may be reached by the corresponding radio equipment of the base station.

8014 **mobile services switching centre (MSC)**

F: centre de commutation pour les services mobiles (CCM)

S: centro de conmutación de los servicios móviles (CCM)

An exchange which performs all necessary signalling and switching functions in order to establish calls to and from mobile subscribers located in its area.

8015 **MSC area**

F: zone du CCM

S: zona de CCM

The part of the network covered by an MSC. An MSC area may consist of several location areas.

8016 **mobile station (MS)**

F: station mobile (SM)

S: estación móvil (EM)

The interface equipment used to terminate the radio path at the user side.

8017 **public land mobile network (PLMN)**

F: réseau mobile terrestre public (RMTP)

S: red móvil terrestre pública (RMTP)

A collection of *mobile service switching centre* areas within a common numbering plan and a common routing plan operated by an administration of a RPOA in order to provide public land mobile services to its subscribers.

8018 **service area**

F: zone de service

S: zona de servicio

An area in which a mobile subscriber reachable by any other subscriber of a public network without the calling subscriber's knowledge of the actual location.

8020 **system area**

F: zone du système

S: zona de sistema

A service area or a collection of service areas accessible by fully compatible mobile stations.

8025 **location area**

F: zone de localisation

S: zona de posición

An area in which a mobile station may move freely without updating the location register. A location area may comprise several cells.

8040 **gateway mobile service switching centre (MSC)**

F: centre de commutation pour les services mobiles (CCM) tête de ligne

S: centro de conmutación de los servicios móviles (CCM) de cabecera

The MSC which receives a call from a fixed subscriber, via a public switched network, for extension to a mobile station. The gateway MSC may vary for interconnection with different public networks.

The gateway MSC could be the home MSC or the visited MSC or any other.

8.1 *Identification and numbering*

8111 **national mobile station identity (NMSI)**

F: identité nationale de la station mobile (INSM)

S: identidad nacional de estación móvil (INEM)

The mobile station identification uniquely identifying the mobile station nationally.

The NMSI consists of the MNC followed by the MSIN.

8112 **mobile network code (MNC)**

F: indicatif de réseau mobile (IRM)

S: indicativo de red móvil (IRM)

A digit or a combination of digits in the national part of the mobile station identification uniquely identifying the home PLMN of the mobile station.

8113 **mobile station identification number (MSIN)**

F: numéro d'identification de la station mobile (NISM)

S: número de identificación de estación móvil (NIEM)

The part of the mobile station identification following the Mobile Network Code uniquely identifying the mobile station within a PLMN.

8114 **mobile country code (MCC)**

F: indicatif de pays de la station mobile (IPSM)

S: indicativo de país de la estación móvil (IPM)

The part of the mobile station identification uniquely identifying the country of domicile of the mobile station.

8115 **international mobile station identity (IMSI)**

F: identité internationale de la station mobile (IISM)

S: identidad internacional de estación móvil (IIEM)

The mobile station identification uniquely identifying the mobile station internationally.

The IMSI consists of the MCC followed by the NMSI.

8120 **mobile subscriber international ISDN number**

F: numéro RNIS international d'un abonné mobile

S: número RDSI internacional de abonado móvil

The number which has to be dialled in order to reach a mobile subscriber in service area.

8125 **national (significant) mobile number**

F: numéro national (significatif) de la station mobile

S: número móvil nacional (significativo)

The national (significant) mobile number could have the following form depending upon the way in which the land mobile numbering plan is integrated with the telephone numbering plan:

i) The land mobile numbering plan could be fully integrated with the telephone numbering plan. In this case the mobile stations will be allocated a *subscriber number* as defined in § 5 of Recommendation E.160. The *national (significant) mobile number* then consists of the *trunk code* allocated to the numbering area corresponding to the home area of the mobile station followed by the *subscriber number* allocated to it.

ii) The public land mobile network could be regarded as a separate numbering area within the telephone network. In this case the national (significant) mobile number will consist of the *trunk code* allocated to the PLMN and the *subscriber number* within the PLMN.

8130 **mobile station roaming number**

F: numéro itinérant de station mobile

S: número itinerante de estación móvil

The network internal number used for routing of calls to the mobile station.

8.2 *Roaming (in public mobile service)*

8230 **home MSC (HMSC)**

F: CCM de rattachement (CCMR)

S: centro de conmutación de servicio móvil (CCM) propio (CCMP)

May be used in cases where the home location register is implemented in an MSC.

8232 **home PLMN**

F: RMTP de rattachement

S: red propia móvil terrestre pública (RMTP)

The PLMN in which a mobile station is permanently registered.

8237 **visited PLMN**

F: RMTP visité

S: red móvil terrestre pública (RMTP) visitada

The PLMN, other than the home PLMN, in which a roaming subscriber is currently located.

8251 **location register**

F: enregistreur de localisation

S: registro de posiciones

A network data base used for handling of calls in a PLMN.

8252 **home location register (HLR)**

F: enregistreur de localisation nominal (ELN)

S: registro de positiones propio (RPP)

The location register to which a mobile station is assigned for record purposes such as subscriber information.

8253 **visitor location register (VLR)**

F: enregistreur de localisation pour visiteurs (ELV)

S: registro de posiciones de visitantes (RPV)

The location register, other than the home location register used by an MSC to retrieve, for instance, information for handling of calls to or from a roaming mobile station, currently located in its area.

equipment identity register

F: enregistreur d'identité d'équipement

S: registro de identidades de equipo

The register to which an international mobile equipment identity is assigned for record purposes.

8.3 *Handover techniques in public land mobile service*

8301 **handover**

F: relais de communication

S: traspaso

Handover is the action of switching a call in progress.

8321 **MSC-A (controlling MSC)**

F: CCM-A (CCM de commande)

S: CCM-A (CCM que ejerce el control)

The MSC which first established the radio connection to or from a mobile station.

8322 **MSC-B**

F: CCM-B

S: CCM-B

The first MSC to which a call is handed over.

8323 **MSC-B′**

F: CCM-B'

S: CCM-B'

The second (or subsequent) MSC to which a call is handed over.

8.4 *Mobile satellite systems*

8405 **aeronautical (ground) earth station (GES)**

F: station terrienne au sol aéronautique (STS)

S: estación terrena aeronáutica (situada en tierra)

An earth station in the fixed satellite service or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service (see Radio Regulations, Article 1).

8406 **aircraft earth station (AES)**

F: station terrrienne d'aéronef (STA)

S: estación terrena de aeronave

A mobile earth station in the aeronautical mobile-satellite service located on board an aircraft (see Radio Regulations, Article 1).

8415 **coast earth station (CES)**

F: station terrienne côtière (STC)

S: estación terrena costera (ETC)

An earth station operating in the fixed satellite service frequency bands or, in some cases, in the maritime mobile-satellite service frequency bands located at a specified fixed point on land to provide a feeder link for the maritime mobile-satellite service (see also Radio Regulations, Article 1).

8416 **ship earth station (SES)**

F: station terrienne de navire (STN)

S: estación terrena de barco (ETB)

A station in the maritime mobile satellite service intended to be used while in motion or during halts at unspecified points and which is located on board a ship (see Radio Regulations Article 1).

8440 **mobile satellite switching centre (MSSC)**

F: centre de commutation du service mobile par satellite (CCMS)

S: centro de conmutación del servicio móvil por satélite (CCMS)

Indicates the signalling interworking point between the fixed networks and the mobile satellite system which works to a single ocean area. The MSSC may be located at the antenna site of the aeronautical ground earth station or coast earth station, in which case it may operate as an independent international switching centre (ISC) connected to one or more ISCs, on national switching centres. It may also be located remotely from the antenna site, as a supplement to, or a part of an ISC. The term MSSC may also indicate a *maritime* satellite switching centre, with an identical functional definition to the above.

9 Telephone subscriber's equipment and local lines

(Still to be prepared.)

ANNEX A

(to Recommendation Q.9)

Alphabetical list of terms defined in this Recommendation

1210 **register**
3220 **register function**
2013 **register signalling** (Signalling System R1)
2120 **regular signalling link**
0212 **release**
2059 **release-guard signal**
6116 **relocatable address**
1020 **remote exchange concentrator**
1016 **remote switching stage**
1008 **remotely controlled exchange**
2121 **reserve signalling link**
2096 **response** (in a transaction)
1425 **retiming**
6311 **reusable program (routine)**
2058 **ringback tone** (USA)
2058 **ringing tone; ringback tone** (USA)
0150 **route**
6308 **routine**
0151 **routing**
1013 **satellite exchange**
6938 **save** (in SDL)
0302 **second-order digital transmission hierarchy**
0312 **second-order multiplexes**
0205 **seizure**
1115 **selection stage**
1030 **semi-automatic system**
1138 **semi-permanent connection**
6922 **separator** (in MML)
1336 **serial to parallel converter; deserializer** (USA) [staticizer]
1335 **serializer** (USA) [dynamicizer]
8018 **service area**
3223 **service control point**
7011 **service, telecommunication service**
2220 **service indicator**
8416 **ship earth station (SES)**
0040 **signal** (general sense)
2041 **signal imitation** (in VF signalling)
6939 **signal** (in SDL)
0041 **signal** (in signalling applications)
2040 **signal spillover** (in VF signalling)
2147 **signal units**
2001 **signalling**
2122 **signalling channel** (Signalling System No. 6)
2123 **signalling data link**
2109 **(signalling) destination point**
2050 **signalling information**
2116 **signalling link**
2119 **signalling link group**
2071 **signalling message**
2137 **(signalling) message route**
2470 **signalling message transfer delay**
2103 **signalling network**
2104 **signalling network**
2460 **signalling network management functions**
2107 **(signalling) originating point**
2106 **signalling point**
2114 **signalling point code**
2112 **signalling point number plan**
2113 **signalling point restart**
2151 **(signalling) protocol**
2132 **signalling relation**
2134 **signalling route**
2450 **signalling route management functions**
2135 **signalling route set**
2451 **signalling route set test procedure**
2136 **signalling routing**
2021 **signalling system**
1416 **signalling time slot**
2462 **(signalling) traffic flow control**
2452 **signalling traffic management functions**
0115 **software**
6407 **source language**
0066 **space division**
1126 **space division switching**
6941 **specification and description language (SDL)**
6940 **specification** (in SDL)
2004 **speech digit signalling**
2043 **splitting** (in VF signalling)
6942 **state** (in SDL)
1169 **static multiplex**
1130 **stored-and-forward switching**
3000 **stored program control (SPC)**
1334 **subframe**
6309 **subroutine**
0050 **subscriber's line**
2081 **subsequent address message (SAM)**
2082 **subsequent address message with one signal**
6310 **supervisor**
6310 **supervisory program**
7019 **supplementary service**
1110 **switching**
1506 **switching delay (processing (handling) time)**
1113 **switching matrix**
1112 **switching network**
1015 **switching stage**
6923 **symbol**
6943 **symbol** (in SDL)
1145 **symmetrical through connection**
1430 **synchronous**
1431 **synchronization**
1446 **synchronized network** [synchronous network]

6405	**syntax**
6924	**syntax diagram**
3103	**system** (in MML)
8020	**system area**
6406	**target language**
6313	**target program; object program**
6944	**task** (in SDL)
0002	**telecommunication**
0015	**telephone circuit**
7015	**teleservice** [telecommunication service]
1141	**terminating connection**
1168	**tertiary digital muldex**
1143	**through connection**
1510	**through connection delay**
0067	**time division**
1305	**(time division) highway**
1127	**time division switching**
6203	**time sharing** [time slicing]
6204	**time slicing** [time sharing]
1414	**time slot**
1422	**time slot interchange**
1421	**time slot sequence integrity**
1426	**timing recovery (timing extraction)**
6301	**to assemble**
6303	**to compile**
6316	**to debug** (in programming)
6211	**to dump**
6306	**to link** (in programming)
6206	**to map (over)**
6205	**to pack**
6212	**to patch**
6207	**to relocate**
0108	**traffic-carrying device**
2094	**transaction** (in signalling applications)
2426	**transceiver**
2453	**transfer-allowed (procedure)**
2454	**transfer-controlled (procedure)**
2456	**transfer-prohibited (procedure)**
2455	**transfer-restricted (procedure)**
1139	**transit connection**
1003	**transit exchange** [tandem exchange, tandem central office, tandem office]
6945	**transition** (in SDL)
1212	**translation**
1213	**translator**
2126	**transmission buffer**
0007	**transmission channel**
1505	**transmission delay** (through a digital exchange)
1137	**trombone (loop) connection**
1170	**two-wire switching**
1337	**µ/A law converter**
0064	**unidirectional**
2091	**unreasonable message**
2117	**unavailable singalling link**
2205	**user (of a signalling system)**
0081	**user packet**
2102	**user part**
4025	**user-user protocol**
1561	**V-interface**
0017	**virtual circuit**
3007	**utility processor**
8237	**visited PLMN**
8253	**visitor location register (VLR)**
2033	**voice-frequency signalling (VF signalling)**

References

[1] CCITT Recommendation *Vocabulary of digital transmission and multiplexing, and pulse code modulation (PCM) terms*, Vol. III, Rec. G.701.

[2] *List of definitions of essential telecommunication terms*, ITU, Geneva, 1961.

[3] CCITT Recommendation *Terms and definitions of engineering*, Vol. II, Rec. E.600.

[4] CCITT Recommendation *CCITT high level language (CHILL)*, Vol. X, Rec. Z.200.

[5] CCITT Recommendation *The character set and basic elements*, Vol. X, Rec. Z.314, Table 1/Z.314.

[6] CCITT Recommendation *Specification and description language (SDL)*, Vol. X, Rec. Z.100.

[7] CCITT Recommendation *Vocabulary of terms for ISDN*, Vol. III, Rec.I.112.

SECTION 2

NUMBERING PLAN AND DIALLING PROCEDURES IN THE INTERNATIONAL SERVICE

Recommendation Q.10

DEFINITIONS RELATING TO NATIONAL AND INTERNATIONAL NUMBERING PLANS [1)]

1 prefix

F: préfixe

S: prefijo

A prefix is an indicator consisting of one or more digits, that allows the selection of different types of number formats (e.g., local, national or international), transit networks and/or the service.

Prefixes are not part of the number and are not signalled over internetwork or international boundaries.

Note – When prefixes are used, they are always entered by the user or automatic calling equipment.

2 international prefix

F: préfixe international

S: prefijo internacional

The combination of digits to be dialled by a calling subscriber making a call to a subscriber in another country to obtain access to the automatic outgoing international equipment.

3 national (trunk) prefix

F: préfixe (interurbain) national

S: prefijo (interurbano) nacional

A digit or combination of digits to be dialled by a calling subscriber, making a call to a subscriber in his own country but outside his own numbering area. It provides access to the automatic outgoing trunk equipment.

4 escape code

F: code d'échappement

S: código de escape

An escape code is an indicator consisting of one or more digits which is defined in a given numbering plan and is used to indicate that the digits that follow are from a specific numbering plan which is different from the given numbering plan.

1) This Recommendation is an extract of Recommendation E.160 [1]. For the examples relating to §§ 1 to 11, see Fascicle II.2.

For example, escape codes are currently used within the X.121 numbering plan to interwork with E.164 (ISDN) and F.69 (Telex) numbering plans.

An escape code can be carried forward through the originating network and can be carried across internetwork and international boundaries. Therefore the digits used for escape codes should be standardized.

5 country code

F: indicatif de pays

S: indicativo de país

The combination of one, two or three digits characterizing the called country.

6 trunk code

F: indicatif interurbain

S: indicativo interurbano

A digit or combination of digits [not including the national (trunk) prefix] characterizing the called numbering area within a country (or group of countries included in one integrated numbering plan).

The trunk code has to be dialled before the called subscriber's number where the calling and called subscribers are in different numbering areas.

7 subscriber number[2)]

F: numéro d'abonné

S: número de abonado

The number to be dialled or called to reach a subscriber in the same local network or numbering area.

This number is the one usually listed in the directory against the name of the subscriber.

8 national (significant) number

F: numéro national (significatif)

S: número nacional (significativo)

The number to be dialled following the national (trunk) prefix to obtain a subscriber in the same country (or group of countries included in one integrated numbering plan) but outside the same local network or numbering area.

The national (significant) number consists of the trunk code followed by the subscriber number.

It should be noted that, in some countries, it is customary to consider *for national purposes* that the national (trunk) prefix is included in the national number [which is then not the national (significant) number]. A careful distinction must therefore be made between such national definition or practice and the CCITT definition, which is internationally valid. In order to avoid misunderstanding, the CCITT definition includes the word "significant" between brackets, reading as follows: "national (significant) number".

9 international number

F: numéro international

S: número internacional

The number to be dialled following the international prefix to obtain a subscriber in another country.

The international number consists of the country code of the required country followed by the national (significant) number of the called subscriber.

2) Care should be taken not to use the term "local number" instead of "subscriber number".

10 national destination code (NDC)

F: indicatif national de destination (IND)

S: indicativo nacional de destino (IND)

A code field, within the E.164 numbering plan, which combined with the subscriber's number (SN) will constitute the national (significant) number of the international ISDN number. The NDC will have a network and/or trunk code selection function.

The NDC can be a decimal digit or a combination of decimal digits (not including any prefix) characterizing a numbering area within a country (or group of countries included in one integrated numbering plan).

The NDC has to be inserted before the called subscriber's number when the calling and called parties are located in different number areas.

NDC assignments are a national responsibility and therefore the NDC structure varies from one country to another. It may take a trunk code format or serve for selection of a destination network.

The NDC can in some instances, provide a combination of both the above functions.

11 destination network (DN) code

F: indicatif de réseau de destination (RD)

S: indicativo de red de destino (RD)

An optional code field within the E.164 numbering plan which identifies the destination network serving the destination subscriber. It performs the destination network selection function of the NDC. In some instances it can be combined with a trunk code to form the NDC. The DN code can be a decimal digit or a combination of decimal digits (not including any prefix).

Reference

[1] CCITT Recommendation *Definitions relating to national and international numbering plans,* Vol. II, Fascicle II.2, Rec. E.160.

Recommendation Q.11 [1)]

NUMBERING PLAN FOR THE INTERNATIONAL TELEPHONE SERVICE

Introduction

This Recommendation describes the numbering plan for the International Telephone Service. Recommendation E.164 describes the numbering plan for the ISDN era. It is for each Administration to choose the method of application from the two Recommendations which would provide the optimum approach to meeting their future national numbering plan needs. Evolution between the plans is for further study. However, for new equipment, it is recommended that E.164 [2] be adopted.

1 National numbering plan

1.1 Each telephone Administration should give the most careful consideration to the preparation of a *national numbering plan*[2)] for its own network. This plan should be designed so that a subscriber is always called by the same number in the trunk service. It should be applicable to all incoming international calls.

1) This Recommendation is also included in the Series E Recommendations under the number E.163.

2) See the CCITT manual cited in [1] for a comprehensive study of national numbering plans from the national point of view.

Administrations are strongly urged to advise the ITU or CCITT of national numbering plan changes well in advance of the event, so that this information can be published in the ITU *Operational Bulletin.*

1.2 *Number analysis*

1.2.1 The national numbering plan of a country should be such that an analysis of a minimum number of digits of the national (significant) number (see definitions in Recommendation E.160 [3]):

a) gives routing that reflects economic and other appropriate network factors;

b) indicates the charging area in those countries where there are several.

1.2.2 In the case of a country with a two- or three-digit country code, not more than two digits of the national (significant) number need be analyzed for these purposes.

In the case of a country with a one-digit country code, not more than the three digits of the national (significant) number need be analyzed for these purposes.

1.2.3 In the case where an integrated numbering plan covers a group of countries, the digit analysis specified in § 1.2.2 should also determine the country of destination.

1.2.4 For the requirements relating to frontier traffic, see Recommendation D.390 R [4].

2 Limitation of the number of digits to be dialled by subscribers

2.1 *International number*

The CCITT recommended in 1964 that the number of digits to be dialled by subscribers in the automatic international service should not be more than 12 (excluding the international prefix). It is emphasized that this is the maximum number of digits and Administrations are invited to do their utmost to limit the digits to be dialled to the smallest possible number.

2.2 *National (significant) number*

Noting that:

a) the international number (excluding the international prefix) consists of the country code followed by the national (significant) number;

b) the smallest possible number of digits to be dialled in the automatic international service is achieved by limiting the number of digits of the country code and/or of the national (significant) number;

c) in some countries where telephony is already developed to an advanced stage, the national numbering plans in force enable the number of digits of the international number to be limited to less than 12;

d) some other countries which drew up their national numbering plans some time before 1964 have taken steps to ensure that the number of digits of the international number will not exceed 12 and may even be less;

the CCITT recommends that the number of digits of the national (significant) number should be equal to a maximum of $12 - n$, where n is the number of digits of the country code.

3 Digit capacity of international registers

The CCITT considers it advisable to recommend that the digit capacity of registers dealing with international traffic should allow for future conditions that may arise, but not possible to specify at the present time. In this regard, registers dealing with international traffic should have a digit capacity, or a capacity that can be expanded, to cater for more than the maximum 12-digit international number envisaged at present. The increase in the number of digits above 12 is left as a matter of decision to be taken by individual Administrations. However, for new applications, a minimum digit capacity of 15 digits is recommended (see Recommendation E.164 [2]). Administrations are recommended, when making such a decision, to take account of the new applications likely to be introduced in the international service, and which are now being studied by the CCITT.

4 Prefixes and codes

4.1 *International prefix* [3]

It is recommended by the CCITT that the Administrations of countries that have not yet introduced automatic international operation, or Administrations that are, for various reasons, revising their numbering plans should adopt an international prefix (a code for access to the international automatic network) composed of the two digits 00.

The reasons for this recommendation are:

- to provide a maximum degree of standardization such that dialling is made as easy as possible for a person travelling in different countries (many countries already use the code 00),
- to minimize the number of digits to be dialled in automatic international operation,
- to simplify, for a future time when the use of the international prefix might have become a universal international standard, the format for writing an international telephone number.

4.2 *Country code* [3], [4]

4.2.1 Country codes will be used:

- in semiautomatic operation, to route calls to the required country when the calls are transit calls or when, on the outgoing positions, there is common dialling access to all the outgoing routes;
- in automatic operation.

4.2.2 A list of country codes was prepared by the CCITT within the framework of a worldwide automatic telephone numbering plan.

This list was set up according to the following principles:

a) The number of digits of the country code is one, two or three according to the foreseeable telephonic and demographic development of the country concerned.

b) The nine digits from 1 to 9 have been allocated as the country code or as the first digit of the country code. These digits define *world numbering zones.*

c) In the case of Europe, owing to the large number of countries requiring two-digit codes, the two digits 3 and 4 have been allocated as the first digit of the country codes.

4.2.3 The list of country codes already assigned is given in Annex A.

4.3 *Assignment of country codes*

4.3.1 The existing world numbering plan should be maintained and codes presently assigned should not be changed, unless consolidation of an existing numbered area yields an advantage in terms of code usage.

4.3.2 All spare country codes will be assigned on a 3-digit basis, as detailed in Annex B. The list of spare country codes for the international semiautomatic and automatic service is given in Annex C.

4.3.3 In the case where all the country codes in a world numbering zone have been assigned and an additional code is required in that zone, a spare country code from another world numbering zone can be used in accordance with the following rules:

4.3.3.1 Preference should be given to the assignment of a spare country code from an adjacent world numbering zone.

4.3.3.2 If spare codes are not available from an adjacent world numbering zone, assignments will be made from the zones with the most spare codes.

4.4 *Codes for new international services*

The introduction of some international services requires the allocation of a country code. In such cases, the assignment of a country code will be determined by the rules detailed in Annex B.

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[3] See definitions in Recommendation E.160 [3].

[4] A "country code" may be assigned either to an individual country or to a geographical area.

4.5 *Trunk prefix* [5)]

4.5.1 The *national (significant) number* (see definition 8 of Recommendation E.160 [3]) does not include the trunk prefix. Accordingly, in the international service, the trunk prefix of the country of destination must not be dialled.

It should be noted that, in some countries, it is customary to consider *for national purposes* that the trunk prefix is included in the national number [which is then not the national (significant) number]. A careful distinction must therefore be made between such national definition or practice and the CCITT definition, which is internationally valid. In order to avoid misunderstanding, the CCITT definition includes the word "significant" between brackets, reading as follows: "national (significant) number".

4.5.2 It is recommended by the CCITT that the Administrations of countries that have not yet adopted a trunk prefix for access to their national automatic trunk network should adopt a prefix composed of a single digit, preferably 0. Irrespective of what digit is adopted as a trunk prefix, this digit should be precluded from being used also as a first digit of the trunk codes.

The reasons for this recommendation are:

- to provide the maximum degree of standardization of the trunk prefixes used in different countries, so that dialling is made as easy as possible for a person travelling from one country to another,
- to minimize the number of digits to be dialled in the automatic national service,
- to reduce user problems which arise because of the requirement, in automatic international operation, that the trunk prefix of the country of destination must not be dialled.

4.5.3 In the automatic international service, following the international prefix and country code of the called country, the caller should dial the national (significant) number of the called subscriber (i.e. without dialling the trunk prefix).

4.5.4 The use and printing of symbols and separators in national and international telephone numbers is detailed in Recommendation E.123 [5].

4.6 *Use of zero as an escape code*

The use of the digit "0" (zero) as an escape code for numbering plan interworking is described in Recommendation E.166.

ANNEX A

(to Recommendation Q.11)

List of country codes incorporating amendments proposed by the World Plan Committee, 1988

World numbering ZONE 1

Anguilla	1 [a)]	Bermuda	1 [a)]
Canada	1 [a)]	Bahamas (Commonwealth of the)	1 [a)]
United States of America, including Puerto Rico and the Virgin Islands	1 [a)]	Dominican Republic	1 [a)]
Jamaica	1 [a)]	Grenada	1 [a)]
Barbados	1 [a)]	Montserrat	1 [a)]
Antigua and Barbuda	1 [a)]	Saint Kitts and Nevis	1 [a)]
Cayman Islands	1 [a)]	Saint Lucia	1 [a)]
British Virgin Islands	1 [a)]	Saint Vincent and the Grenadines	1 [a)]
		Turks and Caicos (Islands)	1 [a)]

a) Integrated numbering area.

5) See definitions in Recommendation E.160 [3].

World numbering ZONE 2

Egypt (Arab Republic of)	20	Guinea-Bissau (Republic of)	245
Morocco (Kingdom of)	21 [a)]	Diego Garcia	246
Algeria (People's Democratic Republic of)	21 [a)]	Ascension	247
Tunisia	21 [a)]	Seychelles (Republic of)	248
Libya (Socialist People's Libyan Arab Jamahiriya)	21 [a)]	Sudan (Republic of the)	249
Gambia (Republic of the)	220	Rwandese Republic	250
Senegal (Republic of)	221	Ethiopia	251
Mauritania (Islamic Republic of)	222	Somali Democratic Republic	252
Mali (Republic of)	223	Djibouti (Republic of)	253
Guinea (Republic of)	224	Kenya (Republic of)	254
Côte d'Ivoire (Republic of)	225	Tanzania (United Republic of)	255
Burkina Faso	226	Uganda (Republic of)	256
Niger (Republic of the)	227	Burundi (Republic of)	257
Togolese Republic	228	Mozambique (People's Republic of)	258
Benin (People's Republic of)	229	Zanzibar (Tanzania)	259
Mauritius	230	Zambia (Republic of)	260
Liberia (Republic of)	231	Madagascar (Democratic Republic of)	261
Sierra Leone	232	Reunion (French Department of)	262
Ghana	233	Zimbabwe (Republic of)	263
Nigeria (Federal Republic of)	234	Namibia	264
Chad (Republic of)	235	Malawi	265
Central African Republic	236	Lesotho (Kingdom of)	266
Cameroon (Republic of)	237	Botswana (Republic of)	267
Cape Verde (Republic of)	238	Swaziland (Kingdom of)	268
Sao Tome and Principe Democratic Republic of)	239	Comoros (Islamic Federal Republic of the)	269
Equatorial Guinea (Republic of)	240	South Africa (Republic of)	27
Gabonese Republic	241	San Marino (Republic of)	295
Congo (People's Republic of the)	242	Trinidad and Tobago	296
Zaire (Republic of)	243	Aruba	297
Angola (People's Republic of)	244	Faroe Islands (Denmark)	298
		Greenland (Denmark)	299

Spare codes

280, 281, 282, 283, 284, 285, 286, 287, 288, 289
290, 291, 292, 293, 294

a) *Integrated numbering area with subdivisions:*
- Morocco: 210, 211, 212 (212 in service);
- Algeria: 213, 214, 215;
- Tunisia: 216, 217;
- Libya: 218, 219.

World numbering ZONES 3 and 4

Greece	30	Hungarian People's Republic	36
Netherlands (Kingdom of the)	31	German Democratic Republic	37
Belgium	32	Yugoslavia (Socialist Federal Republic of)	38
France	33 [a)]	Italy	39
Monaco	33 [a)]	Romania (Socialist Republic of)	40
Spain	34	Switzerland (Confederation of)	41[a)]
Gibraltar	350	Liechtenstein (Principality of)	41[a)]
Portugal	351	Czechoslovak Socialist Republic	42
Luxembourg	352	Austria	43
Ireland	353	United Kingdom of Great Britain and Northern Ireland	44
Iceland	354	Denmark	45
Albania (Socialist People's Republic of)	355	Sweden	46
Malta (Republic of)	356	Norway	47
Cyprus (Republic of)	357	Poland (People's Republic of)	48
Finland	358	Germany (Federal Republic of)	49
Bulgaria (People's Republic of)	359		

a) Integrated numbering plan.

World numbering ZONE 5

Falkland Islands (Malvinas)	500	Brazil (Federative Republic of)	55
Belize	501	Chile	56
Guatemala (Republic of)	502	Colombia (Republic of)	57
El Salvador (Republic of)	503	Venezuela (Republic of)	58
Honduras (Republic of)	504	Guadeloupe (French Department of)	590
Nicaragua	505	Bolivia (Republic of)	591
Costa Rica	506	Guyana	592
Panama (Republic of)	507	Ecuador	593
St. Pierre and Miquelon (French Department of)	508	Guiana (French Department of)	594
Haiti (Republic of)	509	Paraguay (Republic of)	595
Peru	51	Martinique (French Department of)	596
Mexico	52	Suriname (Republic of)	597
Cuba	53	Uruguay (Eastern Republic of)	598
Argentine Republic	54	Netherlands Antilles	599

World numbering ZONE 6

Malaysia	60	Vanuatu (Republic of)	678
Australia	61	Fiji	679
Indonesia (Republic of)	62	Palau	680
Philippines (Republic of the)	63	Wallis and Futuna Islands	681
New Zealand	64	Cook Islands	682
Singapore (Republic of)	65	Niue Island	683
Thailand	66	American Samoa	684
Mariana Islands	670	Western Samoa (Independent State of)	685
Guam	671	Kiribati (Republic of)	686
Australian External Territories	672	New Caledonia and Dependencies	687
Brunei Darussalam	673	Tuvalu	688
Nauru (Republic of)	674	French Polynesia	689
Papua New Guinea	675	Tokelan	690
Tonga (Kingdom of)	676	F.S. of Micronesia	691
Solomon Islands	677	Marshall Islands	692

Spare codes 693, 694, 695, 696, 697, 698, 699

World numbering ZONE 7

Union of Soviet Socialist Republics 7

World numbering ZONE 8

Japan	81	Democratic Kampuchea	855
Korea (Republic of)	82	Lao People's Democratic Republic	856
Viet Nam (Socialist Republic of)	84	China (People's Republic of)	86 [a]
Democratic People's Republic of Korea	850	Maritime Mobile Service	87 [b]
Hong-Kong	852	Bangladesh (People's Republic of)	880 [c]
Macao	853		

Spare codes 800, 801, 802, 803, 804, 805, 806, 807, 808, 809
830, 831, 832, 833, 834, 835, 836, 837, 838, 839
851, 854, 857, 858, 859
890, 891, 892, 893, 894, 895, 896, 897, 898, 899

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[a] Within this national code, the Telecommunications Administration of the People's Republic of China has notified that the code 866 has been allocated to the province of Taiwan. (Reference: Notification No. 1157 of 10 December 1980.)

[b] The country code 87 is reserved for the Maritime Mobile Service. The following three digit country codes are assigned: 871 INMARSAT (Atlantic), 872 INMARSAT (Pacific), 873 INMARSAT (Indian Ocean).

[c] The remaining combinations in series 88 will not be allocated until the stock of spare 3-digit codes for the region is exhausted.

World numbering ZONE 9

Turkey	90	Saudi Arabia (Kingdom of)	966
India (Republic of)	91	Yemen Arab Republic	967
Pakistan (Islamic Republic of)	92	Oman (Sultanate of)	968
Afghanistan (Democratic Republic of)	93	Yemen (People's Democratic Republic of)	969
Sri Lanka (Democratic Socialist Republic of)	94	United Arab Emirates [a]	971
Burma (Socialist Republic of the Union of)	95	Israel (State of)	972
Maldives (Republic of)	960	Bahrain (State of)	973
Lebanon	961	Qatar (State of)	974
Jordan (Hashemite Kingdom of)	962	Kingdom of Bhutan	975
Syrian Arab Republic	963	Mongolian People's Republic	976
Iraq (Republic of)	964	Nepal	977
Kuwait (State of)	965	Iran	98

Spare codes 970, 978, 979
990, 991, 992, 993, 994, 995, 996, 997, 998, 999

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[a] E.A.U: Abu Dhabi, Ajman, Dubai, Fujeirah, Ras Al Khaimah, Sharjah, Umm Al Qaiwain.

ANNEX B

(to Recommendation Q.11)

Rules for the assignment of spare country codes

The rules listed in this Annex are provided as a basis for the most effective utilization of the spare country codes.

B.1 Single isolated 3-digit codes should be assigned prior to the assignment of any 3-digit code which is part of a series of more than two consecutive 3-digit codes.

B.2 The assignment of spare codes of a zone, both within that zone and also to another zone, will take place as follows:

a) When assigning a code to a country in the same zone:

start with the lowest numbered 3-digit codes in ascending order, e.g. 670, 680 ...

b) When assigning a code to a country in another zone:

start with the highest numbered 3-digit codes in descending order, e.g. 688, 685 ...

c) Within code 87 reserved for the Maritime Mobile Service a third digit will be assigned to codes used for maritime satellite ocean area systems, with the restriction that codes 878 and 879 may not be touched because they are reserved for national purposes.

B.3 Country codes for new international services or for the automation of some existing services should be taken from the world numbering zone with the most spare codes.

ANNEX C

(to Recommendation Q.11)

List of spare country codes for the international semiautomatic and automatic service

Spare codes 280, 281, 282, 283, 284, 285, 286, 287, 288, 289
290, 291, 292, 293, 294
693, 694, 695, 696, 697, 698, 699
800, 801, 802, 803, 804, 805, 806, 807, 808, 809
830, 831, 832, 833, 834, 835, 836, 837, 838, 839
851, 854, 857, 858, 859
890, 891, 892, 893, 894, 895, 896, 897, 898, 899
970, 975, 978, 979
990, 991, 992, 993, 994, 995, 996, 997, 998, 999

References

[1] CCITT manual *National telephone networks for the automatic service*, ITU, Geneva, 1964, 1968, 1978.

[2] CCITT Recommendation *Numbering plan for the ISDN era*, Vol. II, Rec. E.164.

[3] CCITT Recommendation *Definitions relating to national and international numbering plans*, Vol. II, Rec. E.160.

[4] CCITT Recommendation *Accounting system in the international automatic telephone service*, Vol. II, Rec. D.390 R.

[5] CCITT Recommendation *The use and printing of symbols and separators in national and international telephone numbers*, Vol. II, Rec. E.123.

Recommendation Q.11 *bis*[1)]

NUMBERING PLAN FOR THE ISDN ERA

1 Introduction

The rapid advances in telecommunications technology coupled with increased diversification of customer demands served by a number of different types of dedicated public switched networks (telephone, telex, data, etc.) have created a need to provide a uniform customer access and network structure. Such a structure is called the Integrated Services Digital Network (ISDN). Implementation of ISDNs have begun in a number of countries and eventually these will carry all existing and new services.

To facilitate ISDN evolution internationally, this Recommendation defines the numbering arrangements for an ISDN. The timetable for implementation of this numbering plan is described in Recommendation E.165.

2 Definitions

Within the integrated service environment, the terms used for all networks and services must be compatible and consistent. A list of terms and their definitions relating to numbering are contained in Recommendation E.160.

1) This Recommendation appears in the Series E Recommendations as Recommendation E.164 and in the I series Recommendations as I.331.

3 ISDN numbering plan principles

3.1 *General*

The ISDN numbering and addressing principles are described in Recommendation I.330. The ISDN numbering plan will be based on and evolve from the existing numbering plans applicable to national and international public telephone networks.

In view of the evolutionary nature of ISDN, the international numbering plan should provide for substantial capacity to accommodate future network requirements.

Where multiple destinations (i.e., RPOAs/networks) serve the called party's geographic area, the national ISDN numbering arrangement in the country[2] of destination shall provide for discrimination between these RPOAs/networks. The procedure for discrimination between multiple transit-RPOAs/networks is not considered to be a destination address requirement and shall therefore be excluded from the ISDN numbering arrangements.

Before the ISDN numbering arrangement attains global penetration, it must allow for interworking between the ISDN and other public networks. Such arrangements are discussed in Recommendation E.166. Interworking with private networks shall also be taken into account. The definition of private networks and the methods of interworking are for further study and will be covered in future Series E Recommendations.

The 10 digit decimal character set 0-9 is used throughout the ISDN numbering plan format including subscriber number, national (significant) number and the country code.

Prefixes and other information concerned with identifying selection procedures or network service parameters (such as quality of service or transit delay) do not form part of the ISDN number.

The ISDN numbering plan shall include an unambiguous identification of a particular country[2]. In addition, the ISDN number will identify networks and/or ISDNs within these countries[2], if required. In doing so, it shall retain the integrity of the telephone country code as defined in Recommendations E.160 and E.163.

3.2 *Structure of the international ISDN number*

The international ISDN number is composed of a variable length of decimal digits arranged in specific code fields. The international ISDN number code fields are the country code (CC) and the national (significant) number.

The country code (CC) is used to select the destination country[2] and varies in length as outlined in Recommendation E.163.

The national (significant) number N(S)N is used to select the destination subscriber. In selecting the destination subscriber, however, it may be necessary to select a destination network. To accomplish this selection, the national (significant) number N(S)N code field comprises a national destination code (NDC)[3] followed by the subscribers number (SN).

The NDC field will be variable in length depending upon the requirements of the destination country. Each NDC may have one of the following structures:

a) a Destination Network (DN) code, which can be used to select a destination network serving the destination subscribers;

b) a Trunk Code (TC), the format of which is defined in Recommendation E.160;

c) any combination of Destination Network (DN) code and Trunk Code (TC).

The NDCs of an Administration may consist of any of the above structures.

Note – The sequences DN-TC and TC-DN are a national matter. This is a subject for further study.

The subscriber's number (SN) varies in length depending on the requirements of the destination country[2] and is in accordance with Recommendation E.160.

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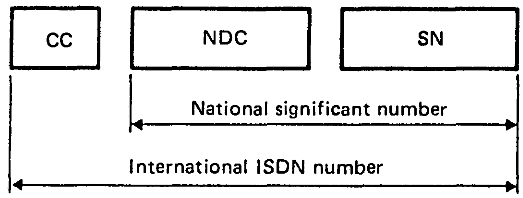
[2] Country or geographical area.

[3] See definitions in Recommendation E.160.

Figure 1/Q.11 *bis* shows the number structure.

Where appropriate, identification of an ISDN within the destination country[4] shall be through the use of a national destination code (NDC) incorporated in the ISDN number.



CCITT-78880

CC Country code as defined by Recommendation E.163
NDC National destination code
SN Subscriber number

Note – National and international prefixes are excluded as they are not considered to be part of the international ISDN number.

FIGURE 1/Q.11 *bis*

Number structure

3.3 *Number length*

The international number may be of variable length. The maximum number length shall be 15 digits. However, some Administrations may wish to increase their register capacity to 16 or 17 digits. The decision on register capacity is left as a matter to be taken by individual Administrations.

The length does not include prefixes, language digit, address delimiters (e.g., end of pulsing signals, etc.) since these items are not considered as part of the international ISDN number.

3.4 *Number analysis*

In order to determine:

- the country[4] of destination,
- the most appropriate network routing,
- the proper charging,

the originating country[4] must analyse a number of digits of the international number. The national destination code (NDC) increases the potential requirement for number analysis because it provides for a combination of either a trunk code (TC) and/or a network identification function. Careful consideration should be given to the preparation of the national destination code (NDC) assignments.

On international calls the number analysis performed at the originating country[4] need not be more than the country code and:

- three digits of the NSN in the case of a country with a three digit country code,
- four digits of the NSN in the case of a country with a two digit country code,
- five digits of the NSN in the case of a country with a one digit country code.

(Translation beyond this requirement could be arranged by bilateral agreement if required, e.g., countries assigned a 1 digit country code may require analysis of up to 6 digits beyond the country code.)

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[4] Country or geographical area.

4 Number allocation principles

The assignment of country codes is administered by the CCITT, while NSN (NDC plus SN) code assignments are a national responsibility.

ISDN subscriber numbers may be allocated from the range of subscriber numbers available in the local ISDN exchange. These will be assigned to customers who subscribe only to the telephone service, customers with one or more data services and customers with a mixture of telephony and data services.

Subscribers equipped with basic access (the definition of ISDN basic access is given in the Series I Recommendations) should normally be allocated one unique number.

5 Network identification

In countries[5] served by more than one ISDN and/or Public Switched Telephone Network (PSTN) the network identification of each is a national matter.

Network identification within the national (significant) number shall be such that:

- in a country[5] all destination ISDN and PSTN networks shall operate under a single Recommendation E.163 country code,
- the international number maximum length of 15 digits shall not be exceeded, nor shall it be necessary for the number of digits for number analysis to exceed that specified in § 3.4,
- provision of network identification is not mandatory for countries using a single integrated numbering plan arrangement for their ISDNs and PSTNs.

6 Service identification

The ISDN number by itself will not identify the particular nature of the service, type of connection or quality of service required. An indication of parameters describing the service required by the calling terminal will be included in a service identifier in the signalling information. This service identifier is not considered to be part of the numbering plan.

7 Calling/called line identity[6]

Calling/called line identity (CLI/CDLI) is address information which is passed across the network to provide supplementary services such as calling (or called) line identification presentation. The format of the CLI and CDLI for international calls should be the full international number, i.e., Country Code (CC), National Destination Code (NDC) and Subscriber Number (SN). No other information, such as prefixes or symbols (e.g. "+"), should be included, although a subaddress may be associated with the CLI/CDLI.

8 Dialling procedures

The subscriber dialling procedures for local, national and international calls shall be in accordance with Recommendation E.163. However, subscribers' control procedures for supplementary services will be as defined in Recommendation E.131 or in separate Recommendations for each service.

ISDN subscribers will always be called by the same subscriber number irrespective of where in the network the call originates. For calls in the same numbering area or local network the subscriber number alone is dialled. For national calls between numbering areas or local networks the subscriber number may be preceded by the national prefix and the national destination code.

The addressing procedures for calls using sub-addressing are described in § 11.

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[5] Country or geographical area.

[6] This termiminology needs further study.

9 Prefixes

The use of prefixes shall be in accordance with Recommendations E.160, E.163 and E.166. Where necessary, prefixes can also be used for network and service selection.

10 Escape code

The use of the digit "0" as an escape code for numbering plan interworking is described in Recommendation E.166.

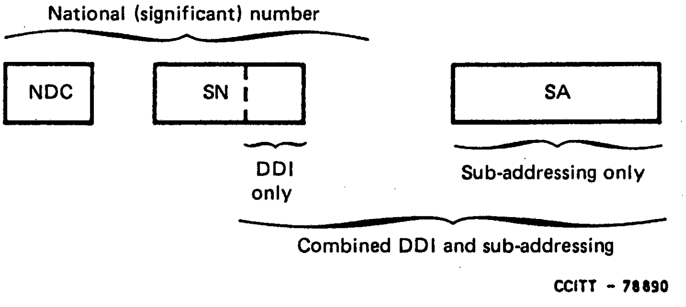
11 Address information

Identification within a subscriber's installation of a point beyond that defined by the ISDN number requires the transfer of address information from the public network to the subscriber's equipment. The following methods apply:

11.1 *Direct dialling-in*

With direct-dialling-in (DDI) the last few digits forming the end of the ISDN subscriber number are transferred to the called subscriber's installation (see Figure 2/Q.11 *bis*). The number of digits used varies and depends upon the requirements of the called subscriber's equipment and the capacity of the numbering plan used.

ISDN subscriber numbers used for DDI may be those published in the public directory.



NDC National destination code
SN Subscriber number
SA Sub-address

FIGURE 2/Q.11 *bis*

11.2 *Sub-addressing (network address extension)*

Sub-addressing provides a separate additional addressing capacity outside the ISDN numbering plan but constitutes an intrinsic part of the ISDN addressing capabilities. As shown in Figure 2/Q.11 *bis* up to 20 octets (or 40 digits) may follow the ISDN number and form the ISDN sub-address, which is transferred to the equipment at the subscriber's premises.

When required, the sub-address is sent by the calling party within the call set-up procedure and is passed transparently through the network as a separate entity from both the ISDN number and user-to-user information. Sub-address information is not required to be processed within the public network.

Sub-addressing procedures are the subject of a separate Recommendation.

11.3 *Combination of sub-addressing and direct dialling-in*

Sub-addressing may be used separately or in combination with DDI (see Figure 2/Q.11 *bis*).

11.4 *Address delimiters*

DDI address information may contain an "end of address" (e.g., ST) delimiter. In the case of sub-addressing, an "end of subscriber number/beginning of sub-address" delimiter and the "end of address" delimiter are required.

(The use of an address delimiter at the end of an ISDN address is for further study.)

Recommendation Q.11 *ter*[1]

TIMETABLE FOR COORDINATED IMPLEMENTATION OF THE FULL CAPABILITY OF THE NUMBERING PLAN FOR THE ISDN ERA (RECOMMENDATION E.164)

1 Introduction

Recommendation I.330 describes ISDN numbering and addressing principles, while Recommendation E.164 describes the numbering plan for the ISDN era. Recommendation E.164 also identifies the need for interworking arrangements between ISDN and present dedicated networks.

This Recommendation sets a specific time (Time *T*), after which all ISDNs and PSTNs can use the full capability of Recommendation E.164, "Numbering plan for the ISDN era", and identifies the numbering requirements on ISDNs and on dedicated networks intending to interwork with ISDNs, before and after Time *T*.

Among the significant principles which form the basis for this Recommendation, the following are considered especially useful for ready reference:

- An E.163/E.164 telephony subscriber may become an ISDN subscriber without a number change.
- Numbers according to Recommendation E.164 apply to both PSTN and ISDN subscribers in the ISDN era. A mixture of PSTN and ISDN terminations on the same exchange is allowed.
- E.164 numbering arrangements may be used to distinguish between ISDN and PSTN subscribers. This is not necessary but is allowed, provided that possible effects on routing and digit analysis remain within the limits of Recommendation E.164.

2 Application and evolution of Time *T*

ISDNs are expected to interwork with dedicated networks. However, due to the different addressing capabilities between the ISDN and existing numbering plans, some temporary constraints need to be imposed on the number length and digit analysis required to access the user network interfaces of the ISDNs before Time *T*.

2.1 *Numbering constraints before Time T*

2.1.1 *ISDNs interworking with dedicated networks*

To allow numbering plan interworking with dedicated networks before Time *T*, an ISDN will not assign international E.164 numbers longer than 12 digits to its user network interfaces capable of receiving calls from dedicated networks.

In addition, for ISDNs and PSTNs, digit analysis as defined in Recommendation E.163 will apply.

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[1] This Recommendation es also included in the series E Recommendations under the number E.165.

2.1.2 *ISDNs which do not interwork with dedicated networks*

These ISDNs are allowed to assign numbers to user network interfaces according to the full capability of the numbering plan for the ISDN era.

Digit analysis according to Recommendation E.164 may be required to access user network interfaces connected to these networks.

2.2 *Evolution after Time T*

After Time *T*, ISDNs and PSTNs can make use of the full capability of E.164 numbers to identify their user network interfaces and terminals respectively. In addition, for routing purposes, the ISDNs and PSTNs conforming to Recommendation E.164 must be capable of analysing the ISDN international number to the extent required in that Recommendation.

Note – Digit analysis for other dedicated networks is for further study.

3 Date of Time *T*

The date for Time *T* has been set for 31 December 1996 at 23h59m Coordinated Universal Time (UTC).

4 Network requirements at Time *T*

ISDNs and PSTNs supporting number length and digit analysis as described in Recommendation E.164 are said to be "E.164-conforming" networks.

All ISDNs must be E.164-conforming networks. Functions associated with E-164-conforming networks are:

a) for calls originated within such a network, provision for carrying E.164 numbers of up to 15 digits to interfacing networks;

b) comparable treatment for transit calls;

c) capability for conducting digit analysis for ISDNs and PSTNs as indicated in Recommendation E.164;

d) screening to ensure that, taking into account agreements between the networks concerned, no transit calls are offered to non-conforming networks incapable of handling number lengths as defined in Recommendation E.164;

e) provision of interim procedures, such as two-stage selection, for internal network sources, e.g., local exchanges, not equipped to handle 15 digits, so that all internal network sources can originate calls to all E.164 addresses.

Note 1 – Other requirements on conforming networks are for further study. Non-conforming networks may seek bilateral agreements with conforming networks, or adopt intra-network procedures to provide means by which subscribers of the non-conforming networks may originate calls to subscribers connected to ISDNs and PSTNs requiring a number length or analysis in excess of the capabilities of the non-conforming network.

Note 2 – Limitations of non-conforming networks and interworking procedures are for further study.

SECTION 3

ROUTING PLAN FOR INTERNATIONAL SERVICE

Recommendation Q.12

OVERFLOW – ALTERNATIVE ROUTING – REROUTING – AUTOMATIC REPEAT ATTEMPT

1 When a call cannot find a free circuit in one group of circuits (first choice), technical arrangements can be made to route the call automatically via another group of circuits (second choice), at the same exchange; this process is called *overflow.* There may also be overflow, at the same exchange, from a second choice group of circuits to a third choice group of circuits, etc.

2 When the group of circuits over which the overflow traffic is routed involves at least one exchange not involved in the previous choice route, the process is called *alternative routing.*

3 It should be noted that overflow can occur without alternative routing for cases such as, when there are in one relation two groups of circuits, one group reserved for one-way operation and the other group used for both-way operation. In this case, when all one-way circuits are busy, the call can overflow to the both-way circuit group.

4 When congestion occurs at a transit exchange, arrangements can be made in some signalling systems, at the outgoing international exchange on receipt of a busy-flash signal or a congestion signal sent by the transit exchange, to reroute the call automatically from the outgoing international exchange over another route. This process is called *re-routing.* The use of rerouting is not envisaged in the International Routing Plan.

. . . .

5 When a difficulty is encountered in the setting-up of a connection – such as double seizure on both-way circuits or error detection – arrangements can be provided to make another attempt to set up the connection for that call from the point where the first attempt took place. This process is called *automatic repeat attempt.*

An automatic repeat attempt may take place:

- on the same circuit; or
- on another circuit of the same group of circuits; or
- on a circuit in another group of circuits.

Recommendation Q.13 [1)]

INTERNATIONAL TELEPHONE ROUTING PLAN

1 Introduction

1.1 This Plan describes an international telephone routing plan designed to enable Administrations to select routings for their traffic which will result in a satisfactory connection between any two telephone stations in the world. The Plan relates to automatic and semi-automatic telephone traffic from fixed and mobile (both land and maritime) stations. The Plan is necessary to allow the objective to be achieved with maximum economy by the most efficient use of costly circuits and switching centres while safeguarding the grade of service and quality of transmission.

1.2 The Plan is one of the basic CCITT Recommendations which influence many other Recommendations, for example the transmission plan (Recommendation G.101).

1.3 In practice the large majority of international telephone traffic is routed on direct circuits (i.e. no intermediate switching point) between International Switching Centres (ISCs). It should be noted that it is the rules governing the routing of connections consisting of a number of circuits in tandem that this Recommendation primarily addresses. These connections have an importance in the network because:

- they are used as alternate routes to carry overflow traffic in busy periods to increase network efficiency,
- they can provide a degree of service protection in the event of failures of other routes,
- they can facilitate network management when associated with ISCs having temporary alternative routing capabilities.

1.4 This Plan replaces the previous one established in 1964 and it can be applied to all existing switching equipment and signalling systems and is intended to be flexible enough to incorporate new switching and signalling developments.

Nevertheless, it is recognized that the Plan, which is complementary to the plan contained in Recommendation E.172, will have to be reviewed and revised to take account of developments in telecommunications.

1.5 The Plan accomplishes its basic purposes unconstrained by, and requiring no changes to, the numbering plan, the rules for charging the calling subscriber and the rules for the apportionment of charges (international accounting).

2 Principles

2.1 The Plan preserves the freedom of Administrations:

a) to route their originating traffic directly or via any transit Administration they choose;

b) to offer transit capabilities to as wide a range of destinations as possible in accordance with the guidelines which it provides.

2.2 The Plan provides guidance on possible international routings. Any routing chosen must be subject to agreements between the Administrations involved before implementation.

The freedom of Administrations to choose the routing of their terminal and transit traffic may be limited by technical, commercial and administrative considerations including:

- the capability of precisely measuring traffic volumes for accounting purposes,
- the need to maximize route profitability,
- the desirability of simplicity in international accounting.

2.3 The governing features of this Plan are:

a) it is not hierarchical;

b) Administrations are free to offer whatever transit capabilities they wish, providing they conform to this Recommendation;

c) direct traffic should be routed over final (fully provided) or high usage circuit groups;

[1)] This Recommendation is also included in the E Series Recommendations under the number E.171

d) no more than 4 international circuits in tandem should be involved between the originating and terminating ISCs;

e) advantage should be taken of the non-coincidence of international traffic by the use of alternative routings to effect circuit economies and provide route diversity (Recommendation E.523);

f) the routing of transit switched traffic should be planned to avoid the possibility of circular routings;

g) when a circuit group has both terrestrial and satellite circuits the choice of routing should be governed by:

   – the guidance given in Recommendation G.114,

   – the number of satellite circuits likely to be utilized in the overall connection,

   – the circuit which provides the better transmission and overall service quality[2)];

h) the inclusion of two or more satellite circuits in the same connection should be avoided in all but exceptional cases. Annex A contains details on the effects of satellite communications.

   Recommendation Q.14 defines the means to control the number of satellite links in an international telephone connection;

i) both originating and transit traffic should be routed over the minimum number of international circuits in tandem unless this is in conflict with one of the above-mentioned features.

3 Number of circuits in tandem

3.1 *International circuits*

For reasons of transmission quality as well as the minimization of post-dialling and answer signal delays and the avoidance of signalling time-outs, it is desirable to limit the number of circuits in tandem in an overall connection (Recommendations G.101 and G.114, § 1). Recommendation Q.7 gives signalling considerations on tandem routings.

In this Plan the number of international circuits in a connection is limited to a maximum of 4. (See § 3.3.2 for a special case with multiple ISCs within the area of one Administration.)

3.2 *National circuits*

Limitations in the national section of the international connection are given in Recommendation G.101, § 3.1.

Many Administrations have fulfilled the requirements of Recommendation G.101, § 3.1 by establishing a national routing plan based on a theoretical final route structure with low-loss-probability circuit groups between switching centres of different categories.

The actual structure in many cases involves direct routes which bypass the theoretical final route or part of it, the structure being rather similar to the former international routing plan.

Note – The former international routing plan was last published in the *Orange Book*, Volume II.2, Recommendation E.171.

3.3 *Multiple ISCs in a country*

3.3.1 *In the originating or terminating country*

Administrations may find it advantageous for technical or economic reasons, or for the protection of service, or to use multiple originating and/or terminating ISCs. In some cases this could result in a routing for a call which includes a circuit between two ISCs in the originating or terminating country. Such circuits may be regarded as national circuits in applying this Plan and as such should be included in the national link allocation (see Recommendation E.172).

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2) When there are circuits between ISCs using different geographical routes with different transmission means, preference should be given to those circuits which provide better transmission quality as long as this is not conflicting with any other part of this Recommendation.

3.3.2 *In a transit country*

Some Administrations may find it desirable to route transit traffic between two ISCs in their own country. In this case the allowable number of international circuits in tandem may be increased from 4 to 5 (this is the only exception to § 3.1 above).

4 Routing techniques

With advanced SPC exchanges and enhanced signalling systems new routing techniques are emerging (see Recommendation E.170). These techniques can be used nationally as found necessary by individual Administrations or bilaterally between Administrations.

5 Basic routing rules

5.1 *Originating traffic*

5.1.1 Originating traffic at an ISC may be offered to any route, taking into account all factors in this Plan, and the following guiding principles, to ensure good overall service quality for the call connection:

a) an originating ISC should first select the direct route to the destination, if it is available;

b) if the direct route is unavailable (because all circuits are busy or because no direct route is provided) then the originating ISC may select the route to any transit ISC which conforms to the principles in § 5.2 below. An agreement should first be reached between the originating, terminating and transit Administrations involved, for the use of this transit route.

5.1.2 A circuit group may be designed as a high usage circuit group (see Recommendation E.522) or as a final circuit group (see Recommendations E.520 or E.521).

5.1.3 Examples of some possible routings are given in Annex B.

5.2 *Transit traffic*

5.2.1 *Two and three international circuits in tandem*

An Administration offering transit capabilities may do so without special arrangements or restrictions to all destinations served by:

a) direct circuit groups, or

b) switching via an additional transit ISC that has a direct final circuit group to the destination, or

c) a combination of a) and b).

Examples of two and three international circuits in tandem are given in b) to e) of Figure B-1/Q.13.

5.2.2 *Four international circuits in tandem*

If an Administration has provided a routing for its originating traffic that involves a maximum of 3 international circuits in tandem to a destination, it may offer this capability to other Administrations for transit traffic. In this case, these other Administrations must not themselves offer transit capabilities to the same destination as this would exceed 4 international circuits in tandem.

Examples of 4 international circuits in tandem are given in f) and g) of Figure B-1/Q.13.

5.2.3 A circuit group may be designed as a high usage circuit group (see Recommendation E.522) or as a final circuit group (see Recommendations E.520 or E.521).

5.2.4 *Special arrangements*

Some Administrations may route transit traffic differently from their own originating traffic to a given destination. These routings will in some cases involve offering transit traffic to direct routes, but not to overflow routes via alternative transit ISCs. On the other hand, originating traffic offered to the same direct routes is given access to overflow routes.

This arrangement may be used for:

a) limiting the number of international circuits in tandem for transit calls, yet allowing originating calls up to the maximum of 4 international circuits in tandem.

b) preventing transit traffic from overflowing from direct routes, to minimize subsequent transit charges.

c) minimizing transmission propagation delay for transit calls.

In such cases, care must be exercised to avoid grade of service problems. Consideration should be given to:

i) the analysis of 24-hour traffic profiles;

ii) the exchange of network status information between Administrations.

In implementing such arrangements, Administrations offering transit capability should provide the necessary information on traffic profiles and network status capabilities. Originating Administrations should evaluate such information taking into account transmission costs, and call completion factors. (See Recommendations E.522 and E.523.)

Examples of some routings involving special arrangements are given in a) and b) of Figure B-2/Q.13.

6 List of international transit capabilities

6.1 To aid in the application of transit routings, a list of international transit capabilities via an Administration is desirable.

6.2 Each Administration that wishes to offer transit capabilities should develop and distribute its own list.

6.3 Annex C details the essential information that should be contained in a list of international transit capabilities plus additional information that might also be distributed by Administrations offering transit capabilities or might be requested by Administrations seeking transit routings.

ANNEX A

(to Recommendation Q.13)

The effects of satellite communication

A.1 The use of geostationary satellite circuits does not call for any alteration in the basic principles and rules of this Plan. However, because of the mean propagation time on satellite circuits, the precautions specified in Recommendation G.114 must be observed.

A.2 At originating ISCs, calls which are to be transit switched at another ISC and likely to use a satellite circuit elsewhere in the connection should be routed using terrestrial circuits from the originating ISC, if available.

A.3 At ISCs arrangements should be made to guard against the inclusion of two or more satellite circuits in the same connection in all but exceptional cases. (See § A.6 below.)

Avoidance of two or more satellite circuits is made more feasible when the signalling systems used have signals indicating whether the connection already includes a satellite circuit. (See Recommendation Q.7.)

In those cases when the signalling system does not provide the necessary information, bilateral agreement should be sought between the Administrations involved to establish a special circuit group on which traffic can be routed that has already one or more satellite circuits in the connections. (See Figure A-1/Q.13.)

A.4 The use of national satellite circuits for international originating and terminating connections should be avoided to the extent possible.

A.5 Connections (originating, terminating or transit) to and from the international maritime mobile satellite service should not, so far as possible, comprise other satellite circuits. In the shore-to-ship direction the country codes allocated to the maritime mobile satellite service should be analysed in order to apply this provision.

A.6 There will be cases when the above provisions cannot be fully applied. These are:

a) routing to and from Administrations with exclusive or almost exclusive use of satellite circuits for international service;

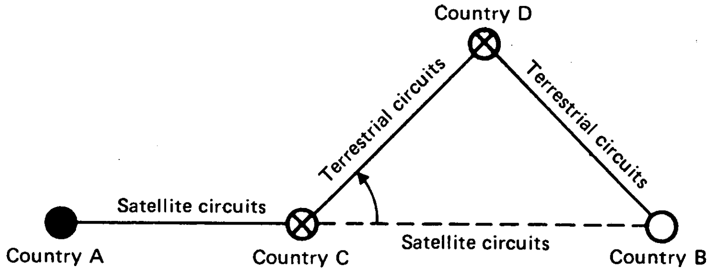
b) routings containing more than one international circuit in tandem in which the signalling systems used on one or more of the circuits in the connection does not provide nature of circuit indicators, or when no agreement can be reached with respect to the special circuit group;

c) when no other reliable means of communication is available; then two or more satellite circuits in one connection may be used.

Note – When it is unavoidable to use more than one satellite circuit in an international connection, attention to echo control as indicated in Notes 2 and 3 of Recommendation G.114 should be exercised.

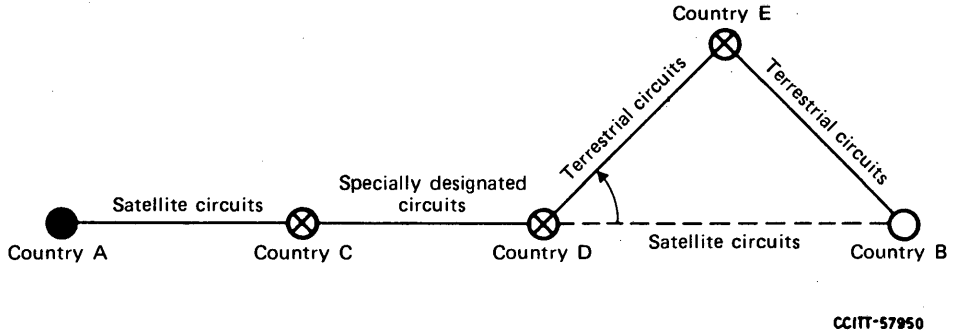
A.7 Control methods for echo suppressors[3] are given in Recommendation Q.115.

A.8 The use of demand assigned satellite systems in international telephony (e.g. SPADE) is governed by the same general and special considerations given above. The entirety of a demand assigned system and its access circuits may be regarded as a single international circuit for transmission purposes and as a transit ISC for routing purposes.



Note – Circuit group Country C to Country B is high usage for traffic originating at C but is not accessed for transit traffic from circuit group Country A to Country C in order to avoid two international satellite circuits in tandem.

a)



Note – Circuit group Country C to Country D is specially designated by the Administration involved to be treated as if it comprised satellite circuits. Circuit group Country D to Country B is high usage for traffic originating at D but is not accessed for transit traffic from the specially designated circuit group Country C to Country D.

b)

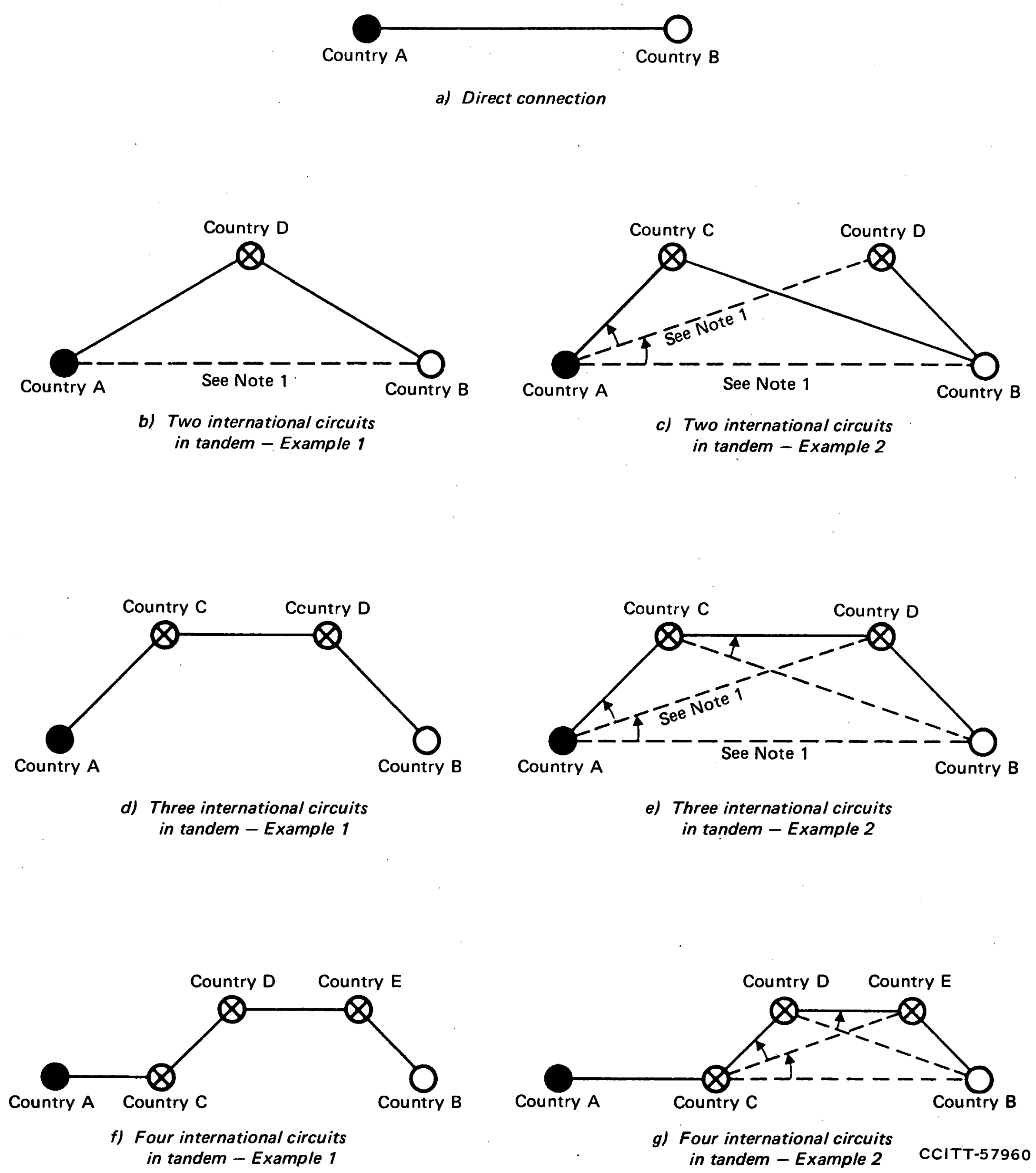
FIGURE A-1/Q.13

3) Echo cancellers are also now in use.

ANNEX B

(to Recommendation Q.13)

Examples of possible routings and special arrangements



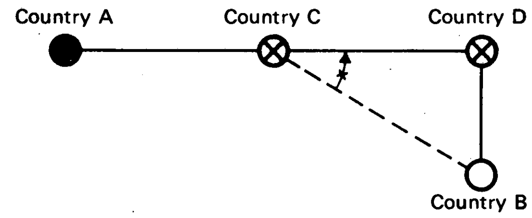
Note 1 – These circuit groups illustrate the choices available to the originating Administration under § 5.1.

Note 2 – For explanation of legends, see Figure B-2/Q.13.

Note 3 – For Figure *a)* see § 5.1.1 a); for Figures *b), c), d), e)* see § § 5.1.1, 5.2.1 b) and 5.2.1 c); for Figures *f), g)* see § § 5.1.1 and 5.2.2.

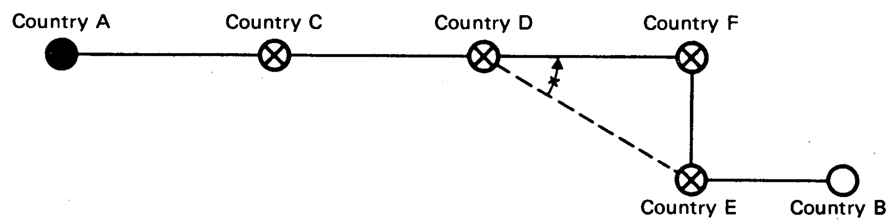
FIGURE B-1/Q.13

Example of some routings possible under the International Telephone Routing Plan



Note – Country C routes its originating traffic to Country B via a direct route with overflow to an alternative route via a transit ISC in Country D. In order to minimize transit charges Country C may bar overflow from the direct route for transit traffic. In establishing this arrangement for Country A, Countries C and A should review the traffic levels and 24 hour profiles to ensure that the transit traffic experiences adequate grade of service.

a)



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Note – This example uses the same principle as *a)* for the purpose of limiting the number of circuits in tandem for transit traffic to 4. This arrangement may be applied at any of the transit ISCs.

b)

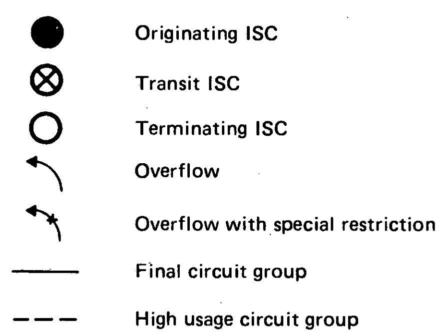


FIGURE B-2/Q.13

Examples of some special arrangements (see § 5.2.4)

ANNEX C

(to Recommendation Q.13)

List of international transit capabilities

C.1 *Essential information on international transit capabilities*

C.1.1 *Use*

Every Administration offering transit capabilities should compile and distribute a list including at least the information shown below in order to enable other Administrations to make a first choice of possible transit routings.

C.1.2 *Suggested format*

See Figure C-1/Q.13.

Administration ______________________________ Date ____________________

Address for Inquiries ____

____

Destination	Transit ISC	Route type	Terrestrial possible	Special restrictions

FIGURE C-1/Q.13

C.1.3 *Instructions for completing the list*

Item A – Administration or RPOA

Enter the name of the Administration or recognized private operating agency responsible for preparing this list.

Item B – Date of information

Enter the date for which the information below applies.

Item C – Address for inquiries

Enter the name, address, telex and telephone number of the organizational unit or individual who will respond to enquiries concerning transit capabilities.

Column 1 – Destination country or Administration

Enter the name of the destination country or Administration. These destinations should be listed alphabetically within each World Zone grouping. Only those destinations for which this ISC can carry automatic transit traffic should be listed in this column. All destinations for which transit capabilities are being offered should be listed.

Column 2 – Transit ISCs

Enter the name or location that identifies the international switching centre(s) that has automatic transit access to the destinations in column 1. For multiple transit ISCs within the same Administration list each ISC in sequence.

Column 3 – Route type

Enter whether the transit route to the destination is either:

DIR – If "direct" to the terminating ISC.

IND – If "indirectly" first routed via a further transit ISC. The name of the further transit ISC should also be entered.

ALT – If either the "DIR" or "IND" route automatically overflows to an "alternative" transit ISC. The name of the alternative transit ISC should also be entered.

Column 4 – Terrestrial possible

Enter YES if at least some transit calls to this destination can obtain an all-terrestrial route beyond the transit ISC.

Enter NO if all transit calls to this destination will use a satellite circuit in the route beyond the transit ISC.

Column 5 – Special restrictions

Enter YES if the transit traffic is subject to overflow restrictions (see § 5.2.4) that might affect the grade of service achieved.

Enter NO if no such restrictions apply.

C.2 *Additional information on international transit capabilities*

C.2.1 *Use*

The information shown below is of value in comparing and selecting possible transit routes. Administrations offering transit capabilities might choose to compile and distribute some or all of these items with their basic list of international transit capabilities. Alternatively, Administrations selecting a transit route may use the items shown below as a basis for enquiries.

C.2.2 *Format*

No particular format is suggested for this information. However, it is recommended that both transit and originating Administrations use the terminology and definitions given below.

If changes are planned in any of the items the change should be indicated together with the effective date.

C.2.3 *Details of additional items*

traffic profile

Under this item the busy hour traffic on the circuit group used beyond the transit ISC should be given together with an indication of the traffic variations during the day. Preferably the variations should be presented in the form of hourly traffic distributions as shown in Recommendation E.523.

Transit charges

Under this item details of the applicable transit charges should be given.

Grade of service

The grade of service normally experienced to the destination should be given. This may be supplemented by time of day variations. If overflow restrictions for transit traffic apply, the information must include at least the hours during which the grade of service is 1% or better.

Circuit quantities

The total circuit quantities available and subtotals for each type of transmission medium should be given.

If indirect routing is used this information should be given for the circuit groups to the next transit ISC.

Signalling

The signalling systems used for the onward routing from the transit ISC should be listed.

Restoration

This item should outline the restoration policy in the case of a major transmission facility outage in the onward routing.

Echo control

This item should list the echo control capabilities at the transit ISC.

Prevention of two or more satellite circuits in tandem

This item should explain the capabilities at the transit ISC for preventing the connection of two satellite circuits in tandem.

Where indirect routing is used, this item should also identify whether a specially designated circuit group has been agreed to allow prevention of two satellite circuits in the same connection at a subsequent ISC.

MEANS TO CONTROL THE NUMBER OF SATELLITE LINKS IN AN INTERNATIONAL TELEPHONE CONNECTION

Recommendation Q.41 states that connections with a mean one-way propagation time in excess of 400 ms should be avoided apart from exceptional circumstances. Means should therefore be provided in international switching centres to prevent the multiple connection of satellite links whenever possible.

The following principles should apply in controlling such connections:

a) If an exchange can determine the prior connection of a satellite link in a connection by:

   – information relating to the incoming circuit,

   – receipt of the Nature of Circuit Indicator: "satellite included",

   the exchange should forward the call on a terrestrial circuit. A satellite circuit may be used in the following exceptional circumstances:

   – where no terrestrial circuits are provided to the required destination,

   – where only a few terrestrial circuits are provided on a final route and the loss of quality of service of a double satellite connection (echo problems and "double-talk") is preferable to the degradation of grade of service that would be caused by the exclusion of the satellite circuits.

   A Nature of Circuit Indicator "satellite included" should be forwarded on the outgoing circuit where possible.

b) If an exchange can determine by an analysis of the call destination that a satellite link will definitely or most probably be included at a later point in the call connection, it should give priority to terrestrial links in its outgoing circuit selection. Special attention is drawn to the analysis of country code 87S which may indicate that the call will include a maritime satellite link. (For the use of the S digit, see Recommendations E.210 [1] and E.211 [2].).

The above principles apply to all international exchanges and to all national exchanges which may connect to circuits via domestic satellite systems.

References

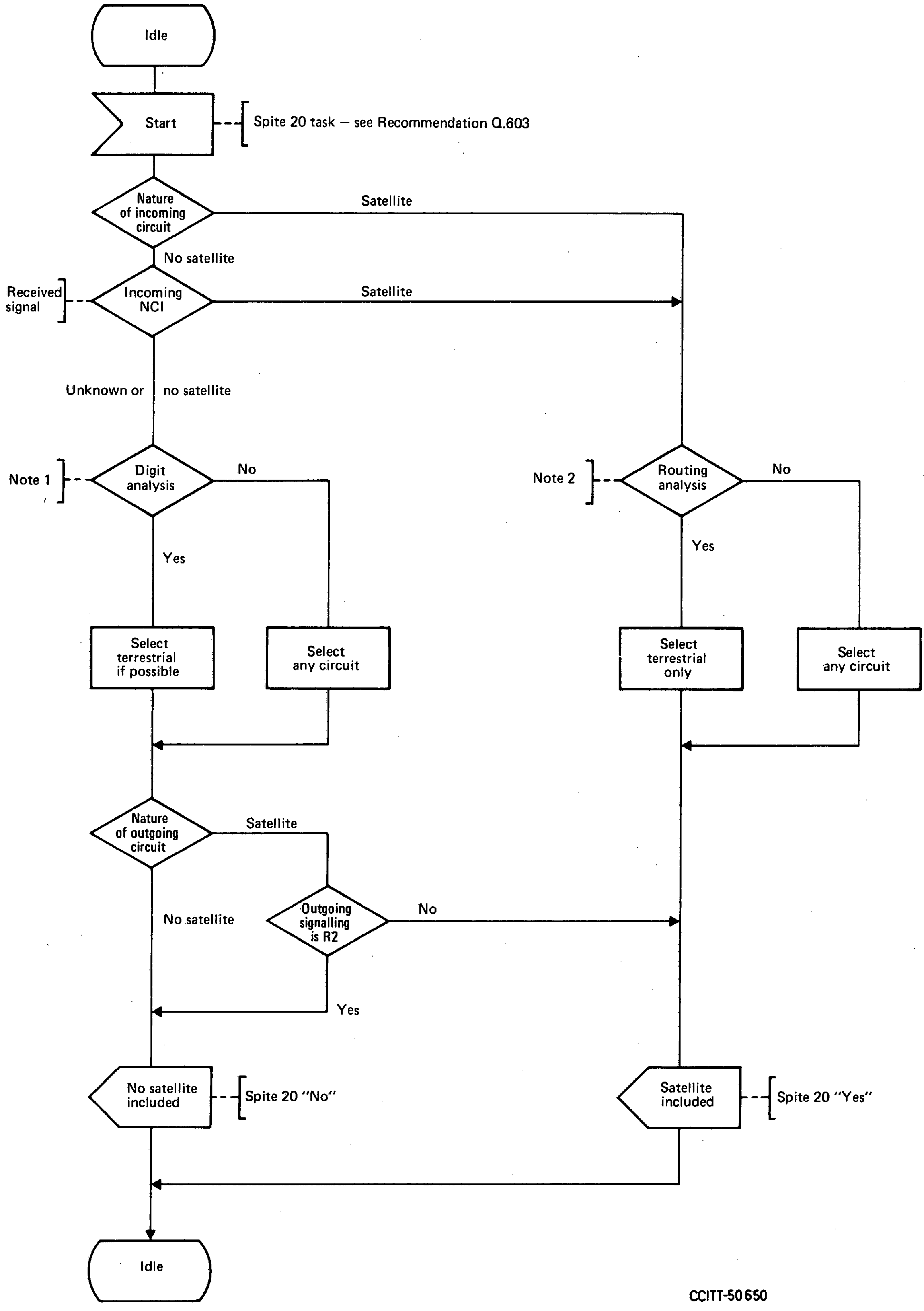
[1] CCITT Recommendation *Ship station identification for VHF/UHF and maritime mobile-satellite services,* Vol. II, Rec. E.210.

[2] CCITT Recommendation *Selection procedures for VHF/UHF maritime mobile services,* Vol. II, Rec. E.211.

ANNEX A

(to Recommendation Q.14)

Call processing logic – Nature of circuit indications



Note 1 – Digit analysis indicates that satellite link will, or may be included at later point.

Note 2 – Are terrestrial circuit groups provided? The answer "no" should be given if the size of the terrestrial circuit group is very small in comparison with the satellite group(s). This can be achieved by giving the terrestrial circuit group the path of entry indication "satellite" for outgoing calls.

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SECTION 4

GENERAL RECOMMENDATIONS RELATIVE TO SIGNALLING AND SWITCHING SYSTEMS (NATIONAL OR INTERNATIONAL)

4.1 Power limits of signals of a signalling system

Recommendation Q.15

NOMINAL MEAN POWER DURING THE BUSY HOUR[1)]

(Remark of Recommendation G.222, Volume III of the Red Book, *amended at Geneva, 1964; further amended)*

Nominal mean power during the busy hour

To simplify calculations when designing carrier systems on cables or radio links, the CCITT has adopted a *conventional* value to represent the *mean absolute power level* (at a zero relative level point) of the speech plus signalling currents, etc., transmitted over a telephone channel in one direction of transmission during the busy hour.

The value adopted for this mean absolute power level corrected to a zero relative level point is −15 dBm0 (mean power = 31.6 microwatts); this is the mean with time and the mean for a large batch of circuits.

Note 1 – This conventional value was adopted by the CCIF in 1956 after a series of measurements and calculations had been carried out by various Administrations between 1953 and 1955. The documentation assembled at the time is indicated in [2]. The adopted value of about 32 microwatts was based on the following assumptions:

i) mean power of 10 microwatts for all signalling and tones (Recommendation Q.15 [2], gives information concerning the apportionment on an energy basis of signals and tones);

ii) mean power of 22 microwatts for other currents, namely:

- speech currents, including echoes, assuming a mean activity factor of 0.25 for one telephone channel in one direction of transmission;
- carrier leaks (see Recommendations G.232, § 5 [3]; G.233, § 11 [4]; G.235, § 5 [5]); and the Recommendations cited in [6] and [7];

1) This Recommendation is, basically, an extract of Recommendation G.223 [1].

– telegraph signals, assuming that few telephone channels are used for VF telegraphy systems (output signal power 135 microwatts (the Recommendation cited in [8])) or phototelegraphy (amplitude modulated signal with a maximum signal power of about 1 milliwatt (the Recommendation cited in [9])).

On the other hand, the power of pilots in the load of modern carrier systems has been treated as negligible.

The reference to "the busy hour" in § 1 is to indicate that the limit (of −15 dBm0) applies when transmission systems and telephone exchanges are at their busiest so that the various factors concerning occupancy and activity of the various services and signals are to be those appropriate to such busy conditions.

It is not intended to suggest that an integrating period of one hour may be used in the specification of the signals emitted by individual devices connected to transmission systems. This could lead to insupportably high short-term power levels being permitted which give rise to interference for durations of significance to telephony and other services.

Note 2 – The question of reconsidering the assumptions leading to this conventional value arose in 1968 for the following reasons:

– changes in the r.m.s. power of speech signals, due to the use of more modern telephone sets, to a different transmission plan, and perhaps also to some change in subscriber habits;

– change in the mean activity factor of a telephone channel due, *inter alia*, to different operating methods;

– increase in the number of VF telegraphy bearer circuits and sound-programme circuits;

– introduction of circuits used for data transmission, and rapid increase in their number.

During several Study Periods these points have been under study and various Administrations carried out measurements of speech signal power and loading of carrier systems. The results are shown in Supplement No. 5. These results indicate that there is no sufficiently firm information to justify an alteration to the conventional mean value of −15 dBm0 (32 μW0) for the long-term mean power level per channel.

Indeed, the steps envisaged by Administrations to control and reduce the levels of non-speech signals indicate a tendency to limit the effect of the increase in the non-speech services.

As regards the subdivision of the 32 μW into 10 μW signalling and tones and 22 μW speech and echo, carrier leaks, and telegraphy, again there is no evidence which would justify proposals to alter this subdivision.

As a general principle, it should always be the objective of Administrations to ensure that the *actual* load carried by transmission systems does not significantly differ from the *conventional* value assumed in the design of such systems.

References

[1] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Rec. G.223.

[2] *CCITT collected documents on the volume and power of speech currents transmitted over international telephone circuits*, Blue Book, Vol. III, Part 4, Annex 6, ITU, Geneva, 1965.

[3] CCITT Recommendation *12-channel terminal equipments*, Vol. III, Rec. G.232, § 5.

[4] CCITT Recommendation *Recommendations concerning translating equipments*, Vol. III, Rec. G.233, § 11.

[5] CCITT Recommendation *16-channel terminal equipments*, Vol. III, Rec. G.235, § 5.

[6] CCITT Recommendation *Characteristics of group links for the transmission of wide-spectrum signals*, Vol. III, Rec. H.14, § 2.3.

[7] CCITT Recommendation *Characteristics of supergroup links for the transmission of wide-spectrum signals*, Vol. III, Rec. H.15, § 2.3.

[8] CCITT Recommendation *Basic characteristics of telegraph equipments used in international voice-frequency telegraph systems*, Vol. III, Rec. H.23, § 1.2.

[9] CCITT Recommendation *Phototelegraph transmission on telephone-type circuits*, Vol. III, Rec. H.41, § 2.3.

Recommendation Q.16 [1)]

MAXIMUM PERMISSIBLE VALUE FOR THE ABSOLUTE POWER LEVEL OF A SIGNALLING PULSE

The CCITT recommends that, for crosstalk reasons, the absolute power level of each component of a short duration signal should not exceed the values given in Table 1/Q.16.

The values given in this table result from a compromise between the characteristics of various existing channel filters.

TABLE 1/Q.16

Maximum permissible value of power at a zero relative level point

Signalling frequency (Hz)	Maximum permissible power for a signal at a zero relative level point (microwatts)	Corresponding absolute power level. Decibels referred to 1 mW (dBm0)
800	750	−1
1200	500	−3
1600	400	−4
2000	300	−5
2400	250	−6
2800	150	−8
3200	150	−8
If the signals are made up of two different frequency components, transmitted simultaneously, the maximum permissible values for the absolute power levels are 3 decibels below the above figures		

Reference

[1] CCITT Recommendation *Maximum permissible value for the absolute power level (power referred to one milliwatt) of a signalling pulse*, Vol. III, Rec. G.224.

4.2 Signalling in the speech frequency band and outside the speech frequency band

Recommendation Q.20

COMPARATIVE ADVANTAGES OF "IN-BAND" AND "OUT-BAND" SYSTEMS

Signalling over telephone circuits may be effected *in* the frequency band used for speech ("in-band" signalling), or *outside* it ("out-band" signalling). In the latter case, the same channel carries both the signalling and speech frequency bands, the signalling band being separate from the speech band, and signalling equipment is an integral part of the carrier system.

1) This Recommendation also appears as Recommendation G.224 [1].

In a further type of out-band signalling, a circuit, not used for speech, can be used to effect the signalling requirements of a number of speech circuits. This may be termed "separate channel signalling". The separate channel may be:

a) a channel in a carrier system used to effect the signalling requirements of the remaining channels in the same carrier system which are used for speech, signalling equipment being an integral part of the carrier system: this may be termed "built-in separate channel signalling";

b) completely separate, in which case signalling equipment is not an integral part of the carrier system; this may be termed "completely separate channel signalling".

1 Advantages of in-band signalling

1.1 In-band signalling can be applied to any type of line plant. The application of out-band signalling, and built-in separate channel signalling, is limited to carrier systems.

1.2 Through-signalling can be employed at transit points, and at carrier system terminals when a telephone circuit comprises two or more carrier links. No direct current repetition and thus no delay and no distortion of signals arises at such points. Out-band signalling and built-in separate channel signalling require a direct current repetition at such points.

1.3 Replacement of a faulty line section is easy. In the case of completely separate channel signalling, replacement of a faulty line section is based on security arrangements.

1.4 It is impossible to set up a connection on a faulty speech path. In the case of completely separate channel signalling, a continuity check of the speech path is required.

1.5 The full bandwidth of the speech channel is available for signalling. This facilitates the use of more than one signalling frequency. Normally the full bandwidth permits faster signalling than with a smaller signalling bandwidth. With in-band signalling, realization of this advantage is limited to those signals not required to be protected against signal imitation due to speech currents.

2 Advantages of out-band signalling

2.1 Relative freedom from disturbances due to speech currents; freedom from disturbances due to echo-suppressors; freedom from disturbances which might arise from connections to other signalling systems. With in-band signalling it is necessary to take steps to guard against such disturbances.

2.2 Possibility of signalling, during the setting-up of the call, by either discontinuous or continuous transmission, and the possibility of transmitting those signals during speech. Signalling during speech is not compatible with in-band signalling.

2.3 Simplicity of terminal equipment due to § 2.1 above and to the possibility of continuous signalling.

Out-band signalling (where the same channel carries both speech and signalling) also has the advantage of § 1.3 of in-band signalling.

Built-in separate channel signalling has the advantages of §§ 2.1, 2.2 and 2.3 of out-band, and the advantage of § 1.3 of in-band signalling.

Completely separate channel signalling has the advantages of §§ 2.1 and 2.2 of out-band signalling and, compared with out-band signalling and built-in separate channel signalling, has the additional advantages that no direct current repetition is necessary, and no distortion of signals arises, at carrier system terminals when a circuit comprises two or more carrier links.

SYSTEMS RECOMMENDED FOR OUT-BAND SIGNALLING

When Administrations wish to make mutual agreements to use out-band signalling systems, the CCITT considers it desirable, from the transmission viewpoint, for them to use one of the types of signalling systems (outside the speech band) defined in the following annexes:

Annex A: Normal carrier systems with 12 channels per group;

Annex B: Carrier systems with 8 channels per group.

ANNEX A

(to Recommendation Q.21)

Out-band signalling systems for carrier systems with 12 channels per group

(The signal levels are quoted in terms of absolute power level at a zero relative level point in dBm0.)

A.1 *Type I* (discontinuous signals)

Frequency: virtual carrier (zero frequency).

Level: high,

for example −3 dBm0.

A.2 *Type II*

1) (discontinuous signals)

Frequency: 3825 Hz.

Level: high,

for example −5 dBm0.

2) (semi-continuous signals)

Frequency: 3825 Hz

Level: low,

for example −20 dBm0.

A.3 The *Type I* signalling system is compatible with only those group and supergroup reference pilots having a displacement from the virtual carrier frequency (zero frequency) of 140 Hz.

Types II-1 and II-2 are compatible with only those group and supergroup reference pilots having a displacement from the virtual carrier frequency (zero frequency) of 80 Hz.

ANNEX B

(to Recommendation Q.21)

Out-band signalling systems for carrier systems with 8 channels per group

[The signal levels are quoted in terms of absolute power level (reference 1 mW) at a zero relative level point.]

Frequency: 4.3 kHz ± 10 Hz.

Level:

- discontinuous signals: −6 dBm0;
- semi-continuous signals: value between −20 dBm0 and −17.4 dBm0.

Recommendation Q.22

FREQUENCIES TO BE USED FOR IN-BAND SIGNALLING

To reduce the risk of signal imitation by speech currents, the frequencies for an in-band signalling system should be chosen from the frequencies in the band in which speech signal power is lowest, i.e. frequencies above 1500 Hz.

The desirability of this was confirmed by tests carried out in London, Paris and Zurich in 1946 and 1948 to choose the signalling frequencies of systems standardized by the CCITT. These tests led to the conclusion that, if relative freedom from false signals was to be obtained other than by undue increase in signal duration, frequencies of at least 2000 Hz would have to be used.

4.3 Signalling frequencies for push-button telephone sets and reception of those signals in exchanges

Recommendation Q.23

TECHNICAL FEATURES OF PUSH-BUTTON TELEPHONE SETS

1 The introduction of push-buttons on telephone sets may have an effect on the operation of international circuits:

a) owing to the greater dialling speed, the post-dialling may be longer, since national and international networks will only be gradually adapted to allow for this greater speed;

b) when pressing the buttons after an international call has been set up, the signalling frequencies for push-button sets may cause interference to foreign signalling systems on the connection. However, the subscriber can be warned of the possible disadvantages of touching the buttons in conditions different from those prescribed.

2 There can be no doubt that, owing to the high dialling speed which can be obtained with push-button sets, their use is bound to spread widely and rapidly and it is desirable for the signalling methods for such sets to be internationally standardized.

One factor in favour of such standardization is the advantage it offers for countries which have to import their equipments from various other countries. This argument, admittedly, applies to any type of telephone equipment.

Other advantages of standardization are:

– the possibility of using the push-button of such sets for signalling directly from one subscriber to another subscriber via a national and/or international connection;

– the standardized allocation of signalling frequencies for push-button sets facilitates the choice of signalling frequencies in the frequency band of a telephone circuit for any other use (data transmission, telephone signalling system, etc.) for which provision might have to be made. The risk of mutual interference among the signalling systems (see Recommendation Q.25) makes it necessary to have an orderly arrangement of the spectrum of frequencies used for signalling.

3 The general use of push-button sets for purposes other than telephone dialling is envisaged by some Administrations. However, some Administrations observe that it would seem advisable to reserve such uses for a network of relatively limited extent; in their view the reliability of standards for data transmission should not make any demands on the push-button set system other than those required for the transmission of telephone numerical information to the local exchange, if the design of push-button sets is to remain within economical limits compatible with their widespread use.

However, the CCITT considered, at Mar del Plata in 1968 that, even if the transmission of data from a push-button telephone set is at present to be envisaged in international traffic on a limited scale only, it would nonetheless be wise not to rule out the possibility of such transmission of data on a general scale.

4 In choosing a signalling system for push-button sets, Administrations may be guided by conditions which vary considerably from one country to another. Economic considerations may, for instance, lead them to prefer a direct current system which might be less expensive than a voice-frequency system. The numerical dialling information would then be transmitted only as far as the telephone exchange to which the subscriber is connected. There are no tones that could affect the connection after its establishment. Data would not be transmitted from the push-button sets unless a suitable converter were used in the exchange.

Standardization of a direct current system for signalling from push-button sets does not seem justified at the international level; it may depend on the conditions peculiar to the local networks of the country concerned.

5 The signalling system for push-button sets recommended by the CCITT applies solely to voice-frequency signals.

A multifrequency code for such signalling is recommended in which the dialling signal is composed of two frequencies emitted simultaneously when a button is pressed. It is planned to have 10 decimal digits and 6 reserve signals, making 16 signals in all. The two frequencies composing each signal are taken from two mutually exclusive frequency groups of four frequencies each, a code known as the "2 (1/4) code".

6 The low group frequencies of this 2 (1/4) code are:

697, 770, 852, 941 Hz.

The high group frequencies are:

1209, 1336, 1477 and 1633 Hz.

The allocation of frequencies to the various digits and symbols of a push-button set appears in Figure 1/Q.23.

7 The frequency variation tolerances and the permissible intermodulation products are defined as follows:

7.1 each transmitted frequency must be within ± 1.8% of the nominal frequency;

7.2 the total distortion products (resulting from harmonics or intermodulation) must be at least 20 dB below the fundamental frequencies.

8 The CCITT determined, at Mar del Plata in 1968, that it was not practicable to specify a standardization of the levels for the frequencies transmitted when a push-button is pressed, as these level conditions depend essentially on national transmission plans which are not the same in all countries.

However, the sending level conditions must be such that on an international connection they do not exceed the values specified in Recommendation Q.16 (maximum permissible value for the absolute power level of a signalling pulse).

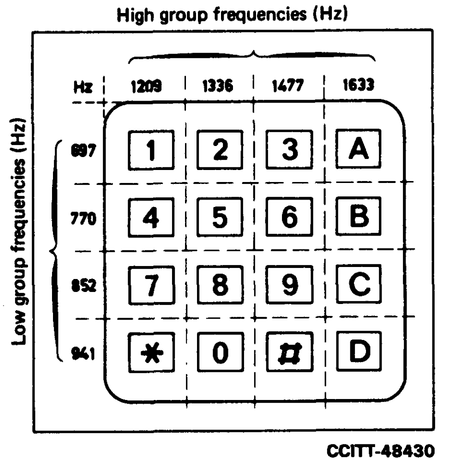

FIGURE 1/Q.23

Allocation of frequencies to the various digits and symbols of a push-button set

MULTIFREQUENCY PUSH-BUTTON SIGNAL RECEPTION

1 Introduction

Characteristics of multifrequency push-button (MFPB) telephone sets using voice frequency signals are included in Recommendation Q.23. This Recommendation Q.24 is intended primarily for application in local exchanges for the reception of MFPB signals. Other MFPB signal receiving applications, such as transit exchanges, would need to take into account the effects of transmission impairments, such as signal clipping, that could be introduced in long distance telephone networks. Since technical factors, such as transmission loss, vary among national networks, varying national standards exist. Varying standards may also exist, for example, to incorporate differences between local and transit exchange applications. This Recommendation is not intended to supersede existing national standards nor is it intended to imply that Administrations should modify those standards.

2 Technical parameters

2.1 *General*

The technical parameters identified herein are fundamental to the MFPB receiving function and reasons are given for the importance of each parameter. The parameters require operational values to be specified for compatibility with the MFPB sending equipment (Recommendation Q.23) and the network environment in which the receiving equipment must function. Annex A contains a Table showing values for some of these parameters that have been adopted by various Administrations and RPOAs. In addition to the fundamental parameters covered by this Recommendation, Administrations should consider whether other parameters need specification to account for operating conditions found in their networks.

2.2 *Signal frequencies*

Each signal consists of two frequencies taken from two mutually exclusive frequency groups (a high group and a low group) of four frequencies each, as specified in Recommendation Q.23. These frequencies and their allocation to form the various digits and symbols of the push-button signalling code are defined in Recommendation Q.23. The exchange shall provide a check for the simultaneous presence of one and only one frequency from the high group and one and only one from the low group.

2.3 *Frequency tolerances*

The exchange should respond to signals whose frequencies are within the tolerances for MFPB sending. Somewhat wider tolerances may be appropriate, for example to cater for transmission impairments encountered in subscriber cables or FDM transmission facilities. However, wider limits may increase susceptibility to noise and digit simulation by speech.

2.4 *Power levels*

The exchange should provide proper reception of signals whose power levels are determined by the amplitude of the sending equipment and loss that may be introduced by the subscriber cables or other network elements. The sending amplitude and transmission attenuation may be different for different frequencies. The reception characteristics may take advantage of a limitation, if specified, on the maximum difference in power level between the two received frequencies forming a valid signal to facilitate improved overall performance.

2.5 *Signal reception timing*

The exchange should recognize signals whose duration exceeds the minimum expected value from subscribers. To guard against false signal indications the exchange should not respond to signals whose duration is less than a specified maximum value. Similarly, pause intervals greater than a specified minimum value should be recognized by the exchange. To minimize erroneous double-registration of a signal if reception is interrupted by a short break in transmission or by a noise pulse, interruptions shorter than a specified maximum value must not be recognized. The maximum rate at which signals can be received (signalling velocity) may be related to the above minimum values. All of these values may also be determined by subscriber feature requirements.

2.6 *Signal simulation by speech*

Because telephone set speech transmitters are normally connected in the circuit during the push-button dialling interval, it is necessary for the exchange to properly receive valid MFPB signals in the presence of voice or other disturbances. The nature of such disturbances may vary from one geographical area to another. The number of calls affected by signal simulation should not significantly degrade the overall telephone network performance experienced by subscribers.

Since actual immunity to digit simulation may be difficult to measure, a test environment using recorded speech, music, and other voice frequency sounds may be utilized to verify design performance.

2.7 *Interference by dial tone*

MFPB reception should not be adversely affected while dial tone is being applied. Characteristics of dial tone such as frequencies, power levels and spurious components are covered in Recommendation Q.35. These characteristics are specified to minimize the interference between the dial tone sending and the MFPB receiving functions. These functions are normally provided by closely related exchange equipment which must be designed to function properly over the entire range of signal characteristics and transmission impairments to be encountered.

2.8 *Interference by echos*

MFPB signal reception from extended subscriber lines having long 4-wire transmission sections must discriminate between a true signal condition and an echo condition which may persist for a number of milliseconds. Failure to provide such discrimination could result in signal reception errors, for example due to a reduction of the detected pause duration. Administrations having such extended subscriber lines with MFPB signalling should therefore specify the echo conditions under which the MFPB signalling function must operate.

2.9 *Noise immunity*

Noise sources such as power lines, electric railways and telecommunication circuits may induce electrical disturbances with various characteristics into MFPB signalling paths. These disturbances may cause MFPB signals to be missed, split (double signal registration) or cause signal simulation. The distortion products produced by the MFPB signalling source should also be included in the noise environment. A realistic noise environment specification and facilities for testing MFPB reception under the specified conditions, e.g., using recorded test tapes, are important to ensure that performance standards will be met under actual service conditions.

ANNEX A

(to Recommendation Q.24)

TABLE A-1/Q.24

Values of multi-frequency push-button receiving parameters adopted by various Administrations/RPOAs

Parameters			Values				
			NTT	AT&T	Danish Administration [a]	Australian Administration	Brazilian Administration
Signal frequencies	Low group		697, 770, 852, 941 Hz	same as left column	same as left column	same as left column	same as left column
	High group		1209, 1336, 1477, 1633 Hz				
Frequency tolerance $\|\Delta f\|$	Operation		$\leqslant$ 1.8%	$\leqslant$ 1.5%	$\leqslant$ (1.5% + 2 Hz)	$\leqslant$ (1.5% + 4 Hz)	$\leqslant$ 1.8%
	Non-operation		$\geqslant$ 3.0%	$\geqslant$ 3.5%		$\geqslant$ 7%	$\geqslant$ 3%
Power levels per frequency	Operation		−3 to −24 dBm	0 to −25 dBm	(A + 25) to A dBm	−5 to −27 dBm	−3 to −25 dBm
	Non-operation		Max. −29 dBm	Max. −55 dBm	Max. (A − 9) dBm (A = −27)	Max. −30 dBm	Max. −50 dBm
Power level difference between frequencies			Max. 5 dB	+4 dB to −8 dB [b]	Max. 6 dB	Max. 10 dB	Max. 9 dB
Signal reception timing	Signal duration	Operation	Min. 40 ms	Min. 40 ms	Min. 40 ms	Min. 40 ms	Min. 40 ms
		Non-operation	Max. 24 ms	Max. 23 ms	Max. 20 ms	Max. 25 ms	Max. 20 ms
	Pause duration		Min. 30 ms	Min. 40 ms	Min. 40 ms	Min. 70 ms	Min. 30 ms
	Signal interruption		Max. 10 ms [c]	Max. 10 ms	Max. 20 ms	Max. 12 ms	Max. 10 ms
	Signalling velocity		Min. 120 ms/digit	Min. 93 ms/digit	Min. 100 ms/digit	Min. 125 ms/digit	Min. 120 ms/digit
Signal simulation by speech			6 false/46 hours for speech with a mean level of −15 dBm	For the codes 0-9, 1 false/3000 calls For the codes 0-9, *, #, 1 false/2000 calls For the codes 0-9, *, # A-D, 1 false/1500 calls	46 false/100 hours for speech with a mean level of −12 dBm		5 false/50 hours for speech with a mean level of −13 dBm
Interference by echos				Should tolerate echos delayed up to 20 ms and at least 10 dB down			

[a] Same characteristics are used by several European Administrations; Values of A range from −22 to −30 to suit national conditions.

[b] The high group frequency power level may be up to 4 dB more or 8 dB less than the low group frequency power level.

[c] For analogue multifrequency push-button receivers only.

4.4 Protection of "in-band" signalling systems against each other

Recommendation Q.25

SPLITTING ARRANGEMENTS AND SIGNAL RECOGNITION TIMES IN "IN-BAND" SIGNALLING SYSTEMS

1 General

In each "in-band" signalling system precautions should be taken so that, when the signalling in that system is taking place:

1.1 no interference in the voice-frequency range from outside the system can pass into the system (i.e. into the transmission path between the sending end and the receiving end of the voice-frequency signals), and

1.2 as far as possible, no signalling current used in the system can pass into other systems, connected in tandem.

2 Sending-end splitting arrangements

2.1 In order to satisfy the condition in § 1.1 above, care should be taken that the correct operation of the signal receiver at the other end of the circuit is not disturbed by:

- surges (transient currents) caused by the opening or closing of direct current circuits connected to the speech wires of the switching equipment, whether these surges precede or follow the sending of a signal;
- noise, speech currents, etc., coming from tandem switched circuits, preceding or during the sending of a signal.

2.2 For this reason the following arrangements have been made in the Signalling Systems No. 4 and No. 5 for the transmission of voice-frequency signals on the international circuit:

i) The exchange side of the circuit shall be disconnected 30 to 50 ms before a voice-frequency signal is sent over the circuit.

ii) The exchange side of the circuit will not be reconnected for 30 to 50 ms following the end of the sending of a voice-frequency signal over the circuit.

2.3 Arrangements of the same type are required on System R1 and on national "in-band" systems [see § 3.4.1 b) below].

3 Receiving-end splitting arrangements

3.1 *General*

3.1.1 In order to satisfy the condition in § 1.2 above, the length of the part of a signal which passes into another system is limited by splitting the speech wires beyond the signal receiver when a signal is received and detected by this receiver.

The time during which the first part (sometimes called *spillover*) of a received signal passes into another system, until the splitting becomes effective, is called "splitting time".

Too long a splitting time may result in interference to signalling on a tandem system depending on the signal recognition time on the tandem system.

Too short a splitting time may result in an increase in the number of false operations of the splitting device by speech currents (*signal imitation*) and so impair speech transmission.

The splitting time must therefore be a compromise between the above two factors.

The splitting device also serves to limit the duration of signals on one path of the 4-wire circuit from returning over the other path by reflections at the termination; these reflections may give rise to faulty operation of signalling equipment on the other path.

3.1.2 The protection against mutual interference between in-band signalling systems in international service involves limitations of the length of any part of:

3.1.2.1 the *international* signal that may be able to pass:

a) from the international signalling system into a national signalling system (protection of the national system);

b) from one international signalling system into another international signalling system, when they are switched in tandem (protection of the international systems);

c) from one international circuit into another international circuit of the same system when they are switched in tandem in the case of link-by-link signalling.

3.1.2.2 the *national* signal that may be able to pass:

a) from the national signalling system into an international signalling system (protection of the international system);

b) from one national signalling system into the national signalling system of another country via an international connection (protection of the national system).

3.2 *Protection of national and international systems against international systems*

Conditions in § 3.1.2.1 above are met because international signalling systems have a splitting device on each circuit. The splitting times of such systems are:

55 milliseconds for the compound signal element in System No. 4;

35 milliseconds for a signal in System No. 5;

20 milliseconds for a signal in System R1.

3.3 *Protection of the international system against national systems*

The condition in § 3.1.2.2 a) above is generally covered because:

– the values given in the specifications of the CCITT standard systems as the minimum recognition time of a line signal are in general greater than the splitting times of national systems (see the tables giving the basic characteristics of national signalling systems in Supplement No. 3 at the end of this fascicle);

– the signalling frequencies used in the international systems are, in the majority of countries, different from those used in national systems.

It may be necessary, if the splitting time of a national signalling system is greater than the minimum signal recognition time of an international system and the signalling frequencies used in the national system and international system are the same or nearly the same, to insert a device at the international exchange which will prevent a part of the national signal from passing into the international circuit for longer than this recognition time.

3.4 *Interference between national signalling systems when they are interconnected via an international circuit*

3.4.1 To ensure protection of national signalling systems one against the other [protection defined under § 3.1.2.2 b) above], it has been recommended by the CCITT since 1954 that new national "in-band" signalling systems should comply with the following two clauses:

a) not more than 35 milliseconds of a national signal should be able to pass into another country;

b) the connection between an international circuit and a national circuit should be split on the national circuit at the international exchange 30 to 50 milliseconds before that exchange sends any signal over the national signalling system.

Note – The object of these two clauses is to avoid interference, especially in conditions that may exist on international automatic connections.

3.4.2 The requirement of § 3.4.1 a) permits the signalling system used in country A to have a minimum signal recognition time based on this value of 35 milliseconds. It will then be possible to ensure, without taking any other precautions at the incoming end of an international circuit, that no fraction of a signal coming from country B, and being of the same, or nearly the same, frequency as that used in country A, will be wrongly recognized as a signal in country A.

One method of meeting the requirement of § 3.4.1 a) is to adopt a splitting time of less than 35 milliseconds for the national systems.

Another method exists which does not involve such a limitation in the splitting times of national systems, and which might be preferred when the design of the national signalling system is such that a short splitting time is not normally justified for that system alone. This second method involves the introduction, in the international exchange, of an arrangement for limiting the length of national signals which are liable to pass into the international circuit. Such an arrangement would be used only on circuits to those countries where there is a danger that interference might arise.

3.4.3 The requirement of § 3.4.1 b) avoids the false operation of the guard circuit of a signal receiver situated at the distant end of a national circuit.

4.5 Miscellaneous provisions

Recommendation Q.26

DIRECT ACCESS TO THE INTERNATIONAL NETWORK FROM THE NATIONAL NETWORK

The choice of the method of access to an outgoing international exchange from the national network is a purely national matter. Nevertheless, if an international connection is set up by automatic switching from an exchange other than the international exchange which is the outgoing point of the international circuit used, arrangements should be made in the national network to transmit over the international circuit at least the signals required to ensure the satisfactory setting-up, control and clearing-down of the international connection.

In addition, where a group of national circuits used in the above manner carries both semi-automatic and automatic traffic, means should be provided for distinguishing between these two classes of traffic for the purposes of international accounting [1].

Reference

[1] CCITT Recommendation *Basic technical problems concerning the measurement and recording of call durations*, Vol. II, Rec. E.260, § 2.

Recommendation Q.27

TRANSMISSION OF THE ANSWER SIGNAL

It is essential for the answer signal to be transmitted with a minimum of interference to the transmission of speech currents, because the called subscriber may already be announcing his presence at this stage of the call.

On a connection which has been set up, the answer signal generally entails, at a certain number of points:

a) repetitions and conversions, which delay transmission; and

b) splitting of the speech path, where in-band signalling is used.

It is therefore desirable to minimize the delays and the duration of the interruption of the speech path. Minimization of the latter can be achieved by:

– short send line splitting;
– short duration of the signal; and
– fast termination of the sending and receiving splits on cessation of the signal.

Recommendation Q.28

DETERMINATION OF THE MOMENT OF THE CALLED SUBSCRIBER'S ANSWER IN THE AUTOMATIC SERVICE

1 Arrangements should be made in the national signalling system of the incoming country to determine (in the outgoing international exchange) the moment when the called subscriber replies; this information is necessary in the international service for the purposes of:

- charging the calling subscriber [1];
- measuring the call duration [2].

2 Where subscribers in an outgoing country have direct access to an operator's position (in a manual exchange, for instance) in a public exchange of an incoming country, arrangements should be made in the national network of the incoming country to ensure that – in the outgoing country – the calling subscriber is charged, and the call duration measured, only from the moment when the called subscriber replies. This means that an answer signal is not sent when the operator in a public exchange of the incoming country replies. These provisions are set out in detail for CCITT standardized systems (see Recommendation Q.102).

References

[1] CCITT Recommendation *Chargeable duration of calls*, Vol. II, Rec. E.230.

[2] CCITT Recommendation *Basic technical problems concerning the measurement and recording of call durations*, Vol. II, Rec. E.260.

Recommendation Q.29

CAUSES OF NOISE AND WAYS OF REDUCING NOISE IN TELEPHONE EXCHANGES

Circuit noise may be classified as follows:

1) power supply noise,
2) noise generated in the speech path circuit,
3) noise induced in the speech path circuit.

1 Power supply noise

1.1 *Power sources*

The interference resulting from the harmonics, ripple and current fluctuation of machines, rectifiers and batteries.

This noise may be reduced by d.c. generators with low harmonics and good regulation and rectifiers with good regulation, effective filters, and batteries with large capacity (i.e. with low internal impedance).

1.2 *Supply leads*

The interference in the speech circuits of an exchange due to power supply equipment originates mainly in the common impedances of the supply paths of speech and switching circuits, and is caused mainly by the sudden fluctuation of the current resulting from the sudden operation and release of the different relays, magnets and contacts.

These common impedances may be reduced by:

a) the use of common power supply leads of sufficiently low resistance, the use of large capacitors fitted at apparatus ends of supply leads with minimum impedances, e.g. minimum distance between bus bars, or coaxial feeders. Another method employs close-spaced cables with alternate polarity;

b) the use of a common battery with separate power supply leads for speech and switching circuits. Better results may be obtained at an increased cost by independent batteries adequately separated;

c) the arrangement of the cells of the battery in a U formation.

1.3 *Earth returns*

Independent earth returns should be used for signalling-frequency supply circuits.

2 Noise generated in the speech circuit

2.1 *Contact noise caused by vibration*

This kind of noise is caused by contact resistance variations of the various commutator, switch and relay contacts due to mechanical vibration.

This contact noise may be reduced by:

a) the use of damping devices to reduce the generation of vibration caused in particular by relay sets, mechanical and electromagnetic clutches;

b) the use of multiple brushes, spring or resilient mountings to reduce the transmission of vibration;

c) a suitable choice of contact materials;

d) the use of the best contact shape and of twin contacts;

e) maintaining atmospheric conditions at an appropriate relative humidity and the use of air filters; use of dust covers on equipment, arranging design of columns, window sills, radiators and floor to avoid harbouring dust;

f) careful maintenance cleaning and lubrication in accordance with specifications.

2.2 *Frying noise*

In speech circuits some contact materials are liable to cause frying noise.

This noise may be reduced by the use of suitable contact materials and by keeping an appropriate relative humidity.

2.3 *Contact noise caused by wetting currents*

Speech circuits without d.c. currents are liable to fading due to contact resistance fluctuations. Fading may be reduced by wetting. However, wetting currents may introduce frying noise on the lines.

2.4 *Charge and discharge clicks*

Clicks may frequently be caused by the charging or discharging of capacities (cable capacity) by switches when rotating over occupied and non-occupied terminals.

Objectionable clicks are also likely to result from sudden battery reversals, dialling and other abrupt changes in the current flowing in the speech circuits.

These effects may be reduced:

a) by disconnecting the speech circuits from the brushes during the hunting period of the switch;

b) by the use of twisted pairs, by limiting the length of cabling and also by locating relays as close as possible to the selectors they control.

2.5 *Unsound contacts*

Objectionable noise may be due to unsound contacts on distribution frames, particularly when work is in progress such as adding or changing jumpers, etc. Such unsound contacts may be due to "dry" contacts inadequately soldered, poorly wrapped joints, or to the use of distribution frame equipment having inadequate contact pressure. It is suspected that this type of trouble is responsible for most of the "hits" and "misses" and usually for an increase in noise.

2.6 *Tapping losses*

When lines are tapped for service interception, observation, etc., the tapping circuit should be designed to give the minimum of unbalance to earth and the transmission loss introduced should be a minimum. Semi-permanent connections should be used in preference to base-metal sliding connections at the tapping point.

2.7 *Reduction of the number of switching contacts*

Circuits should be designed so that at each switching stage there is a minimum number of contacts in the speech circuit in order to reduce the risk of microphonic noise from "dry" contacts.

3 **Noise induced in the speech circuit**

3.1 *Noise induced in the speech circuit may be due to:*

a) speech crosstalk;

b) signalling frequency crosstalk;

c) induction from tone supplies;

d) direct current pulses;

e) clicks caused by abrupt changes in inductive and capacitive circuits.

Clicks may be reduced at the source by the use of spark quench devices or other means to reduce the steepness of the interfering wave-front concerned. In addition, noise may be reduced by balancing, by using twisted pairs and/or by screening.

3.2 *Noises due to unbalanced transmission bridge circuits*

A well-balanced circuit is necessary for the transmission bridge to avoid noise interference. This can be achieved by:

a) the use of balanced components;

b) the separation of components used for speech from those used for control and switching;

c) the separation of individual transmission bridges by screening or spacing;

d) the addition of balancing components, e.g. balancing transformers of retardation coils;

e) taking the precautions listed at the end of § 3.1 above.

3.3 *Low-level speech circuits*

Low-level electronic speech circuits are particularly susceptible to noise induction and should therefore be screened.

3.4 *Longitudinal interference*

Such noise may be induced into the speech circuit from the line by power distribution systems and traction circuits or by earth potential differences.

These may be reduced by balancing the line or by the addition of transformers.

Note – Interference which is sufficiently severe to cause unwanted operation of relays, etc., may be overcome by the use of loop circuits which should also reduce noise.

Recommendation Q.30

IMPROVING THE RELIABILITY OF CONTACTS IN SPEECH CIRCUITS

The following methods can be used for improving the reliability of contacts in speech circuits:

a) use of precious metals such as platinum, palladium, gold, silver, or alloys of these metals. If, for one reason or another, it is not desired to "wet" the contacts, or if enough contact pressure cannot be provided, it is preferable to use the metals or alloys mentioned above, with the exception of pure silver;

b) use of high contact pressure;

c) double contacts;

d) lubrication (with suitable oils) of certain non-precious metal contacts in the case of sliding contacts;

e) direct current "wetting" of contacts, care being taken to avoid the introduction of noise due to transients when the contacts are made or broken;

f) air filtration or other protective measures to avoid dust;

g) the maintenance of suitable humidity;

h) the use of protective covers;

i) protection against fumes, vapours and gases;

j) avoidance of the use, near contacts, of materials likely to be detrimentral to the contacts.

When voice-frequency signals are sent over a transmission path, as it is not possible to use direct current wetting for the voice-frequency signal transmitting contacts due to the surges which occur on closing and opening the contact, it is preferable to use static modulators with rectifier elements.

Recommendation Q.31

NOISE IN A NATIONAL 4-WIRE AUTOMATIC EXCHANGE

It is desirable that the requirements concerning noise conditions for a national 4-wire automatic exchange be the same as for an international exchange (see Recommendation Q.45, § 5).

Recommendation Q.32

REDUCTION OF THE RISK OF INSTABILITY BY SWITCHING MEANS

For any connection between two-wire terminations, the transmission plan admits a certain risk of instability. In an international connection, Recommendation G.122 defines for each national network its responsibility in this respect.

It is recognized in § 2 of that Recommendation that during certain phases of the call, the risk of instability could in certain circumstances become excessive; this refers in particular to conditions other than that of an established connection, viz. during set-up, clear-down and changes in a connection. Appropriate precautions must then be taken by the switching services.

Techniques applicable to analogue exchanges which will afford a reduction of the risk of instability for a national network have been shown in earlier versions of Recommendation Q.32 (*Red Book* 1985 and earlier). For digital exchanges these methods are as a rule not equally suitable, however, it should be noted that, with today's digital networks giving 4-wire transmission down to the local exchanges and with corresponding terminating losses, the transmission plan may often not require extra loss during setting-up, etc., conditions.

Recommendation G.121, § 6.2 calls for a sum of losses round the a-t-b path of at least 6 dB; calculating according to Recommendation G.122, § 2.2, this would be some four times the standard deviation, corresponding to a risk of about 3 in 10 000. (The six calls per thousand risk called for in Recommendation G.122 corresponds to about 3.25 times the standard deviation.) The switching services thus only need to maintain this minimum loss in cases where it is reduced in the conditions mentioned.

The use of a restricted value of loss (rather than total interruption of the 4-wire loop) allows the passage of information tones or recorded announcements or of communication with an operator, and of national use for non-chargeable calls. Although as a rule digital pads are deprecated, the reasons for this are all concerned with their presence in an established connection, and do not apply to their use for the present purpose.

Recommendation Q.33

PROTECTION AGAINST THE EFFECTS OF FAULTY TRANSMISSION ON GROUPS OF CIRCUITS

1 General

1.1 Although certain signalling systems may have the capability to provide an indication when an individual circuit is faulty, in order to maintain the required availability of the public network, it is considered necessary to provide alarm facilities to alert maintenance staff when a group of circuits provided by a multiplex transmission system is faulty.

1.2 An alarm indication can be initiated on failure of a FDM system by means of pilot supervision. On failure of a PCM system, and alarm indication initiated at both ends by the loss of frame alignment (or multiframe alignement as appropriate) [1], [2].

These failure indicators provide the means whereby the faulty circuits can be removed from service automatically and, when the fault condition no longer exists, be restored automatically by the switching control of an international exchange (see § 1.4 below).

Additionally, the existence of such failure indications allow an end-to-end indication of circuit availability which is a prerequisite to the operation of Signalling System No. 7 without a per call continuity check [see Recommendations Q.724 (TUP) and Q.764 (ISUP)].

1.3 Where transmission links comprise several transmission systems in tandem, the protection against the effects of faulty transmission on groups of circuits can only be maintained if the primary multiplex structure is maintained from end-to-end together with a transparency of alarm indications. In other cases the provisions of §§ 2 and 3 below apply.

1.4 Following a transmission failure a number of specific signalling actions are required to be carried out by the switching control of an international exchange. These actions are designed to:

a) prevent failure of new call attempts;

b) provide appropriate failure indications on established calls;

c) provide a means of releasing circuit connections beyond the point of transmission failure.

Paragraph 4 below details the actions to be taken for circuits employing Signalling Systems Nos. 5, 6 and 7 (TUP and ISUP). For circuits employing Signalling System R2, Recommendation Q.416 details the actions to be taken.

1.5 The recognition time used by the international exchange to validate the alarm ON/alarm OFF states shall be 20 ± 10 milliseconds. The recognition time is defined as the duration that signals representing the alarm ON/OFF states must be present at the input of the exchange terminal equipment.

Following recognition of the alarm ON or alarm OFF states the exchange shall carry out the actions detailed in § 4.

2 Mixed transmission systems

2.1 Some transmission links comprise differing transmission systems which for maintenance purposes are treated separately (see Recommendation G.704). Examples of such transmission links are those with:

- analogue/digital conversion via transmultiplexers;
- conversion between 24 and 30 channel PCM systems;
- links via TDMA/DSI satellite systems.

In these cases, failure indications from the local multiplex equipment can be used, but alone these do not provide an end-to-end indication of circuit availability. Since the multiplex systems use different standards, it is usually impossible to provide a ready conversion of alarms from one system to another. In order to retain the benefits of the alarm indications for groups of circuits it is necessary to carry the fault indications on a circuit basis. This may be inherent in the normal circuit signalling (as in the case of the digital version of Signalling System R2) but in the general case some form of individual circuit supervision is required.

2.2 *Circuit supervision for digital systems*

2.2.1 *2048 kbit/s systems* (Recommendations G.732, G.734)

8448 kbit/s systems (Recommendation G.744)

In these systems there are two frame structure possibilities. One supports channel associated signalling, and the other is intended for common channel signallig which allows extra time-slots to be used for speech circuits. In order to provide circuit supervision it is necessary to use the frame strcuture for channel associated signalling, even in the case of voice frequency and common channel signalling systems. This implies a number of restrictions:

- in the 2048 kbit/s system time slot 16 is not available for speech. Additionally, the common channel signalling links of Systems No. 6 and No. 7 must use a time slot other than number 16;
- similarly, in the 8448 kbit/s system time slots 67-70 are required for the circuit supervision and cannot be used for speech.

Other systems of transmitting circuit supervision information (for example, using a common channel) are for further study.

2.2.2 *1544 kbit/s systems* (Recommendations G.733, G.735)

In this system the S bit is used for circuit supervision in a similar manner to its use for channel associated signalling.

2.2.3 *Non-standard systems*

In non-standard transmission systems it will often be necessary to provide a discrete signalling path for the transmission of circuit supervision indications. Annex A to this Recommendation describes the arrangements used for circuit supervision on TDMA/DSI satellite systems together with the interfacing with the terrestrial channels.

3 Signalling of circuit supervision indications

3.1 In integrated digital transmission systems interfacing directly with exchanges (e.g. Recommendations G.734, G.744) and where systems connect to the other Administrations, it is recommended that a standard form of circuit supervision be used. This is detailed below for 2048 kbit/s PCM systems and 1544 kbit/s PCM systems.

3.2 *2048 kbit/s PCM systems*

Signalling bits "a" and "b" of time slot 16 are used. Under abnormal (alarm) conditions both a and b bits are set to 1. The normal (no-alarm) condition is when "a" and "b" bits are not both equal to 1.

3.3 *1544 kbit/s PCM systems*

In this system the circuit supervision information is generated:

- by forcing bit 2 in every channel time slot to the value 0, or
- by modifying the S bit as described in § 3.1.3.2.2 of Recommendation G.704 for the 12 frame multiframe, or
- by sending a frame alignment alarm sequence (1111111100000000) as described in § 3.1.1.3 of Recommendation G.704 for the 24 frame multiframe [1)].

4 Actions in Signalling Systems Nos. 5, 6 and 7 when a transmission alarm occurs

This section details the actions which should be taken on circuits using Signalling Systems No. 5, No. 6 and No. 7 when a transmission alarm occurs concerning the speech path. This annex is intended to be applied to new exchange equipment only.

It is split into two broad areas dealing firstly with Signalling System No. 5 and then with Signalling Systems No. 6 and No. 7. This split is required because the actions taken for inband signalling systems is slightly different to that taken for common channel signalling systems.

4.1 *Signalling System No. 5*

The action taken if a transmission alarm occurs during the states shown below is as follows:

4.1.1 *Outgoing circuit failure*

4.1.1.1 *IDLE STATE*

Take the circuit out of service to outgoing traffic. Return to service when transmission is restored.

4.1.1.2 *REGISTER STATE*

The register state is assumed to start with sending of seizure signal and to end with sending of end of pulsing signal (ST).

- Send clear forward.
- Send a call unsuccessful indication on incoming circuit or possibly carry out a repeat attempt.
- If clear forward release guard sequence fails, inhibit the repeat clear forward sequence. Resume the repeat clear forward sequence when the transmission is restored limiting the number of simultaneous signals to a value which will prevent overload of the transmission system.
- If the clear forward release guard sequence is successful, take the circuit out of service to outgoing traffic.

4.1.1.3 *SEIZED BUT AFTER REGISTER STATE*

- Wait for calling party to clear and send clear forward.
- If answer signal has not been returned from called party, send a call unsuccessful indication on incoming circuit.
- If clear forward release guard sequence fails, inhibit the repeat clear forward sequence. Resume the repeat clear forward sequence when the transmission is restored limiting the number of simultaneous signals to a value which will not overload the transmission system.
- If clear forward release guard sequence is successful take the circuit out of service to outgoing traffic.

4.1.1.4 *BLOCKED*

- No special action required.

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1) The third method proposed cannot ensure a proper end to end supervision if a TDMA system with multidestination of multiplexes or a CME is involved in the connection.

4.1.2 *Incoming circuit failure*

4.1.2.1 *IDLE STATE*

- No special action required, respond to incoming call as normal.

4.1.2.2 *ALL OTHER STATES*

- In answered state no special action to be taken, send all signals as normal.
- If answer signal has not been returned from called party, start a time out device which after a certain interval clears the chain beyond the faulty circuit.

4.1.3 *Bothway circuit*

4.1.3.1 *IDLE STATE*

- Take the circuit out of service to outgoing traffic, respond normally to incoming signals.
- Return to outgoing service when transmission is restored.

4.1.3.2 *OUTGOING REGISTER STATE*

- See § 4.1.1.2.

4.1.3.3 *OUTGOING AFTER REGISTER STATE*

- See § 4.1.1.3.

4.1.3.4 *INCOMING ANY STATE*

- See § 4.1.2.

4.1.3.5 *BLOCKED*

- See § 4.1.1.4.

4.2 *Signalling System No. 6 or Signalling System No. 7*

The action taken per speech circuit is as follows.

4.2.1 *Outgoing circuit failure*

4.2.1.1 *IDLE STATE*

- Take the circuit out of service to outgoing traffic. Return to service when the transmission is restored.

4.2.1.2 *REGISTER STATE*

The register state is assumed to start with sending of Initial Address Message and to end with the receipt of an address complete message.

- Send clear forward.
- Send a call unsuccessful indication on incoming circuit or possibly carry out a repeat attempt to set up the call on another circuit.
- Following receipt of release guard signal, take the circuit out of service to outgoing traffic. Return to service when transmission is restored.
- Inhibit any repeat continuity check which may be taking place.

4.2.1.3 *SEIZED BUT AFTER REGISTER STATE*

- If answer signal has not been received from called party, send a call unsuccessful indication on incoming circuit.
- If answer signal received, no special action required.
- Take the circuit out of service when it becomes idle. Return to service when the transmission is restored.

4.2.1.4 *BLOCKED*

- No special action required.

4.2.2 *Incoming circuit failure*

4.2.2.1 *CIRCUIT IN ANY STATE*

- If answer signal has not been returned from called party, start a time out device which after a certain interval clears the chain beyond the faulty circuit.
- If answer has been received no special action is required, the transmission of blocking messages when end to end alarm continuity is not provided should be for further study.

4.2.3 *Bothway circuit failure*

4.2.3.1 *IDLE STATE*

- Take the circuit out of service to outgoing traffic, the transmission of blocking messages when end to end alarm continuity is not provided should be for further study.
- Return to outgoing service when transmission is restored.

4.2.3.2 *OUTGOING REGISTER STATE*

- See § 4.2.1.2 above.

4.2.3.3 *OUTGOING AFTER REGISTER STATE*

- See § 4.2.1.3 above.

4.2.3.4 *INCOMING CIRCUIT IN ANY STATE*

- See § 4.2.2 above.

4.2.3.5 *BLOCKED*

- No special action required.

ANNEX A

(to Recommendation Q.33)

Circuit supervision via TDMA/DSI satellite systems

A.1 *General*

A.1.1 When satellite systems employ Time Division Multiple Access (TDMA) transmission techniques with Digital Speech Interpolation (DSI) equipment at an earth station, the integrity of multiplex transmission systems, FDM as well as PCM, used for terrestrial access to the satellite system cannot be maintained within the satellite system. For exemple, time slots 0 and 16 of a 2048 kbit/s PCM system of the group pilot of a FDM system may not be available between earth stations for the transfer of signalling or transmission alarm information. The provision of equivalent facilities over the satellite section therefore needs special consideration.

A.1.2 Although not necessarily a fault condition, an increase in circuit activity on a TDMA/DSI system may lead to an overload condition, e.g. "bit stealing" in the DSI equipment. Conveyance of overload indicators to the associated ISC may be used to initiate appropriate network management actions to reduce or eliminate the overload conditions on groups of circuits routed on the TDMA/DSI systems.

Implementation of this capability is at the discretion of individual Administrations.

A.1.3 In accordance with Recommendation Q.7, specified signalling systems considered to be suitable for international application via TDMA/DSI satellite systems are:

- System R2, provided that the satellite system is designed to be transparent to pulsed inter-register signals;
- System No. 5;
- Systems Nos. 6 and 7.

A.2 *Circuit supervision*

Possible methods of passing circuit supervision information for these signalling systems via a TDMA/DSI satellite system are as follows:

A.2.1 *Signalling System R2*

A.2.1.1 In the case of System R2, only the digital version of line signalling (Recommendations Q.421-Q.424) is specified for use on international digital links.

A.2.1.2 A satellite Line Signalling Channel (LSC) is required to convey the System R2 digital line signalling code. Two signalling bits, "a" and "b" are required in the LSC for each System R2 terrestrial circuit accessing the satellite section. Under transmission failure conditions, bits "a" and "b" are set to State 1, so that the line signalling protocols of digital R2 will eventually block the circuit.

Appendix I shows a typical format and organization of the LSC for System R2 line signalling.

A.2.1.3 Fault conditions detected at the earth station and the consequent actions to be taken are given: in Tables A-1/Q.33 and A-2/Q.33 when terrestrial access is via a 2048 kbit/s PCM system or via an FDM system with signalling conversion employed at the earth station, respectively.

The application of actions given in these tables enables appropriate end-to-end supervision to be provided on a per-circuit basis.

A.2.2 *Signalling System No. 5*

A.2.2.1 It should be noted that on circuits employing System No. 5 signalling, some administrations utilize a repeat forward clear procedure as a means of achieving clear down under failure conditions. This procedure, which may involve periodic sending of forward clear signals synchronously on a number of circuits, can result in severe periodic overloading of DSI channels. In order to avoid this possible overloading of DSI channels it is preferable to limit the number of simultaneous forward clear signals on the circuits involved.

A.2.2.2 In order to convey circuit supervision information via the satellite system, it will be necessary to provide a satellite signalling channel.

The preferred method of conveying circuit supervision information by use of a satellite digital non-interpolated (DNI) channel is described in § A.2.2.3.

If an LSC, as provided for in System R2, is available, then a second method of passing circuit supervision information is as described in § A.2.2.4.

A.2.2.3 *Use of a DNI supervision channel*

When a DNI channel is utilized for circuit supervision purposes, detection by an earth station of circuit failures on its terrestrial sector will result in the setting of bits in the DNI channel to "1", in accordance with the information contained in Appendix II.

Thus, if the failed circuits are digital, the detection of failure conditions, such as loss of frame alignment, described in Table A-3/Q.33 will result in the setting to "1" of bits in the DNI channel associated with the affected circuits.

When the affected circuits are analogue, the failure will be detected at the earth station, e.g. by the loss of pilot, or if appropriate, by receipt of a pulsed bakward pilot. Fault conditions and consequent actions when analogue access links are employed are given in Table A-4/Q.33.

The alarm information passed over the DNI channel can be forwarded by the receiving earth station to its associated ISC as described in Recommendation Q.33.

An Administration may utilize the alarm information at its ISC to block or busy affected circuits, or, for example, to inhibit the sending of repeat forward clear signals.

Appendix II shows the format and organization of the DNI supervisory channel.

A.2.2.4 *Use of System R2 LSC*

In this case the "a" and "b" signalling bits in the LSC corresponding to the Terrestrial Channels (TCs) for which supervision is applied shall assume the following meaning:

Under normal conditions:

b = 0 indicates that the relevant TC is in a normal condition. The b = 0 state may be established either within the TDMA terminal or at the ISC.

The "a" signalling bit contained in the same slot shall be set, as convenient, either to zero or "1".

Under abnormal conditions:

a = b = 1 indicates that the relevant TC is in an abnormal condition.

Thus, for effective application, the failure of a distant terrestrial transmission system (FDM or PCM) in either direction between an earth station and its associated ISC should result in the sending of a = b = 1 for each affected circuit backward over the satellite section. The alarm information passed via the LSC is transferred from the receiving earth station to its associated ISC as follows:

- when digital access circuits are provided, bits a and b, in Time Slot 16 corresponding to the faulty circuits, are set to "1";
- when analogue access circuits are employed receipt by the earth station of bits a = b = 1 for 6 or more circuits in an analogue group should result in the removal of the group pilot towards the ISC.

This method of using two signalling bits to convey circuit supervision information for System No. 5 circuits is inefficient in the utilization of satellite channel capacity. However, Administrations may need to take into account the possible advantages of such utilization, for example, a common terrestrial interface module for both System R2 and System No. 5 circuits may be employed at the earth station.

Appendix I shows the format and organization of the LSC for System R2 line signalling. Where appropriate to such use of circuits employing System No. 5 signalling, the fault conditions and consequent actions given in Tables A-1/Q.33 and A-2/Q.33 also apply.

A.2.3 *Signalling System No. 6 and No. 7*

A.2.3.1 These signalling systems employ a common signalling channel which may be conveyed via the satellite system (for example, via a 64 kbit/s signalling channel) or via a terrestrial transmission path.

A.2.3.2 The provision of transmission alarm information for circuit supervision purposes is necessary because:

a) Although a speech path continuity check, where used, will remove faulty circuits from service, a faster method is required if severe operational problems at the ISC are to be avoided when a large number of circuits are affected by a transmission system failure.

b) In the case of circuits employing System No. 7, end-to-end circuit supervision is required in accordance with Recommendation Q.724.

c) It is not mandatory for an ISC recognizing a transmission system failure to send a blocking signal for each affected circuit.

A.2.3.3 If the common signalling channel and associated circuits are routed via the same satellite system, methods of conveying circuit supervision information are identical to those described for System No. 5. This will require a DNI satellite channel to carry circuit supervision information in addition to the common signalling channel. Digital terrestrial access systems will also require a time slot for circuit supervision purposes besides that required for common channel signalling.

A.2.3.4 Methods of utilizing the common signalling channel in lieu of the DNI channel for the purpose of conveying information on the status of the transmission path of the speech circuits require further study.

A.2.3.5 Fault conditions and consequent actions to be taken at earth stations when system No. 6 or No. 7 is employed, via digital and analogue access links, are given in Tables A-3/Q.33 and A-4/Q.33, respectively.

TABLE A-1/Q.33

Fault conditions and consequent actions at earth stations with 2048 kbit/s digital access links for System R2 circuits

Digital earth station equipment (digital access links) / Fault conditions	Consequent actions	Terrestrial link to own CT: Remote backward alarm indication (bit 3, TS 0, even frames)	Terrestrial link to own CT: Backward alarm indication (bit 6, TS 16, frame 0)	Terrestrial link to own CT: a = b = 1 in TS 16 for all circuits concerned	Terrestrial link to own CT: AIS in non-interpolated channels	Prompt maintenance alarm	Satellite link: Action to prevent overlap of bursts in a TDMA frame	Satellite link: Backward alarm indication concerning satellite path	Satellite link: Backward alarm indication concerning data unique word	Satellite link: AIS in non-interpolated channels	Satellite link: a = b = 1 in satellite signalling channel for circuits concerned	Satellite link: Block switched circuits concerned	Satellite link: Backward alarm indication concerning satellite signalling channel
Transmitting part	Loss of frame alignment, BER exceeded or loss of incoming signal	Yes				Yes Note 1				Yes	Yes	Yes	
Transmitting part	Loss of multiframe alignment		Yes			Yes Note 1					Yes		
Transmitting part	Alarm indication from CT (bit 3 TS 0 even frame, bit 6 TS 16 frame 0)										Yes		
Transmitting part	Power supply failure – TDMA/DSI			Yes if possible		Yes				Yes if possible	Yes if possible	Yes if possible	
Transmitting part	Power supply failure – satellite signalling equipment			Yes if possible		Yes					Yes if possible		
Receiving part	Loss of reference timing			Yes	Yes	Yes	Yes						
Receiving part	BER exceeded in satellite path			Yes	Yes	Yes		Yes					
Receiving part	Backward alarm indication from remote ES concerning BER in satellite path			Yes		Yes Note 2							
Receiving part	Loss of data unique word			Yes	Yes	Yes			Yes				

TABLE A-1/Q.33 *(cont.)*

	Digital earth station equipment (digital access links) / Fault conditions — Consequent actions	Terrestrial link to own CT				Prompt maintenance alarm	Satellite link						
		Remote backward alarm indication (bit 3, TS 0, even frames)	Backward alarm indication (bit 6, TS 16, frame 0)	a = b = 1 in TS 16 for all circuits concerned	AIS in non-interpolated channels		Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	a = b = 1 in satellite signalling channel for circuits concerned	Block switched circuits concerned	Backward alarm indication concerning satellite signalling channel
Receiving part	Backward alarm indication from remote ES concerning data unique word			Yes		Yes Note 2	Yes Note 3						
Receiving part	Loss of alignment or BER exceeded in satellite signalling channel			Yes		Yes							Yes
Receiving part	Backward alarm indication from remote ES concerning satellite signalling channel			Yes		Yes Note 2							
Receiving part	Power supply failure – TDMA/DSI			Yes if possible	Yes if possible	Yes					Yes if possible		
Receiving part	Power supply failure – satellite signalling equipment			Yes if possible		Yes					Yes if possible		

Note 1 – Prompt maintenance alarm is inhibited if AIS is present.

Note 2 – Prompt maintenance alarm shall be inhibited if the backward alarm is received from only one origin if the interface concerned is working to more than one destination. It is not inhibited when working to a single destination.

Note 3 – If prompt maintenance alarm according to Note 2 is not inhibited.

TABLE A-2/Q.33

Fault conditions and consequent actions at earth stations with analogue access links for System R2 circuits and signalling conversion at the earth station

	Digital earth station equipment (analogue access links) / Fault conditions — Consequent actions	Terrestrial link to own CT		Prompt maintenance alarm	Satellite link						
		Relevant blocking signal (Note 1)	a = b = 1 at the input of the converter		Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	a = b = 1 in satellite signalling channel for circuits concerned	Block switched circuits concerned	Backward alarm indication concerning satellite signalling channel
Transmitting part	Loss of forward signal (Group pilot failure)	Yes		Yes				Yes	Note 4	Yes	
	Power supply failure from trans. equip.	Yes if possible		Yes				Yes if possible	Note 4	Yes if possible	
	Failure of line signal converter	Yes		Yes					Note 5		
	Power supply failure – TDMA/DSI	Note 6	Yes if possible	Yes				Yes if possible	Yes if possible	Yes if possible	
	Power supply failure – satellite signalling equipment		Yes if possible	Yes					Yes if possible		
Receiving part	Loss of reference timing	Note 6	Yes	Yes	Yes						
	BER exceeded in satellite path		Yes	Yes		Yes					
	Backward alarm indication from remote ES concerning BER in satellite path		Yes	Yes Note 2							
	Loss of data unique word		Yes	Yes			Yes				

TABLE A-2/Q.33 *(cont.)*

Digital earth station equipment (analogue access links) / Fault conditions		Consequent actions: Terrestrial link to own CT		Prompt maintenance alarm	Satellite link						
		Relevant blocking signal (Note 1)	a = b = 1 at the input of the converter		Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	a = b = 1 in satellite signalling channel for circuits concerned	Block switched circuits concerned	Backward alarm indication concerning satellite signalling channel
Receiving part	Backward alarm indication from remote ES concerning data unique word		Yes	Yes Note 2	Yes Note 3						
	Loss of alignment or BER exceeded in satellite signalling channel		Yes	Yes							Yes
	Backward alarm indication from remote ES concerning satellite signalling channel	Note 6	Yes	Yes Note 2							
	Power supply failure – TDMA/DSI		Yes if possible	Yes					Yes if possible		
	Power supply failure – satellite signalling equipment		Yes if possible	Yes					Yes if possible		

Note 1 – The "relevant blocking signal" is that signal which the Recommendation for analogue R.2 line signalling calls for in the event of interruption control or it may be the defined blocking condition resulting from busying equipment (Orange Book, Recommendation Q.416 and Q.424).

Note 2 – Prompt maintenance alarm shall be inhibited if the backward alarm is received from only one origin if the interface concerned is working to more than one destination. It is not inhibited when working to a single destination.

Note 3 – If prompt maintenance alarm according to Note 2 is not inhibited.

Note 4 – In this case the line signalling converter shall apply this condition. It is assumed that power supply failure on FDM transmission equipment will result in a group pilot failure.

Note 5 – The line signalling converter should comply with the principles described in Recommendation Q.422.

Note 6 – A relevant blocking signal will be generated by the converter in the analogue part.

TABLE A-3/Q.33

Fault conditions and consequent actions at earth stations using DNI supervision channel for circuits using in-band and common channel signalling with digital access links

Digital earth station equipment (digital access links) / Fault conditions — Consequent actions		Terrestrial link to own CT				Prompt maintenance alarm	Satellite link					
		Remote backward alarm indication	Backward alarm indication	Circuit supervision signal for all circuits concerned	AIS in non-interpolated channels		Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	Indication of fault in affected channels via circuit supervision channel	Block switched circuits concerned
Transmitting part	Loss of frame alignment. BER exceeded or loss of incoming signal	Yes Note 4				Yes Note 1				Yes	Yes	Yes
Transmitting part	Loss of multiframe alignment		Yes			Yes Note 1					Yes	
Transmitting part	Alarm indication from CT										Yes	
Transmitting part	Power supply failure – TDMA/DSI			Yes if possible		Yes				Yes if possible	Yes if possible	Yes if possible
Transmitting part	Power supply failure – service supervision signalling equipment			Yes if possible		Yes					Yes if possible	
Receiving part	Loss of reference timing or burst			Yes	Yes	Yes	Yes					
Receiving part	BER exceeded in satellite path			Yes	Yes	Yes		Yes				
Receiving part	Backward alarm indication from remote ES concerning BER in satellite path			Yes		Yes Note 2						
Receiving part	Loss of data unique word			Yes	Yes	Yes			Yes			

TABLE A-3/Q.33 *(cont.)*

Digital earth station equipment (digital access links) / Fault conditions	Consequent actions	Terrestrial link to own CT				Prompt maintenance alarm	Satellite link					
		Remote backward alarm indication	Backward alarm indication	Circuit supervision signal for all circuits concerned	AIS in non-interpolated channels		Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	Indication of fault in affected channels via circuit supervision channel	Block switched circuits concerned
Receiving part	Backward alarm indication from remote ES concerning data unique word			Yes		Yes Note 2	Yes Note 3					
Receiving part	Loss of TDMA frame alignment			Yes		Yes						
Receiving part	Power supply failure – TDMA/DSI			Yes if possible	Yes if possible	Yes					Yes if possible	
Receiving part	Power supply failure – service supervision signalling equipment			Yes if possible		Yes					Yes if possible	
Receiving part	Indication of remote end transmission failure via circuit supervision channel			Yes								

Note 1 – Prompt maintenance alarm is inhibited if AIS is present.

Note 2 – Prompt maintenance alarm shall be inhibited if the backward alarm is received from only one origin. If the interface concerned is working to more than one destination. It is not inhibited when working to a single destination.

Note 3 – If prompt maintenance alarm according to Note 2 is not inhibited.

Note 4 – For a 2048 kbit/s digital access, bit 3 (TS 0, even frames) could be used for this indication. For a 1544 kbit/s digital access, fault indication as described in G.733, § 4.2.4 could be used for this indication.

TABLE A-4/Q.33

Fault conditions and consequent actions at earth stations using DNI supervision channel for circuits using in-band and common channel signalling with analogue access links

Digital earth station equipment (analogue access links) Note 3 — Fault conditions / Consequent actions		Terrestrial link to own CT			Satellite link					
		Removal of group pilot or supergroup pilot		Prompt maintenance alarm	Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	Indication of fault in affected channels via circuit supervision channel	Block switched circuits concerned
Transmitting part	Loss of forward signal (group pilot failure) or supergroup			Yes				Yes	Yes	Yes
	Power supply failure from trans. equip.			Yes				Yes if possible	Yes	Yes if possible
	Power supply failure – TDMA/DSI			Yes				Yes if possible	Yes if possible	Yes if possible
	Power supply failure – service supervision signalling equipment			Yes					Yes if possible	
Receiving part	Loss of reference timing or burst	Yes		Yes	Yes					
	BER exceeded in satellite path	Yes		Yes		Yes				
	Backward alarm indication from remote ES concerning BER in satellite path	Yes		Yes Note 1						
	Loss of data unique word	Yes		Yes			Yes			

TABLE A-4/Q.33 *(cont.)*

Digital earth station equipment (analogue access links) Note 3 — Consequent actions / Fault conditions		Terrestrial link to own CT		Prompt maintenance alarm	Satellite link					
		Removal of group pilot or supergroup pilot			Action to prevent overlap of bursts in a TDMA frame	Backward alarm indication concerning satellite path	Backward alarm indication concerning data unique word	AIS in non-interpolated channels	Indication of fault in affected channels via circuit supervision channel	Block switched circuits concerned
Receiving part	Backward alarm indication from remote ES concerning data unique word	Yes		Yes Note 1	Yes Note 2					
	Loss of TDMA frame alignment	Yes		Yes						
	Power supply failure – TDMA/DSI	Yes		Yes					Yes if possible	
	Power supply failure – service supervision signalling equipment	Yes		Yes					Yes if possible	
	Indication of remote end transmission failure via circuit supervision channel	Yes Note 4								

Note 1 – Prompt maintenance alarm shall be inhibited if the backward alarm is received from only one origin if the interface concerned is working to more than one destination. It is not inhibited when working to a single destination.

Note 2 – If prompt maintenance alarm according to Note 1 is not inhibited.

Note 3 – Apart from the requirements concerning the loss of group or supergroup pilots and indication of remote and transmission failure, all other fault conditions and subsequent actions are optional.

Note 4 – An Administration's decision to remove group or supergroup pilot is dependent on the number of failed circuits in the group or supergroup.

APPENDIX I

(to Annex A of Recommendation Q.33)

Format of each 64 kbit/s unit forming a satellite line signalling channel (LSC) for System R2 line signalling

Symbol N	1	2	3	4	5	6	7	63	64
P channel	0	1	Y_1	Y_3	a_{x+1}	a_{x+2}	a_{x+3}	a_{x+59}	a_{x+60}
Q channel	1	0	Y_2	Y_4	b_{x+1}	b_{x+2}	b_{x+3}	b_{x+59}	b_{x+60}

Symbols 1 and 2 carry the fixed pattern shown.

Symbols 3 and 4 carry Backward Alarm Indications related to the satellite system.

a_n and b_n are the signalling bits relating to the terrestrial channel connected to International Circuit (IC) number n.

Indicated by the subscript, where:

x = 0 in the first 64 kbit/s unit,

x = 60 in the second 64 kbit/s unit,

x = 120 in the third 64 kbit/s unit,

x = 180 in the fourth 64 kbit/s unit.

APPENDIX II

(to Annex A of Recommendation Q.33)

End-to-end circuit supervision for in-band and common channel signalling systems

End-to-end circuit supervision between corresponding Administrations may be provided using a pre-assigned digital non-interpolated (DNI) supervisory channel allocated for the purpose.

A recommended method of providing such supervision, which uses the binary information content of the DNI supervisory channel, is shown below. It should be noted that multi-destination operation requires a DNI supervisory channel from each destination.

Format of satellite circuit supervision channel (non-interpolated)

Symbol No.	1	2	3	4	5	6	7	–	63	64
P Channel	0	1	1	0	a_1	a_3	a_5	–	a_{117}	a_{119}
Q Channel	1	0	1	0	a_2	a_4	a_6	–	a_{118}	a_{120}

Symbols 1, 2, 3 and 4 are not used and carry the fixed sequence shown.

Symbols 5 to 64 represent supervision conditions, with bit a_n being used for supervision of the Terrestrial Channels (TCs) 2n and (2n – 1), connected to international circuits.

The meaning of each bit a_n is shown below:

$a_n = 0$ Indicates that both of the relevant TCs are in a normal condition.

$a_n = 1$ Indicates that either or both of the relevant TCs are in an abnormal or fault condition.

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Rec. G.732.

[2] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Rec. G.733.

SECTION 5

TONES FOR USE IN NATIONAL SIGNALLING SYSTEMS

Recommendation Q.35 [1)]

TECHNICAL CHARACTERISTICS OF TONES [2)] FOR THE TELEPHONE SERVICE

1 General

Administrations are reminded of the advantages of standardizing audible tones as far as possible so that subscribers and operators may quickly recognize any tone transmitted of whatever origin [3)].

Guidance on the application of tones and recorded announcements in various situations is given in Recommendation E.182 [2].

In considering the degree of standardization, the CCITT took account of the nature of the various tones already in use. It was also considered that Administrations introducing new tones would find it helpful to know the preferred limits of cadence frequency and level.

Limits for tone cadences and frequencies are set forth below, all working tolerances being included in the limits.

Besides the limits applying to specifications, limits have been laid down for application to existing exchanges.

These latter limits are herein called *accepted* limits, while those for new equipment are called *recommended* limits.

The present Recommendation covers the case where audible tones are applied within the network. However, the same frequencies and cadences are to be applied if, in the ISDN, the audible tones are generated at the terminal equipment.

2 Electrical levels for tones

For international purposes, the levels of the ringing tone, the busy tone, the congestion tone, the special information tone and the warning tone have to be defined at a zero relative level point at the incoming (in the traffic direction) end of the international circuit.

The level of tones so defined must have a nominal value of -10 dBm0. The recommended limits should be not more than -5 dBm0 nor less than -15 dBm0 measured with continuous tone.

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1) This Recommendation is also included in the Series E Recommendations under the number E.180 (Fascicle II.2)

2) See [1] for particular values of tone cadences and frequencies in actual use.

3) Recommendation E.181 [3] specifies the information which could be given to users to facilitate recognition of foreign tones.

For the special information tone, a difference in level of 3 dB is tolerable between any two of the three frequencies which make up the tone.

For the power level of the dial tone the point of reference is the local exchange, where the subscriber line is connected. In the existing networks the absolute power at the 2-wire access in the direction towards the subscriber station is normally in the range of -10 dBm $\pm$ 5 dB. However, with respect to interference with multifrequency pushbutton (MFPB) receivers dial tone levels higher than -10 dBm should be avoided.

Note – The relative level of local exchanges in an analogue network is not fixed. For digital local exchanges the relative levels are given in Recommendation Q.552 [4]. A preferred level range of digital tone generators is -8 dBm0 to -3 dBm0 corresponding with the above level range at the output of local exchanges.

3 Acoustical levels for tones

When tones are generated by a source within a network, e.g. by a telephone exchange, the power level as perceived by the user will be influenced by the characteristics of the subscriber's line and the equipment between the source and the user's ear.

Furthermore, tones can be generated within the user's equipment, triggered by signals from the exchange. In these circumstances it is necessary to define the tone level in terms of the preferred range of sound pressure levels as heard by the listener.

Research has shown that the preferred listening level for information tones is substantially independent of room noise, circuit noise and tone cadence, but does vary over a range of tone frequencies. Figure 1/Q.35 shows the recommended sound pressure levels, with upper and lower limits of the recommended range, over a range of tone frequencies, based on these experiments.

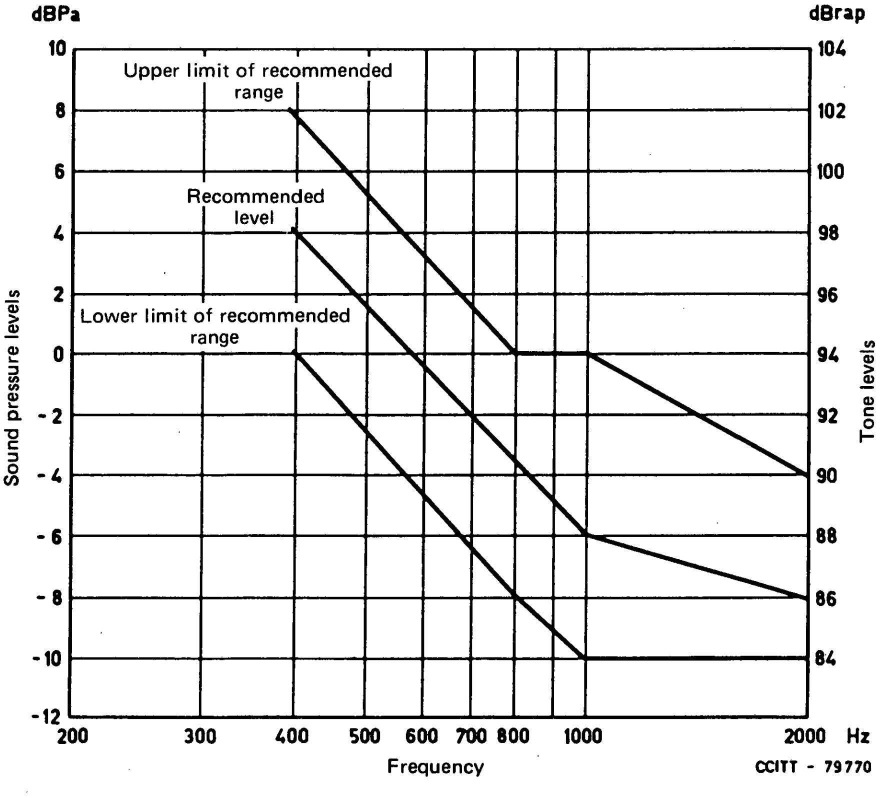


FIGURE 1/Q.35

Recommended listening level limits for tones

It is emphasized that there is no one-to-one relationship between electrical and acoustical power levels. What acoustic level will result from a given electrical level is dependent on various parameters such as the characteristics of the user's equipment.

It should be noted that the recommended sound pressure levels apply only to the most common situation of a user listening via a telephone handset, held reasonably close to the ear so that normal "ear coupling loss" values apply.

When using a loudspeaking telephone or a headset, the preferred sound pressure level is generally lower than the recommended levels.

4 Dial tone

4.1 It is recommended that dial tone should be a continuous tone.

4.2 It is recommended that dial tone should be:

- *either* a single frequency tone in the range 400-450 Hz,
- *or* a combined tone composed of up to three frequencies, with at least one frequency in each of the ranges 340-425 Hz and 400-450 Hz. The difference between any two frequencies should be at least 25 Hz.

4.3 Recognizing the local nature of "normal" use of dial tone, as well as the technical and economic consequences and consequences on customer habits of changes in dial tone, the full range of existing dial tones, including non-continuous tones as in Supplement No. 2 at the end of Fascicle II.2 [1], are considered acceptable. However, when adopting a new single frequency dial tone, Administrations are recommended to use 425 Hz.

4.4 Where digital tone generation is applied, the frequencies for dial tone should be the same as those recommended for analogue generated tones (see Annex A).

4.5 In order to prevent interference of harmonics or spurious components of the dial tone with the frequencies recommended for pushbutton telephone sets in Recommendation Q.23 and the MFPB signal reception specified in Recommendation Q.24, the maximum permissible power level of harmonics or quantizing noise of the dial tone has to be limited in a suitable way, depending on the specific characteristics of the implementations of the dial tone generator and the MFPB receivers within the same exchange. Examples of such limitations for the dial tone generator are given in Annex B.

Note – In cases of digital generation of the dial tone, the quantizing noise is composed of a number of spectral lines which depend on the number of samples in the generating pattern. In order to reduce the amplitude of the quantizing components, the number of samples should be chosen sufficiently high, thus spreading the quantizing distortion power more evenly over the whole spectrum.

5 Ringing tone

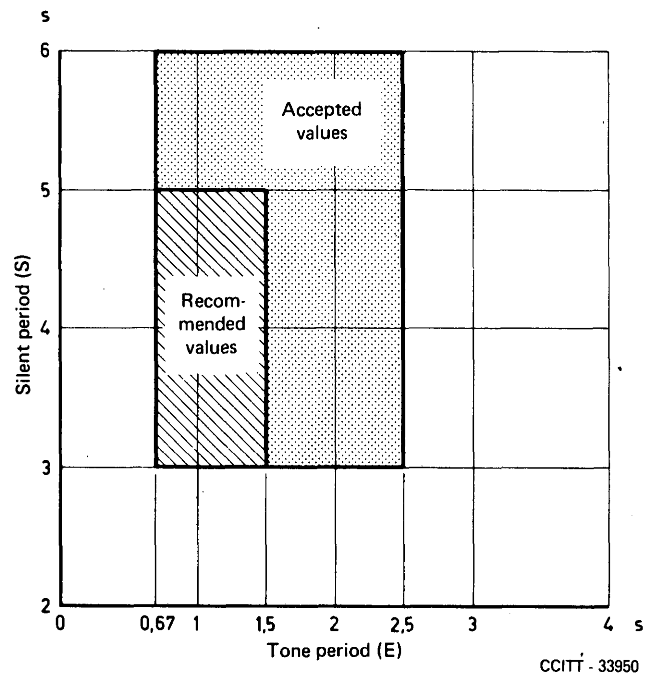
5.1 Ringing tone is a slow period tone, in which the tone period is shorter than the silent period.

The *recommended* limits for the tone period (including tolerances) are from 0.67 to 1.5 seconds. For existing exchanges, the *accepted* upper limit for the tone period is 2.5 seconds.

The *recommended* limits for the silent period separating two tone periods are 3 to 5 seconds. For existing exchanges, the *accepted* upper limit is 6 seconds.

The first tone period should start as soon as possible after the called subscriber's line has been found.

Figure 2/Q.35 shows the recommended and accepted limits for the ringing tone periods.



Frequency:

– recommended interval: 400-450 Hz
– accepted interval: 340-500 Hz

FIGURE 2/Q.35

Ringing tone

5.2 The ringing tone cadence should be similar to the cadence used for applying ringing current to the called subscriber's telephone set, but these two cadences need not be synchronized. The electrical parameters of the ringing current must be evaluated by the Administration concerned to prevent shock hazard.

5.3 The recommended frequency for the ringing tone is between 400 and 450 Hz. The accepted frequency should be not less than 340 Hz, nor more than 500 Hz. Frequencies between 450 and 500 Hz in the accepted frequency range should, however, be avoided. Administrations adopting a new single frequency ringing tone are recommended to use 425 Hz.

The ringing tone frequency may be modulated by a frequency between 16 and 100 Hz, but such modulation is not recommended for new equipment. If the accepted frequency is more than 475 Hz, no modulation by a lower frequency is allowed.

5.4 Where digital tone generation is applied, the frequency for ringing tone should be the same as that recommended for analogue generated tones (see Annex A).

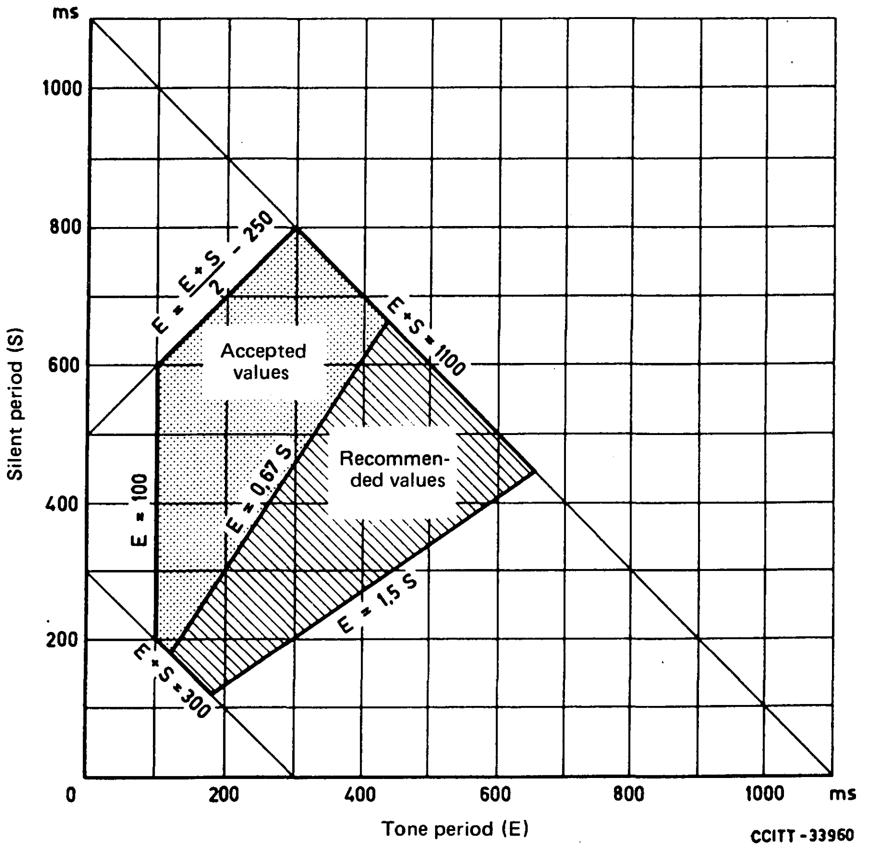
6 Busy tone and congestion tone

6.1 The (subscriber) busy tone and the (equipment or circuit group) congestion tone are *quick* period tones in which the tone period is theoretically equal to the silent period. The total duration of a complete cycle (tone period E + silent period S) should be between 300 and 1100 milliseconds.

The ratio E/S of the tone period to the silent period should be between 0.67 and 1.5 (*recommended* values).

For existing exchanges, or for tones to be used in a special way, it is *accepted* that the tone period may be up to 500 milliseconds shorter than the silent period ($E \geqslant S$ – 500 milliseconds). In no circumstances should the tone period be shorter than 100 milliseconds.

Figure 3/Q.35 shows the recommended and the accepted areas for the busy tone and the congestion tone periods.



Frequency:
- recommended interval: 400-450 Hz
- accepted interval: 340-500 Hz

FIGURE 3/Q.35

(Subscriber) busy tone and (equipment or circuit group) congestion tone

6.2 The busy tone (of the called subscriber) and the congestion tone (of switching equipment or circuit groups) can be identical or almost identical, providing that this does not create any serious problems for the network and does not cause the subscriber to become confused. However, a distinction between these two tones is desirable:

- to allow Administrations to assess the quality of service,
- for the convenience of experienced subscribers.

6.3 Where a distinct congestion tone is used, it is recommended that:

a) the same *frequency* should be used for the busy tone and the congestion tone;

b) the busy tone should have a slower cadence than the congestion tone, but both cadences should be within the limits mentioned in § 5.1 above.

6.4 The *recommended* frequency for the busy tone and for the congestion tone must be between 400 and 450 Hz. The *accepted* frequency must not be less than 340 nor more than 500 Hz. Frequencies between 450 and 500 Hz in the accepted frequency range should, however, be avoided. Administrations adopting a new single frequency for busy and congestion tones are recommended to use 425 Hz.

6.5 Where digital tone generation is applied, the frequency for busy and congestion tones should be the same as that recommended for analogue generated tones (see Annex A).

7 Special information tone

7.1 The special information tone is provided for all cases in which neither the busy nor the congestion tone can give the required information to the calling subscriber in the case of call failure. There are three ways in which it may be used:

a) when in special cases no provision is made for recourse either to a recorded announcement or to an operator, the equipment at the point which the calls have reached must:

   1) *either* connect the special information tone to the call,

   2) *or* preferably, if technically available, send an appropriate backward signal such that connection to the special information tone will be made by equipment which is nearer to the caller;

b) when the call is connected to a recorded voice machine; the tone is then given during the silent intervals between transmissions of the announcement;

c) under arrangements made at manual positions serving lines which have been abnormally routed so that by operating a key the operators may send the special information signal when, for example, the calling subscriber fails to understand the operator.

When the special information tone is applied with or without a recorded announcement, it should be recognized that customers may refer to an operator if they fail to understand the meaning of the recorded announcement and/or the special information tone.

7.2 The special information tone has a tone period theoretically equal in length to the silent period.

Tone period – The tone period consists of three successive tone signals, each lasting for 330 ± 70 milliseconds. Between these tone signals there may be a gap of up to 30 milliseconds.

Silent period – This lasts for 1000 ± 250 milliseconds.

7.3 The frequencies used for the three tone signals are: 950 ± 50 Hz; 1400 ± 50 Hz; 1800 ± 50 Hz, sent in that order.

8 Warning tone to indicate that a conversation is being recorded

Where a conversation is being recorded at a subscriber's station, it is recommended that the Administration require the use of a warning tone to indicate that the conversation is being recorded. When such a tone is applied, it is recommended that:

a) it consists of a 350-500 ms pulse every 15 ± 3 seconds of recording time, and

b) the frequency of the tone should be 1400 Hz ± 1.5%.

9 Payphone recognition tone

9.1 Where Administrations see the necessity of application of a payphone recognition tone in order to allow operators to recognize that a call originates at a payphone station or that the called number belongs to a payphone station it is recommended to use a payphone recognition tone.

The application of the tone will depend on the operational requirements of individual Administrations, e.g. in some cases the tone will only be required on an incoming call to the payphone, whilst in others there may be a requirement for the tone to be present on originating calls and throughout the period of the call.

9.2 The tone is a combination of two frequencies f_1 and f_2 in the range:

f_1: 1100-1750 Hz

f_2: 750-1450 Hz

with the ratio: $f_1/f_2 = 1.2$ to 1.5 and with a cadence (frequency sequence) as follows:

f_1 on 200 ms, silence 200 ms, f_2 on 200 ms, silence 2 s (one cycle is therefore 2.6. s).

9.3 *Duration and level*

9.3.1 A principal purpose of the payphone recognition tone in international telephony is to identify a called station as a payphone where the possibility exists of attempted fraud on a collect call. For this purpose the tone must be produced as soon as a payphone answers a call, it must be clearly audible to an operator, and it must cease before it can seriously interfere with conversation.

When the tone is used on an incoming call to a payphone, it should have, in addition to those characteristics defined in § 9.2, a duration of 5 complete cycles (13 s).

9.3.2 If the tone is used to identify payphones which are originating calls, its duration is not specified.

9.3.3 The specification in § 9.3.1 applies only to the first five cycles of the tone when the payphone is the receiving station.

For use throughout a call or during conversation, the level and duration of the tone have to meet two contradictory requirements:

- the public exchange operator should be able to detect and recognize the tone in the presence of the highest expected levels of speech;
- the tone should not interfere unduly with normal conversation.

Experience of customer reaction to the tone requires that the time during which the tone is applied should be as short as possible, subject to operational requirements. Similarly the level of the tone should be as low as possible and significantly lower than the recommended levels for other tones (e.g. -20 dBm at the payphone output). The duration of the tone and the level at which it is applied are interdependent factors, the shorter the duration the higher the level and vice versa. (Further studies on the recommended levels and duration will be carried out.)

10 Call waiting tone

10.1 The call waiting tone is used to advise a subscriber who is engaged on a call that another subscriber is attempting to call.

10.2 The tone is intended to be sufficiently alerting to succeed in its purpose without interfering with existing conversation.

10.3 The *recommended* specification of the tone is one or more cycles defined by a frequency f in the range:

f: 400 to 450 Hz

and with a cadence (frequency sequence) as follows:

a) f on 300 to 500 ms, silence 8 to 10s; (f = 300 ms is preferable to the longer tone since the ongoing conversation would be interrupted for a briefer interval), or

b) f on 100 to 200 ms, silence 100 to 200 ms, f on 100 to 200 ms (the total to be no more than 500 ms); 8 to 10 s silence.

Other tones may be *acceptable*

10.4 The second and subsequent cycles may be at a lower level than the initial tone.

10.5 Where the tone continues for more than one cycle, it should preferably cease when it is no longer possible to accept the waiting call.

11 Caller waiting tone

11.1 This tone advises a caller that a called station, though busy, has a call waiting service active.

11.2 It is intended that, if this tone is not correctly interpreted by subscribers, it be misinterpreted as the ringing tone.

11.3 To dissuade a caller from waiting indefinitely, the tone may cease 30 seconds[4] after it starts and may be replaced by busy tone, or an Administration may decide to disconnect the calling station.

[4] The specification of this time needs further study.

11.4 The caller waiting tone consists of a ringing tone followed after a silent interval of 0 to 200 ms, by one of the following:

(a) the tone defined in § 10.3 a),

(b) the pair of tones defined in § 10.3 b), or

(c) another call waiting tone in use by an Administration, provided that it can be appended to each sounded part of the ringing tone.

11.5 The caller waiting tone, as defined in § 11.4, should be distinguishably different from the ringing tone when directly compared with it.

12 Machine recognition of tones

The CCITT appreciates the value of machine recognition of tones for the purpose of service observations, maintenance, testing or for the collection of statistics where equivalent electrical signals do not exist. However, the CCITT considered, at Mar del Plata in 1968, that such machine recognition should not be a substitute for electrical signals. Where machine recognition of audible tones is to be introduced, the tone frequencies and cadences must be within close limits of precision.

For dial tone, ringing tone, busy and congestion tones a working frequency tolerance of ± 1% should be met.

Note – The figure of 1% is taken as a compromise out of several national specifications which vary between ± 0.5% and ± 1.5%. (See also Supplement No. 3 in Fascicle II.2.)

ANNEX A

(to Recommendation Q.35)

Digital generation of tones

The practice of several Administrations and equipment designers for digital generation of tones is known to deviate largely:

– in the frequency chosen within the recommended range;

– in the power level which varies with the national application;

– in the mechanism of generation of tones and signal frequencies where, in part, the same equipment is used.

Therefore, it was found difficult to standardize on a fixed number of samples with a coded bit-stream, which represents one frequency with one distinct power level.

On the other hand there is no necessity for standardizing digital generated tones in a more stringent way than analogue generated tones for the following reasons:

– It is to the interest of Administrations that subscribers should not be confused by hearing different tones for the same purpose within their national networks. Consequently the practice already in use for analogue generated tones should be maintained for reasons associated with the human factor.

– The advantages that can be achieved by standardizing the code words for the tones in order to allow automatic recognition of tones by monitoring the bit stream seem to be so small that they do not justify a stringent restriction on all possible methods for digital generation of any frequency allocated with any level.

– For a long period of time a mixture of analogue and digital networks will exist. Thus, machine recognition of tones will have to be performed also with analogue receivers.

However, when Administrations have full freedom to make new decisions about tones in future networks, especially with respect to an all-digital network, they may consider a preferred solution for the digital generation of dial tone, busy tone, congestion tone and ringing tone having a uniform frequency of 425 Hz, as recommended by CCITT.

ANNEX B

(to Recommendation Q.35)

Examples for limitation of spurious components of the dial tone with respect to interference with the frequencies recommended for pushbutton telephone sets in Recommendation Q.23

B.1 *Method A* (used by ATT)

The total distortion power should be at least 33 dB less than the dial tone power, and the distortion power in any 100 Hz band above 500 Hz should be at least 40 dB less than the dial tone power.

B.2 *Method B* (used by the Federal Republic of Germany)

In the frequency range from 500 to 2000 Hz [i.e. the range of multifrequency pushbutton (MFPB) frequencies] the distortion power in any 100 Hz band should be at least 40 dB below the dial tone power. In addition, in the frequency range above 2000 Hz up to 4000 Hz the total distortion power should be at least 25 dB below the dial tone power.

References

[1] *Various tones used in national networks*, Vol. II, Supplement No. 2.

[2] CCITT Recommendation *Application of tones and recorded announcements in telephone services*, Vol. II, Rec. E.182.

[3] CCITT Recommendation *Customer recognition of foreing tones*, Vol. II, Rec. E.181.

[4] CCITT Recommendation *Transmission characteristics at 2-wire analogue interfaces of a digital exchange*, Vol. VI, fascicle VI.5, Rec. Q.552.

Recommendation Q.36[1]

CUSTOMER RECOGNITION OF FOREIGN TONES

1 In order to facilitate recognition of foreign ringing and busy tones by a subscriber dialling an automatic international call, the information given to subscribers should:

1) emphasize that a slow repetition rate of the tone means "ringing" whereas a rapid repetition rate means "busy";
2) indicate that in some countries the ringing tone may be heard as a sequence of two short tones, pause, two more short tones, pause, and so on.

In addition, it may be useful for the purpose of educating subscribers:

– to provide auditory samples of such tones by tape recording or other means, or
– to include detailed descriptions of tones in directories.

[1] This Recommendation is also included in the Series E Recommendations under the number E.181.

2 Modern international signalling systems are capable of exchanging signals corresponding to indications normally given to subscribers by means of audible tones (busy, congestion, ringing, etc.). Administrations are encouraged to arrange their networks so that these information signals can be sent between countries in order that they can be recognized and converted into tones or announcements as near to the calling subscriber as practical. This procedure could significantly reduce the language problems arising from the growing use of recorded announcements.

Note – This Recommendation is complementary to Recommendation E.180 on the standardization of tones in the international telephone network. Whilst standardization is of primary importance, telephone users need information to assist them in recognizing foreign tones until such time as standardization is complete.

This is the purpose of § 1 of the present Recommendation which, as extensive human factor experiments show, should greatly reduce subscriber confusion.

The measure mentioned in § 2 does not eliminate the need for tone standardization as well, but can reduce customer difficulties in cases where standardization may be impractical for a long period but sophisticated exchanges arrangements are available.

SECTION 6

GENERAL CHARACTERISTICS FOR INTERNATIONAL TELEPHONE CONNECTIONS AND INTERNATIONAL TELEPHONE CIRCUITS

6.0 General

Recommendation Q.40

THE TRANSMISSION PLAN[1)]

1 Principles

The transmission plan of the CCITT established in 1964 was drawn up with the object of making use, in the international service, of the advantages offered by 4-wire switching. It is referred to in the Recommendations appearing in Part I, Section 1 of the Series G Recommendations. However, the recommendations in the plan are to be considered as met if the use of technical means other than those described below gives an equivalent performance at the international exchange.

Recommendations G.121 [1] and G.122 [2] describe the conditions to be fulfilled by a national network for this transmission plan to be put into effect.

Note 1 – From the point of view of the transmission plan, no distinction is made between intercontinental circuits and other international circuits.

Note 2 – Short trans-frontier circuits are not covered by this plan and should be the subject of agreement between the Administrations concerned.

. . . .

2 Definition of the constituent parts of a connection

2.1 *The international chain of circuits and the national systems*

A complete **international telephone connection** consists of three parts, as shown in Figure 1/Q.40. The division between these parts is determined by the *virtual analogue switching points* in the originating/terminating international switching centres (ISCs). These are theoretical points with specified relative levels (see Figure 2/Q.40 and §§ 5.1 and 5.2 of Recommendation G.101).

1) This Recommendation is an extract of Recommendation G.101 [3]. The suspensive points show where a passage in Recommendation G.101 has not been reproduced under Q.40.

The three parts of the connection are:

- Two national systems, one at each end. These may comprise one or more 4-wire national trunk circuits with 4-wire interconnection, as well as circuits with 2-wire connection up to the local exchanges and the subscribers sets with their subscriber lines.
- An international chain made up of one or more 4-wire international circuits. These are interconnected on a 4-wire basis in the international centres which provide for transit traffic and are also connected on a 4-wire basis to national systems in the international centres.
- An international 4-wire circuit is delimited by its virtual analogue switching points in an international switching centre.

Note 1 – In principle the choice of values of the relative levels at the virtual analogue switching points on the side of a national system is a national matter. In practice, several countries have chosen −3.5 dBr for receiving as well as for sending. These are theoretical values; they need not actually occur at any specific equipment item; however they serve to determine the relative levels at other points in the national network. If, for instance, the loss "*t-b*" or "*a-t*" is 3.5 dB (as is the case in several countries, see Table A-1/G.121), then it follows that the relative levels at point *t* are 0 dBr (input) and −7 dBr (output).

Note 2 – The virtual analogue switching points may not be the same as the points at which the circuit terminates physically in the switching equipment. These latter points are known as the *circuit terminals*; the exact position of these terminals is decided in each case by the Administration concerned.

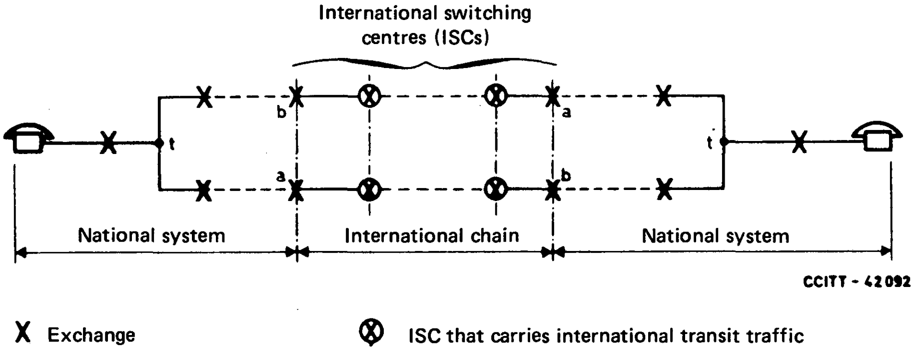


FIGURE 1/Q.40

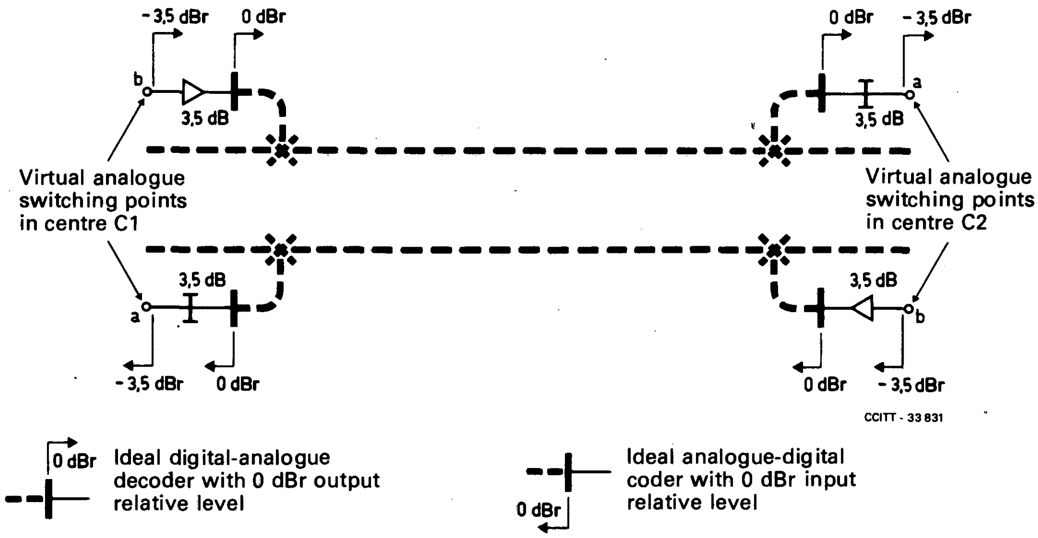
Definition of the constituent parts of an international connection

2.2 *National extension circuits: 4-wire chain*

When the maximum distance between an international exchange and a subscriber who can be reached from it does not exceed about 1000 km or, exceptionally, 1500 km, the country concerned is considered as of average size. In such countries, in most cases, not more than three national circuits are interconnected on a 4-wire basis between each other and to international circuits. These circuits should comply with the Recommendations of Subsection 1.2 [4] of Volume III, Fascicle III.1 (Recs. G.120, G.121, G.122, G.123 and G.125).

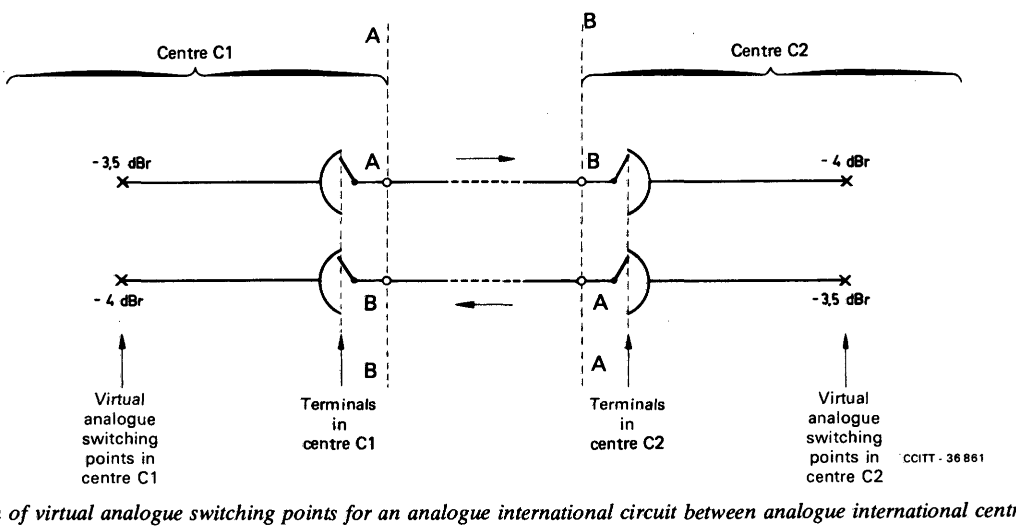
In a large country, a fourth and possibly a fifth national circuit may be included in the 4-wire chain, provided it has the nominal transmission loss and the characteristics recommended for international circuits used in a 4-wire chain (see Recommendation G.141, § 1, § 4 of this Recommendation and the Recommendations in Subsection 1.5 of Volume III, Fascicle III.1, Recs. G.151 [5], G.152 [6] and G.153 [7]).

Note – The abbreviation "a **4-wire chain**" (see Figure 3/Q.40) signifies the chain composed of the international chain and the national extension circuits connected to it, either by 4-wire switching or by some equivalent procedure (as understood in § 1 above).



Note – Ideal coders and decoders are assumed to show a relation between analogue and digital signals and vice versa exactly in accordance with the appropriate tables for A-law or μ-law of Recommendation G.711 [8].

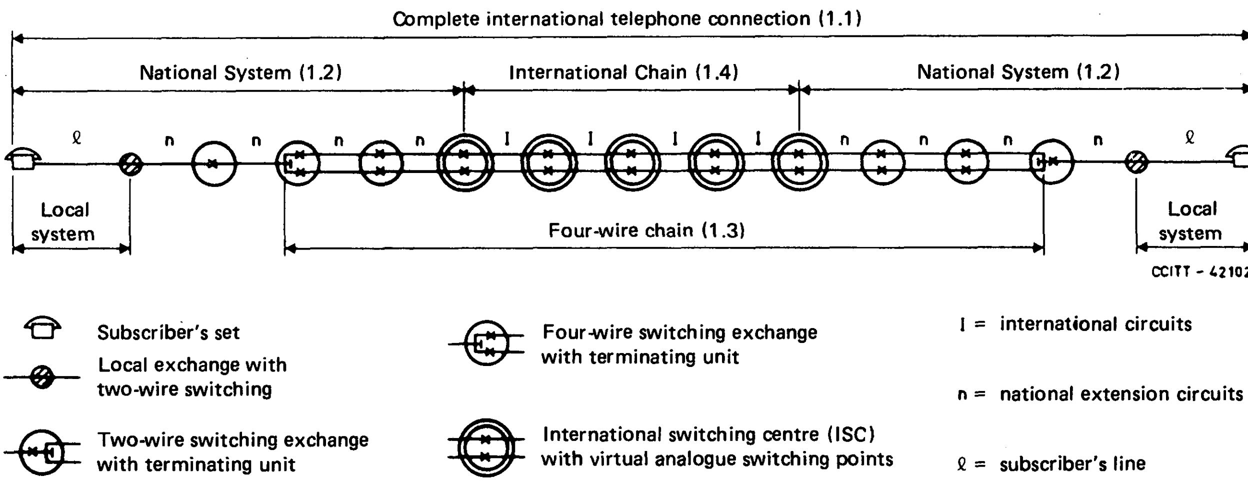
a) *Definition of virtual analogue switching points for a digital international circuit between digital international centres*



b) *Definition of virtual analogue switching points for an analogue international circuit between analogue international centres*

FIGURE 2/Q.40

Definitions for international circuits



Note – The arrangement shown for the national systems are examples only. The numbers given in brackets refer to the Subsections of Section 1 (Fascicle III.1) in which recommendations may be found relevant to that part of the connection. In addition, the circuits making up this chain must individually meet the requirements of Subsection 1.5.

FIGURE 3/Q.40

An international connection to illustrate the nomenclature adopted

3 Number of circuits in a connection

3.1 *National circuits*

It seems reasonable to assume that in most countries any *local exchange* can be connected to the international network by means of a chain of four (or less) national circuits. Five national circuits may be needed in some countries, but it is unlikely that any country may need to use more than five circuits. Hence the CCITT has reached the conclusion that four circuits is a representative figure to assume for the great majority of international connections.

In most modern national networks, the four circuits will probably include three 4-wire amplified circuits (usually set up on FDM carrier systems) and one 2-wire circuit, probably unamplified. However, cases in which local exchanges are reached by four amplified circuits, among them usually at least one PCM circuit, are becoming more and more frequent. All these circuits may be 4-wire circuits.

3.2 *International circuits*

According to the International Telephone Routing Plan (Recommendation E.171), the number of international circuits is restricted to four.

3.3 *Hypothetical reference connections*

(See Recommendation G.103 [9].)

. . . .

References

[1] CCITT Recommendation *Loudness ratings (LRs) of national systems*, Vol. III, Rec. G.121.

[2] CCITT Recommendation *Influence of national systems on stability, talker echo, and listener echo in international connections*, Vol. III, Rec. G.122.

[3] CCITT Recommendation *The transmission plan*, Vol. III, Rec. G.101.

[4] CCITT Recommendations G.120, G.121, G.122, G.123 and G.124; Subsection 1.2: *General characteristics of national systems forming part of international connections* of Volume III.

[5] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Rec. G.151.

[6] CCITT Recommendation *Characteristics appropriate to long-distance circuits of a length not exceeding 2500 km*, Vol. III, Rec. G.152.

[7] CCITT Recommendation *Characteristics appropriate to international circuits more than 2500 km in length*, Vol. III, Rec. G.153.

[8] CCITT Recommendation *Pulse code modulation (PCM) of voice frequencies*, Vol. III, Rec. G.711.

[9] CCITT Recommendation *Hypothetical reference connections*, Vol. III, Rec. G.103.

6.1 General recommendations on the transmission quality for an entire international telephone connection

Recommendation Q.41

MEAN ONE-WAY PROPAGATION TIME [1)]

The times in this Recommendation are the means of the propagation times in the two directions of transmission in a connection. When opposite directions of transmission are provided by different media (e.g. a satellite channel in one direction and a terrestrial channel in the other) the two times contributing to the mean may differ considerably.

1 Limits for a connection

It is necessary in an international telephone connection to limit the propagation time between two subscribers. As the propagation time is increased, subscriber difficulties increase, and the rate of increase of difficulty rises, see b) below. Relevant evidence is given in the bibliography of Recommendation G.114 [1].

As a network performance objective, CCITT therefore *recommends* the following limitations on mean one-way propagation times when echo sources exist and appropriate echo control devices, such as echo suppressors and echo cancellers, are used:

a) 0 to 150 ms, acceptable.

   Note – Echo suppressors specified in Reference [2] may be used for delays not exceeding 50 ms (see Reference [3]).

b) 150 to 400 ms, acceptable, provided that increasing care is exercised on connections as the mean one-way propagation time exceeds about 300 ms, and provided that echo control devices, such as echo suppressors and echo cancellers, designed for long delay circuits are used.

c) Above 400 ms, unacceptable. Connections with these delays should not be used except under the most exceptional circumstances.

. . . .

1) This Recommendation is an extract of Recommendation G.114 [1]. The suspensive points show where a passage in Recommendation G.114 has not been reproduced under Q.41.

2 Values for circuits

In the establishment of the general interconnection plan within the limits in § 1 the one-way propagation time of both the national extension circuits and the international circuits must be taken into account. The propagation time of circuits and connections is the aggregate of several components; e.g. group delay in cables and in filters encountered in FDM modems of different types. Digital transmission and switching also contribute delays. The conventional planning values given in § 2.1 may be used to estimate the total propagation time of specified assemblies which may form circuits or connections.

2.1 *Conventional planning values of propagation time*

Provisionally, the conventional planning values of propagation time in Table 1/Q.41 may be used.

2.2 *National extension circuits*

The main arteries of the national network should consist of high-velocity propagation lines. In these conditions, the propagation time between the international centre and the subscriber farthest away from it in the national network will probably not exceed:

a) In purely analogue networks

$$12 + (0.004 \times \text{distance in kilometres}) \text{ ms.}$$

Here the factor 0.004 is based on the assumption that national trunk circuits will be routed over high-velocity plant (250 km/ms). The 12 ms constant term makes allowance for terminal equipment and for the probable presence in the national network of a certain quantity of loaded cables (e.g. three pairs of channel translating equipments plus about 160 km of H 88/36 loaded cables). For an average-sized country (see Figure 2/G.103) the one-way propagation time will be less than 18 ms.

b) In mixed analogue/digital networks the propagation time can generally be estimated by the equation given for purely analogue networks. However, under certain unfavourable conditions increased delay may occur compared with the purely analogue case. This occurs in particular when digital exchanges are connected with analogue transmission systems through PCM/FDM equipments in tandem, or transmultiplexers. With the growing degree of digitisation the propagation time will gradually approach the condition of purely digital networks.

c) In purely digital networks between exchanges (e.g. an IDN) the propagation time as defined above will probably not exceed:

$$3 + (0.004 \times \text{distance in kilometres}) \text{ ms.}$$

The 3 ms constant term makes allowance for one PCM coder or decoder and five digitally switched exchanges.

Note – The value 0.004 is a mean value for coaxial cable systems and radio-relay systems; for optical fibre systems 0.005 is to be used.

d) In purely digital networks between subscribers (e.g. an ISDN) the delay of c) above has to be increased by up to 3.6 ms if burst-mode (time compression multiplexing) transmission is used on 2-W local subscriber lines.

2.3 *International circuits*

International circuits[2] will use high-velocity transmission systems, e.g. terrestrial cable or radio-relay systems, submarine systems or satellite systems. The planning values of § 2.1 may be used.

The magnitude of the mean one-way propagation time for circuits on high altitude communication satellite systems makes it desirable to impose some routing restrictions on their use. Details of these restrictions are given in Recommendation Q.13. (See also Annex A to Recommendation G.114.)

. . . .

[2] For short nearby links, telecommunications cables operated at voice frequencies may also be used in the conditions set out in the introduction to Sub-section 5.4 of Fascicle III.2.

TABLE 1/Q.41

Transmission medium	Contribution to one-way propagation time	Remarks
Terrestrial coaxial cable or radio relay system; FDM and digital transmission	4 μs/km	Allows for delay in repeaters and regenerators
Optical fibre cable system; digital transmission	5 μs/km	Allows for delay in repeaters and regenerators
Submarine coaxial cable system	6 μs/km	
Satellite system – 14 000 km altitude – 36 000 km altitude	 110 ms 260 ms	Between earth stations only
FDM channel modulator or demodulator	0.75 ms [a)]	Half the sum of propagation times in both directions of transmission
FDM compandored channel modulator or demodulator	0.5 ms [b)]	
PCM coder or decoder	0.3 ms [a)]	
PCM/ADPCM/PCM transcoding	0.5 ms	
Transmultiplexer	1.5 ms [c)]	
Digital transit exchange, digital-digital	0.45 ms [d)]	
Digital local exchange, analogue-analogue	1.5 ms [d)]	
Digital local exchange, analogue subscriber line-digital junction	0.975 ms [d)]	
Digital local exchange, digital subscriber line-digital junction	0.825 ms [d)]	
Echo cancellers	1 ms [e)]	

a) These values allow for group-delay distortion around frequencies of peak speech energy and for delay of intermediate higher order multiplex and through-connecting equipment.

b) This value refers to FDM equipments designed to be used with a compandor and special filters.

c) For satellite digital communications where the transmultiplexer is located at the earth station, this value may be increased to 3.3 ms.

d) These are mean values; depending on traffic loading, higher values can be encountered, e.g. 0.75 ms (1.950 ms, 1.350 ms or 1.250 ms respectively with 0.95 probability of not exceeding). (For details see Recommendation Q.551).

e) Echo cancellers, when placed in service, will add a one-way propagation time of up to 1 ms in the send path of each echo canceller. This delay excludes the delay through any codec in the echo canceller. No significant delay should be incurred in the receive path of the echo canceller.

References

[1] CCITT Recommendation *Mean one-way propagation time*, Vol. III, Rec. G.114.

[2] CCITT Recommendation *Definitions relating to echo suppressors and characteristics of a far-end operated, differential, half-echo suppressor*, Blue Book, Vol. III, Rec. G.161, ITU, Geneva, 1965.

[3] CCITT Recommendation *Stability and echo*, Vol. III, Rec. G.131, § 2.2.

6.2 General characteristics of national systems forming part of international connections

(See Recommendations G.120 to G.125, Fascicle III.1.)

6.3 General characteristics of the "4-wire chain" formed by the international circuits and national extension circuits

(Overall characteristics for the 4-wire chain are defined in Recommendation Q.40, § 2.)

Recommendation Q.42

STABILITY AND ECHO (ECHO SUPPRESSORS)

(See Recommendation G.131 in Fascicle III.1 and Recommendation Q.115)

6.4 General characteristics of the 4-wire chain of international circuits; international transit

Recommendation Q.43

TRANSMISSION LOSSES, RELATIVE LEVELS[1)]

. . . .

5.3 *Definitions*

5.3.1 **transmission reference point**

F: point de référence pour la transmission

S: punto de referencia para la transmisión

A hypothetical point used as the zero relative level point in the computation of nominal relative levels. At those points in a telephone circuit the nominal mean power level (−15 dBm) defined in the Recommendation G.223 [2] shall be applied when checking whether the transmission system conforms to the noise objectives defined in Recommendation G.222 [3].

Note – For certain systems, e.g. submarine cable systems (Recommendation G.371 [4]), other values apply.

Such a point exists at the sending end of each channel of a 4-wire switched circuit preceding the virtual switching point; on an international circuit it is defined as having a signal level of +3.5 dB above that of the virtual switching point.

In frequency division multiplex equipment, a hypothetical point of flat zero relative level (i.e. where all channels have the same relative level) is defined as a point where the multiplex signal, as far as the effect of intermodulation is concerned, can be represented by a uniform spectrum random noise signal with a mean power

1) This Recommendation is an extract of Recommendation G.101 [1]. The suspensive points show where a passage in Recommendation G.101 has not been reproduced under Q.43.

level as defined in the Recommendation cited in [5]. The nominal mean power level in each telephone channel is -15 dBm as defined in the Recommendation cited in [2].

5.3.2 **relative (power) level**

F: niveau relatif de puissance

S: nivel relativo (de potencia)

5.3.2.1 *Basic significance of relative level in FDM systems*

The relative level at a point in a transmission system characterizes the signal power handling capacity at this point with respect to the conventional power level at a zero relative level point [2)].

If, for example, at a particular point in an FDM system designed for a large number of channels the mean power handling capacity per telephone channel corresponds to an absolute power level of S dBm, the relative level associated with this point is $(S + 15)$ dBr. In particular, at a 0 dBr point, the conventional mean power level referred to one telephone channel is -15 dBm.

5.3.2.2 *Definition of relative level, generally applicable to all systems*

The relative level at a point on a circuit is given by the expression $10 \log_{10} (P/P_0)$ dBr, where P represents the power of a sinusoidal test signal at the point concerned and P_0 to the power of that signal at the transmission reference point. This is numerically equal to the composite gain (definition in *Yellow Book*, Fascicle X.1) between the transmission reference point and the point concerned, for a nominal frequency of 1000 Hz. For example, if a reference signal of 0 dBm at 1000 Hz is injected at the transmission reference point, the level at a point of x dBr will be x dBm (apparent power $P_x = 10^{x/10}$mW). In addition, application of a digital reference sequence (DRS, § 5.3.3) will give a level of x dBm at a point of x dBr. The voltage of 0 dBm0 tone at any voiceband frequency at a point of x dBr is given by the expression:

$$V = \sqrt{10^{x/10} \times 1 \text{ W} \times 10^{-3} \left| Z_R \right|_{1000}} \text{ volts}$$

where $\left| Z_R \right|_{1000}$ is the modulus of the nominal impedance of the point at a nominal frequency of 1000 Hz.

Note 1 – The nominal reference frequency of 1000 Hz is in accordance with Recommendation G.712, § 16. For existing (analogue) transmission systems, one may continue to use a reference frequency of 800 Hz.

Note 2 – The relative levels at particular points in a transmission system (e.g. input and output of distribution frames or of equipment like channel translators) are fixed by convention, usually by agreement between manufacturers and users.

The Recommendations of the CCITT are elaborated in such a way that the absolute power level of any testing signal to be applied at the input of a particular transmission system, to check whether it conforms to these recommendations, is clearly defined as soon as the relative level at this point is fixed.

Note 3 – The impedance Z_R may be resistive or complex; in the latter case the power P_x is an apparent power.

Note 4 – It is assumed that between the virtual analogue switching points of a circuit, established over international transmission systems, only points of equal relative level are interconnected in those systems, so that the transmission loss of the circuit will be equal to the difference in relative levels at the virtual analogue switching points (see § 5.2 of this Recommendation).

5.3.2.3 *Relation between corrected send reference equivalents, loudness ratings and relative levels*

The relationship between the 0 dBr point and the level of T_{max} in PCM encoding/decoding processes standardized by the CCITT is set forth in Recommendation G.711 [6]. In particular, if the minimum nominal corrected send reference equivalent (CSRE) of local systems referred to a point of 0 dBr of a PCM encoder is not less than 3.5 dB, or the minimum nominal send loudness rating (SLR) under the same conditions is not less than -1.5 dB, and the value of T_{max} of the process is set at $+3$ dBm0 (more accurately 3.14 dBm0 for A-law and 3.17 for μ-law), then in accordance with § 3 of Recommendation G.121 [7], the peak power of the speech will be suitably controlled.

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2) Taking into account such aspects as (basic) noise, intermodulation noise, peak power, etc. (see Recommendation G.223).

5.3.2.4 *Compatibility of relative levels of analogue and digital systems*

When the signal load is controlled as outlined in § 5.3.2.3, points of equal relative levels of FDM and PCM circuits may be directly connected together and each will respect the other's design criteria. This is of particular importance when points in the two multiplex hierarchies are connected together by means of transmultiplexers, codecs or modems.

5.3.2.5 *Determination of relative level*

Figure 1/Q.43 illustrates the principle of how the relative level at the input and output analogue points of a "real" codec can be determined.

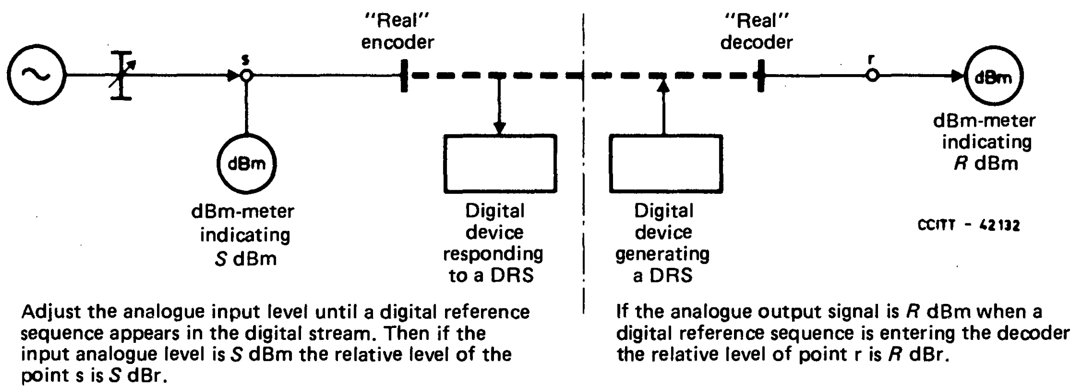


FIGURE 1/Q.43

Set-up for determining the relative level at the input and output analogue points of a "real" codec using digital reference sequences

When using Figure 1/Q.43 to determine the relative levels of a "real" codec with non-resistive impedances at the analogue input and output ports, the following precautions must be observed:

i) the test frequency should be 1000 Hz with a suitable offset;

ii) the power at points *s* and *r* is expressed as apparent power, i.e.:

$$\text{Apparent power level} = 10 \log_{10} \left[\frac{(\text{Voltage at point})^2 \times 10^3}{(\text{Modulus of nominal impedance at 1000 Hz})\ (1\ \text{W})} \right] \text{dBm}$$

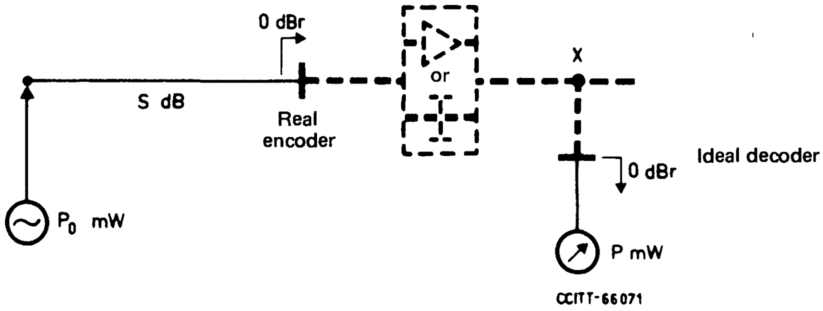
iii) point r is terminated with the nominal design impedance of the decoder to avoid significant impedance mismatch errors.

Note – Precautions ii), iii) above are, of course equally applicable to the case of resistive input and output impedances and would generally be observed by conventional test procedures. Standardizing the reference frequency as in i) above is, however, essential for complex impedances because of the variation of nominal impedance with the test frequency.

5.3.2.6 *Relative level of a point in a digital link*

The relative level to be associated with a point in a digital path carrying a digital bit stream generated by a coder lined-up in accordance with the principles of § 5.3.2.3 above is determined by the value of the digital loss or gain between the output of the coder and the point considered. If there is no such loss or gain the relative level at the point considered is, by convention, said to be 0 dBr.

The equivalent absolute power level of a digital link may be established as in Figure 2/Q.43 by using an ideal decoder. The relative level at a point X in the bit stream can then be assigned by comparing the power at the output of the ideal decoder with that at the analogue zero relative level point originating the digital signal.



Procedure

An analogue input signal is applied to the coder with a level of P_0 mW at the 0 dBr point. If this signal results in an analogue signal of P mW at the output of the ideal decoder then:

$$\text{Relative level at point X} = 10 \log_{10} \left(\frac{P}{P_0} \right) \quad \text{dBr}$$

Note – It is understood that the signal is always within the dynamic range of the conversion process.

FIGURE 2/Q.43

Procedure for determining the relative level of a point in a digital link

5.3.3 PCM digital reference sequence (DRS)

F: séquence numérique de référence MIC

S: secuencia de referencia digital MIC (SRD)

5.3.3.1 A PCM digital reference sequence is one of the set of possible PCM code sequences that, when decoded by an ideal decoder, produces an analogue sinusoidal signal at the agreed test reference frequency (i.e. a nominal 800 or 1000 Hz signal suitably offset) at a level of 0 dBm0.

Conversely, an analogue sinusoidal signal at 0 dBm0 at the test reference frequency applied to the input of an ideal coder will generate a PCM digital reference sequence.

Some particular PCM digital reference sequences are defined in Recommendation G.711 [6] in respect to A-law and μ-law codecs.

5.3.3.2 In studying circuits and connections in mixed analogue/digital networks, use of the digital reference sequence can be helpful. For example, Figure 3/Q.43 shows the various level relationships that one obtains (conceptually) on a Type 2 international circuit where one end terminates at a digital exchange and the other end at an analogue exchange. In the example of Figure 3/Q.43, the analogue portion is assumed to require a loss of 0.5 dB and that provision for this loss is made by introducing a 1.0 dB pad (0.5 dB for each direction of transmission) in the receive direction at the analogue exchange. This has been deliberately chosen to illustrate the utility of the concept of a digital reference sequence.

Figure 3/Q.43 gives an example where all the analogue loss is introduced in the output direction at the analogue exchange. In this case the relative levels at the various codecs can be derived from either the DRS or the transmission reference point at the input of the international circuit with no ambiguity.

If, however, in Figure 3/Q.43 the analogue circuit section is lined up so as to give an overall loss in the direction b_1-a_2, care must be taken in the use of the DRS. In this case the 0 dBm0 sinusoidal reference signal and DRS may result in different levels at the point a_2. Account should be taken of this effect when designing lining-up procedures for mixed analogue/digital circuits.

As a general principle, the relative levels on a mixed analogue/digital circuit should be referred to the transmission reference point at the input of the circuit.

5.3.4 circuit test access point

The CCITT has defined circuit test access points as being "4-wire test-access points so located that as much as possible of the international circuit is included between corresponding pairs of these access points at the two centres concerned". These points, and their relative level (with reference to the transmission reference point), are determined in each case by the Administration concerned. They are used in practice as points of known relative level to which other transmission measurements will be related. In other words, for measurement and lining-up purposes, the relative level at the appropriate circuit test access point is the relative level with respect to which other levels are adjusted.

5.3.5 *Measurement frequency*

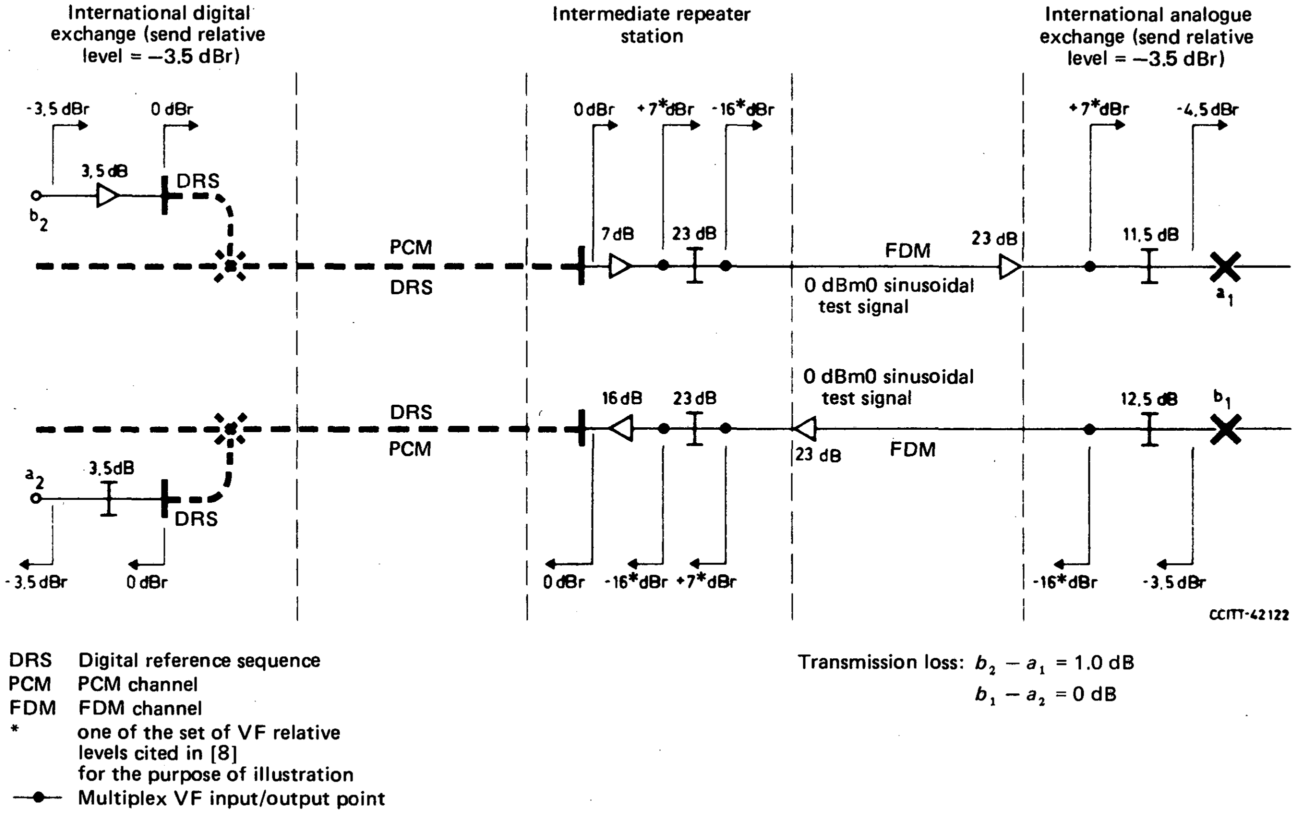
For all international circuits 800 Hz is the recommended frequency for single-frequency maintenance measurements. However, by agreement between the Administrations concerned, 1000 Hz may be used for such measurements.

A frequency of 1000 Hz is in fact now widely used for single-frequency measurements on some international circuits.

Multifrequency measurements made to determine the loss/frequency characteristic will include a measurement at 800 Hz and the frequency of the reference measurement signal for such characteristics can still be 800 Hz.

Note 1 – Definitions of §§ 5.3.1 and 5.3.2 are used in the work of Study Group XII. Definitions of §§ 5.3.4 and 5.3.5, taken from Recommendations M.565 [10] and M.580 [11], are included for information.

Note 2 – In order to take account of PCM circuits and circuit sections, the nominal frequencies 800 Hz and 1000 Hz are in fact offset by appropriate amounts to avoid interaction with the sampling frequency. Details can be found in Supplement No. 3.5 to Volume IV [12].



Note – For meaning of other symbols, see legend for Figure 5/G.101 [9].

FIGURE 3/Q.43

Use of a digital reference sequence in the design and line-up of a Type-2 international circuit

5.4 *Interconnection of international circuits in a transit centre*

In a transit centre, the virtual analogue switching points of the two international circuits to be interconnected are considered to be connected together directly without any additional loss or gain. In this way a chain of international circuits has a nominal transmission loss in transit equal to the sum of the individual circuit losses.

References

[1] CCITT Recommendation *The transmission plan*, Vol. III, Rec. G.101.

[2] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Rec. G.223, § 1.

[3] CCITT Recommendation *Noise objectives for design of carrier-transmission systems of 2500 km*, Vol. III, Rec. G.222.

[4] CCITT Recommendation *FDM carrier systems for submarine cable*, Vol. III, Rec. G.371.

[5] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Rec. G.223, § 2.

[6] CCITT Recommendation *Pulse code modulation (PCM) of voice frequencies*, Vol. III, Rec. G.711.

[7] CCITT Recommendation *Loudness ratings (LRs) of national systems*, Vol. III, Rec. G.121, § 3.

[8] CCITT Recommendation *12-channel terminal equipments*, Vol. III, Rec. G.232, § 11.

[9] CCITT Recommendation *The transmission plan*, Vol. III, Rec. G.101, Figure 5/G.101.

[10] CCITT Recommendation *Access points for international telephone circuits*, Vol. IV, Rec. M.565.

[11] CCITT Recommendation *Setting up and lining up an international circuit for public telephony*, Vol. IV, Rec. M.580.

[12] *Test frequencies on circuit routed over PCM systems*, Vol. IV, Supplement No. 3.5.

Recommendation Q.44

ATTENUATION DISTORTION

1 Attenuation distortion

1.1 *All-analogue conditions*

The design objectives recommended for carrier terminal equipment by the Recommendation cited in [3] are such that for a chain of six circuits, each equipped with a single pair of channel translating equipments in accordance with that Recommendation, the network performance objective for the attenuation distortion given by Figure 1/G.132 [2] will in most cases be met. The distortion contributed by the seven international centres is thereby included.

Note – To assess the attenuation distortion of the international chain, the limits indicated for international circuits in Recommendation G.151, § 1 [4] must not be added to the limits for international centres mentioned in Recommendation Q.45. In fact, on the one hand, some exchange equipment would be counted twice if this addition were made; on the other, the specification limits of Recommendation Q.45 apply to the worst possible connection through an international exchange, while the maintenance limits of Recommendation G.151, § 1 apply to the poorest international circuit. The specifications of the various equipments are such that the mean performance will be appreciably better than could be estimated by the above-mentioned addition.

1.2 *Mixed analogue/digital conditions*

In the mixed analogue/digital period, it is expected that the attenuation/frequency characteristics of the analogue carrier terminal equipment that is to be used in international telephone connections will continue to be governed by existing Recommendations that are relevant to this type of circuit.

Where unintegrated PCM digital processes are to be included in international telephone connections, it is recommended that the attenuation/frequency characteristic of the bandpass filters associated with such processes should comply with the more stringent version of Figure 1/G.712 [5]. The latter Recommendation applies specifically to cases where integrated PCM digital processes are associated with trunk junctions (toll connecting trunks), trunk circuits (intertoll trunks), and international circuits.

With regard to the incoporation of unintegrated PCM digital processes in local telephone networks, the required attenuation/frequency characteristics of the bandpass filters involved are still under study.

2 The network performance objectives for the variation with frequency of transmission loss in terminal condition of a worldwide 4-wire chain of 12 circuits (international plus national extensions), each one routed over a single group link, are shown in Figure 1/Q.44 which assumes that no use is made of high-frequency radio circuits or 3-kHz channel equipment.

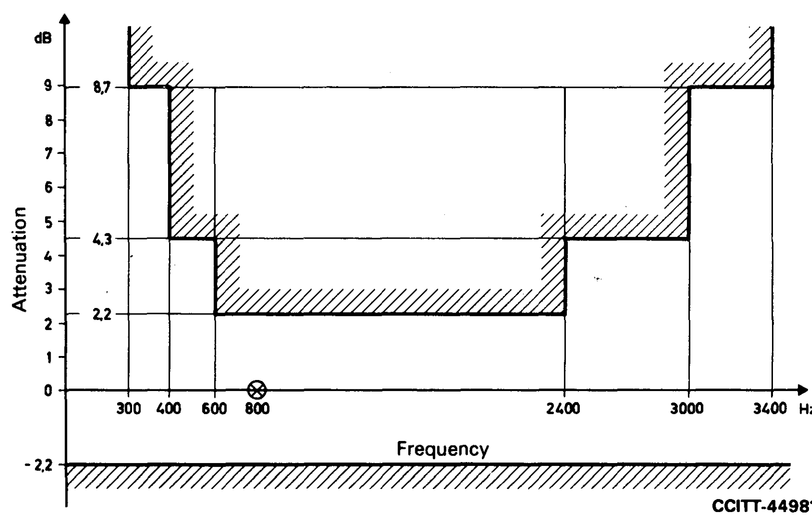


FIGURE 1/Q.44

Permissible attenuation variation with respect to its value measured at 800 Hz (objective for worldwide 4-wire chain of 12 circuits in terminal service)

References

[1] CCITT Recommendation *Transmission losses, relative levels and attenuation distortion*, Vol. III, Rec. G.141.

[2] CCITT Recommendation *Attenuation distortion*, Vol. III, Rec. G.132.

[3] CCITT Recommendation *12-channel terminal equipments*, Vol. III, Rec. G.232, § 1.

[4] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Rec. G.151, § 1.

[5] CCITT Recommendation *Performance characteristics of the PCM multiplex at audio frequencies*, Vol. III, Rec. G.712.

Recommendation Q.45

TRANSMISSION CHARACTERISTICS OF AN ANALOGUE INTERNATIONAL EXCHANGE

A new Recommendation Q.45 *bis* is published in the *Blue Book* with terminology and structure consistent with Recommendations Q.551-Q.554. There are no changes of technical substance. Recommendation Q.45 in the *Red Book* is adequate for existing references to Q.45.

TRANSMISSION CHARACTERISTICS OF AN ANALOGUE INTERNATIONAL EXCHANGE

1 Introduction

1.1 *General*

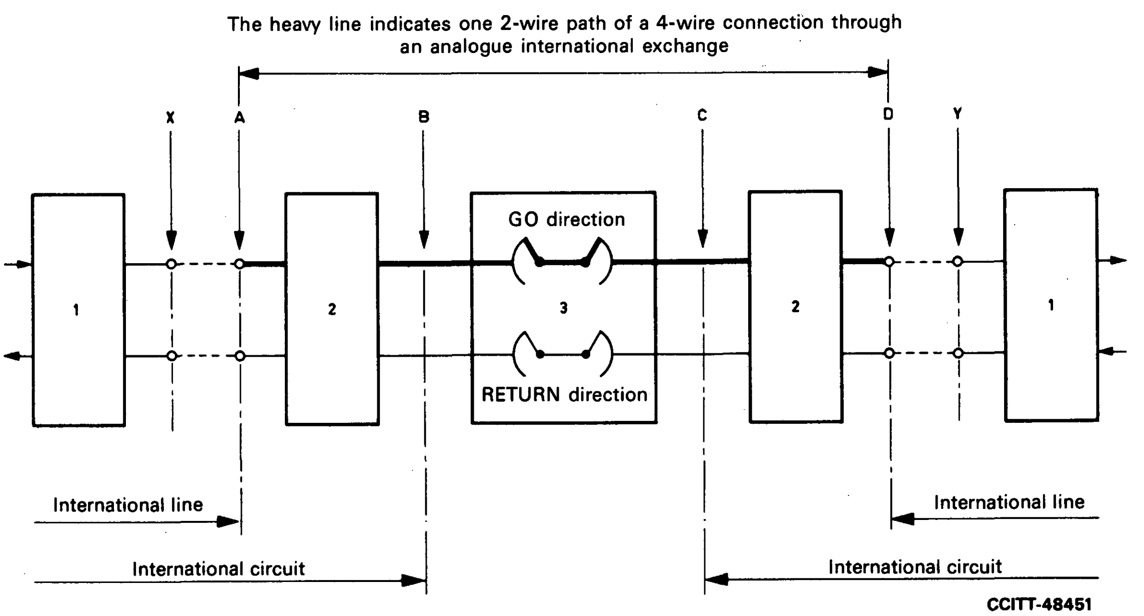
1.1.1 The concern of this Recommendation is the transmission performance of an analogue international exchange in terms of design objectives [1]. Related commissioning objectives [1] may be based on this Recommendation.

For the purposes of this Recommendation an analogue international exchange is a collection of equipment regarded as an entity by the Administration concerned. In the case of an analogue international transit exchange, it extends from the end of the incoming international line (point A of Figure 1/Q.45 *bis*) to the beginning of the outgoing international line (point D of Figure 1/Q.45 *bis*).

Exchange testing uses measuring points at boundaries of the same exchange individually agreed upon.

In contrast to exchange testing, circuit testing [2] is recommended between circuit access points expected to be located at or near by the actual analogue switching points (points B or C of Figure 1/Q.45 *bis*). For the purpose of circuit line-up and maintenance procedures, automatic international exchanges should be provided with circuit test access points.

Applying this Recommendation due account should be taken to the different constitution of the section of transmisison under test compared to circuit testing [2].



1 = channel translating equipment
2 = incoming and outgoing relay set
3 = automatic switching equipment

Note – Between points X and A and points D and Y, there may be equipment such as echo suppresors, compandors, equalizers, line signal receivers, etc., in addition to the cabling.

FIGURE 1/Q.45 *bis*

Analogue international exchange

1.1.2 The essential transmission requirements for an international exchange are:

a) The transmission loss through the exchange should be substantially constant with time and independent of the routing through the exchange.

b) Crosstalk and noise contribution should be negligible compared with other transmission sections in a world-wide connection [3].

c) The distortion introduced should be small. These include attenuation distortion, non-linear distortion and intermodulation products.

d) Impedance and balance with respect to earth at the points in the international exchange to which the lines are connected should be closely controlled.

1.1.3 This Recommendation applies to analogue automatic 4-wire international exchanges. It is desirable that it should also apply to analogue national 4-wire exchanges.

The following requirements are intended to be used only for type tests, acceptance tests, or for special investigations. They do not constitute a complete specification. Generally the recommended tests should be conducted on a sampling basis.

1.2 *Definitions*

1.2.1 **connection through an analogue international exchange**

A connection through an analogue international exchange comprises the 4-wire speechpath between the exchange boundaries denoted by points A and D of Figure 1/Q.45 *bis*. However with exception of crosstalk all transmission requirements are addressed to the 2-wire path of each direction. The GO direction is indicated by a heavy line in Figure 1/Q.45 *bis* and referred to as a typical section of transmission in the context of this Recommendation.

1.2.2 *Reference points*

1.2.2.1 **exchange input and output ports**

An exchange input and output port has to be defined for unidirectional measuring access. For the GO direction of transmission indicated by a heavy line in Figure 1/Q.45 *bis*, the boundary at the point A constitutes the input port and the boundary at the point D constitutes the output port respectively. For the RETURN direction of transmission the constitution is approached vice versa.

The exact location of each of the points A and D, and hence of input and output ports depends on national practice and therefore it is unnecessary for the CCITT to define it. Only the national authority responsible for each international transit exchange can fix the location of these points and thus define the boundaries of the exchange concerned.

1.2.2.2 **virtual analogue switching points (VASP)**

The virtual analogue switching points are theoretical points. They are fixed by convention as points where two circuits are considered to be directly connected without any additional loss or gain [4, 5]. Depending on the transmission loss T of the circuits to be connected the relative levels at the virtual analogue switching point can be different for the incoming and outgoing direction respectively. The relative levels agreed upon by CCITT are shown in a hypothetical arrangement in Figure 2a/Q.45 *bis*. The corresponding relative levels at actual switching points may differ in values, as for example indicated in Figure 2b/Q.45 *bis*.

1.2.3 *Relative levels*

1.2.3.1 **nominal relative levels at exchange boundaries**

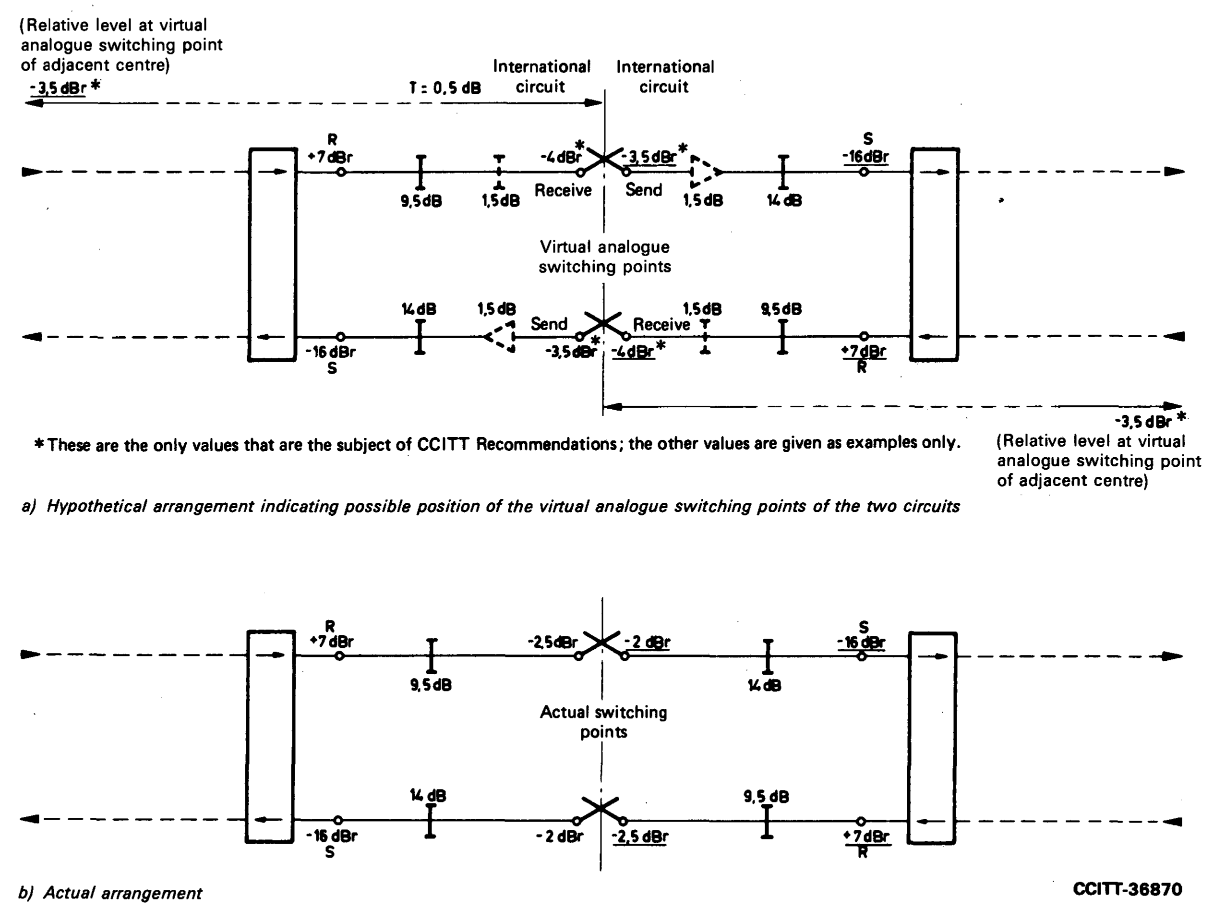
For the GO direction of transmission indicated by the heavy line in Figure 1/Q.45 *bis*:

– the nominal relative level at the exchange input port at point A is designated L_i;

– the nominal relative level at the exchange output port at point D is designated L_o.

For the RETURN direction of transmission the input port with its nominal relative level L_i is located at point D and the output port with its nominal relative level L_o is located at point A.

The values of the nominal relative levels L_i and L_o may be different for each 2-wire path of a 4-wire connection through the analogue international exchange.



Note – Underlined values of relative level refer to the circuit on the right of the point concerned. Values of relative level not underlined refer to the circuit on the left of the point concerned. In an actual switching centre the virtual analogue switching points would not physically exist.

FIGURE 2/Q.45 *bis*

Example showing a simplified representation of a transit connection in an international exchange with actual arrangement and possible location of virtual analogue switching points

(The recommended levels of channel translating equipment are stated according to Table 2/G.232, case 2)

1.2.3.2 **nominal relative levels at virtual analogue switching points**

The nominal relative levels at the virtual analogue switching points are defined to assure stability and to assist maintenance procedures [3] [4].

The difference of the nominal relative level at the end of the incoming 2-wire path and the nominal international through-connecting level, which is by convention −3.5 dBr, is the stability loss T assigned to a 2-wire path of a 4-wire circuit. By the value of this loss T the nominal transmission loss of a 2-wire path of a connection through an analogue international exchange is referred to its virtual analogue switching point.

1.2.4 *Measurement conditions*

1.2.4.1 **reference frequency**

The nominal reference frequency, on which relative levels, transmission loss, loss-frequency distortion etc. are based, is 800 Hz or 1000 Hz alternatively [5].

Note – Since 1020 Hz is the recommended nominal frequency for techniques using digital processes this frequency should be preferred to harmonize into the evolving digital network [6].

1.2.4.2 **impedance**

Measurements shall be made under nominally matched conditions, i.e. the exchange boundaries are terminated with their nominal exchange impedance.

1.2.4.3 **test levels at exchange boundaries**

At the nominal reference frequency, test levels are defined in terms of the apparent power relative to 1mW. At frequencies different from the nominal reference frequency, test levels are defined as having the same voltage as the test level at the nominal reference frequency. Measurements are based on the use of a test generator with a frequency-independent e.m.f. and which has an impedance equal to the nominal impedance.

1.2.5 *Transmission loss*

1.2.5.1 **nominal transmission loss**

A connection through an analogue international exchange (see Figure 1/Q.45 *bis*) is established by connecting an input port located at one exchange boundary to an output port located at another exchange boundary in both directions.

The nominal transmission loss of a 2-wire path of a connection through an exchange is equal to the difference of the relative levels at the input and the corresponding output:

$$NL = (L_i - L_o) \text{ dB}$$

Note – The nominal transmission loss of the exchange may be different in the GO and RETURN direction of transmission.

1.2.6 **loss distortion with frequency**

The loss distortion with frequency is the logarithmic ratio of output voltage at the reference frequency, $U(\text{Ref})$, divided by its value at frequency f, $U(f)$:

$$LD = 20 \log \left| \frac{U(\text{Ref})}{U(f)} \right|$$

(See Supplement No. 1 to Volume VI, Fascicle VI.5, CCITT [6].)

2 VF-parameters of a connection through the exchange

2.1 *Impedance*

2.1.1 *Nominal value*

The nominal impedance at the input and output ports located at points A and D of Figure 1/Q.45 *bis* shall be 600 ohms, balanced.

2.1.2 *Return loss*

The return loss of one port located at point A or D of Figure 1/Q.45 *bis* has to be measured againts the nominal impedance whilst all other ports of the connection through the exchange are terminated with the nominal impedance.

At any frequency from 300 to 600 Hz the return loss should be not less than 15 dB. The corresponding value from 600 to 3400 Hz should be not less than 20 dB.

2.1.3 *Impedance unbalance about Earth*

The impedance unbalance about Earth is measured as longitudinal conversion loss (LCL) according to Figure 1/O.9 [16] and as longitudinal conversion transfer loss (LCTL) according to Figure 2/O.9 [16] at the interfaces located at points A and D of Figure 1/Q.45 *bis* using Z = 600 ohms and ZL = 150 ohms.

The measured values should not be worse than:

300- 600 Hz: 40 dB

600-3400 Hz: 46 dB

Note – Some Administrations guided by their knowledge of local conditions may feel a need to specify a value of impedance unbalance about Earth for a lower frequency, for instance, 50 Hz.

2.2 *Values of relative levels L_i and L_o*

2.2.1 *Basic nominal values*

Basic nominal values for the input level L_i and the output level L_o of a connection through an analogue international exchange are given in Table 1/Q.45 *bis*. For the purpose of demonstration, these values are valid under the following hypothetical assumptions:

– there is no transmission impairment between the points X and A and the points D and Y of Figure 1/Q.45 *bis*;

– the nominal relative levels L_i and L_o are determined by the corresponding nominal relative levels of the channel translating equipment recommended for two cases in Table 2/G.232 [7] corrected by the nominal per-channel loss of the international circuit, T = 0.5 dB.

TABLE 1/Q.45 *bis*

Basic nominal values of relative levels at the exchange boundaries of a connection through an analogue international exchange

Relative level	Channel translating equipment	
	Case 1	Case 2
L_i	+4 dBr	+7 dBr
L_o	–14.5 dBr	–16.5 dBr

Nominal values of relative levels will differ in practice from these basic nominal values by the impact of various equipment being inserted and the necessary cabling to interconnect the channel translating equipment to the exchange boundaries. Due account should be taken of this impact in specifying corresponding nominal relative levels, especially by cable length between points X and A and points D and Y in Figure 1/Q.45 *bis*.

2.2.2 *Offset of mean actual values*

The actual value of the output relative levels depend on the tolerances of components, i.e. mainly attenuation pads, and on the routing of a connection through an exchange via the switchblock (Points B and C in Figure 1/Q.45 *bis*).

The offset of the mean value of the distribution of the actual output relative levels L_o should be very close to zero but does not need to be specified.

2.2.3 *Dispersion of actual values*

The dispersion of actual values of the output relative level L_o is mainly due to the diversity of paths in the switchblock. The standard deviation of a representative distribution of the actual output relative levels measured at the nominal reference frequency should be as small as practicable. For purpose of calculation a value of 0.2 dB may be assumed.

In order to confirm this value, it is considered sufficient that for purposes of design and acceptance testing, the difference between the actual relative output levels at the nominal reference frequency of the shortest and longest paths from point B to point C in Figure 1/Q.45 *bis* in no case exceeds 0.8 dB. For a practical assessment of the average value of the actual relative output level, the influence of the switchblock between points B and C can be achieved using the arithmetically computed mean of the maximum and minimum actual relative output levels.

These values apply for connections routed directly, and once only, through the switchblock. If special re-entrant trunking arrangements are used, requiring the connection to pass through the switchblock twice (this may be a convenient way to extend the availability of the switching network or to introduce additional equipment, e.g. echo suppressors), the distribution of the actual relative output levels will be increased to lower values. In view of this, the re-entrant technique should not be used to such an extent as to decrease significantly the mean value of the actual relative output level distribution.

2.3 *Basic nominal values of transmission loss*

In accordance with the definition in § 1.2.5.1 and the basic nominal values of relative levels quoted in § 2.2.1 the following basic nominal values of transmission loss result for the purpose of demonstration:

case 1: NL $= +4$ dB $-$ (-14.5) dB $=$ 18.5 dB

case 2: NL $= +7$ dB $-$ (-16.5) dB $=$ 23.5 dB.

2.4 *Response to frequency and input level*

2.4.1 *Loss distortion with frequency*

The loss distortion with frequency according to the definition in § 1.2.6 measured on any 2-wire path of connection through the exchange between points A and D of Figure 1/Q.45 *bis* should lie within the following limits:

300- 400 Hz: -0.2 dB to $+0.5$ dB

400-2400 Hz: -0.2 dB to $+0.3$ dB

2400-3400 Hz: -0.2 dB to $+0.5$ dB.

2.4.2 *Variation of output level with input level*

The actual output level measured on any 2-wire path of a connection through the exchange between points A and D of Figure 1/Q.45 *bis* should follow the input level with a variation not more than 0.2 dB in the range of the input level from -40 dBm0 to $+3.5$ dBm0, using the reference frequency.

2.4.3 *Group delay distortion with frequency*

According to the definition of group delay [9], the group delay distortion measured on any 2-wire path of a connection through the exchange between points A and D of Figure 1/Q.45 *bis* over the frequency band 600 to 3000 Hz should not exceed 100 microseconds.

2.4.4 *Intermodulation*

The intermodulation products shall be measured on any 2-wire path of a connection through the exchange between points A and D of Figure 1/Q.45 *bis*.

The intermodulation products to be taken into account for end-to-end multifrequency signalling and for data transmission are those of the third order, of type $(2f_1\text{-}f_2)$ and $(2f_2\text{-}f_1)$ where f_1 and f_2 are two signalling frequencies.

For a measurement of the intermodulation products, the two frequencies applied to an input are $f_1 = 900$ Hz and $f_2 = 1020$ Hz (see [8]). With each frequency f_1 and f_2 at a level of -6 dBm0, the difference at the output between the level of either frequency f_1 or f_2 and the level of either of the intermodulation products at $(2f_1\text{-}f_2)$ or $(2f_2\text{-}f_1)$ should be at least 40 dB.

2.5 *Noise*

For a 4-wire international exchange, noise measurements should be performed on a connection through the exchange between points A and D of Figure 1/Q.45 *bis* during the busy hour [10]. Each port should be terminated with 600 ohms. The noise should be measured at the output port of each 2-wire path and should be referred to a point of zero relative level. Thus in Figure 1/Q.45 *bis* the noise in the 2-wire path of the GO direction is measured at point D and the noise in the 2-wire path of the RETURN direction is measured at point D and the noise in the 2-wire path of the RETURN direction is measured at point A. A sufficient variety of connections should be chosen to ensure that the measurements are representative of the various possible routes through the exchange.

2.5.1 *Weighted noise*

The mean value of the psophometrically weighted noise over a long period during the busy-hour should not exceed −67 dBm0p (200 pW0p).

2.5.2 *Unweighted noise*

Unweighted noise has to be measured with a device having a uniform response curve throughout the frequency band 31.5 Hz-16 kHz [11].

The mean value of the unweighted noise over a long period during the busy-hour should not exceed −40 dBm0 (100,000 pW0).

2.5.3 *Impulsive noise*

For measurement procedure of impulsive noise see Annex A of this Recommendation.

Noise counts should not exceed 5 counts in 5 minutes at a threshold level of −35 dBm0.

Note – Figure 3/Q.45 *bis* shows the maximum number of impulsive noise counts acceptable in a 5-minute period.

2.6 *Crosstalk*

Crosstalk should be measured in exchanges at a frequency of 1100 Hz in accordance with Recommendation G.134 [12].

2.6.1 *Crosstalk between different connections*
(Inter-connection crosstalk)

In an analogue international 4-wire exchange the signal to crosstalk ratio measured at points A and D of Figure 1/Q.45 *bis* between any 2-wire paths of different 4-wire connections through the exchange should be 70 dB or better.

This limit of 70 dB should normally apply to the most unfavourable case, in which two connections have parallel paths throughtout the exchange. It should be noted that this does not occur in practice, because normal cabling layout in such that when, at one switching stage, two connections use adjacent switches, in the following stage the two connections generally use switches which are not adjacent.

2.6.2 *Go-to-return crosstalk of the same connection*
(Intra-connection crosstalk)

The signal-to-crosstalk ratio between the GO and RETURN 2-wire path of the same 4-wire connection through the exchange should be 60 dB or better.

3 **Use of cables specified by the IEC**

The cables for telephone exchanges in accordance with IEC (International Electrotechnical Commission) publication 189 [13] will meet the electrical characteristics required by the CCITT (especially as regards crosstalk) for ordinary exchanges, but this may no longer hold good for larger exchanges with considerable lengths of cable.

In accordance with Recommendation G.231 [14], it will be for the Administrations or the contractors to check whether standard cables will be satisfactory in equipping an exchange which requires telephone cables of exceptional lenght.

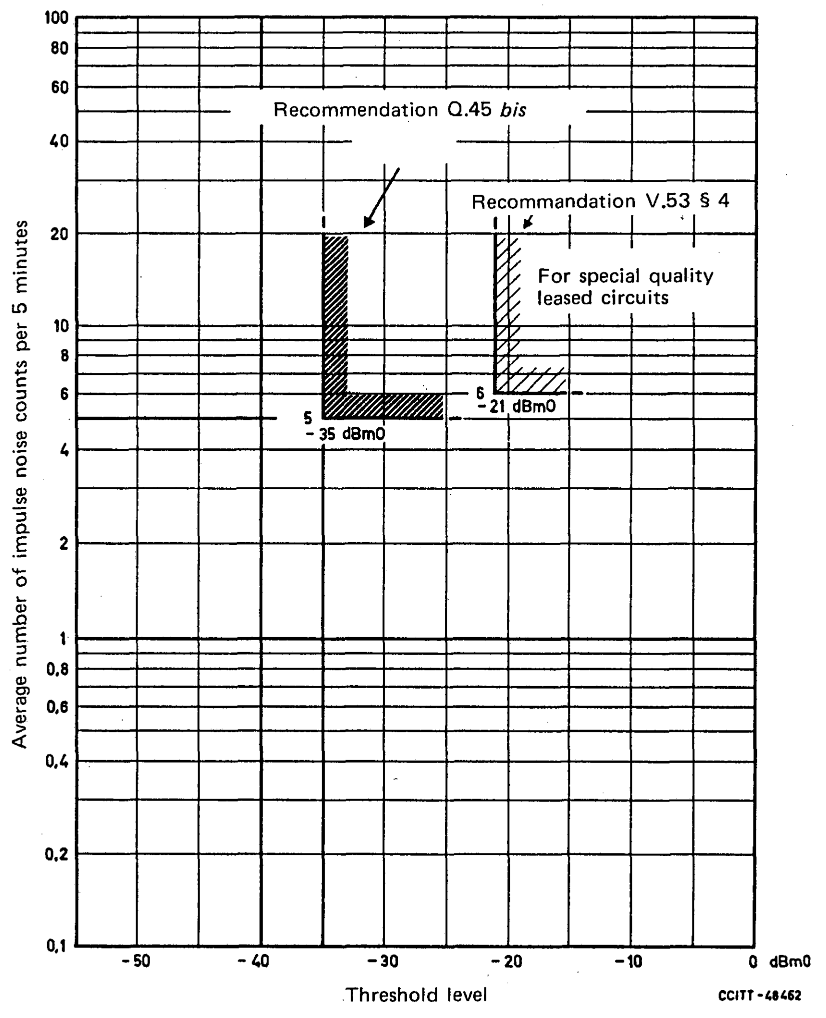


FIGURE 3/Q.45 *bis*

Acceptable noise counts for 4-wire exchanges

ANNEX A

(to Recommendation Q.45 *bis*, § 2.5.3)

Procedure for impulsive noise measurement

A.1 A test circuit should be formed by setting up a connection across the switching unit and terminating the connection on the exchange input by the nominal impedance and on the exchange output by the impulse measuring device in parallel to the terminating nominal impedance. Those terminated ports should be at points A and D in the diagram of Figure 1/Q.45 *bis* which includes the switching equipment of the exchange. Where it is the desire of an Administration, measurements may be made at points X and Y if precautions are taken to ensure that the result apply only to the automatic switching equipment, signalling equipment, echo suppressors, relay sets, pads and cabling of the exchange.

A.2 The measurements should be made using the device specified in Recommendation O.71 [15]. The 600-3000 Hz filter network should be in the circuit.

A.3 The measurements should be made at times when the probability of noise occurring is at its highest, that is normally during the busy-hour.

A.4 The time of observation for each test should be five minutes.

Note – The number of different test circuits set up through the exchange for measuring should take into account the size and complexity of the switching unit and should be representative for all various routes through the exchange. See also the documents cited in [15] and [17].

References

[1] Recommendation *Transmission performance objectives and Recommendations*, Vol. III. Fascicle III.1, Rec. G.102, §§ 3 and 4.

[2] CCITT Recommendation *Circuit testing*, Vol. IV, Fascicle IV.1, Rec. M.110, § 1.

[3] CCITT Recommendation *The transmission plan*, Vol. III, Fascicle III.1,Rec. G.101, §§ 2.1 and 5.4.

[4] CCITT Recommendation *Loudness ratings (LR) in an international connection*, Vol. III, Fascicle III.1, Rec. G.111, § 1.1.

[5] CCITT Recommendation *The transmission plan*, Vol. III, Fascicle III.1, Rec. G.101, § 5.3.5.

[6] CCITT Recommendation *Transmission characteristics of digital exchanges*, Vol. VI, Fascicle VI.5, Recs. Q.551 and Q.553 (including Supplement No.1).

[7] CCITT Recommendation *12-channel terminal equipment*, Vol. III, Fascicle III.2, Rec. G.232, Table 2/G.232.

[8] CCITT Recommendation *Characteristics of compandors for telephony*, Vol. III, Fascicle III.1, Rec. G.162, § 5.2.

[9] CCITT Definitions: *Group delay*, Vol. I, Fascicle I.3 (Terms and definitions)

[10] CCITT Definitions: *Busy-hour*, Vol. I, Fascicle I.3 (Terms and definitions)

[11] CCITT Recommendation *Psophometer for use on telephone-type circuits*, Vol. IV, Fascicle IV.4, Rec. O.41, Figure 1/O.41

[12] CCITT Recommendation *Linear crosstalk*, Vol. III, Fascicle III.1, Rec. G.134.

[13] Publication 189 of the IEC.

[14] CCITT Recommendation *Arrangement of carrier equipment*, Vol. III, Fascicle III.2, Rec. G.231.

[15] CCITT Recommendation *Impulsive noise measuring equipment for telephone-type circuits*, Vol. IV, Fascicle IV.4, Rec. O.71.

[16] CCITT Recommendation *Measurement arrangements to assess the degree of unbalance about Earth*, Vol. IV, Fascicle IV.4, Rec. O.9.

[17] *Measurements of impulsive noise in a 4-wire telephone exchange*, Green Book, Vol. IV-4, Supplement No. 7, ITU, Geneva, 1973.

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SECTION 8

SIGNALLING FOR SATELLITE SYSTEMS

Recommendation Q.48

DEMAND ASSIGNMENT SIGNALLING SYSTEMS[1]

1 The term "demand assignment" (abbreviated as DA) should be taken as meaning that the assignment is on a per-call basis.

Note – Satellite circuits with demand assigned multiple access are those circuits which may be set up by assignment of a satellite link to operate between specified earth stations when the actual demand arises.

The origin, destination, or both of the satellite link can be varied. The link is assigned to set up the required telephone circuit according to the call.

This defines the following concepts:

1) variable destination satellite link;
2) variable origin satellite link;
3) fully variable satellite link (the origin and destination of which may both be varied).

The Recommendation covers, when applicable, fully variable and variable destination types of DA systems.

2 The DA signalling system shall be capable of interworking with all currently standardized CCITT signalling systems and shall have the capacity to carry all the telephony signals currently provided by these CCITT signalling systems and shall in addition provide reserve capacity.

Any currently standardized CCITT signalling system shall be able to be applied to any access link. Different CCITT signalling systems may be applied to the various access links at the same time.

3 Account should be taken of the fact that particular earth stations may have special signalling requirements to suit the CTs using these earth stations (e.g. joint use of an earth station by a number of CTs, long distances between CT and earth station, CTs with access to more than one earth station).

4 The DA signalling system shall be an integrated signalling system used both for:

a) signalling for setting up the DA speech circuit; and
b) transfer of the information flow for telephony.

5 The DA signalling system shall be capable of transmitting address information in both the *en bloc* and the overlap mode of operation. The transmission of address information by the outgoing DA system terminal should be such as to result in minimum delay to these signals in the DA system.

The manner of transmitting signals over the DA signalling system shall be independent of the type of signalling system to be encountered in the access link at the far end.

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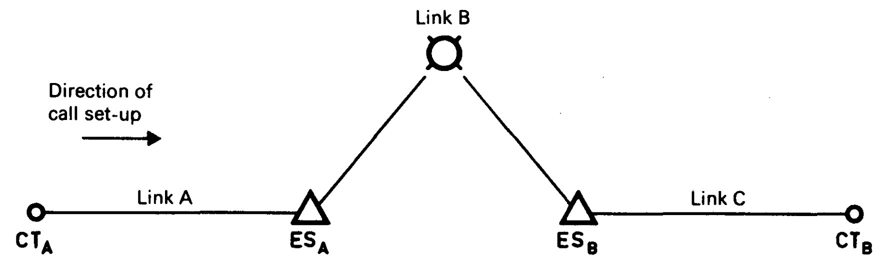
[1] See also the reference cited in [1].

Accordingly, the interworking arrangements described in Table 1/Q.48 are recommended. (For definitions of "*en bloc*" and "*en bloc* overlap" see the definitions in Recommendation Q.151 [2].)

TABLE 1/Q.48

Interworking arrangements for DA signalling systems



En bloc – system No. 6	*Case 1* En bloc	En bloc – system No. 5 En bloc – system No. 6
En bloc – system No. 6	*Case 2* En bloc	Overlap – system R2
En bloc – system No. 5	*Case 3* En bloc-overlap or en bloc	En bloc – system No. 5 En bloc – system No. 6
En bloc – system No. 5	*Case 4* En bloc-overlap or en bloc	Overlap – system R2
Overlap – system No. 6 Overlap – system R2	*Case 5* Overlap	En bloc – system No. 5
Overlap – system No. 6 Overlap – system R2	*Case 6* Overlap	Overlap – system No. 6 Overlap – system R2

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6 The DA signalling system shall send out address digits from ES_B to CT_B in the correct order, that is, the order of dialling.

7 Means shall be provided for preventing spillover of signals between successive calls, which use the same satellite channel through the DA signalling system.

8 The DA signalling system should be capable, for the sequence *re-answer signal-clear back signal* of correctly extending to CT_A from ES_A, the last state representing the final position of the called party's switch hook.

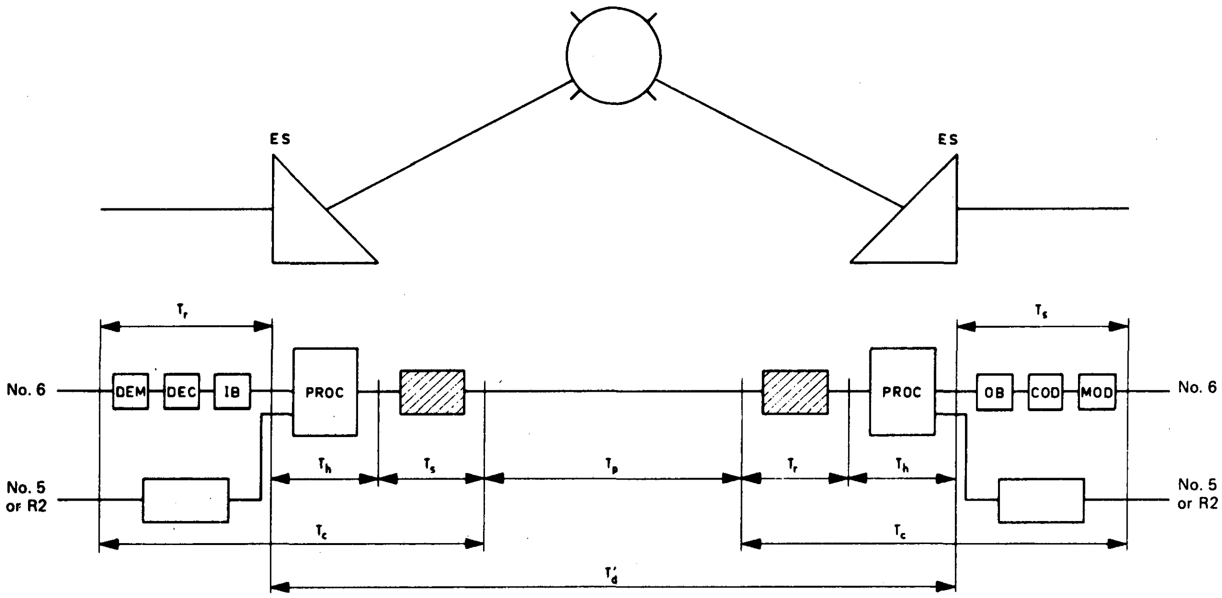
9 The message structure of the demand assignment signalling system should be such that one message will contain all the information necessary for one event (e.g. answer signal for one particular circuit). Single unit and multi-unit messages should be catered for. Each signal unit should contain both information and check bits.

10 All time-outs for both normal and abnormal conditions in the DA signalling system should be designed according to the recommendations concerning the relevant CCITT signalling systems.

11 Signal transfer time through the DA signalling system should be fast. While no firm time requirements in regard to the various components of signal transfer time have been established, design objectives in terms of average and 95% level values for the signal transfer time (T_d) for answer signals, other one-unit messages and the initial address message are given. These figures are to be viewed as reasonable objectives and not as firm requirements.

11.1 *Signal transfer time in the DA signalling system*

A signal transfer time in the DA signalling system is specified. This signal transfer time is called T'_d in the diagram of Figure 1/Q.48.



$$T'_d = 2T_h + T_s + T_r + T_p = T_h + T_c + T_p$$

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T'_d = Signal transfer time in DA signalling system.
(For other symbols, see Recommendation Q.252 [3].)

To facilitate the calculation of the total signal transfer time of the DA system, it is assumed that the time T_r as well as T_s respectively of the terrestrial and satellite transmission links are equal

FIGURE 1/Q.48

Functional signal transfer time diagram

The value $T_d = T'_d - T_p$ should be used as the design objective for the DA signalling system. The values of T_d calculated for the design of the system are shown in Table 2/Q.48.

Note – These figures have to be interpreted as reasonable estimates and not as firm requirements.

TABLE 2/Q.48

Values of signal transfer times for design of a DA signalling system

Design objectives for T_d

$T_d = T'_d - T_p$

	Type of message	Answer	Other one-unit message	IAM of 5 SU
T_d in ms	AV	52	85	145
	95% level	85	175	235

For calculation use the following relations:

$$T_d = 2\,T_h + T_s + T_r = T_c + T_h \tag{11-1}$$

$$T_{d\,\mathrm{av}} = T_{c\,\mathrm{av}} + T_{h\,\mathrm{av}} \tag{11-2}$$

$$T_{d\,95\%} = T_{d\,\mathrm{av}} + \sqrt{(\Delta T_c)^2 + (\Delta T_h)^2} \tag{11-3}$$

where

$$\Delta T_c = T_{c\,95\%} - T_{c\,\mathrm{av}} \tag{11-4}$$

$$\Delta T_h = T_{h\,95\%} - T_{h\,\mathrm{av}} \tag{11-5}$$

For basis of calculation see [4].

12 Dependability requirements

The requirements specified for System No. 6 (see [5]) are recommended as the objectives for the DA signalling system.

12.1 *Signal transfer dependability* (see [6])

"*b)* Signal units of any type which give rise to wrongly accepted signals due to undetected errors and causing false operation (e.g. false clear-back signal):

not more than one error in 10^8 of all signal units transmitted, and

c) As in item *b)* but causing serious false operation (e.g., false metering or false clearing of a connection):

not more than one error in 10^{10} of all signal units transmitted."

12.2 *Error correction by retransmission* (see [7])

Although the bit error rate in the DA signalling system has not been determined, the design of the system should be made such that a design objective "not more than one in 10^4 signal units carrying telephone information is allowed to be delayed as a consequence of error correction by retransmission."

12.3 *Interruption of the signalling service* (see [8])

System No. 6 requirements are:

– interruption of duration between 2 seconds and 2 minutes: not more than once a year;

– interruption of duration exceeding 2 minutes: not more than once in 10 years.

Since the speech circuits and the signalling channel in the DA system normally will be interrupted simultaneously, it is understood that the above figures are related to the signalling equipment and not to the transmission media common to both the signalling channel and the speech circuits.

References

[1] *Signalling for demand assignment satellite systems*, Green Book, Vol. VI-4, Supplement No. 8, ITU, Geneva, 1973.

[2] CCITT Recommendation *Signal code for register signalling*, Vol. VI, Rec. Q.151.

[3] CCITT Recommendation *Signal transfer time definitions*, Vol. VI, Rec. Q.252.

[4] CCITT Recommendation *Signal transfer time requirements*, Vol. VI, Rec. Q.287, Annex A.

[5] CCITT Recommendation *Service dependability*, Vol. VI, Rec. Q.276, § 6.6.1.

[6] *Ibid.*, § 6.6.1, b) and c).

[7] *Ibid.*, § 6.6.1, a).

[8] *Ibid.*, § 6.6.1, d).

SECTION 9

AUTOMATIC TESTING EQUIPMENT

Recommendation Q.49

SPECIFICATION FOR THE CCITT AUTOMATIC TRANSMISSION MEASURING AND SIGNALLING TESTING EQUIPMENT ATME No. 2

(The specification for ATME No. 2 appears in Recommendation O.22, Fascicle IV.4.)

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SECTION 10

SIGNALLING FOR CIRCUIT MULTIPLICATION EQUIPMENT

Recommendation Q.50

SIGNALLING BETWEEN CIRCUIT MULTIPLICATION EQUIPMENTS (CME) AND INTERNATIONAL SWITCHING CENTRES (ISC)

1 Introduction

This Recommendation contains principles and examples of signalling between ISC (exchanges) and their associated circuit multiplication equipments.

Circuit multiplication equipments may have integral echo control and A/μ law converter functions. The information in this Recommendation is compatible with the control procedures for such devices.

2. Definitions relating to CME

For a complete description of additional definitions see Recommendation G.763.

2.1 *Digital circuit multiplication equipment (DCME) and CME*

DCME and CME constitute a general class of equipment which permits concentration of a number of trunks on a reduced number of transmission channels. DCME in particular permits concentration of a number of 64 kbit/s PCM encoded trunks on a reduced number of digital transmission channels.

2.2 *Speech interpolation; digital speech interpolation (DSI)*

A method of profiting from the time instants when a speaker is not active, which is indicated by a speech detector. The channel is then used by another active connection. The signals carried by a transmission channel therefore represent interleaved bursts of speech signals derived from a number of different trunks.

2.3 *Low rate encoding (LRE)*

Speech coding methods with bit rates less than 64 kbit/s, e.g. the 32 kbit/s transcoding process defined in G.721 applied to speech coded according to G.711.

2.4 *Speech activity*

The ratio of the time speech and corresponding hangover occupies the trunk to the total measuring time, averaged over the total number of trunks carrying speech.

2.5 *CME gain*

The trunk channel to transmission channel multiplication ratio, which is achieved through application of CME, including LRE and/or speech interpolation (DSI).

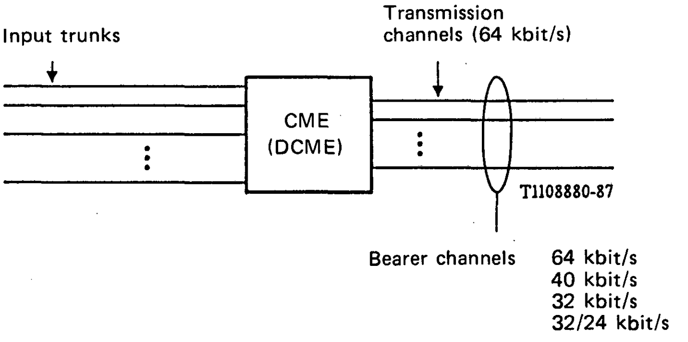

FIGURE 1/Q.50

CME gain

2.6 *Trunk*

A bidirectional connection consisting of a forward channel and a backward channel between the ISC and CME not subject to LRE or DSI operation.

2.7 *Transmission channel, bearer channel*

One channel of the connection between the transmit unit and receive unit of corresponding CME.

2.8 *Freeze-out*

The temporary condition when a trunk channel becomes active and cannot immediately be assigned to a transmission channel, due to lack of available transmission capacity.

2.9 *Freeze-out fraction*

The ratio of the sum of the individual channel freeze-outs to the sum of the active signals and their corresponding hangover times and front end delays, for all trunk channels over a fixed interval of time, e.g. one minute.

2.10 *Transmission overload*

The condition when the freeze-out fraction or average bits per sample goes beyond the value set in accordance with speech quality requirements.

2.11 *Operating modes*

2.11.1 *Point-to-point mode* (see Figures 2a/Q.50 and 2b/Q.50)

Using Figure 2a/Q.50 for reference, the transmit side CME concentrates N trunks into N/G transmission channels, where G is the CME gain.

At the receive side, the receiving CME simply reconstitutes the N trunks from the N/G transmission channels.

The example in Figure 2b/Q.50 also shows a point-to-point mode. From the switching point of view there could be a difference between the configurations in Figures 2a/Q.50 and 2b/Q.50.

For transmission of alarms, it has also to be considered that different exchanges may be connected to one CME.

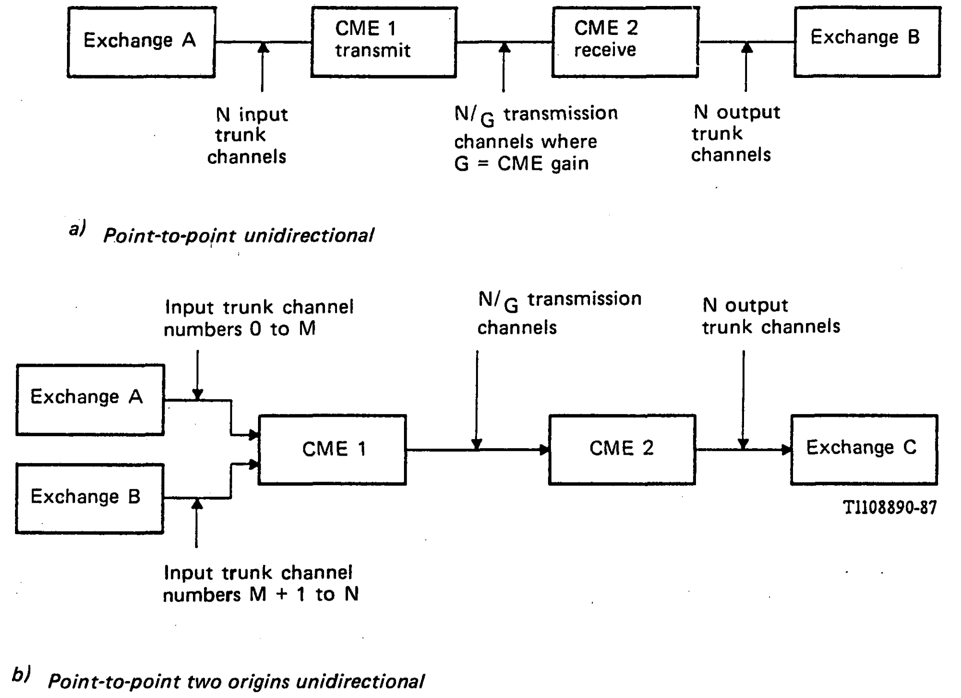

FIGURE 2/Q.50

Multi-clique for two origins and two destinations unidirectional

2.11.2 *Multi-clique mode* (see Figure 3/Q.50)

In this mode the pool of transmission channels is subdivided into several independent pools (cliques) of fixed capacity, each destination specific. If a part of the cliques capacity is not used, it cannot be used for another destination.

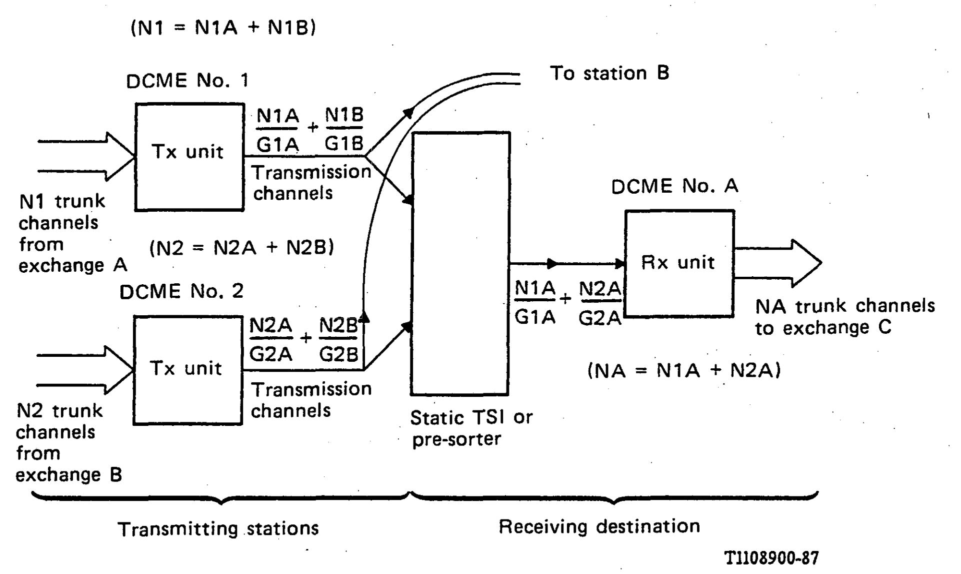

FIGURE 3/Q.50

Multi-clique mode (only one direction shown)

2.11.3 *Multi-destination mode*

A DCME operational mode where input trunk channel traffic is interpolated over a pool of available transmission channels for all destinations having traffic in the pool. The transmit trunk channels are designated to receive trunk channels at corresponding locations.

Figure 4/Q.50 shows a unidirectional system block diagram for a multi-destination mode with two transmit and two receive DCME units.

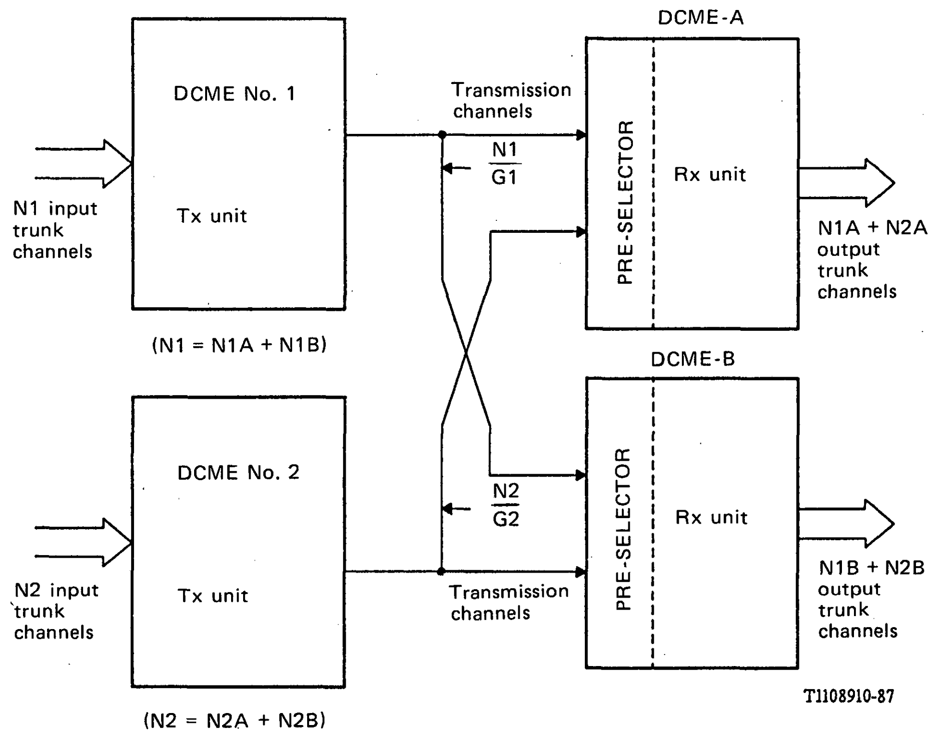

FIGURE 4/Q.50

Multi-destination mode (only one direction shown)

3 Requirements for control

3.1 *Reasons for use of circuit multiplication equipments (CME)*

Circuit multiplication equipments are used in order to reduce the bandwith required for transmission of a given set of calls. This can be achieved by reducing the redundancy which is inherent in speech communications. CME gains of up to 5:1 can be achieved using DSI + LRE with subjectively acceptable quality. Thus, the amount of line plant required between switching points and hence the cost of provision can be minimized.

3.2 *Integration of CMEs into the telephone network*

Normally, when an exchange needs an outgoing circuit, the circuit selection is based on circuit availability. In this example, the call may be blocked if all of the circuits are unavailable due to traffic or maintenance. If the same call encounters a CME, the possible outcomes are more complex.

From the point of view of call set-up, two CME aspects may necessitate information transfer between the exchange and the CME.

a) Transmission capacity – The circuit multiplication characteristics of a CME result in a lower total transmission capacity for the CME as compared to the transmission capacity of all of the input trunks. A call may find a free (unseized) circuit from the exchange to the CME but no available transmission channels between two CMEs. For systems employing speech interpolation, allowing additional calls could lead to unacceptable speech quality degradation due to freeze-out. The probability of freeze-out can be reduced by the creation of overload channels using bit-stealing techniques. Additional quality control is achieved if the exchange knows, through a Transmission Resource Management System, if the CME has available capacity to complete a new call.

b) Call set-up/release – Depending on the bearer service type of the call to be set-up, and on whether or not the CME is able by itself to establish the inter-CME connections, the seizing/releasing actions in the exchange may need to be extended to the CME by means of out-of-band information transfer. For example, in DSI systems, speech connections are made dynamically on detection of channel activity performed by built-in speech detectors. For 64 kbit/s unrestricted on-demand connections (and for 3.1 kHz audio, if appropriate) through DSI systems (i.e., not through internal pre-assignment), the establishment and disestablishment of connections between the CMEs have to be initiated from the outgoing exchange.

In general, these two aspects are strictly independent from each other as each serves a different purpose. However, depending on the design criteria in the CME and the call set-up procedures in the exchange and the CME associated with one aspect may be related to that of the other.

3.3 *Factors for signalling functions determination*

The functional requirements for signalling between CMEs and exchanges are determined by the type of CME with its capabilities and limitations, and by the types of bearer services it supports.

The remote control of echo control devices and A/μ-law converters, if they are integrated into the CME, is accomplished either by the terminal or test equipment or directly from the ISC (based on call set-up information/signalling information).

Requirements and actions for control of ECD are described in Recommendation Q.115.

3.3.1 *Circuit multiplication equipment and physical location*

There are different types of CME which are being used or will most likely be used in the international telephone network, each with its own capabilities and limitations:

a) 32 kbit/s low rate encoding (LRE);

b) analogue speech interpolation equipment;

c) digital speech interpolation (DSI) with 64 kbit/s PCM;

d) combined 32 kbit/s LRE and DSI

e) 16 kbit/s LRE.

The location of certain types of CME relative to the exchange determines the choice of signalling interface. These CMEs can be located at the ISC or remote from the ISC (e.g., at an earth station). Certain types of signalling interfaces may be more practical when these CMEs are co-located with the ISC, and others may be more practical when they are remote from the ISC. Therefore, the location of the CME needs to be considered when choosing the signalling between ISC and CME.

When the CME is remote from the ISC, the link between the ISC and CME could be composed of digital or analogue transmission path. Both conditions have different equipment configurations and different signalling requirements (see § 7).

3.3.2 *Bearer services supported on CME links*

Up to four basic bearer service types are supported or will likely be supported by CMEs in the international network:

– speech bearer service (full duplex, analogue or digital);

– 3.1 kHz audio bearer service (full duplex);

- 64 kbit/s unrestricted bearer service (full duplex);
- alternate speech/64 kbit/s unrestricted bearer service (full duplex) (in-call modification is for further study).

Each CME type supports one or more bearer services depending on special facilities or functional options built in the equipment.

Different LRE algorithms will also have different levels of performance, for instance, in terms of voiceband data. Since certain speech optimized algorithms have limited transparency to voice band data, the CME has internal facilities (e.g., data detectors combined with route around mechanisms and/or special algorithms) to overcome its inherent limitations. This approach clearly separates the CME transmission problems from the ISC switching functions as much as possible to allow independent developments.

4 Bearer services and CME techniques in the context of signalling

Table 1/Q.50 gives the relationship between CME techniques and the four bearer services identified in § 3.3.2 with regard to their supportability and the need for CME-exchange message transfer.

The signalling function requirements are categorized on the basis of bearer services supported by the different CME techniques. For speech bearer services, transmission resource management (TRM) information alone is adequate especially for CMEs employing speech interpolation. The objective of this provision is to maintain the reduction of transmission quality within tolerable limits. In addition to TRM information, external call set-up message (CSM) exchange is needed for bearer services involving on-demand 64 kbit/s unrestricted service in contemporary digital circuit multiplication equipment (32 kbit/s LRE and DSI).

TABLE 1/Q.50

Bearer services supported in CMEs in relation to CME-exchange signalling

	Circuit multiplication equipment				
Bearer service	Analogue TASI	LRE 32 kbit/s	DSI 64 kbit/s PCM	DCME DSI+32 kbit/s/LRE	CDR 16 kbit/s
1. Speech	TRM [1)]	NX [b)]	TRM [a)]	TRM	NX [b)]
2. 3.1 kHz audio (up to 9.6 kbit/s VBD)	NX	NS	NX	TRM + CSM [d)]	FS
3. 64 kbit/s unrestricted	NS	NX [b), c)]	NX [b)]	TRM+CSM	FS
4. Alternate speech 64 kbit/s	NS	NX [b)]	NX [b)]	TRM+CSM	FS

TRM Transmission resource management

CSM Call set-up messages between CME and ISC

NS Bearer service not supported

NX Bearer service supported without message exchange

FS Further study

[a)] Message exchange not necessarily implemented

[b)] Supported through pre-assignments (e.g., Recommendation G.761 transcoder DNI)

[c)] Supported in a limited fashion (e.g., Recommendation G.761)

[d)] CSM not needed with internal CME special handling facilities.

5 Division of functionality between the ISC and the CME

5.1 *CME dynamic load control process*

Transmission resource management (TRM) information is based on traffic load measurements at the local and distant CMEs. Therefore in the multi-destination and multi-clique mode of operation, TRM information is provided for each destination/clique separately.

A universal arrangement is used for handling TRM information between CME and an ISC. The TRM information is dynamically presented to the exchange in one of two states for each bearer service. The states are called "available" and "not available". Logic within the CME is used to determine which of the two states should be indicated to the exchange regardless of any condition at the exchange.

When a CME encounters a "not available" state for a bearer service (either locally or remotely), it presents this indication to the exchange so it will stop routing new calls to the CME for that bearer service even if there are free, unseized circuits available. The exchange will continue to prohibit calls to the CME until it receives an "available" indication for the bearer service when in both, local and remote CMEs, there is no overload.

This dynamic load control information is therefore directly influencing the circuit selection process in the exchange during call set-up for each bearer service separately. The circuit selection in the exchange is a check whether or not a free unseized circuit is suitable for a certain bearer service type, for which a new call is to be accommodated. For example, the exchange would select a free circuit for a speech call if "speech capacity available" is indicated, irrespective of the indications for other bearer service types. If the DCME link is unable to accommodate additional new 64 kbit/s calls, all free unseized circuits within the exchange will be marked accordingly. Even though the generation of bearer service related TRM information with DCMEs may be in part mutually dependent (i.e., no capacity for speech implies no capacity for any other bearer service types but not necessarily vice versa), separate signalling and processing for each bearer service type are necessary to allow different future CMEs to develop independently.

5.2 *Call set-up process*

According to Table 1/Q.50, the contemporary digital circuit multiplication equipment, having the capability to support on-demand all four identified bearer services, in addition to providing TRM to the exchange, requires call set-up messages (CSM) (from the exchange) for selecting bearer services.

For the 64 kbit/s unrestricted bearer service, a circuit is selected if "unrestricted capacity available" is indicated, and a CSM in the form of seizure/select request is forwarded to the DCME. An acknowledgement (positive or negative) is sent upon recognition of a 64 kbit/s request even if capacity is available.

The positive acknowledgement can be used by the ISC to initiate the interexchange signalling to the next ISC (e.g. transmission of the IAM of Signalling System No. 7). A failure to establish a 64 kbit/s circuit between CMEs must be reported to the ISC as soon as the condition has been identified by the CME by using an out-of-service message.

The out-of-service message is considered by the ISC to be equivalent to the alarm signal defined in Recommendation Q.33. The ISC will take release actions (if appropriate) as specified in Recommendation Q.33, § 4.

The released 64 kbit/s message from the ISC will be positively acknowledged after proper completion of the DCME circuit disestablishment process. Failure to complete this process shall be notified to the ISC using an *out-of-service* message and the DCME will put the circuit in a blocked condition. After the failure condition is removed, this circuit will be in idle condition and a *back-in-service* message shall be sent to the ISC.

Under a 64 kbit/s unrestricted dual seizure situation, the non-controlling ISC will initiate a release of the DCME connection using procedures defined in the appropriate inter ISC signalling system protocol. If the DCME is unable to re-establish a remotely released 64 kbit/s duplex connection, it shall indicate this abnormal situation to the appropriate ISC by an out-of-service message.

The information elements and procedures necessary to support the alternate 64 kbit/s speech bearer services are for further study.

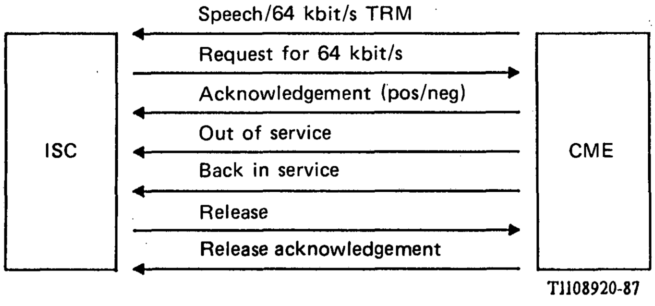

FIGURE 5/Q.50

Typical ISC/CME information flows

5.3 *Inter-dependency between dynamic load control and call set-up process*

To allow a standard method of interworking with inter-exchange signalling systems it is important to adopt the functional interdependency between TRM and CSM as described above.

6 Control information elements between ISC and CME

The amount of control information elements utilized between the ISC and the CME depends on the capabilities of the CME and the ISC. Two categories of CME signalling capabilities are recognized. The first category of CME (Type 1) is capable of only transmitting signals from the CME to the ISC (e.g. Dynamic Load Control, see § 6.1). The second category of CME (Type 2) is able to transmit and receive signals to/from the ISC. Tables 2/Q.50, 3/Q.50 and 4/Q.50 give a set of information elements and their flow on the control link between the ISC and the CME for the second category of CME.

6.1 *Information elements for Type 1 CME*

Type 1 CME only should use the following types of information elements. The "m" indicates mandatory use, the "o" optional use.

1. No capacity for speech available (m)
2. Channel(s) available for speech (m) (speech includes 3.1 kHz audio)
3. Out-of-service (o)
4. Back-in-service (o).

6.2 *Information elements for Type 2 CME*

TABLE 2/Q.50

Information elements for transmission resource management (load control) CME/ISC (Type 2)

Type of information element [a)]	Notes	Direction of the information element
1.1 No capacity for speech available (m)	No bearer capacity for additional trunk(s) available	CME→ ISC
1.2 Trunk(s) available for speech (m)	This information element is sent to notify the end of the "No capacity for speech available"	CME→ ISC
1.3 No trunk(s) available for 3.1 kHz audio (o) (Note 1)	No bearer capacity for additional 3.1 kHz audio trunk(s) available	CME→ ISC
1.4 Trunk(s) available for 3.1 kHz (o) (Note 1)	This information element is sent to notify the end of "No trunk available for 3.1 kHz audio" condition	CME→ ISC
1.5 No 64 kbit/s capacity available (m) (Note 2)	No bearer capacity for additional 64 kbit/s trunk(s) available	CME→ ISC
1.6 Acknowledgement of "No 64 kbit/s (o) capacity available"		ISC→ CME
1.7 Trunk(s) available for 64 kbit/s (m)	This information element is sent to notify the end of "No. 64 kbit/s capacity available" overload condition	CME→ ISC
1.8 Acknowledgement of trunk(s) available (o) for 64 kbit/s		ISC→ CME

m Mandatory for this type of CME

o Optional for this type of CME

[a)] Each information element may be sent as a message or may be implicit by the lack of a signal (e.g., the CME may send a signal for no capacity for speech available and remove the same signal to indicate trunks available for speech).

Note 1 – This information may be implicit in information element 1.1 (e.g., because 3.1 kHz audio data and speech may be supported by the same LRE algorithm or 3.1 kHz audio data is detected by the CME using in-band signals (2100 Hz) from the data terminal).

Note 2 – If a defined portion of the bearer capacity is used for special call types (definition of a minimum and/or maximum number of channels per call type, e.g. for 3.1 kHz audio or 64 kbit/s), a special load control information is needed for each of these call types.

TABLE 3/Q.50

Information elements for seizure/release (CME/ISC) (Type 2)

Type of information elements	Notes	Direction of the information element
2.1 64 kbit/s select/seizure (m)	Sent when 64 kbit/s circuit is required via the DCME (Note 1)	ISC→ CME
2.2 Trunk identity (m)	Explicit or implicit information to assign an information element to a specific trunk	ISC→ CME CME→ ISC
2.3 64 kbit/s positive acknowledgement (m)	Sent if 64 kbit/s request can be satisfied (Notes 2 and 3)	CME→ ISC
2.4 64 kbit/s negative acknowledgement (m)	Sent if a 64 kbit/s request cannot be satisfied (Note 3)	CME→ ISC
2.5 Release 64 kbit/s (m)	Sent by the originating ISC to indicate that a 64 kbit/s circuit is not necessary	ISC→ CME
2.6 Release 64 kbit/s positive (m) acknowledgement	Sent to indicate successful completion of Release (Note 3)	CME→ ISC
2.7 3.1 kHz service/select seizure (o)	Request to allocate data optimized facilities	ISC→ CME
2.8 3.1 kHz service, positive (o) acknowledgement	Sent if 3.1 kHz service request can be satisfied	CME→ ISC
2.9 3.1 kHz service/ (o) negative acknowledgement	Sent if 3.1 kHz service request cannot be satisfied	CME→ ISC
2.10 Release 3.1 kHz service (o)	Sent to indicate termination of the call	ISC→ CME
2.11 Speech service select/seizure (o) (Note 4)	Sent to indicate speech service request	ISC→ CME
2.12 Speech, positive acknowledgement (o) (Note 4)	Sent if speech request can be satisfied	CME→ ISC
2.13 Speech negative acknowledgement (o) (Note 4)	Sent if speech request cannot be satisfied	CME→ ISC
2.14 Release speech (o) (Note 4)	Sent to indicate that the speech circuit is not required any longer	ISC→ CME

m Mandatory for this type of CME
o Optional for this type of CME

Note 1 – Preassigned digital non-interpolated (DNI) 64 kbit/s channels do not need this information element.

A 64 kbit/s select/seizure information element between CME and ISC is mandatory for type 2 CME equipment, if 64 bit/s channels are used on a demand basis.

Note 2 – Depending on the realization of the CME there could be a longer or shorter delay for 64 kbit/s channel acknowledgement.

Note 3 – "Mandatory" refers to the presence of these information elements at the signalling interface between ISC and CME. The use of these elements is optional; however, these elements are preferred to provide safeguards for proper operation.

Note 4 – The request for speech service may be implicit, that means, that a discrete information flow may be required.

For indication of termination (not interruption) of a call, select/seizure and release may be necessary on a per call basis.

TABLE 4/Q.50

Information elements for maintenance (CME/ISC) (Type 2)

Type of information element	Notes	Direction of the information element
3.1 Maintenance release signal (o) (Note)	Sent for manual control, *planned* removal from service	CME→ ISC
3.2 Maintenance release acknowledgement (o) (Note)	Sent to acknowledge reception of Maintenance Release, ISC is waiting for the release of the trunk	ISC→ CME
3.3 CME clear of traffic signal (released (o) after maintenance release signal) (Note)	Signal sent when all (this) trunk(s) are (is) idle. The ISC prevents new seizures on these (this) trunk(s)	ISC→ CME
3.4 Out-of-service (m)	General CME trunk unavailable signal used on a per circuit basis	CME→ ISC
3.5 Out-of-service acknowledgement (o)	Sent to acknowledge "out-of-service signal" used on a per circuit basis	ISC→ CME
3.6 Back-in-service (m) (Note)	Sent after the removal from service is no longer necessary – used on a per circuit or per CME basis	CME→ ISC
3.7 Acknowledgement of "back-in-service" (o)	Used on a per circuit basis	ISC→ CME

m Mandatory for this type of CME

o Optional for this type of CME

Note – Information elements 3.1, 3.2, 3.3 and 3.6 are a set of elements that should only be used together. Information element 3.6 could also be used after "out-of-service" information without 3.1, 3.2 and 3.3.

7 Transmission techniques for ISC-CME signalling

The selection of a transmission technique (signalling protocol) for transferring CME control information between the CME and the ISC will be determined by each Administration and it will be based on numerous factors. Some of the key factors are:

- location of the CME and the ISC(s);
- type of facility between the CME and the ISC (e.g. analogue, digital);
- performance of the signalling link;
- electrical interface with the ISC;
- software capabilities of the ISC;
- and the complexity of the desired signalling.

All these functions need to be considered when selecting a transmission technique.

The choice of a transmission technique is for further study.

7.1 *External data path*

Examples of separate data paths are:

- V.24 interface;
- copper loop.

7.2 *Channel associated signalling*

Examples of channel associated links are:

- TS16 of PCM 2 Mbit/s;
- outband signalling, e.g., 3825 Hz;
- a nominated 64 kbit/s PCM time-slot.

7.3 *Common channel signalling in the PCM access stream*

Examples of common channel signalling are:

- use of specialized messages integrated into the common channel signalling systems to be interpreted by the CME;
- one dedicated common channel signalling link for exchange of information elements between ISC and CME.

8 Recommendation for signalling system

For further study.

9 Example systems

Two example systems can be found in Annexes A and B to this Recommendation.

ANNEX A

(to Recommendation Q.50)

Controlled DCME interface utilizing time-slot 16

A.1 This annex describes a signalling protocol which utilizes time-slot 16 of a CEPT 30 channel 2 Mbit/s system (see Recommendation G.704). Use is made of the standard frame and multi-frame structure of TS16 to convey both transmission resource management information, bearer service selection and maintenance signals between a DCME terminal and its associated switching centre. Spare bits within TS16 are used to provide a comprehensive range of signals.

A.2 TS16 frame 0 has three spare bits (5, 7 and 8).

A.3 In order to allow TS16 to carry other other channel associated signalling protocols (e.g. R2D), only two of the four available bits are used in TS16 frames 1-15, for DCME signalling; either bits A and B, or C and D. The DCME terminal and the switching centre can select either pair of bits per 2 Mbit link if this option is necessary.

A.4 The signalling system employs a continuous state protocol, utilizing TS16 frame 0 for transmission resource management (TRM) and maintenance signals. TS16 frames 1-15 within the multi-frame are assigned to telephone channels 1-30 according to Recommendation G.704, and provide the DCME bearer service requests for individual channels.

A.5 The TS16 signals are passed over each 2 Mbit/s system. This allows one or more ISCs to be served by a single DCME. Independent working of each 2 Mbit/s system ensures that under failure conditions of a 2 Mbit/s transmission link, traffic carried by other 2 Mbit/s systems is unaffected.

A.6 The DCME terminal will transmit and receive transmission resource management, bearer service selection, and maintenance signals, from each TS16 of a 2 Mbit/s system. For example, the DCME will transmit a number of simultaneous "No capacity for speech" signals to the ISCs. Bearer service selection signals are exclusive to the channels within each 2 Mbit/s system.

Signal descriptions

Transmission Resource Management

A.7 *No capacity for speech:* (DCME >>> ISC). No bearer capacity is available to set up new calls. BUSY or CAMP-ON BUSY conditions are applied to the appropriate circuits by the ISC.

A.8 *No channel(s) available for 3.1 kHz data:* (DCME >>> ISC). No bearer capacity is available for additional 3.1 kHz calls. This signal is optional, depending upon the facilities and design of the DCME. If it is not required the "No capacity for speech" signal also means "No 3.1 kHz capacity."

A.9 *No 64 kbit/s capacity available:* (DCME >>> ISC). Receipt of this signal shall cause the switching centre to prevent setting up any calls requiring unrestricted 64 kbit/s capacity, end to end.

A.10 *DCME terminal working normally:* (DCME >>> ISC). This is transmitted if no other signals are to be sent.

A.11 *ISC normal:* (ISC >>> DCME). When the ISC has no other signal to send, this signal is transmitted.

Maintenance signals

A.12 *Maintenance release request:* (DCME >>> ISC). This request is sent when the DCME terminal is to be removed from service for maintenance. The switching centre(s) can refuse the request by withholding its acknowledgement signal. This gives security in the event of erroneous operation at the DCME.

A.13 *Maintenance release request acknowledgement:* (ISC >>> DCME). If the switching centre accepts the maintenance release request an acknowledgement is sent.

A.14 *All DCME circuits idle:* (ISC >>> DCME). If the ISC has accepted the maintenance release request signal, this signal informs the DCME when all circuits are idle, enabling maintenance to be performed. The ISC also prevents new calls from being generated.

A.15 Maintenance signals are sent for the duration of maintenance procedures until a change of status is required. (e.g. the maintenance release request signal remains until DCME normal is sent).

A.16 The coding for the transmission resource management, and maintenance signals in TS16 frame 0 are as follows:

DCME >>> switching centre	Bits 5 7 8
Maintenance release request	1 1 0
No capacity for speech	1 1 1
No channel(s) available for 3.1 kHz	0 1 1
No 64 kbit/s capacity available	1 0 1
DCME normal	1 0 0

Note – * indicates that this signal is optional.

Switching centre >>> DCME	Bits 5 7 8
Maintenance release request acknowledgement	1 1 0
DCME circuits idle	1 1 1
Switching centre normal	1 0 1

Bearer service select signals

A.17 The appropriate signals are sent on an individual circuit basis. Special service signals are sent for the duration of every call attempt, whilst the availability signals are sent continuously. Use of TS16 frames 1-15 removes the need to provide the identity of the requesting circuit on a separate basis.

A.18 *64 kbit/s unrestricted request:* (ISC >>> DCME). This is a call request for a transparent 64 kbit/s channel, i.e. no DCI or LRE must be applied. This signal is maintained for the duration of the call. Its removal by the ISC indicates to the DCME that the connection can be released.

A.19 *3.1 kHz data request:* (ISC >>> DCME). This is a call request to allocate a channel suitable for data transmission. This signal is maintained for the duration of the call. Its removal by the ISC indicates to the DCME that the connection can be released. This signal is optional.

A.20 *Normal service:* (ISC >>> DCME). This is transmitted when the ISC requires only speech facilities.

A.21 *Channel out of service/unavailable:* (DSCE >>> ISC). The DCME transmits this signal when for any reason it is unable to accept traffic. The switching centre shall then apply busy or force release conditions to the related circuit. This signal allows actions to be taken on a per-circuit basis similar to CCITT Recommendation Q.33.

A.22 *Normal service available:* (DCME >>> ISC). Indicates that the channel will only carry speech.

A.22 *Special service acknowledgement:* (DCME >>> ISC). This signal is sent as an acknowledgement to either:

i) 3.1 kHz data request,

ii) 64 kbit/s request,

to confirm that the DCME resources have been allocated to meet the requirements of the requested service.

A.24 The coding of the bearer service signals in TS16 frames 1-15 are as follows:

Switching centre >>> DCME	Bits A(C) B(D)
64 kbit/s request	1 1
3.1 kHz*** request	1 0
Normal service available	0 1

Note – *** indicates that the signal is optional.

DCME >>> switching centre	Bits A(C) B(D)
Channel out of service/unavailable	1 1
Special service acknowledgement	1 0
Normal service available	0 1

ANNEX B

(to Recommendation Q.50)

Example of a signalling system between DCME and ISC

B.1 *General*

The interface between ISC and DCME described below is intended to connect Deutsche Bundespost exchanges to the TAT-8 cable from 1988 onward.

Appropriate test equipment has been available since the end of 1986.

The mentioned interface has three basic functions:

- dynamic load control between ISC and DCME;
- conveyance of transmission-related alarms;
- seizure and release of 64-kbit/s unrestricted circuits "on demand".

B.2 *Physical level of interface*

For transmission of the signalling signals, the interface operates with 2 bits each for the forward and backward directions during call set-up. In the incoming seizure direction the same bits are used only for the transmission of alarm conditions (see also Recommendation Q.33).

To avoid a special interface at the ISC, DCME/ISC signalling is transmitted in the same PCM system to the DCME as the speech and data circuits.

Since the connected ISC has only 2-Mbit/s interfaces, time slot (TS) 16 of these 2-Mbit/s PCM-systems is used in the manner described in Recommendation G.704, § 3.3.3.2.2. (In principle, any other physical interface with 2×2 bits is suitable for the forward and backward directions.)

The use of TS16 offers the possibility of transmitting information for each channel individually (channel associated signalling).

The application of this transmission mode between ISC and DCME has considerable merits (e.g. transmission of alarms per channel, "soft" DLC, flexible use for point-to-point, multiclique, multi-destination modes, flexible size of circuits groups, simple control for selective traffic management (STM), i.e. 64 kbit/s seizures can be limited to a pre-selectable maximum number of simultaneous seizures at different daytimes). This means that TS16 is not available for other applications on the section between ISC and DCME. This restriction, however, concerns only the short section up to the DCME. Due to the time slot interchange (TSI) function, no loss is caused on the LRE/DSI section.

B.3 *Distribution of functions between DCME and ISC*

B.3.1 *DCME functions*

The DCME converts the bit rate available on the bearer into ISC-intelligible information on seizable/non-seizable circuits, the seizable ones being distinguished according to 64 kbit/s or speech/3.1 kHz audio seizability. In this process, the DCME takes account of the instantaneous limits for the number of 64-kbit/s circuits (min, max, STM function).

Consequently, three conditions are distinguished for each circuit:

- free for 64-kbit/s seizures;
- free for speech/3.1 kHz audio;
- non-seizable.

A change between these conditions is allowed with a maximum of only 0.1 Hz, whereas a transition to the non-seizable condition is directly possible.

The 3.1 kHz bearer and the speech bearer services are distinguished only in the DCME, using a 2100 Hz tone sent by the terminal. No distinction is made by the ISC. Information on the seizable and non-seizable circuits is sent continuously to the ISC. Moreover, alarm and maintenance information is passed on to the ISC.

B.3.2 *ISC functions*

The ISC takes over the information sent by the DCME and searches circuits, according to their condition reported by the DCME.

B.4 *Signalling code*

The codes shown in Table B-1/Q.50 are applied for transmission of the necessary signals.

TABLE B-1/Q.50

Signalling modes

Signal No.	Type of signal	Direction ISC-DCME	Bits a, b of TS 16, call set-up direction Forward a_f b_f	Backward a_b b_b	Group of information element
1	Circuit available for 64 kbit/s		1 0	1 0	Load control
2	Circuit available for 3.1 kHz data, speech		1 0	0 1	
3	Circuit not available		1 0	0 0	
4	64 kbit/s seizure		1 1	1 0	Seizure release
5	3.1 kHz/speech seizure		0 1	0 1	
			(0 1	1 0) (Note)	
6	64 kbit/s positive acknowledgement		1 1	0 1	
7	3.1 kHz/speech positive acknowledgement		0 1	1 0	
			(0 1	0 1) (Note)	
8	Release 64 kbit/s		1 0	0 1	
9	Release 3.1 kHz/speech		1 0	1 0	
			(1 0	0 1) (Note)	
10	Maintenance release signal (after 3.1 kHz, speech seizure)		0 1	0 0	Maintenance
11	Maintenance release signal (after 64 kbit/s seizure)		1 0	0 0	
12	Maintenance release acknowledgement		0 0	0 0	
13	CME clear of traffic		1 0	0 0	
14	Out of service a		0 0	1 1	
	b		0 1	1 1	
	c		1 0	1 1	
	d		1 1	1 1	
15	Out of service acknowledgement		0 0	1 1	
16	Back in service		0 0	0 1	

Note – This bit combination is required only if 3.1 kHz/speech seizure is to be permitted for circuits marked available for 64 kbit/s.

B.5 *Signalling procedures*

B.5.1 *Successful call setup*

The ISC searches a circuit as requested and sends the corresponding seizure signal for a circuit. The DCME receives the seizure signal and sends

- an immediate positive acknowledgement in the case of a 3.1 kHz/speech seizure (if not opposed by DCME-internal reasons);
- a positive acknowledgement in the case of 64 kbit/s seizure as soon as possible, i.e. as soon as through-connection of the 64 kbit/s circuit has been ensured.

After receipt of the positive acknowledgement the ISC starts the interexchange signalling (e.g. Signalling Systems No. 5 and No. 7). (Basically, the same procedure (sending of the corresponding seizure signal/acknowledgement/continuation of interexchange signalling) allows also a change of the bearer service during the call.)

B.5.2 *Unsuccessful call setup*

In the event of a missing positive acknowledgement the ISC sends, after 150 ms, a busy signal in the backward direction or another, free circuit is searched.

B.5.3 *Call release*

As soon as an ISC recognizes that the call is to be released (clear forward, release), it sends a release signal to the DCME. If required, the DCME releases the connection to the other DCME. A renewed seizure of the released circuit must not take place before a time-out of 150 ms in order to enable the DCME to indicate changes in the seizability of this circuit.

B.5.4 *Maintenance procedures*

The DCME offers the possibility to prevent renewed seizures of circuits after their release. For this purpose the maintenance release signal is sent.

This signal is immediately acknowledged by the ISC.

After the connection has been released, the ISC sends the signal "CME clear of traffic" and prevents a renewed seizure of this circuit. After maintenance work on the release circuits has been terminated, the DCME sends one of the "load control" signals. If the return signal "CME clear of traffic" is not sent

- the maintenance activities can be postponed and the DCME be reactivated via the "back in service" signal; or
- a forced release of the circuits still busy is achieved with the "out of service signal".

Thereafter operation is resumed also by means of the "back in service" signal.

If the DCME equipment is faulty, it sends an "out of service" signal and, after fault removal, normal operation starts again, using the "back in service" signal.

B.6 *DCME load tests*

To conduct a test of both the DCME equipment and ISC-SCME signalling under realistic conditions, call simulators have been installed since the end of 1986. These simulators:

1) simulate the ISC-DCME signalling protocol for both interfaces (ISC side/DCME side);
2) simulate the switching-specific part of the call setup via interexchange signalling (first CCITT System No. 5 and later, after its introduction, also S.S. No. 7);
3) generate pre-selectable load situations in the DCME by application of pulsed in-band tones.

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PART III

Recommendations Q.65 to Q.87

FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN

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SECTION 1

METHODOLOGY

Recommendation Q.65

STAGE 2 OF THE METHOD FOR THE CHARACTERIZATION OF SERVICES SUPPORTED BY AN ISDN[1)]

1 Introduction

1.1 The overall method for deriving switching and signalling Recommendations for ISDN services consists of three stages and is described in general in Recommendation I.130. This Recommendation (Q.65) describes Stage 2 in detail.

1.2 Stage 2 of the method takes as its input, the Stage 1 basic and supplementary service descriptions contained in the I.200-Series of Recommendations. The Stage 1 description views the network (this term, in this context, could include some capability in the user equipment) as a single entity which provides these services to the user. The Stage 2 description defines the functions required and their distribution within the network. The Stage 1 user/network interactions are used and interpreted within Stage 2, as illustrated in Figure 1/Q.65.

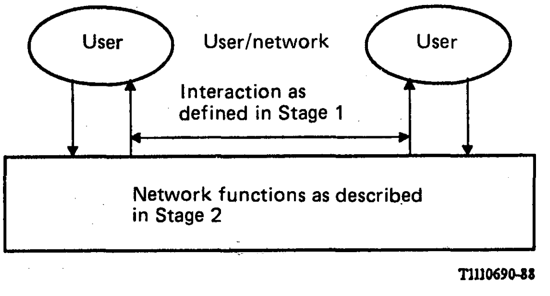

FIGURE 1/Q.65

Stage 1/Stage 2 relationship

1.3 Stage 2 identifies the functional capabilities and the information flows needed to support the service as described in Stage 1. The Stage 2 service description will also include user operations not directly associated with a call (e.g., user change of call forwarding parameters via his service interface) as described in Stage 1. Furthermore, it identifies various possible physical locations for the functional capabilities. The output of Stage 2, which is signalling system independent, is used as an input to the design of signalling system and exchange switching Recommendations.

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1) Some other CCITT Recommendations (e.g., I.310, I.324) deal with the functional description of the network. The relationship between some of the concepts in this Recommendation (Q.65) (e.g., function entity actions, service providing functions) and those in Recommendation I.130 (e.g., executive processes, elementary functions) needs urgent further study.

1.4 This Recommendation describes the five steps of Stage 2 in detail. The order of these steps represents an idealized application of the method, however, in practice there will of necessity be interactions to define fully the Stage 2 outputs. The Appendix contains detailed formats and graphical conventions to be used. The Appendix has a parallel structure to the basic Recommendation. The service specific Recommendations which follow conform to these procedures.

1.5 Stage 2 of the method employs techniques that provide the following desirable characteristics:

- a precise definition of functional capabilities and their possible distribution in network equipment (and in some cases, in user equipment) to support the basic and supplementary services as described in Stage 1;
- a detailed description of what functions and information flows are to be provided, but not how they are to be implemented;
- a single functional specification which can be applied in a number of different physical realizations for providing the service;
- requirements for protocol and switching capabilities as input to Stage 3 of the method;
- consistency, within the ISDN principles, of service and protocol Recommendations which permits substantial implementation flexibility to Administrations and manufacturers.

Note – The Stage 2 description method and specific service work currently address only ISDN user to ISDN user calls in an ISDN. The extensions to interworking with other networks is for further study.

2 Steps of the method

2.1 *Step 1 – functional model*

A functional model is derived for each basic supplementary service. In each case the model is matched to the requirements and characteristics of the service concerned.

The functional model used in the Stage 2 description of a service identifies functional entities and the relationships between them. (The concept of functional entity is similar to that of a stored program (not necessarily implemented in software).)

The refinement of the initial functional model is carried out by development and/or iteration of steps 2 to 5, as described below. The final functional model represents a result of the completion of Stage 2.

2.1.1 *Functional entities*

Functional entities are initially derived from an overall understanding of the network functions needed to support the service. Functional entities are defined as follows:

- a functional entity is a grouping of service providing functions in a single location and is a subset of the total set of functions required to provide the service. Further work is needed to provide a formal way of identifying service providing functions. In particular the list of elementary functions in Recommendation I.310 should be used as the basis of this study;
- a functional entity is described in terms of the control of one instance of a service (e.g., one call or one connection);
- a functional entity is visible to other functional entities that need to communicate with it to provide a service (i.e., functional entities are network addressable entities);
- a functional model may contain functional entities of different types. The type of a functional entity is characterized by the particular grouping of functions of which it is composed. Thus two or more functional entities are said to be of the same type if they consist of the same grouping of functions;
- a separate functional entity type is normally defined for each different grouping of functions that may be distributed to separate physical devices. However, where there is a high degree of commonality between different required groupings it may be convenient to define them as subsets of a single type rather than as different types;
- functional entities are derived for each basic and supplementary service. The same functional entity type may occur more than once in a functional model and also may appear in the model of more than one service.

2.1.2 *Functional entity relationships*

Services are supported by the cooperative actions of a set of functional entities. Cooperation requires that communication relationships be established.

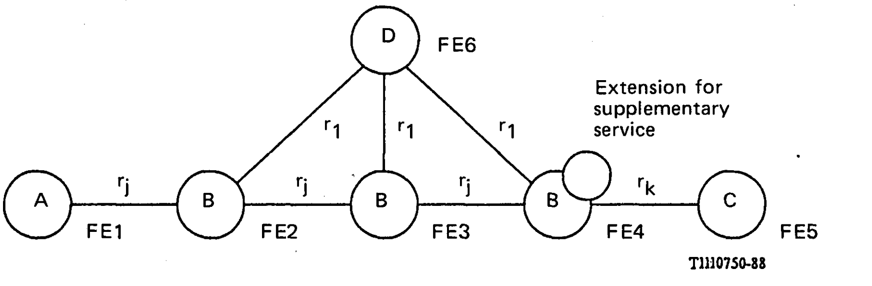
- Each communicating pair of functional entities in a specific service functional model is said to be in a relationship.
- Each interaction between a communicating pair of functional entities is termed an information flow. The relationship between any pair of functional entities is the complete set of information flows between them.
- If a communicating pair of functional entities is located in physically separate devices, the information flows between them define the information transfer requirements for a signalling protocol between the devices.
- Different communicating pairs of functional entities may have relationships of different types. The type of a relationship is characterized by the set of information flows between two functional entities. The relationships between functional entities FE1 and FE2 and between functional entities FE3 and FE4 are said to be of the same type if they comprise the same set of information flows.
- Relationships are assigned type identifiers (e.g., r_1, r_2, r_3, etc.) which uniquely identify specific sets of information flows within the functional model of a service. The same relationship type may occur more than once in a functional model.

2.1.3 *Derivation of the functional model*

Based on the above definitions the functional model for a particular service is derived using the following criteria and guidelines:

- appropriate functional entities are chosen based on knowledge of the variety of anticipated network realizations. All reasonable distributions of functions should be considered, thus leaving the option open to an Administration as to how actually to offer the service;
- relationship types are initially assigned based on an assessment of the probable nature of the interactions between each pair of functional entities. Revisions to the initial model may be necessary in the light of more detailed definition of functional entity actions, information flows and the range of physical locations for functional entities;
- the model for some services may require that a functional entity be replicated a number of times (e.g., tandem functions). The functional model should only describe replications up to the point where no new combinations of external relationships to functional entities are encountered by further replication. Thus, a single functional entity may represent multiple physical tandem entities providing the same functions.

Figure 2/Q.65 illustrates a functional model.



Note 1 — FE1, FE2, etc., are functional entities (type A, B, etc.) defined to meet the requirements of the particular service considered. The diagram also includes a functional extension to FE4.

Note 2 — r_l, r_j, etc., are relationship types between communicating pairs of functional entities.

Note 3 — This diagram illustrates the following points:

a) a functional model may include more than one FE of the same type (e.g., type B);

b) a functional model may include more than one relationship of the same type (e.g., r_j);

c) an extension to an FE does not modify its type of relationship to adjacent FEs (e.g., r_l).

FIGURE 2/Q.65

Example of a functional model

2.1.4 *Relationship between basic and supplementary service models*

The functional model for a supplementary service is based upon, and includes at least part of a basic service model.

The relationship between the model for a supplementary service and that for a basic service may be derived by comparing the models. How the functional entities of the supplementary service model relate to the functional entities of the basic service model is then clarified.

The model for some supplementary services may not require the definitions of additional functional entities (e.g., when the service is a manipulation of an already defined service, for which the functionality required to provide the service cannot be remote from a functional entity of the basic service). In such cases, the supplementary service model will typically involve additional extensions to basic service functional entities and their relationships.

The following guidelines should be followed in resolving whether the functions associated with a supplementary service should be defined in the form of extensions to existing functional entities or in the form of new functional entities.

A grouping of functions within a supplementary service model should be integrated into a basic service functional entity (e.g., see Figure 3/Q.65) if it modifies an object (e.g., call or connection) that is controlled by the basic service.

A functional grouping should be a separate functional entity if it is potentially assignable to more than one location in relation to particular functional entities of the basic service. A functional entity that is separate from a basic service functional entity typically would not require detailed call/connection state information. A separate functional entity may also be characterized by having a transactional relationship with a functional entity of the basic service (e.g., to provide number translation to the basic service functional entity).

Figure 3/Q.65 illustrates these relationships.

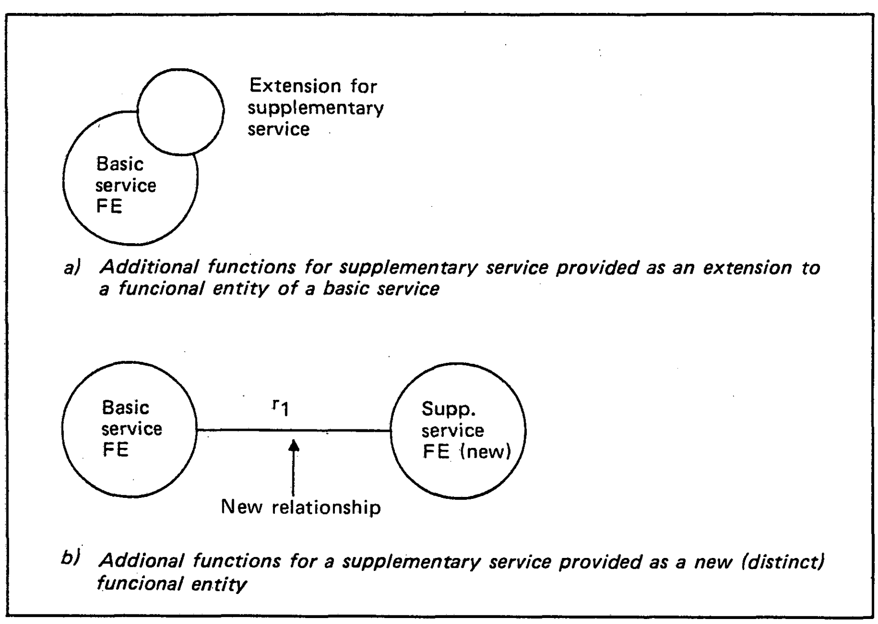


FIGURE 3/Q.65

Alternative ways of adding supplementary service functions to basic service functional model

2.2 *Step 2 – information flow diagrams*

2.2.1 *Identification of information flows*

The distribution of the functions required to provide a service, as defined by the functional model, requires that interactions occur between functional entities. Such an interaction is referred to as an "information flow" and will have a name descriptive of the intent of the information flow.

Information flow diagrams are created to contain all the information flows necessary for typical cases of succesful operation of the service. Information flow diagrams may need to be created as appropriate for other cases. Figure 4/Q.65 illustrates the general form of an information flow diagram for a basic or supplementary service.

Information flow diagrams for supplementary services should not unnecessarily duplicate information flow descriptions that are part of a basic service. However, it may be that a supplementary service description identifies additional information flow requirements between the functional entities of the basic service representation, and this should be described.

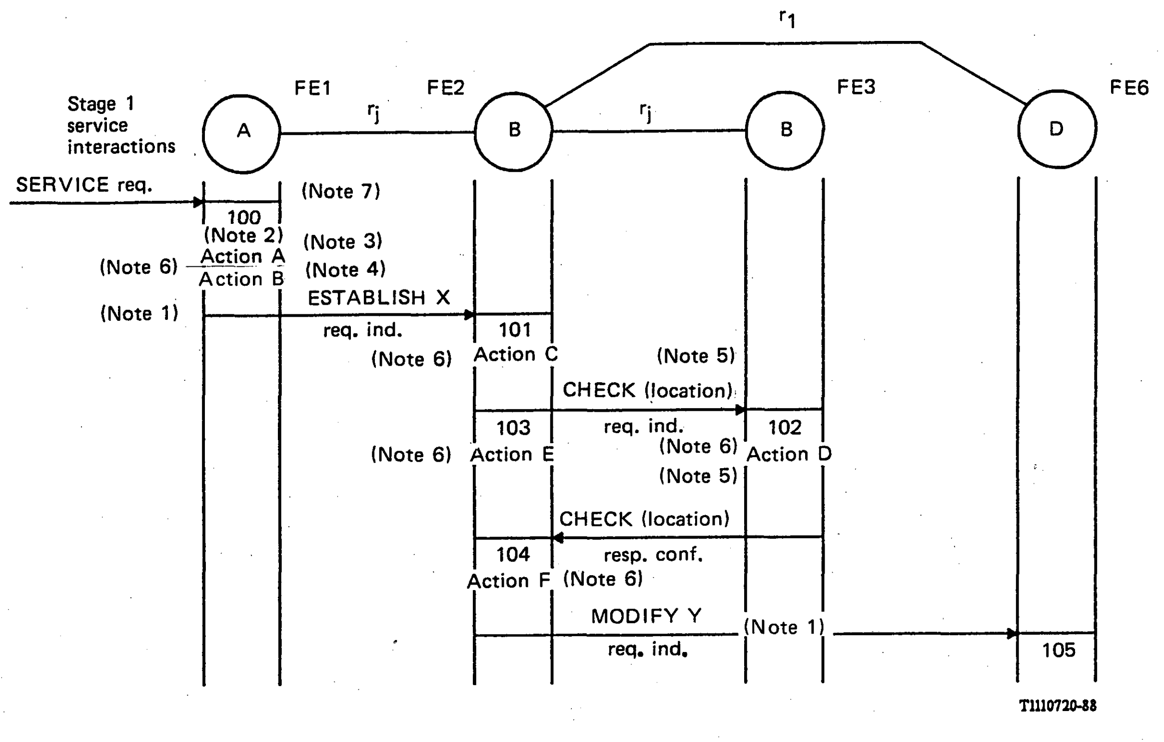


FIGURE 4/Q.65

Example of information flow diagram

(the example shows part of an information flow diagram corresponding to the functional model examples in Figure 2/Q.65)

Notes to Figure 4/Q.65

Note 1 – Receipt and emission of user inputs/outputs and information flows are shown by horizontal lines across the relevant functional entity columns. Conversely, the absence of a line indicates no receipt or emission.

Note 2 – A reference number is assigned to each point in the overall sequence at which functional entity actions are shown.

Note 3 – A brief description of the most significant functional entity actions is shown on the diagram.

Note 4 – Information flows are shown as arrows with the name of the information flow above and below the arrow. The descriptive name is written in capitals above the arrow and the label (e.g., req.ind) written below line in lower case. For unconfirmed information flows and the "request" part of confirmed information flows the label "req.ind" is shown in lower case below the information flow arrows. For the "confirmation" part of confirmed information flows the label "resp.conf" is used.

Note 5 – If knowledge of one or more of the items of information content in the information flow is important to the understanding of the diagram (i.e. the name of the information flow is not enough), the items may be shown in lower case in brackets, following the information flow name.

Note 6 – In a particular functional entity column:

- actions shown below a line representing the receipt of a user input or information flow are dependent upon that receipt (i.e. they cannot be carried out beforehand). Thus Action C, for example, cannot be carried out before ESTABLISH X is received;
- similarly, actions shown above a line representing the emission of a user output or an information flow must be completed prior to the emission of the information flow. Thus, ESTABLISH X cannot be emitted until Actions A and B are both completed. No implications regarding the order of execution of Actions A and B are intended;
- actions shown below a line representing the emission of a user output or information flow do not need to be completed before emission (although in many practical implementations they may). No constraint on the relative order of the emission and the action which immediately follows it is intended. Thus Action E may be executed before, after or in parallel with the emission of the "request" part of the CHECK information flow.

Note 7 – The Stage 1 service interactions are inputs to and outputs from the Stage 2 information flow diagram. Stage 1 service interactions *from* the user are either of the form XXXXX.req or XXXXX.resp. Stage 1 service interactions *to* the User are either of the form XXXXX.ind or XXXXX.conf.

2.2.2 *Definition of individual information flows*

The semantic meaning and information content of each information flow is determined. An individual information flow may be identified as requiring confirmation, and if so, it requires a return information flow of the same name.

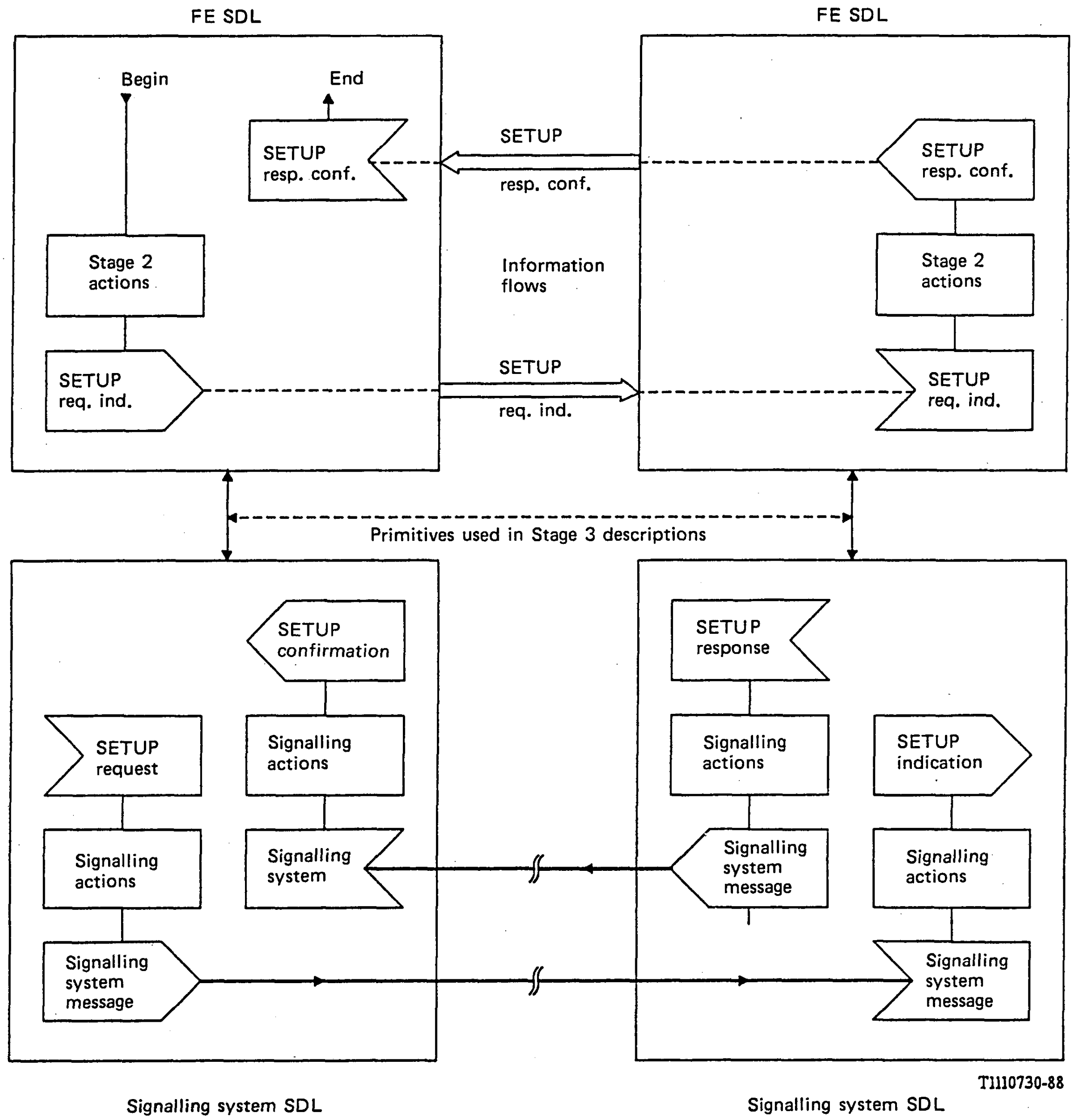
Confirmed information flows take the form of a request for an action (in one direction) and confirmation that the action has been carried out (in the return direction). Confirmed information flows are typically required for synchronization purposes. The two main cases are when requesting allocation and/or release of a shared resource.

When interacting functional entities are implemented in physically separate locations, information flows will normally be conveyed by signalling system protocols. When interacting functional entities are implemented in the same location, information flows are internal and do not effect signalling systems protocols.

2.3 *Step 3 – SDL diagrams for functional entities*

SDL diagrams are used to provide a complete description of actions for each functional entity in relation to the associated information flows. They are based on (and consistent with) information flow diagrams but also cover more complex cases including cases of unsuccessful and/or abnormal operation. Consideration of such cases may result in the need to define new information flows.

The inputs to and outputs from the SDL diagram for a functional entity are information flows. The Stage 3 definition work will make use of these information flows to define signalling system output and input primitives (see Figure 5/Q.65). Thus, signalling system SDL descriptions are precisely related to and derived from the Stage 2 information flows and functional relationships which the signalling system is designed to support.



Note – The primitives to the underlying signalling system are derived from the information flows between the functional entities.

FIGURE 5/Q.65

Relationship of primitives, information flows and SDLs

2.4 *Step 4 – functional entity actions*

The Stage 2 actions performed within a functional entity, from the reception of each information flow to the transmission of the next resulting information flow, are identified and listed. The need for a generic list of functional entity actions (FEAs), to ensure consistency between different services, is an urgent item for further study. All externally visible actions (those which are explicitly or implicitly notified to other functional entities) are included. The identified actions are then represented on the information flow diagrams and SDL diagrams by brief prose statements, or separately using reference numbers.

2.5 *Step 5 – allocation of functional entities to physical locations*

In Step 1, a functional model consisting of functional entities, each of which has a well defined relationship to the others, is defined for each basic and supplementary service. Step 5 is an allocation of these functional entities to physical locations and defines all relevant physical implementations, henceforth called scenarios.

More than one scenario may be defined for one functional model so that Administrations will have options as to where the service is actually provided. For example, a supplementary service functional entity could be located either in an ISPBX or in an exchange.

For the allocation of functional entities, it should be noted that:

a) a functional entity may in principle, be allocated to any physical location;

b) a number of functional entities may be allocated to the same physical location;

c) for every supplementary service, network scenarios which include the location of its basic service functional entities should be defined;

d) different physical locations of functional entities may imply minor differences in node capabilities (e.g., the transmission path switch-through actions may depend on whether the access is in an exchange or an ISPBX);

e) the relationships between pairs of functional entities, according to the functional model used, should be invariant for all of the recommended scenarios.

Item e) implies e.g., that the information flows for a supplementary service would not be affected by a re-allocation of one or more of the required functional entities from public network exchange to an ISPBX or viceversa.

All identified scenarios will be considered in Stage 3 for definition of signalling protocols, switching capabilities and service centre capabilities.

APPENDIX I

(to Recommendation Q.65)

Formats and graphical conventions used in the Stage 2 service description

I.1 *General*

This Appendix describes the structure and conventions to be used when creating a Stage 2 description of a particular service. It describes the contents of each section and the graphical conventions to be used.

I.1.1 *Introduction*

Each Stage 2 service definition starts with an introduction. The introduction includes the definition of the service from the Stage 1 recommendation, plus any further sentences needed for clarification or to give extra background information. The Stage 1 recommendation number is included.

I.2 *Steps of the method*

I.2.1 *Step 1 – identification of a functional model*

I.2.1.1 *Functional model description*

This section contains a description of the functional model of this service (i.e. there is one model for each service). The functional model identifies and names the individual functional entities and their types. It also identifies the relationships and relationship types between communicating functional entities. Functional entities are represented by circles and the relationship between two communicating functional entities is identified by a line joining them. The functional entity type is contained within the circle. Each functional entity is given a unique label (e.g., FE1, FE2) adjacent to the circle.

The relationship types are numbered r_1, r_2, r_3 etc., for ease of reference (see Figure 3/Q.65 for an example).

I.2.1.2 *Description of functional entity "x"*

This paragraph provides a brief prose description of the functional entity "x". Each functional entity identified in the model has a corresponding section and prose description.

In the case of supplementary service it is necessary to describe how the model for this supplementary service relates to that of the basic service. This relationship may be derived by comparing the models. This relationship should be clearly indicated in accordance with the guidelines of § 2.1.4 of the main body of the Recommendation. A prose explanation may also be useful (e.g., to describe that certain supplementary service functions actually form a modular extension to a functional entity defined in the basic service). See Figure 3/Q.65 for an example.

I.2.2 *Step 2 – information flow diagrams*

I.2.2.1 *Identification of information flows*

This paragraph contains information flow (arrow) diagrams describing the information flows between the functional entities of the model. See Figure 4/Q.65. The purpose of this section is to define in a precise and descriptive manner, the successful operation of the service. This may require a number of arrow diagrams depending on the service. Explanatory prose description may also be provided where useful.

The following guidelines are observed in drafting these information flow diagrams:

- vertical columns represent each of the functional entities identified in the functional model for the service. Information flows are shown is descending order in which they are to occur in the processing of a call. The order of functional entity actions shown between information flows is not significant;
- an information flow will be characterized in the arrow diagrams as being associated with the terms request/indication or response/confirmation. This is reflected in the primitive which is communicated to the underlying signalling system as illustrated in Figure 5/Q.65. The primitive name is, in general, a direct derivation of the information flow name. The terms "req.ind" and "resp.conf" are part of the information flow name. The terms are shown in association with the information flow to show the relation between the Stage 2 SDL and the SDL of the underlying signalling system.

Further details on drafting conventions can be found in the notes to Figure 4/Q.65.

A reference number uniquely identifies a particular point in the Stage 2 information flow sequence and appears on the information flow diagram at that point. It also serves as a pointer to a description (see § I.2.4 below) of the actions required at this point in the sequence. A brief description of the functional entity actions will also appear on the relevant part of the information flow diagrams. The reference numbering scheme to be used is described below.

Each number is of the form NNN and is a decimal number assigned by the drafter of the Stage 2 description, which identifies a particular point in the Stage 2 procedural description (arrow diagrams and SDL) at which functional entity actions are described.

This number is unique within the Stage 2 description of a particular service (all variants).

I.2.2.2 *Definition of information flow name*

I.2.2.2.1 *Meaning of information flow name*

This paragraph defines the meaning of the information flow in terms of the actions, operations, events, etc. which are requested and/or reported by the information flow. The description will indicate if this is confirmed or unconfirmed information flow. If confirmed, the meaning of the confirmation is also identified.

I.2.2.2.2 *Information content of information flow name*

This paragraph defines the information content conveyed by the information flow. This consists of elements of static information (e.g., called address). For confirmed information flows, a set of elements is required in each direction. The name of each element, its range of values and the relationships where it occurs should be identified.

I.2.3 *Step 3 – SDL diagrams for functional entities*

This paragraph contains an SDL diagram for each of the functional entities identified in the functional model in § I.2.1. If the provision of the service implies a modular extension to the SDL diagram for a functional entity of the basic service, then the SDL describing the extension is provided (e.g., see Figure I-1/Q.65). This may require some modification to the basic service SDL to show the extension and the point in the basic service SDL where it occurs. Alternative approaches which do not require modification ("hooks") in the basic service SDL are for further study.

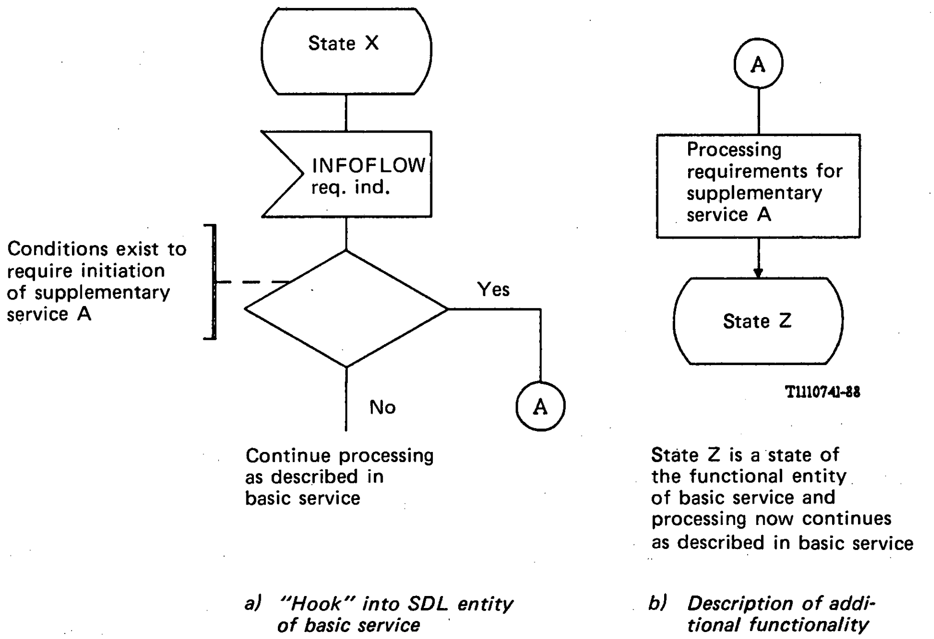


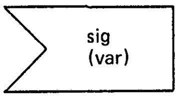
FIGURE I-1/Q.65

An example technique to describe extension to functional entity of the basic service

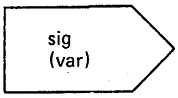
The reference numbers used in the relevant information flow diagrams (see § I.2.2.1) are also used in the SDL diagrams. Where a group of actions appears only on the SDL diagram, a reference number is also assigned.

Each group of actions is in a concise form in a single task box on the SDL diagrams. As before, the associated reference number points to a description (see § I.2.4) of the functional entity actions required at this point in the sequence.

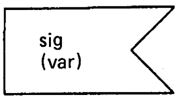
The functional entity SDL diagrams employ conventions and procedures of SDL as described in Recommendation Z.100. An extract of Z.100 follows to identify briefly the use of some of these conventions in the context of the Stage 2 service description.



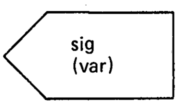
A signal conveying a variable received from the preceding (in the context of call setup) functional entity or user.



A signal conveying a variable sent to the subsequent functional entity or user.



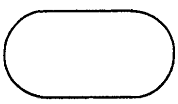
A signal conveying a variable received from the subsequent functional entity or user.



A signal conveying a variable sent to the preceding functional entity or user.

XX X.X XX — A set of alphanumeric characters which constitute the name of an object (e.g., a state, signal, variable or timer).

XX XXX — An informal text.



Each process begins with an optical START symbol. (The START symbol is mandatory according to SDL version 1988). The START symbol is empty.

XXXXXX — Designates a note

}-- — Designates a note

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I.2.4 *Step 4 – functional entity actions*

This paragraph contains descriptions of actions required for each functional enity and is identified by the reference number, as described in §§ I.2.2.1 and I.2.3.

The presentation form for functional entity actions is illustrated in Figure I-2/Q.65.

> *Functional entity – FE2*
>
> Reference number: NN1
>
> *Process service request*
>
> – Receive and acknowledge user's service request
> – Interact with user to accumulate information
> – Select network access resource
> – Reserve facilities, both directions, as required
>
> Reference number: NN2
>
> – Interact with user to obtain call address
> – Determine and indicate end of dialling

FIGURE I-2/Q.65

Example of descriptions of functional entity actions

I.2.5 *Step 5 – allocation of functional entities to physical locations*

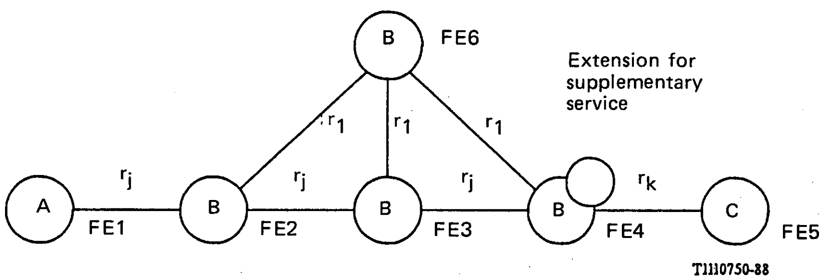
This paragraph describes the possible scenarios for the physical location of the functional entities shown in the functional model of the service. They are presented in a matrix form.

The matrix represents the functional entities of the service description functional model as columns and each scenario as a row. The points of the matrix identify the physical location to which that functional entity is allocated for that scenario.

The conventions used for the matrix are illustrated in Figure I-3/Q.65.

Possible physical locations and their corresponding symbolic representation are:

- Terminal equipment; Type 1 or terminal adapter: TE
- Network termination; Type 2: NT2 (typically in ISPBX)
- Local exchange: LE
- Transit exchange: TR
- Service centre: SC



Scenarios \ Functional entities	FE1	FE2	FE3	FE6	FE4/E1	FE5
Scenario 1	NT2 (orig)	LE (orig)	TR	TR	LE (term)	NT2 (term)
Scenario 2	LE	TR	TR	SC	LE (term)	LE (term)
Scenario 3	TE	NT2	LE	NT2	LE	TE
Scenario M	TE (orig)	LE (orig)	TR	SC	LE (term)	LE (term)

FIGURE I-3/Q.65

Example of a scenario matrix format

SECTION 2

BASIC SERVICES

Recommendation Q.71

ISDN 64 kbit/s CIRCUIT MODE SWITCHED BEARER SERVICES

1 Introduction

1.1 *General*

This Recommendation provides information on the functions in ISDN entities and the information flows between the entities which are required to provide en-bloc call set-up and call release procedures for circuit mode switched 64 kbit/s, 8 kHz structured bearer services. Such services include:

- speech information transfer,
- 3.1 kHz audio information transfer,
- unrestricted information transfer,
- alternate speech/unrestricted information transfer.

Information about digit-by-digit call set-up, in-call rearrangement, relationship to and interworking with Teleservices, interworking with other networks and connections involving users with multipoint configurations is not included but is expected to be added to this Recommendation at a later date.

1.2 *Definitions of services*

1.2.1 **speech information transfer** (Recommendation I.231, § 1)

This bearer service category is intended to support speech.

The digital signal at the S/T reference point is assumed to conform to the internationally agreed encoding laws for speech (i.e. Recommendation G.711 A-law, μ-law) and that the network may use processing techiques appropriate for speech such as analogue transmission, echo cancellation and low bit rate encoding. Hence, bit integrity is not assured. This bearer service is not intended to support modem derived voiceband data.

All CCITT Recommendations for the transfer of speech information in the network apply to this service.

1.2.2 **3.1 kHz audio information transfer** (Recommendation I.231, § 2)

This bearer service corresponds to the service which is currently offered in the PSTN.

This bearer service provides the transfer of speech and for the transfer of 3.1 kHz bandwidth audio information such as voiceband data via modems, groups I, II and III facsimile information (see Note). The digital signal at the S/T reference point is assumed to conform to the internationally agreed encoding laws for speech

A-law, μ-law, i.e. Recommendation G.711. Connections provided for this service should provide for the transfer of the information indicated above. (This means that the network may include speech processing techniques provided that they are appropriately modified, or functionally removed prior to non-speech information transfer.) The control of echo control devices, speech processing services etc. is only made by use of a 2100 Hz (disabling) in-band tone.

All CCITT Recommendations for the transfer of speech information in the network apply to this service.

Note – The maximum modem bit rate that can be used by users in applications of this bearer service depends on the modulation standard employed by the user and on the transmission performance within, or between, different Administrations. The extent of support is a network, or bilaterally agreed matter.

1.2.3 **unrestricted information transfer** (Recommendation I.231, § 3)

An unrestricted bearer service provides information transfer without alteration between S/T reference points. It may, therefore, be used to support various user applications. Examples include:

1) speech (Note 2);
2) 3.1 KHz audio (Note 2);
3) multiple subrate information streams multiplexed into 64 kbit/s by the user;
4) transparent access to an X.25 public network (Recommendation I.462, case a).

User information is transferred over a B channel: signalling is provided over a D channel.

Note 1 – During an interim period some networks may only support restricted 64 kbit/s digital information transfer capability, i.e. information transfer capability solely restricted by the requirement that the all-zero octet is not allowed. For interworking the rules given in Appendix 1 of Recommendation I.430 should apply. The interworking functions have to be provided in the network with restricted 64 kbit/s capability. The ISDN with 64 kbit/s transfer capabilities will not be affected by this interworking, other than conveying the appropriate signalling message to and from the ISDN terminal.

Note 2 – Whilst speech and 3.1 kHz audio have been given as one application for this bearer service, it is recognized that it is the responsibility of the customers to ensure that a compatible encoding scheme is in operation. Customers should also recognize that no network provision can be made for the control of such items as echo and loss, as the network is unaware of the application in use. Furthermore, the quality of service attribute for information transfer delay will indicate the suitability of a particular version of this bearer service for speech.

1.2.4 **alternate speech/unrestricted information transfer** (Recommendation I.231, § 4)

The service provides the alternate transfer at either speech of 64 kbit/s unrestricted digital information with the same call.

The request for this alternate capability and the initial mode desired by the user must be identified at call set-up time.

This service must be provided for the support of multiple capability terminals or single capability terminals.

Note – Initially, this service will only be applicable to multiple capability terminals. The use of this service by, and the network support of, single capability terminals is for further study (e.g., how a user changes terminals). All references to single capability terminals reflect possible future enhancements and are subject to change and have only been included for information.

1.3 *Service invocation*

Users indicate their required bearer service capabilities at the time of call set-up by including appropriate information in the service request sent to the network via the user/network signalling channel. Subsequent interactions involving status and control information also occur using the signalling channel. However, tones and announcements associated with speech and 3.1 kHz audio information services are sent to the user over the 64 kbit/s user access channel used for the call.

2 Call set-up and release

2.1 *Functional model*

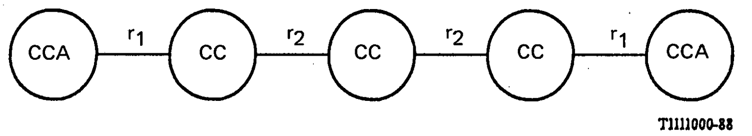


FIGURE 2-1/Q.71

Functional model for 64 kbit/s circuit mode switched bearer service

CCAs are functional entities that serve the users and are responsible for initiating functional requests and interacting with CCs. CCs are functional entities that cooperate with each other to provide the services requested by the CCAs. r_1 and r_2 are relationships between functional entities wherein information flows occur in order to process call attempts or service requests.

2.1.1 *Description of the call control agent (CCA) functional entity*

The CCA functional entity supports the functionality to:

a) access the service-providing capabilities of the CC entities, using service requests for the establishment, manipulation and release of a single call (e.g. set-up, transfer, hold, etc.).

b) receive indications relating to the call from the CC entity and relay them to the user.

c) maintain call state information as perceived from this functional end-point of the service (i.e, a single-ended view of the call).

2.1.2 *Description of the call control (CC) functional entity*

The CC functional entity supports the functionality to:

a) establish, manipulate and release a single call (upon request of the CCA entity).

b) associate and relate the CCA entities that are involved in a particular call and/or service.

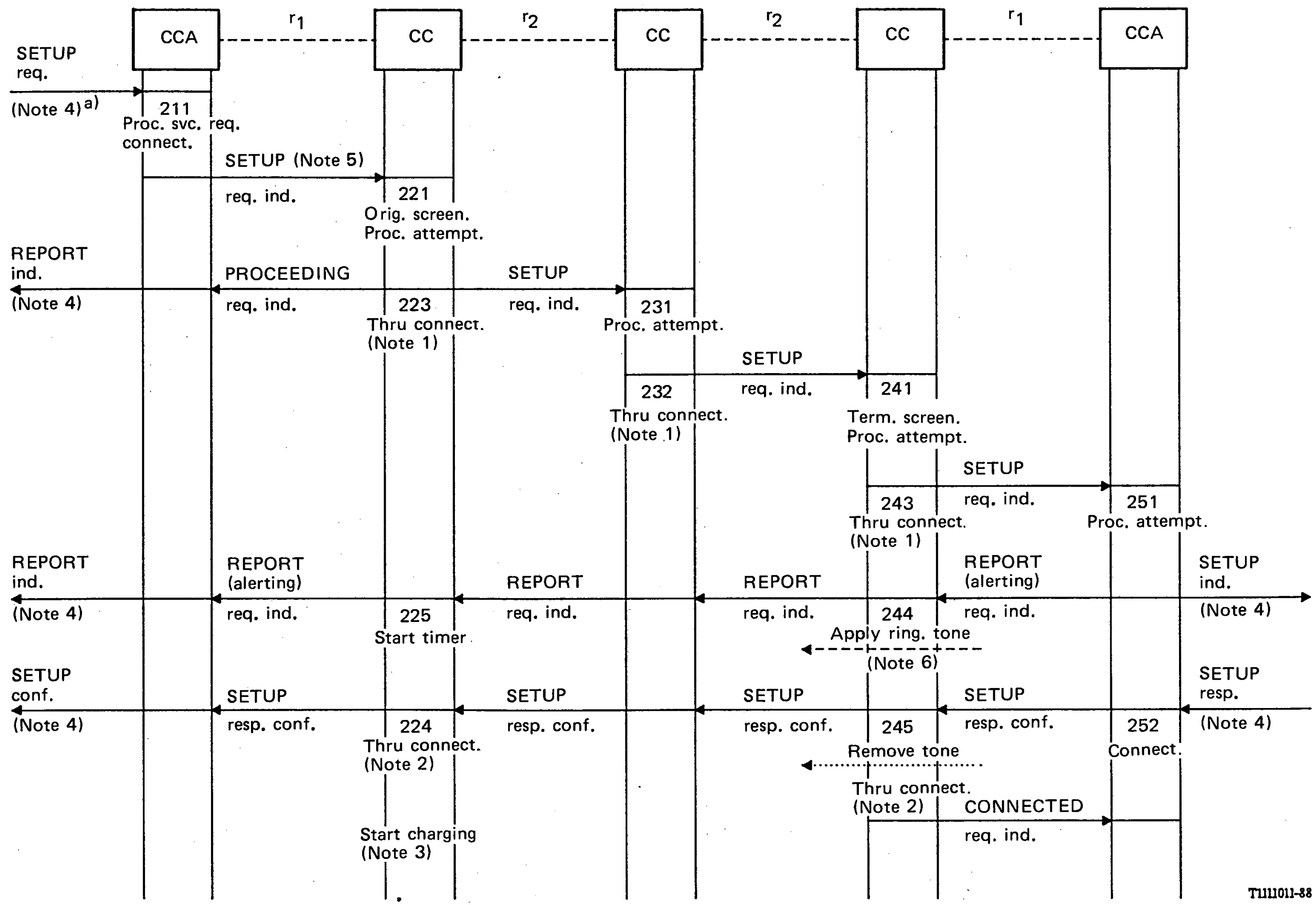
c) manage the relationship between the CCA entities involved in a call (i.e. reconcile and maintain the overall perspective of the call and/or service).

2.2 *Information flows required for en-bloc and digit-by-digit sending call set-up and call release*

2.2.1 *Information flow diagrams*

Information flow diagrams for 64 kbit/s circuit mode switched bearer service call setup and call release are shown in Figures 2-2/Q.71 through 2-6/Q.71:

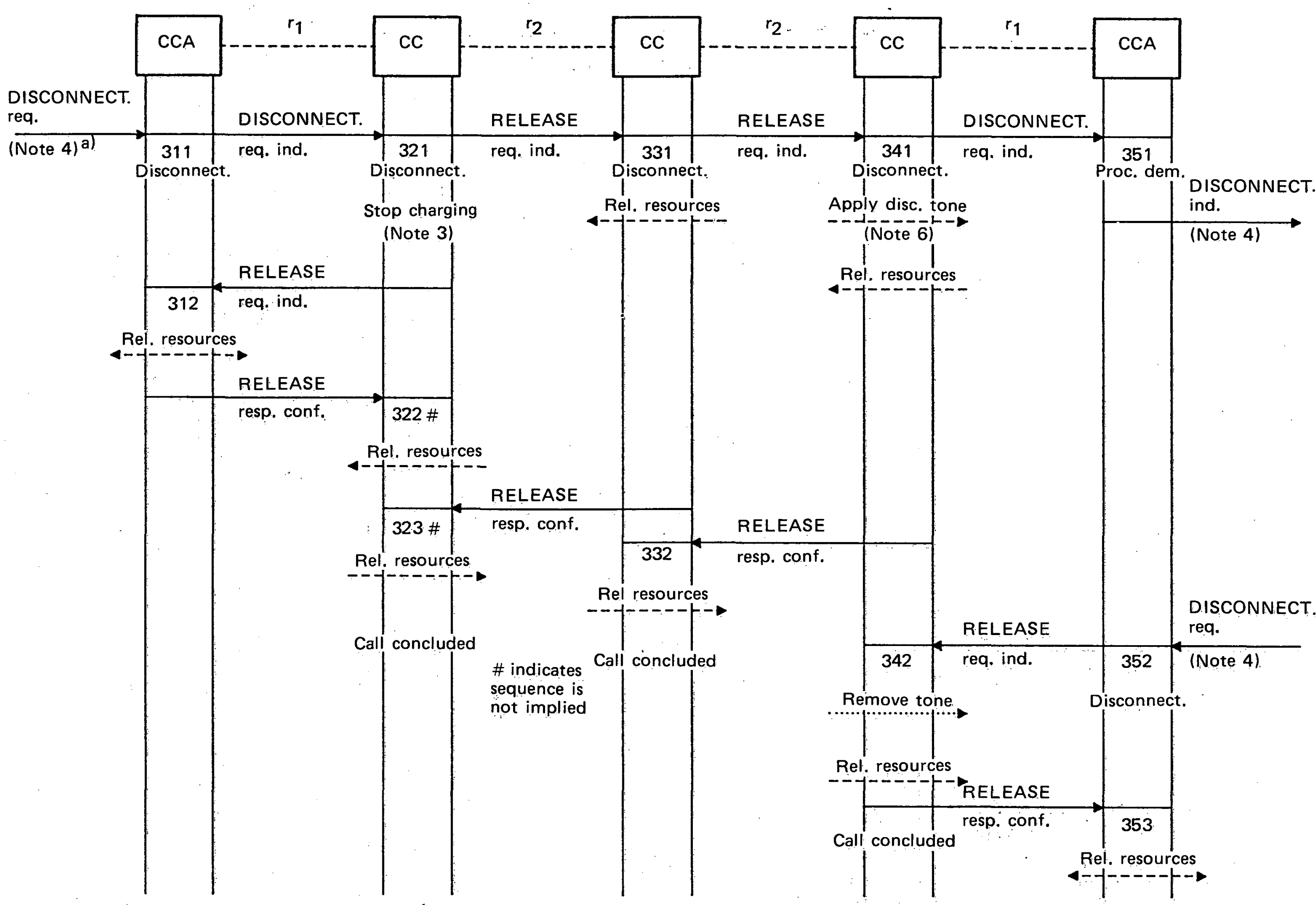
- Figure 2-2/Q.71 shows a successful call set-up using en-bloc sending;
- Figures 2-3/Q/.71 and 2-4/Q.71 are reserved to show call set-up procedures for digit-by-digit sending cases;
- Figure 2-5/Q.71 shows normal clearing initiated by a calling party disconnection;
- Figure 2-6/Q.71 shows normal clearing initated by a called party disconnection.



[a] The notes are found after Figure 2-6/Q.71.

FIGURE 2-2/Q.71

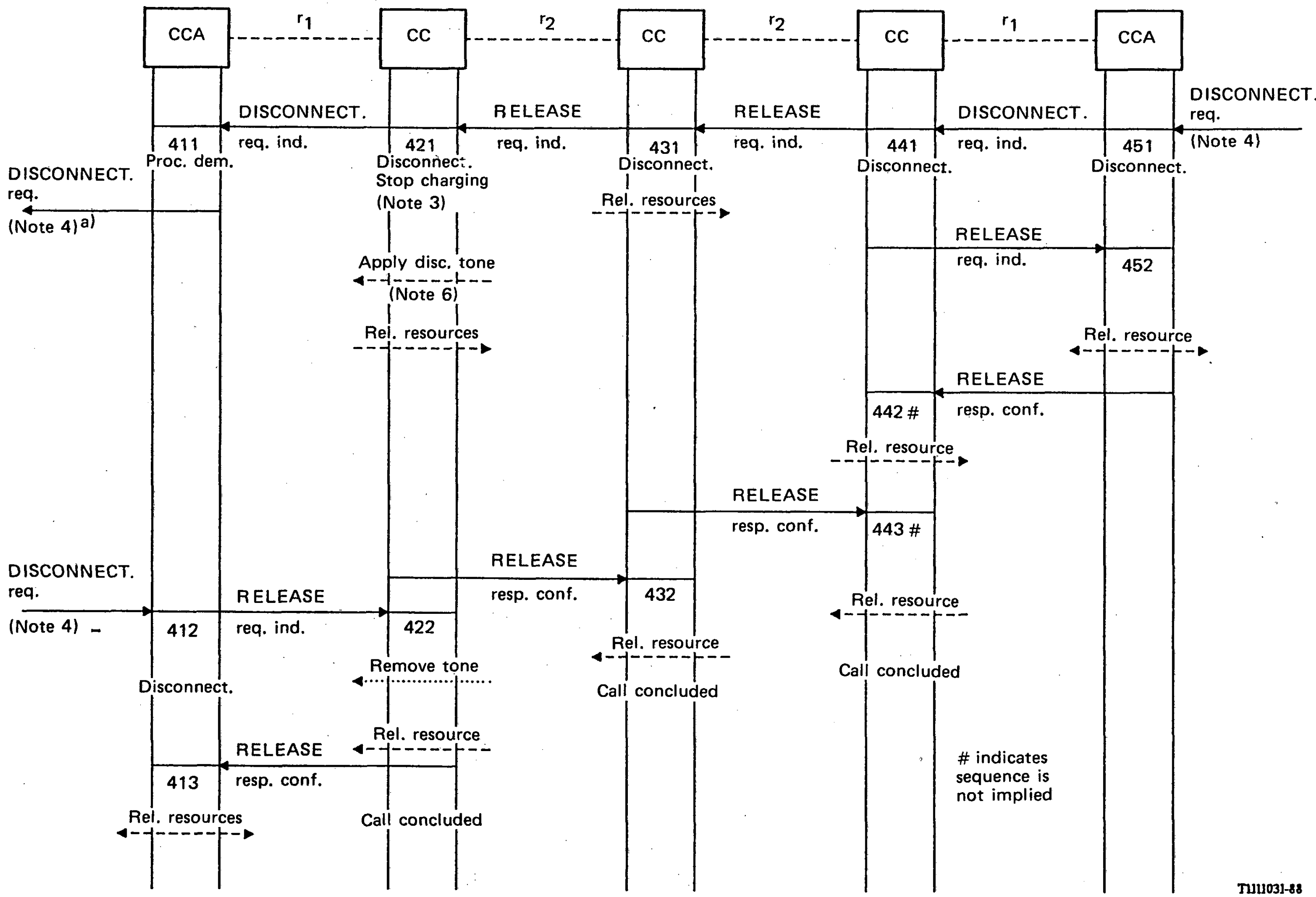
Successful ISDN 64 kbit/s circuit mode switched call setup en-bloc sending



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-5/Q.71

Normal clearing – 64 kbit/s circuit mode switched call calling party disconnect



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-6/Q.71

Normal clearing – 64 kbit/s circuit mode switched call called party disconnect

Notes to Figures 2-2/Q.71 through 2-9/Q.71

Note 1 – Through connection is dependent on the physical location of the functional entity:

a) Originating local exchange –

i) for 3.1 kHz audio bearer service, speech and telephony services, backwards only or both directions, depending on the approach adopted by the Administration or RPOA.

ii) for 64 kbit/s unrestricted information transfer, backwards only, except for own-exchange calls, which may be either backwards only or in both directions at the discretion of the Administration or RPOA.

b) Transit exchange – both directions.

c) Terminating local exchange – no through connection at this stage of call set-up, except as a national option for certain classes of users, e.g. PABXs.

d) NT2 – may through connect as required.

Note 2 – If not already done, complete the through connection in both directions.

Note 3 – The method of initiating and stopping charging will depend on the Administration's method of charging for service (e.g. pulse metering, recording call detail and billing, etc.). The charging function may be performed at different entities at the discretion of the Administration and/or RPOA.

Note 4 – Further study is required on the possible inclusion of an entity from/to which information is passed and on the information flows themselves. The "Report" indications may or may not be sent to the user terminal and/or to the user depending on the terminals involved.

Note 5 – The intended use of the service (transfer capability required, e.g. speech, 3.1 kHz audio, unrestricted or alternate speech/unrestricted information transfer) must be indicated as an element of the call SETUP information flow from the CCA to the CC.

Note 6 – Tones are used with speech and 3.1 kHz bearer services and telephony. The use of disconnect tone is a national option.

2.2.2 *Definition of information flows*

2.2.2.1 CONNECTED req.ind is used to acknowledge that a previously sent SETUP resp.conf has been received and accepted. This is an uncomfirmed information flow within the r_1 relationship and is sent from the CC to the CCA.

2.2.2.2 DISCONNECT req.ind is used to notify that the end user has disconnected from the connection or cannot be connected (e.g. the called user is busy). This is used to solicit a confirmed release of local channels and other resources associated with the connection. In general, it will not always result in immediate release of the connection and related resources. DISCONNECT req.ind is not confirmed and appears within relationship r_1.

The following item of information is conveyed with the DISCONNECT req.ind information flow:

Item	*Relationship*	*Req.ind*
Cause	r_1	mandatory

2.2.2.3 PROCEEDING req.ind optionally reports that the received connection set-up is valid and authorized and that further routing and progressing of the call is proceeding. The user entity is not required to provide this indication. This information flow is not confirmed and appears within relationship r_1.

The following item of information may be conveyed with the PROCEEDING req.ind information flow:

Item	*Relationship*	*Req.ind*
Channel ID	r_1	optional

2.2.2.4 RELEASE req.ind and resp.conf is used to free the resources associated with the call/connection such as call references and channels. This is a confirmed information flow whose confirmation indicates that all resources previously associated with the connection have been freed. It appears within relationship r_1 and r_2.

The following item of information is conveyed with the RELEASE req.ind and resp.conf information flows:

Item	*Relationship*	*Req.ind*	*Resp.conf*
Cause	r_1, r_2	mandatory	mandatory

2.2.2.5 REPORT req.ind is an information flow that is used to report status and/or other types of information across the network. The type of information may be indicated (e.g. alerting, suspended, hold, resume, etc.). This is an unconfirmed information flow within the relationship of both r_1 and r_2.

The following items of information are or may be conveyed with the REPORT req.ind information flow:

Item	*Relationship*	*Req.ind*
Channel ID	r_1, r_2	optional
Conn. request	r_2	optional
Called line category	r_2	mandatory
Called line status	r_2	mandatory
Report type	r_2	mandatory

2.2.2.6 SETUP req.ind is used to request establishment of a connection. This is a confirmed information flow and SETUP resp.conf is used to confirm that the connection has been established. The request for establishment of a connection can be originated by either the network or the user. This information flow is within the r_1 and r_2 relationships.

The following items of information are or may be conveyed in the SETUP req.ind and SETUP resp.conf information flows:

Use	*Item*	*Relationship*	*Req.ind*	*Resp.conf*
Protocol info	Conn. request	r_2	optional	optional
Bearer info	Bearer capability	r_1, r_2	mandatory	
Bearer info	Nature of trans.	r_2	mandatory	
Bearer info	Channel ID	r_1, r_2	mandatory	
Routing info	Called number	r_1, r_2	mandatory	
Routing info	Transit network sel.	r_1, r_2	optional	
Orig. info	Calling line ID	r_1, r_2	optional	
Term. info	Connected line ID	r_2		mandatory
Term. info	Connected line status	r_2		mandatory
Access info	Low layer compatibility	r_1	optional	
Access info	High layer compatibility	r_1	optional	

2.2.2.7 SETUP REJECT req.ind is used to notify the CCA that the SETUP req.ind has been rejected. This information is within the r_1 relationship.

The following items of information are or may be conveyed in the SETUP REJECT req.ind information flow:

Item	*Relationship*	*Req.ind*
Channel ID	r_1	mandatory
Reject indication	r_1	mandatory
Cause	r_1	optional

2.2.3 *Additional information flows required for digit-by-digit call set-up cases*

Under study.

2.2.4 *Information flow meanings – Summary table*

The individual semantics of the above information flows, and in particular the relationship between information flow meanings, is summarized in Table 2-1/Q.71.

TABLE 2-1/Q.71

Information flow meanings

Semantics	SETUP req. ind.	SETUP. resp. conf.	SETUP REJECT req. ind.	PROCEEDING req. ind.	REPORT (Alerting) req. ind.	DISCONNECT req. ind.	RELEASE req. ind.	RELEASE resp. conf.	CONNECT-ED req. ind.
Request for connection	X								
Connection accepted by user		X							
Call information complete		X		X	X				
Connection request accepted		X		X	X				
Connection request rejected			X						
Called user being alerted					X				
Connection unavailable						X	X		
Demand to disconnect bearer resources						X			
Demand to release bearer resources with acknowledgement							X		
Disconnected – ready to be released						X	X		
Bearer resources – released – reallocatable								X	
Request to terminate call						X	X		
Setup response accepted									X

2.3 *SDLs*

The SDLs included in this Recommendation cover only the allowable (expected) sequences for successful call set-up and release. It is assumed that errors detected by the incoming and outgoing signalling system protocols are handled within those protocol state machines.

The call controll states describe the state of the entity in terms of the states of the relationships in both directions (i.e. when describing states related to the relationship "$r_1 - r_2$" the CC state identifies the states of the relationship over r_1 and r_2).

Figure 2-7/Q.71 shows the directional convention used in drawing event symbols.

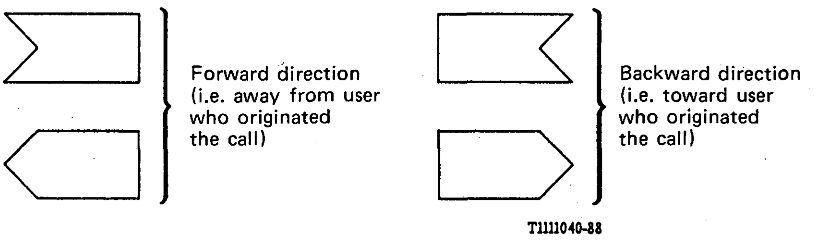


FIGURE 2-7/Q.71

Legend and convention used for SDL diagrams

2.3.1 SDLs for the Call Control Agent (CCA) entity are shown in Figure 2-8/Q.71.

2.3.2 SDLs for the Call Control (CC) entity are shown in Figure 2-9/Q.71.

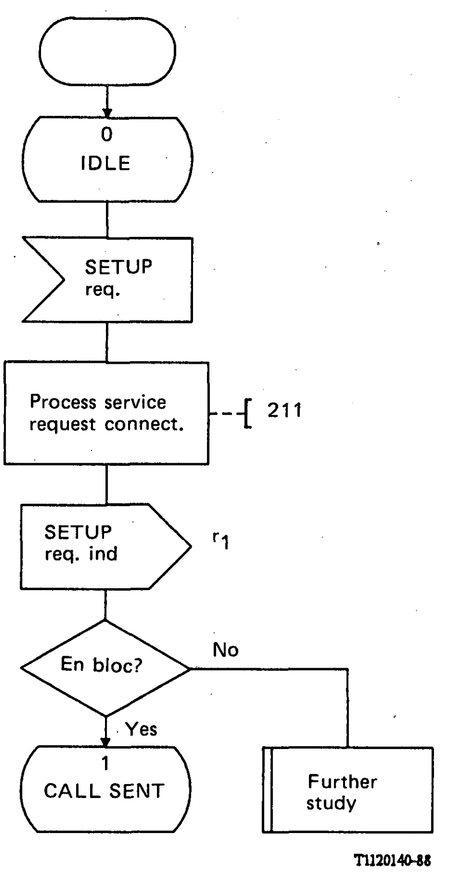


FIGURE 2-8/Q.71 (Sheet 1 of 11)

CCA functional entity. En-bloc sending (User - r_1)

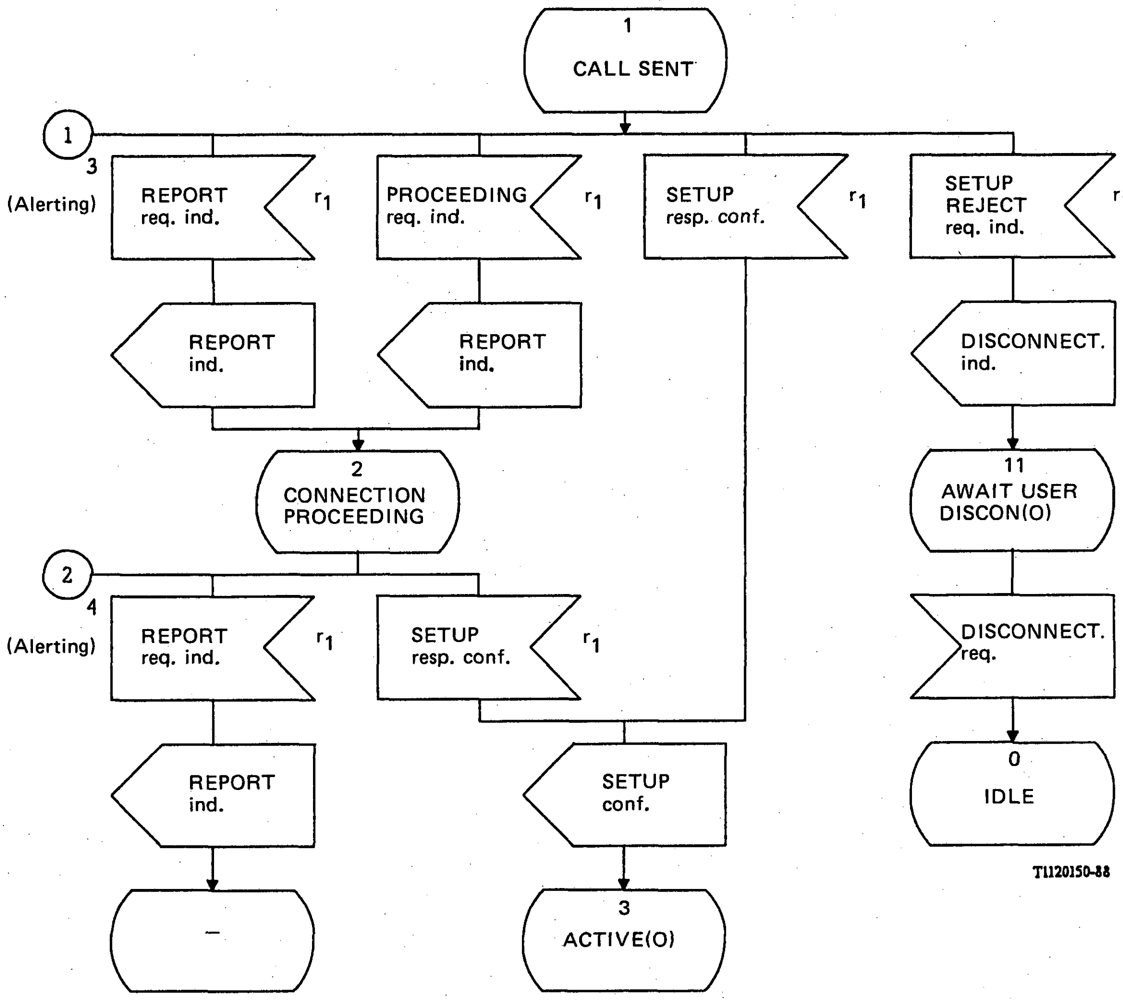


FIGURE 2-8/Q.71 (Sheet 2 of 11)

CCA functional entity. En-bloc sending (User - r_1) *(cont.)*

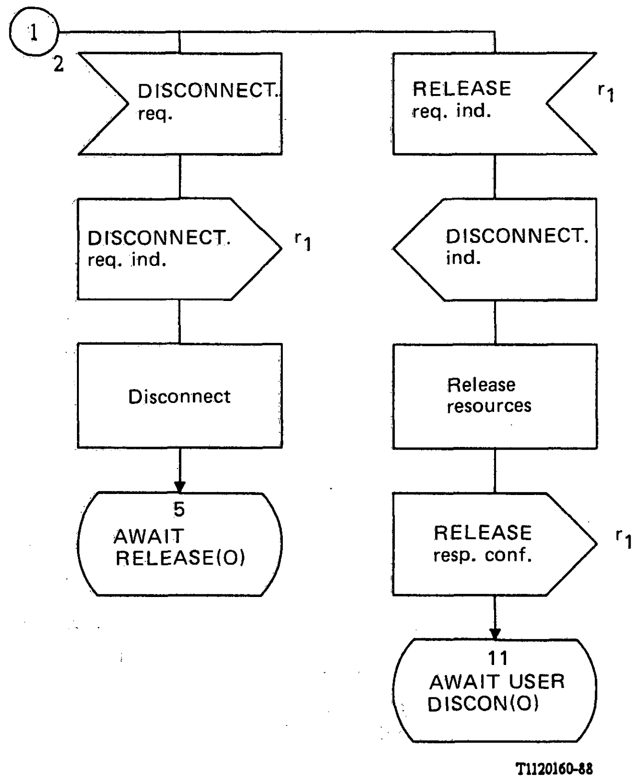
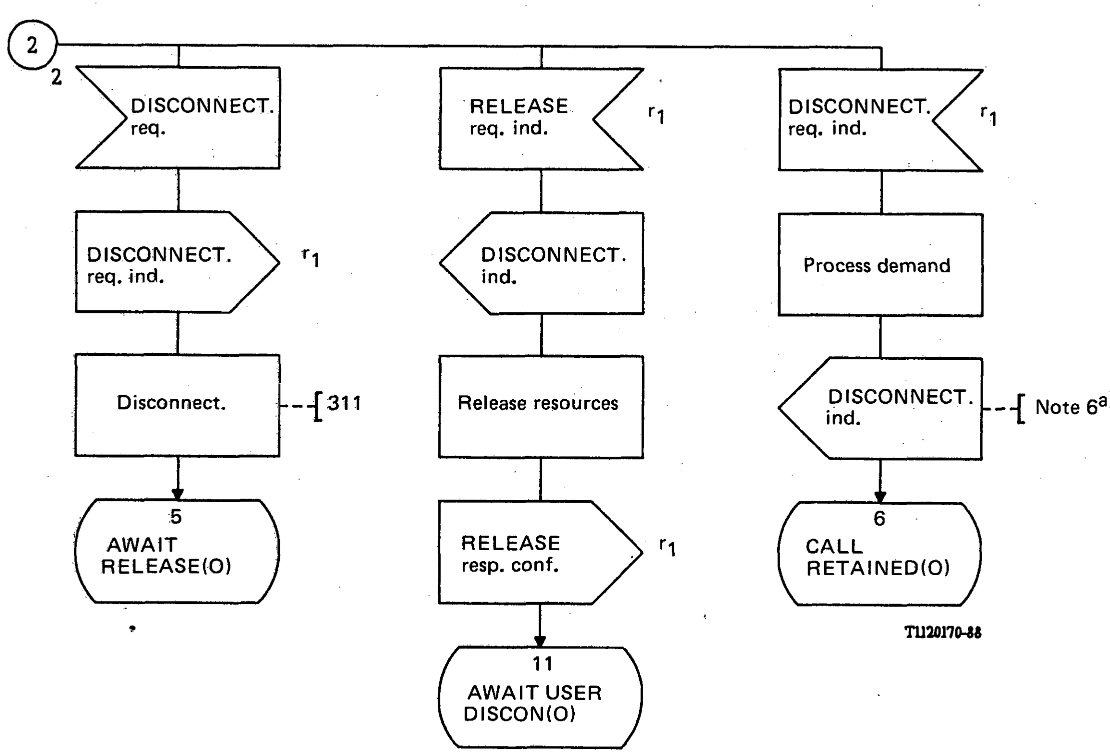


FIGURE 2-8/Q.71 (Sheet 3 of 11)

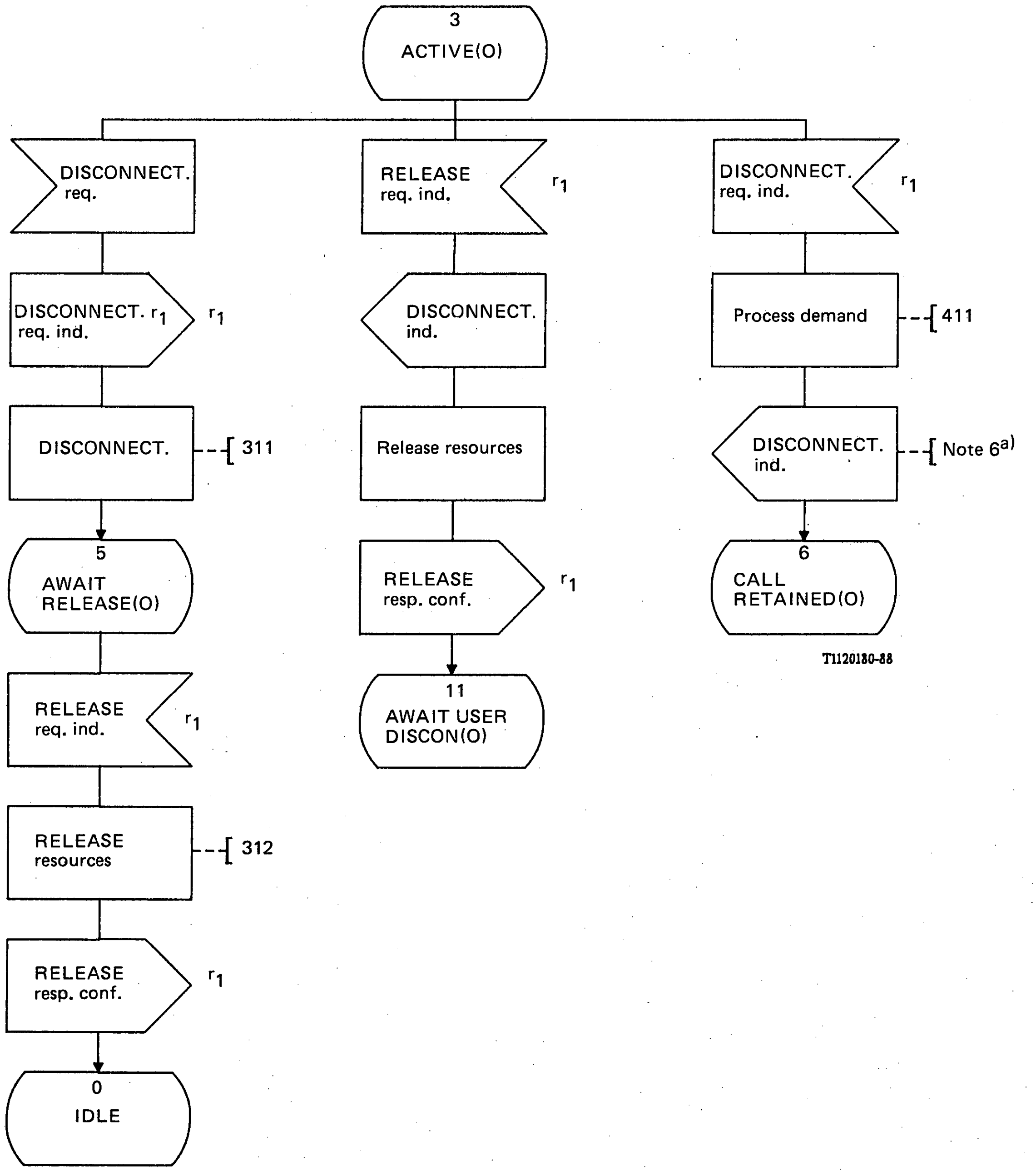
CCA functional entity (User - r_1)



[a] The notes are found after Figure 2-6/Q.71.

FIGURE 2-8/Q.71 (Sheet 4 of 11)

CCA functional entity (User - r_1) *(cont.)*



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-8/Q.71 (Sheet 5 of 11)

CCA functional entity (User - r_1) *(cont.)*

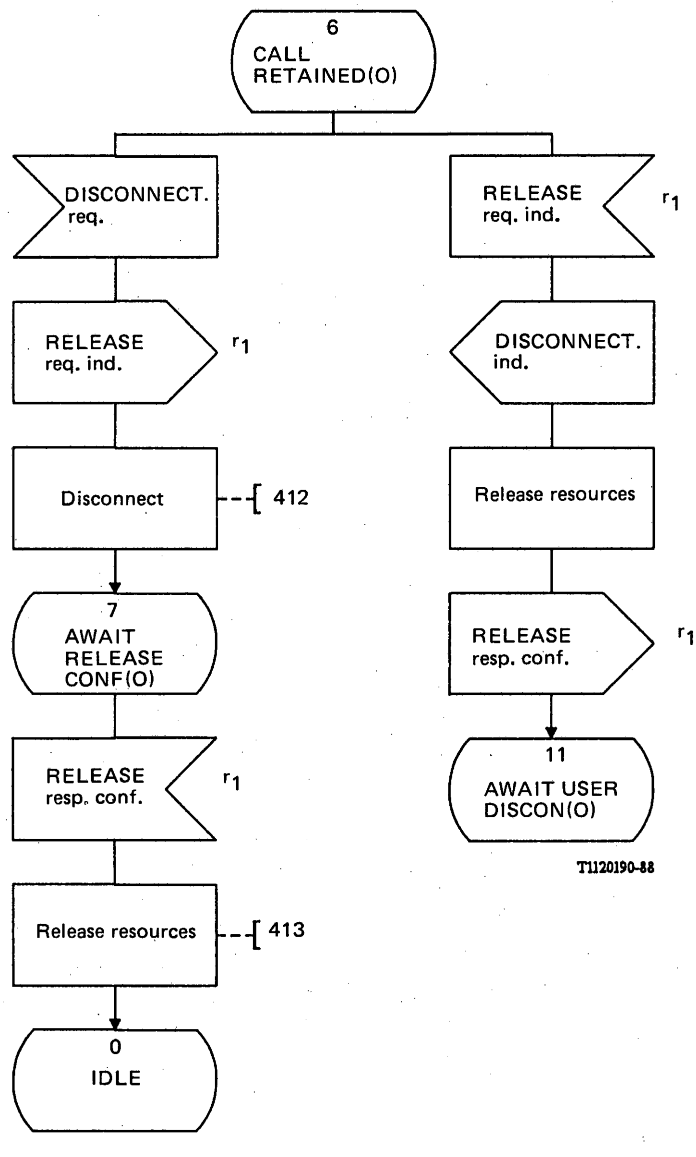


FIGURE 2-8/Q.71 (Sheet 6 of 11)

CCA functional entity (User - r_1) *(cont.)*

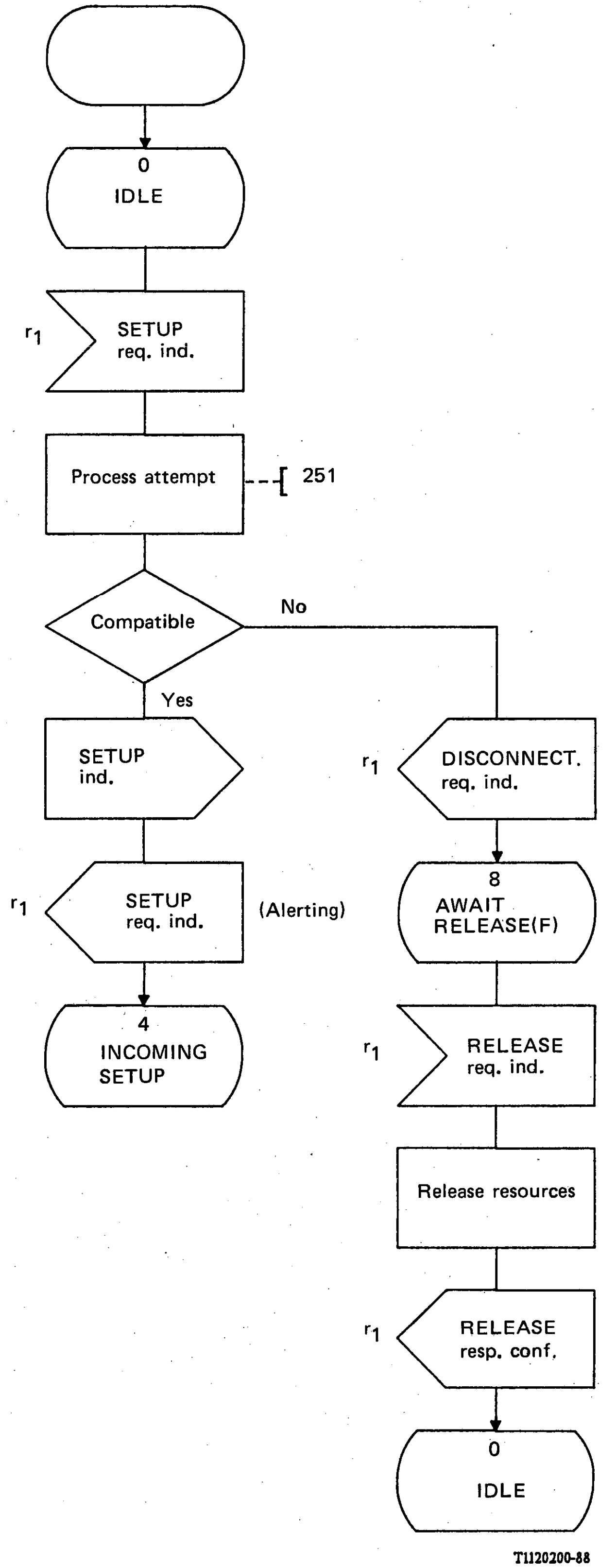


FIGURE 2-8/Q.71 (Sheet 7 of 11)

CCA functional entity. En-bloc sending (r_1 - User)

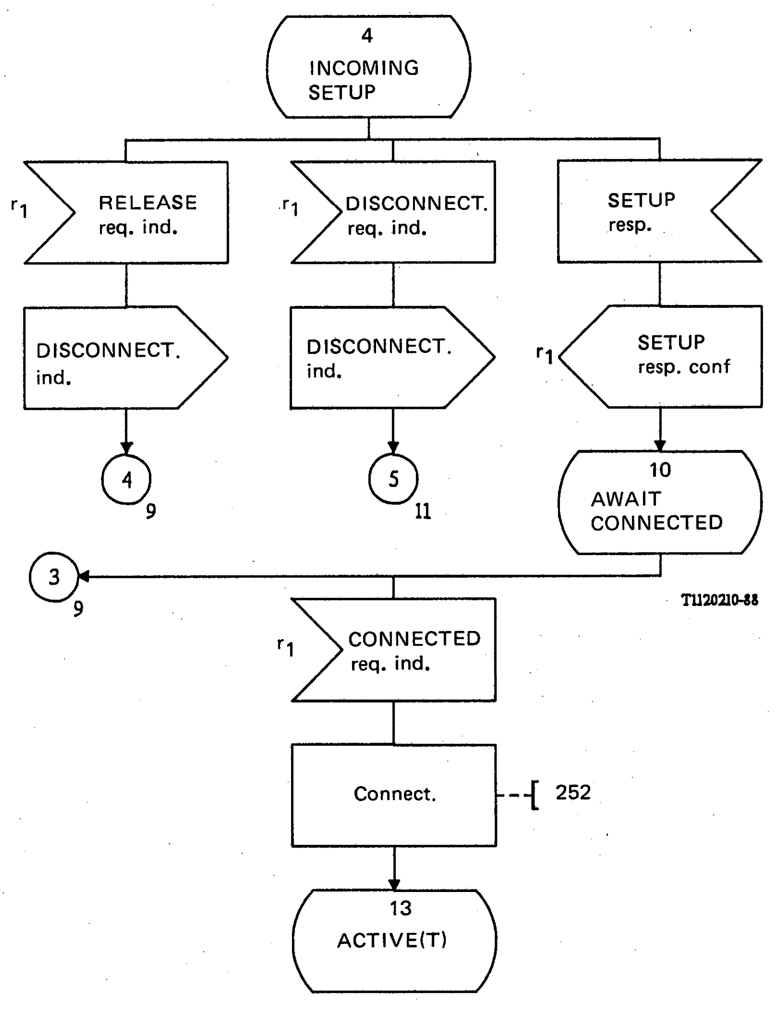


FIGURE 2-8/Q.71 (Sheet 8 of 11)

CCA functional entity. En-bloc sending (r_1 - User) *(cont.)*

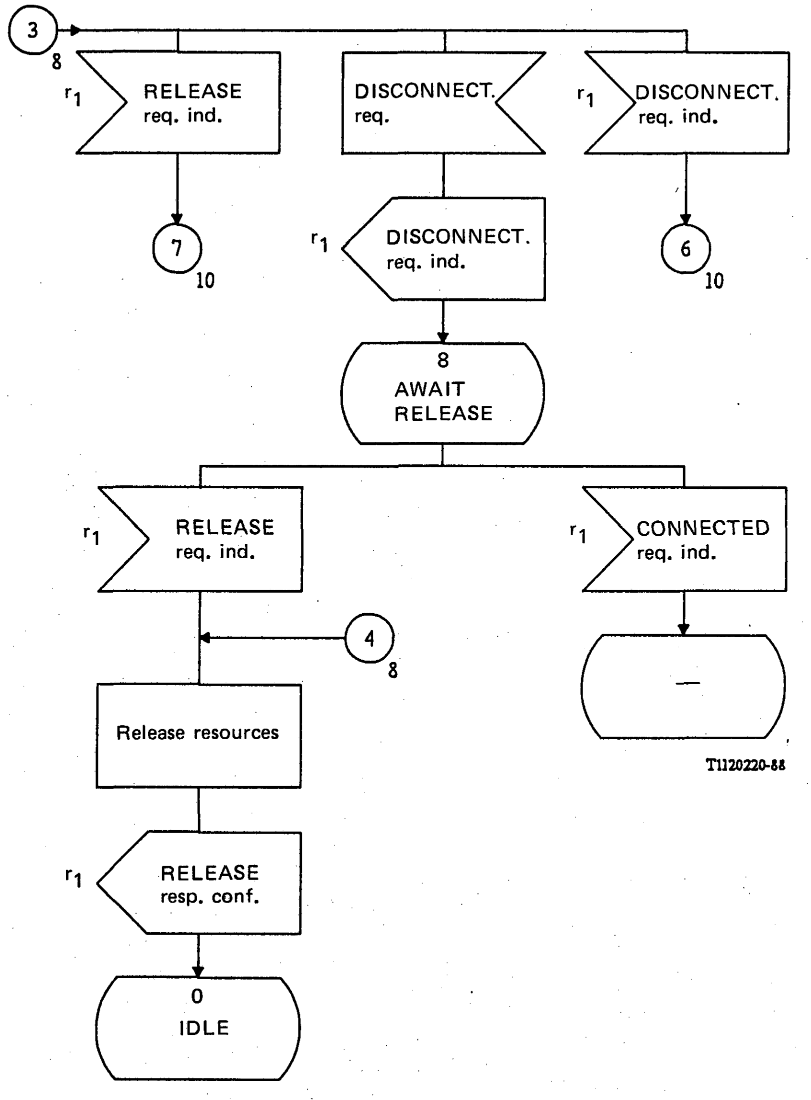


FIGURE 2-8/Q.71 (Sheet 9 of 11)

CCA functional entity (r_1 - User)

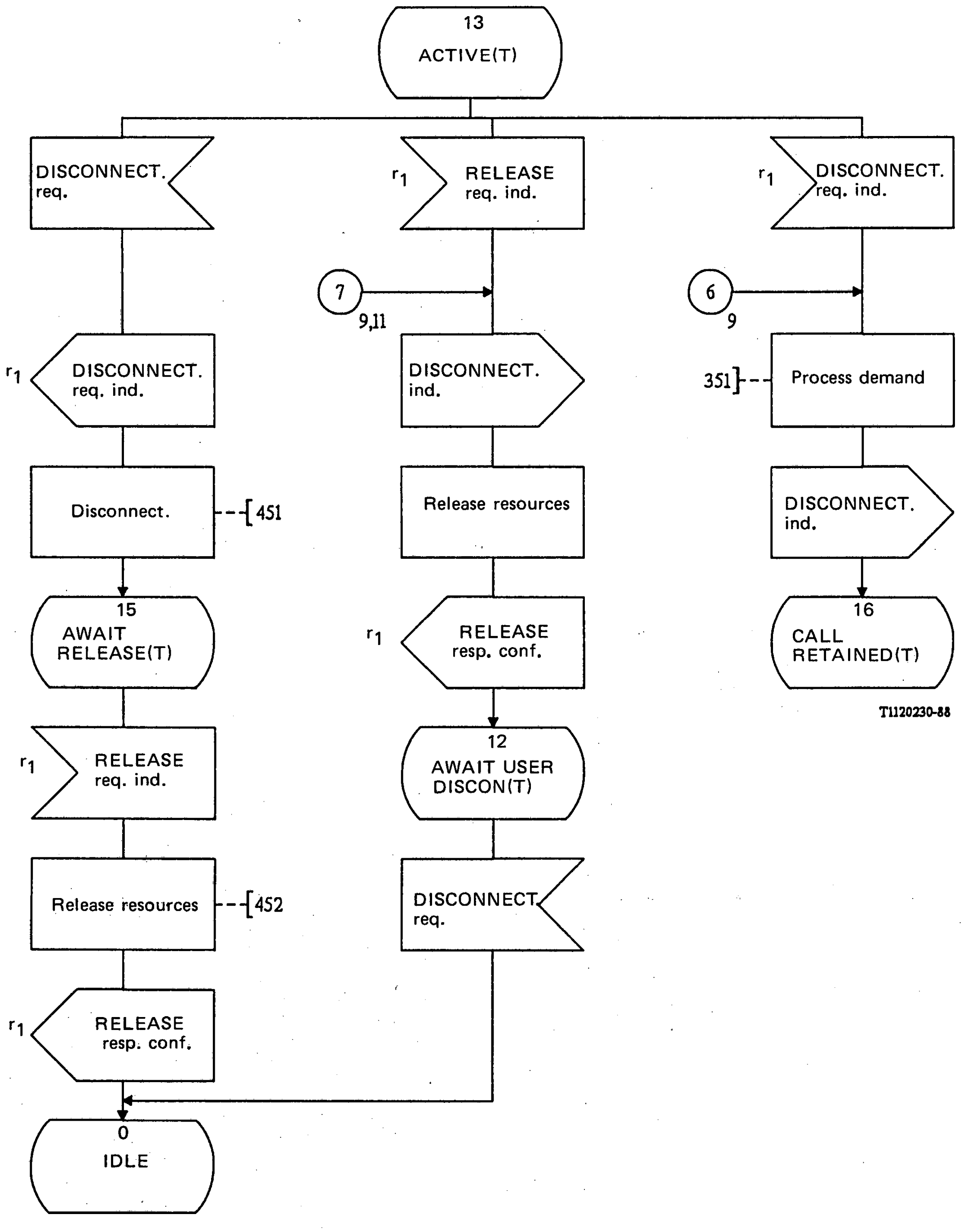


FIGURE 2-8/Q.71 (Sheet 10 of 11)

CCA functional entity (r_1 - User) *(cont.)*

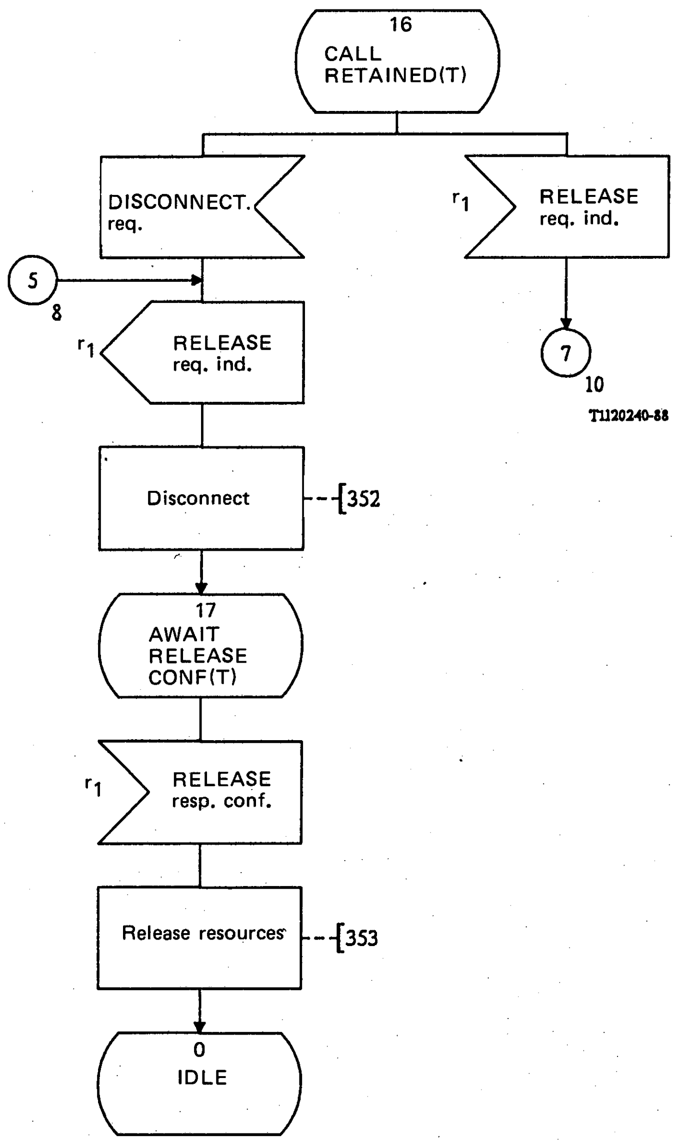
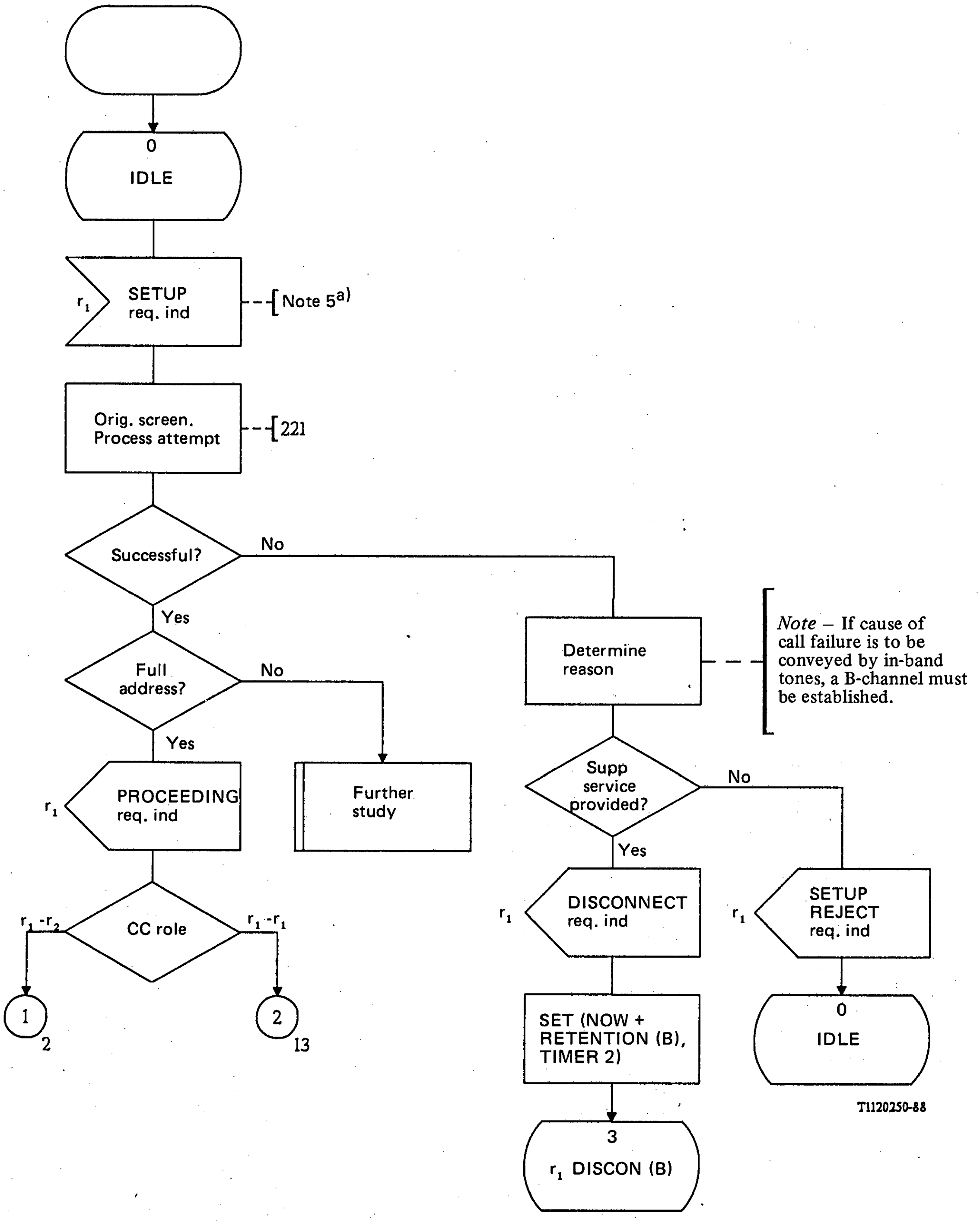


FIGURE 2-8/Q.71 (Sheet 11 of 11)

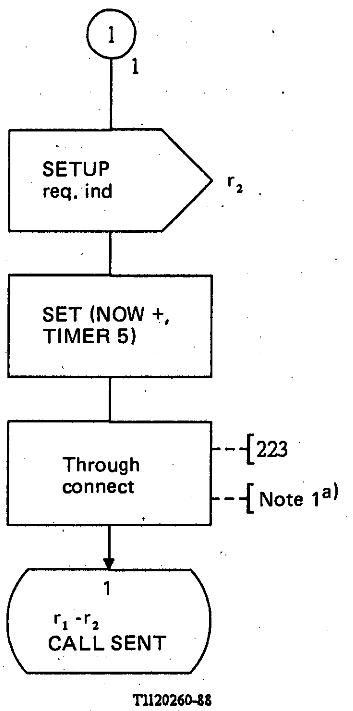
CCA functional entity (r_1 - User) *(end)*



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 1 of 19)

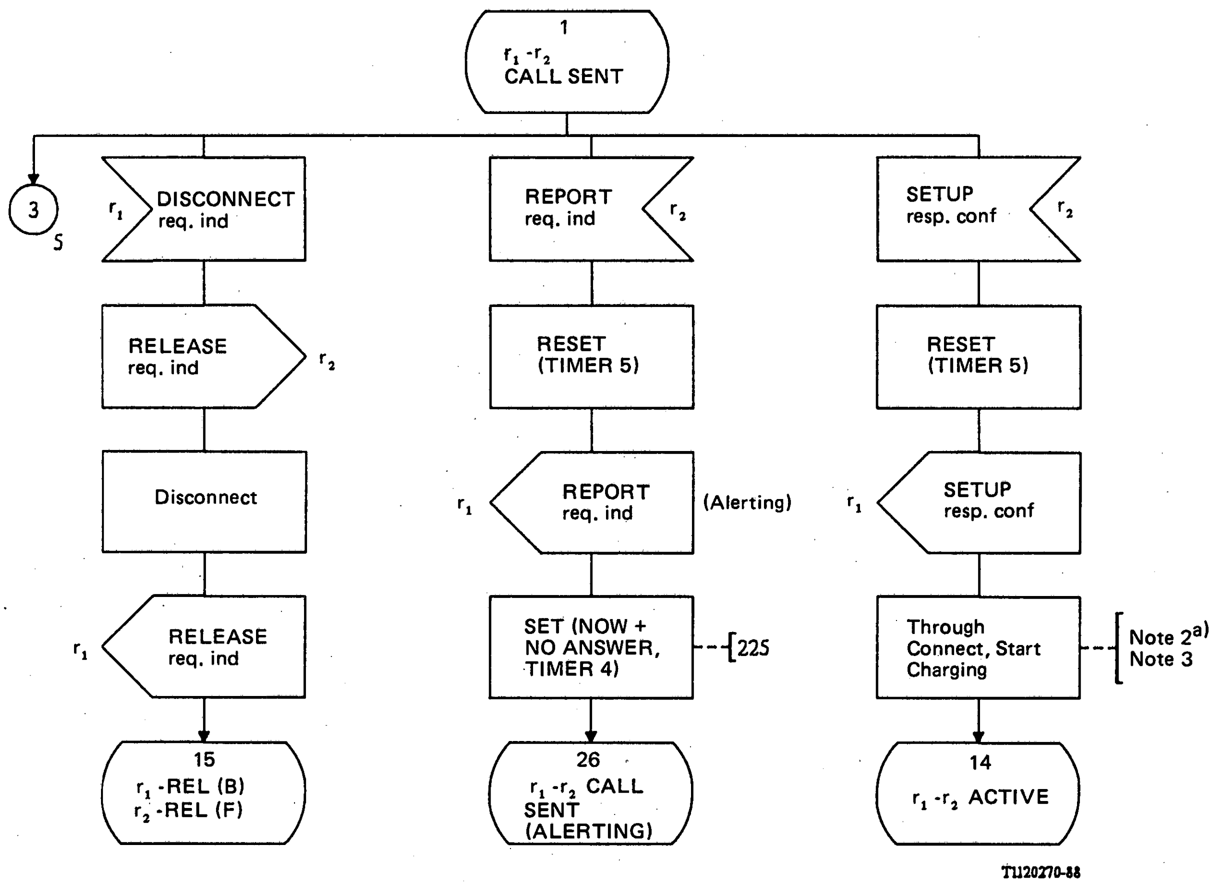
CC functional entity (r_1-r_1, or r_1-r_2)



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 2 of 19)

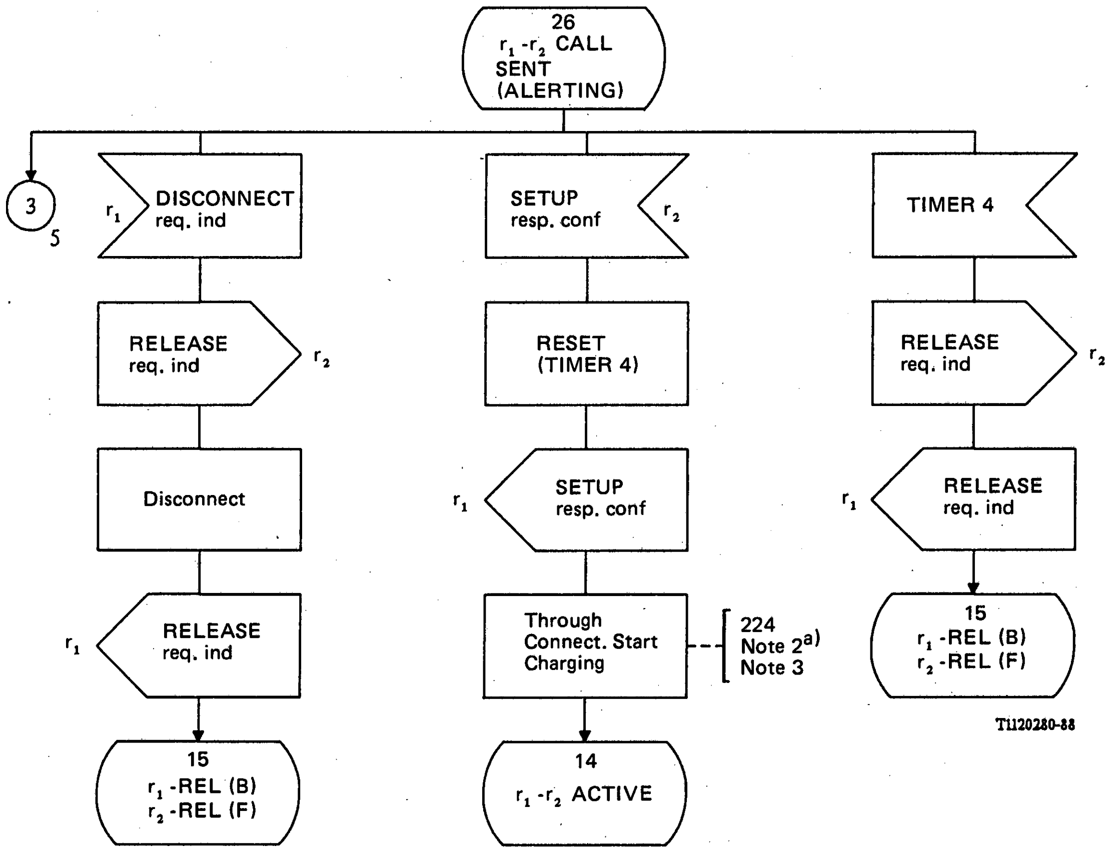
CC functional entity (r_1-r_2)



[a] The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 3 of 19)

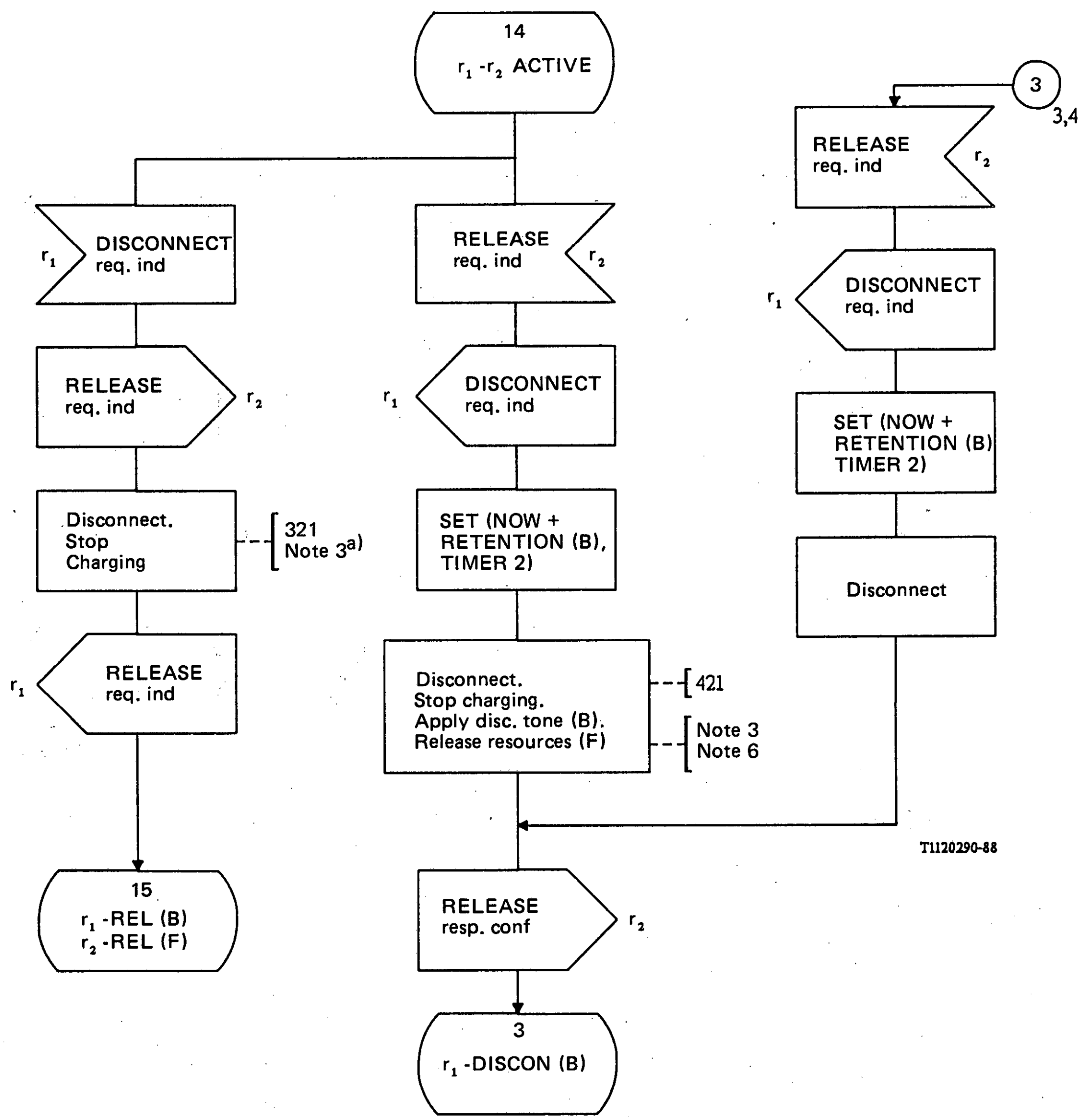
CC functional entity (r_1-r_2) *(cont.)*



[a] The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 4 of 19)

CC functional entity (r_1-r_2) *(cont.)*



[a] The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 5 of 19)

CC functional entity (r_1-r_2) *(cont.)*

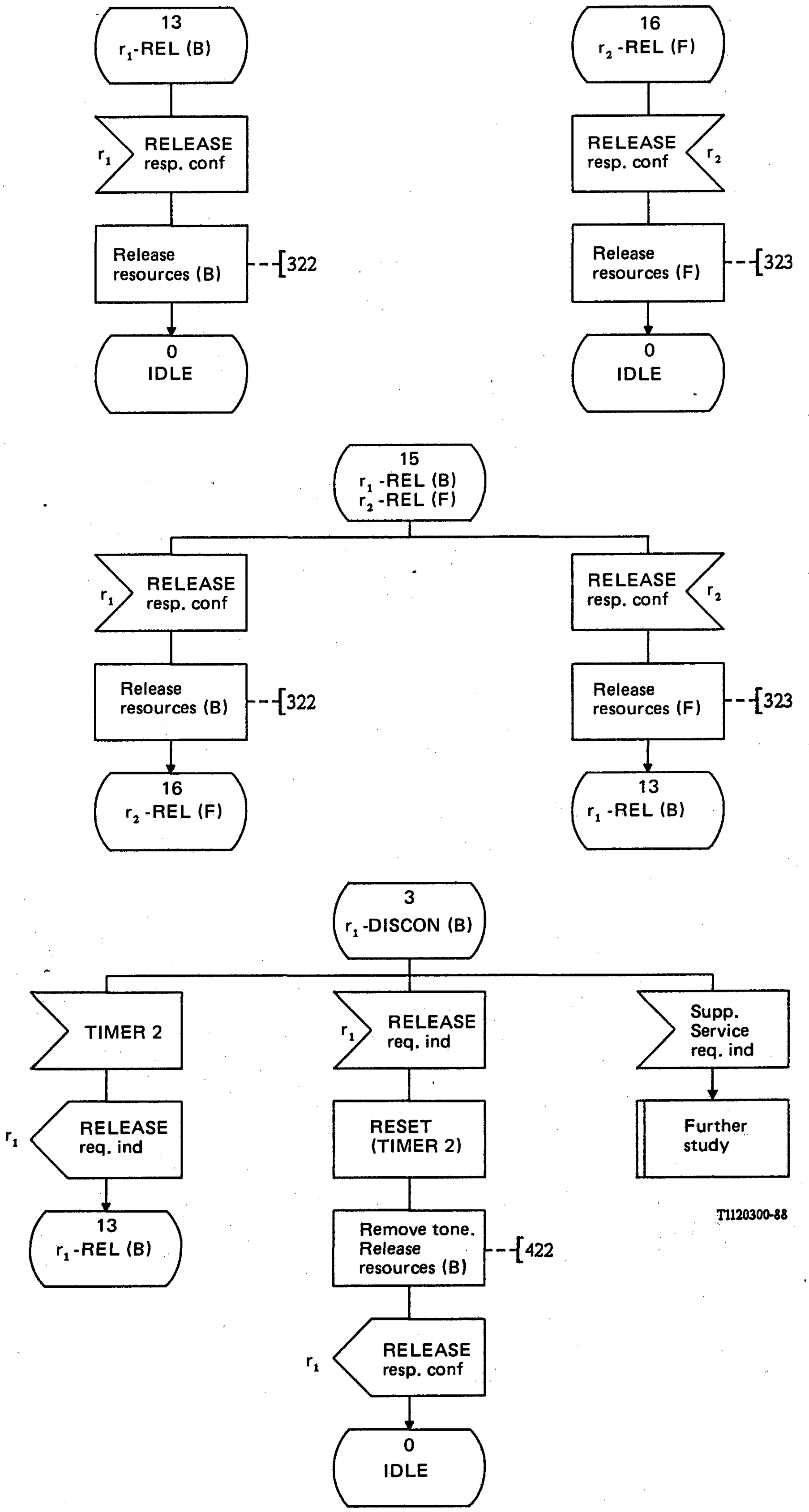
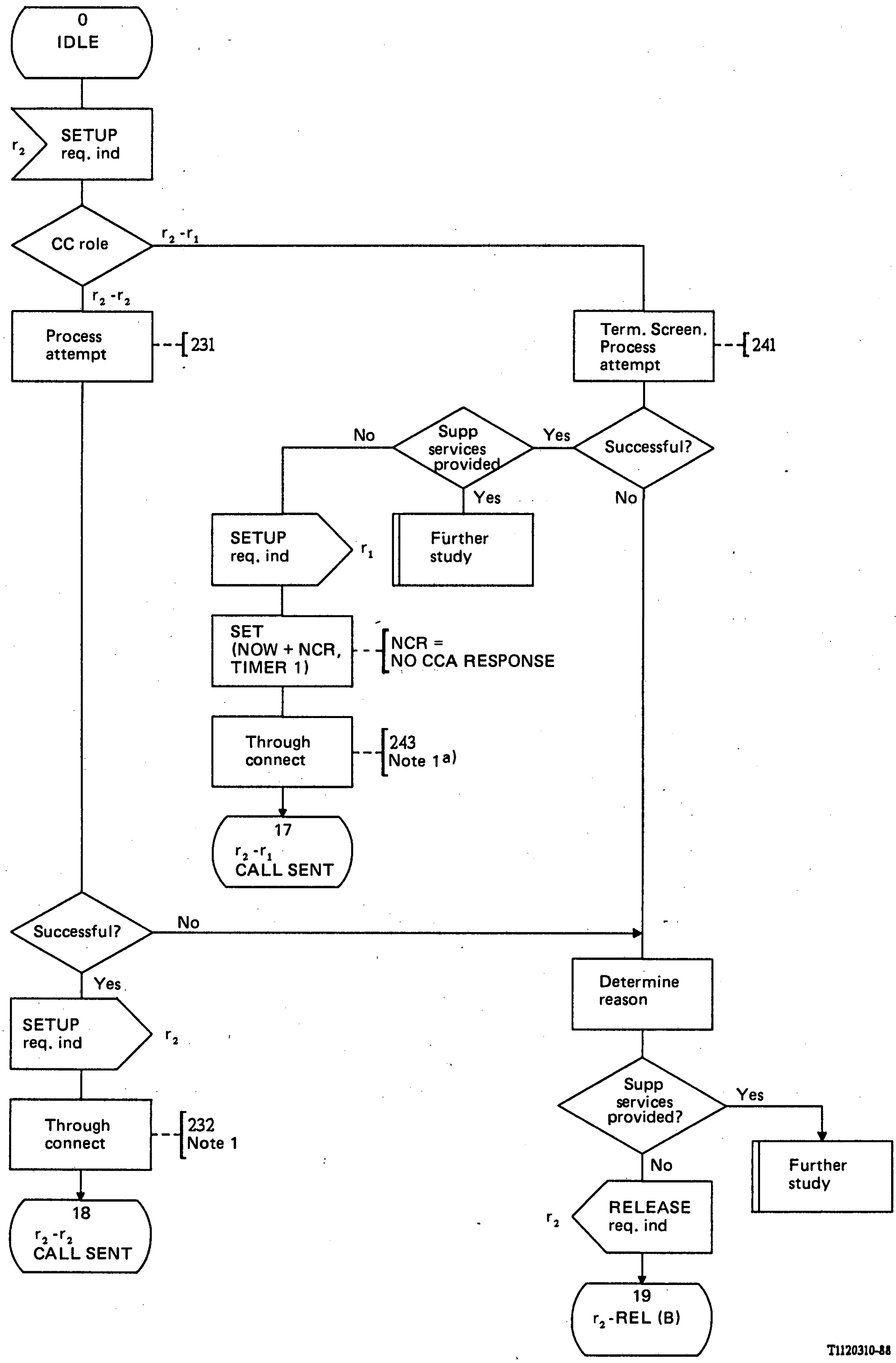


FIGURE 2-9/Q.71 (Sheet 6 of 19)

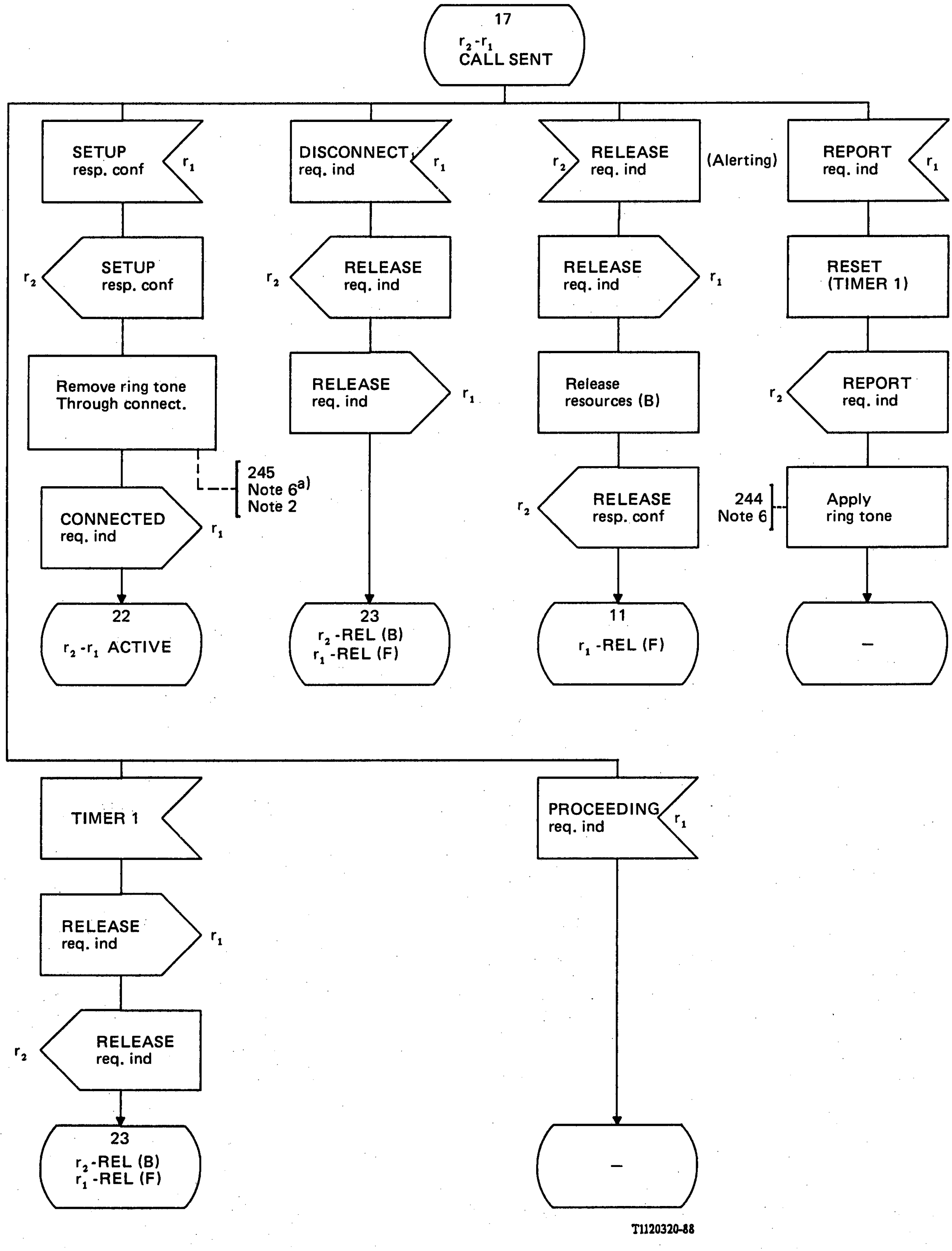
CC functional entity (r_1-r_2) *(cont.)*



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 7 of 19)

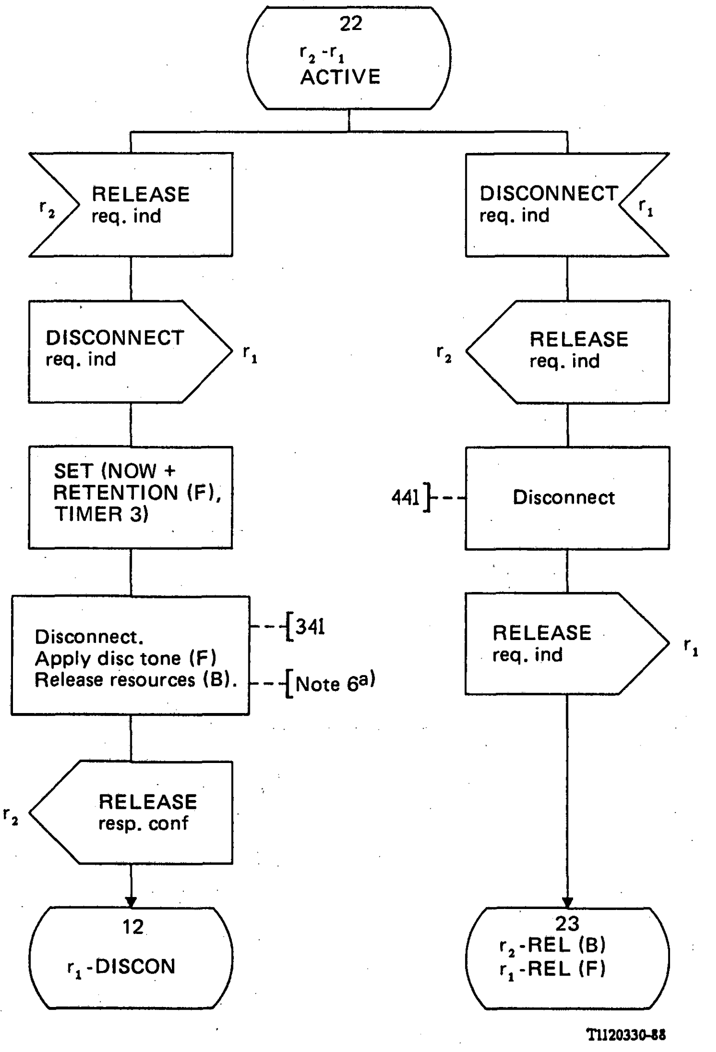
CC functional entity (r_2-r_1) i = 1,2 en-bloc sending



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 8 of 19)

CC functional entity (r_2-r_1)



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 9 of 19)

CC functional entity (r_2-r_1) *(cont.)*

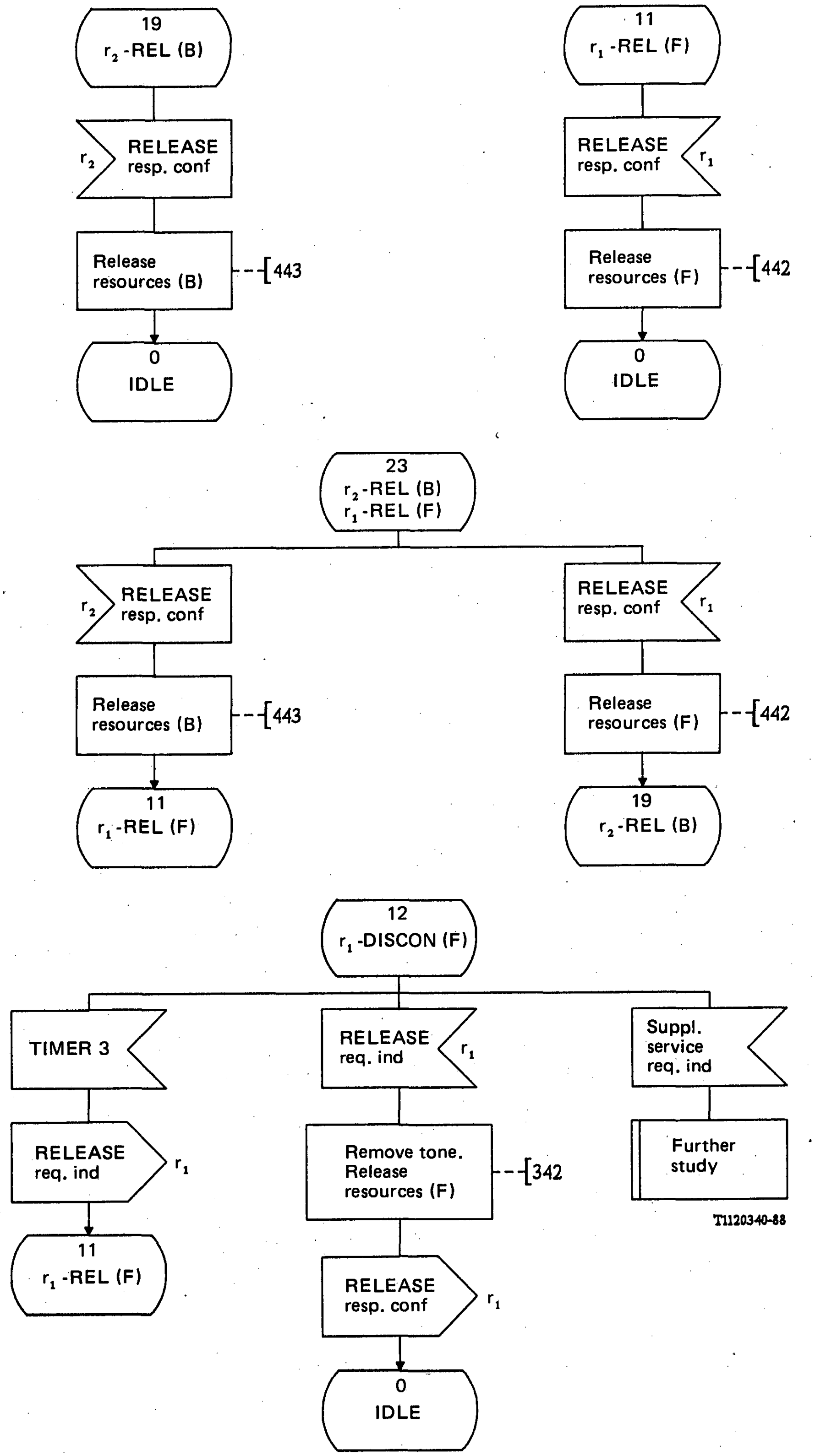


FIGURE 2-9/Q.71 (Sheet 10 of 19)

CC functional entity (r_2-r_1) *(cont.)*

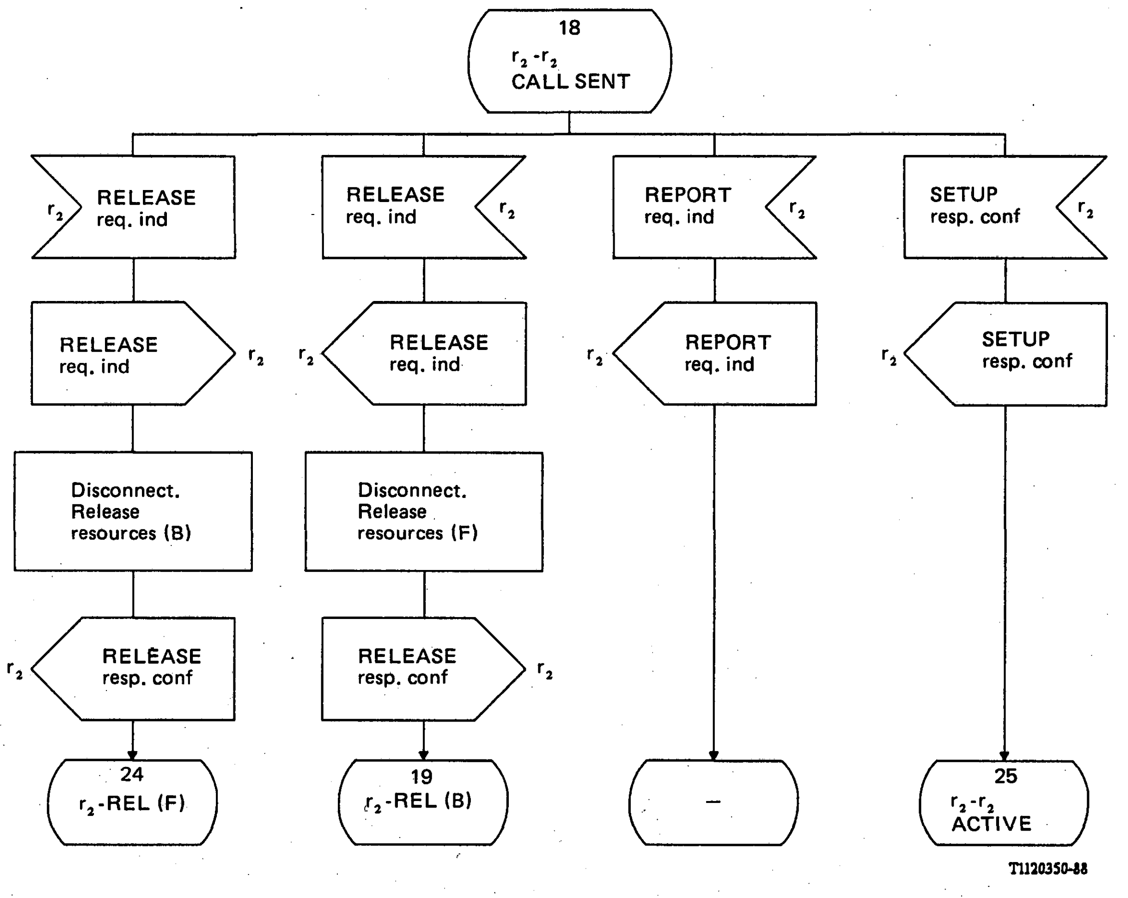


FIGURE 2-9/Q.71 (Sheet 11 of 19)

CC functional entity (r_2-r_2)

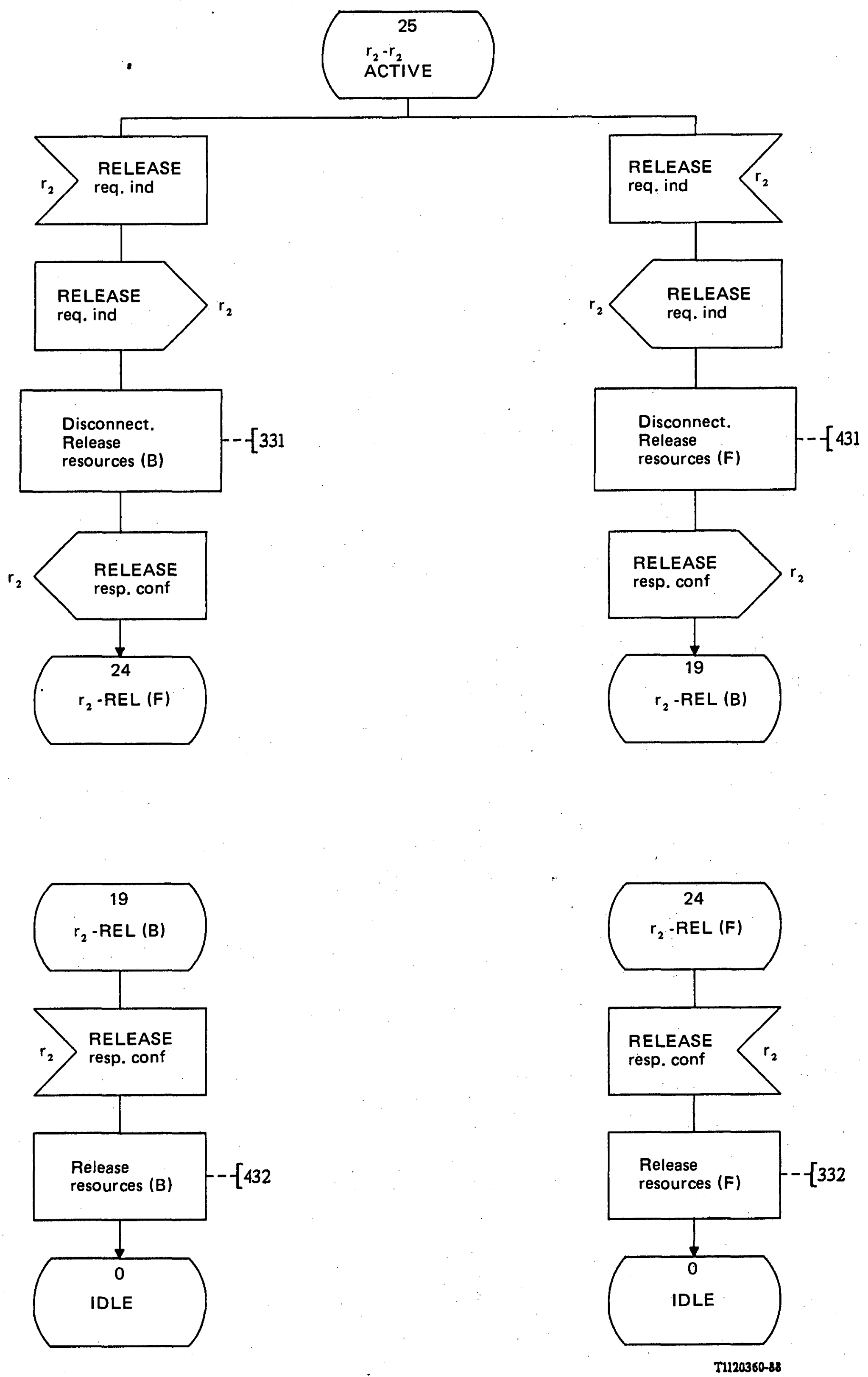
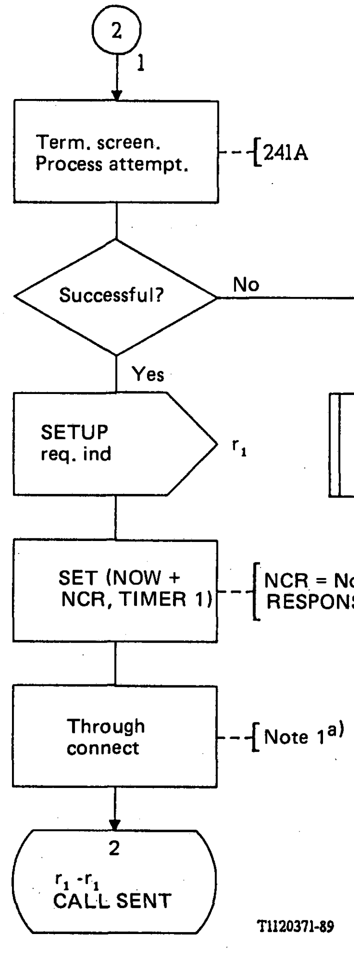


FIGURE 2-9/Q.71 (Sheet 12 of 19)

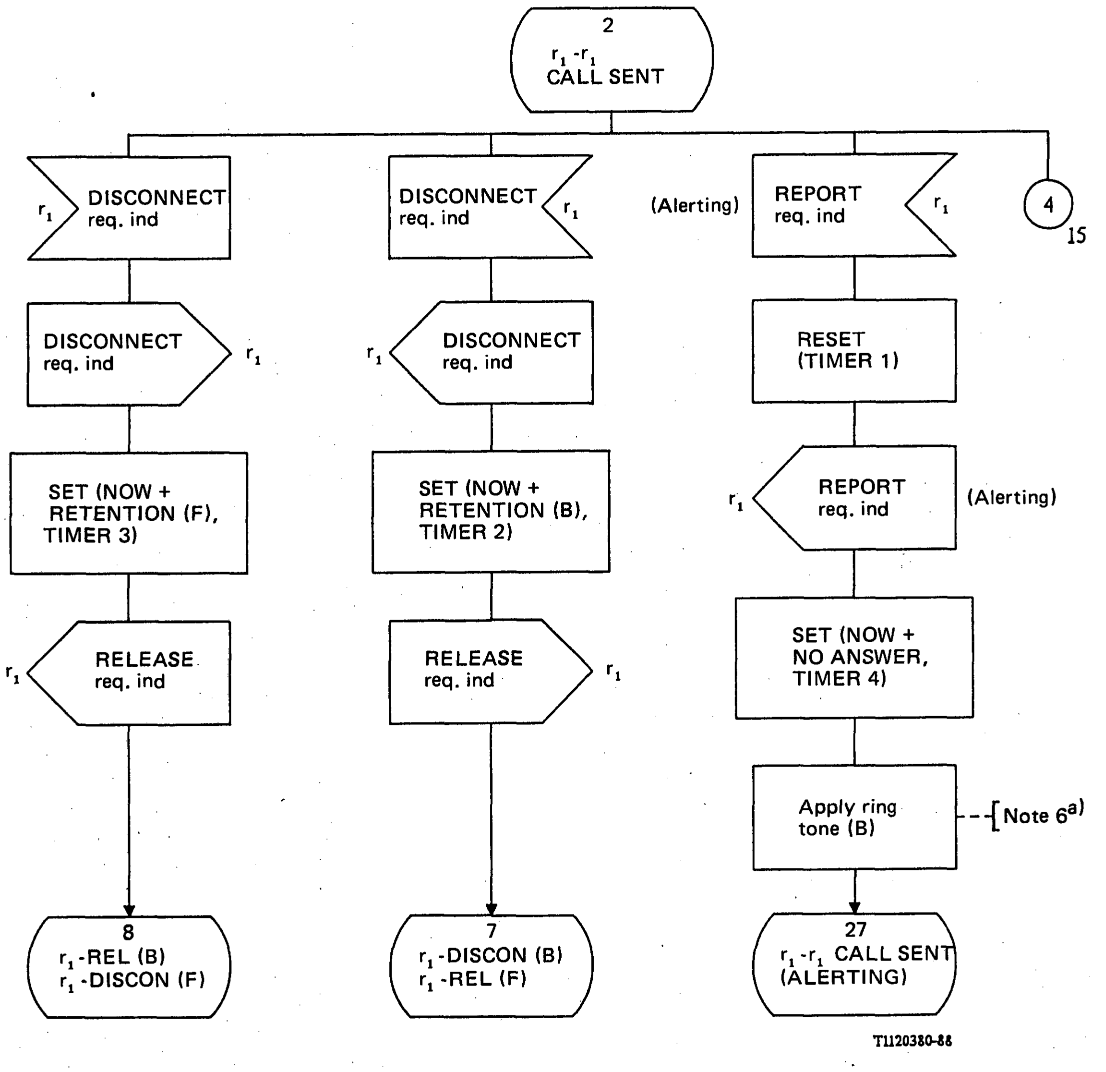
CC functional entity (r_2-r_2) *(cont.)*



[a)] The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 13 of 19)

CC functional entity (r_1-r_1)



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 14 of 19)

CC functional entity (r_1-r_1) *(cont.)*

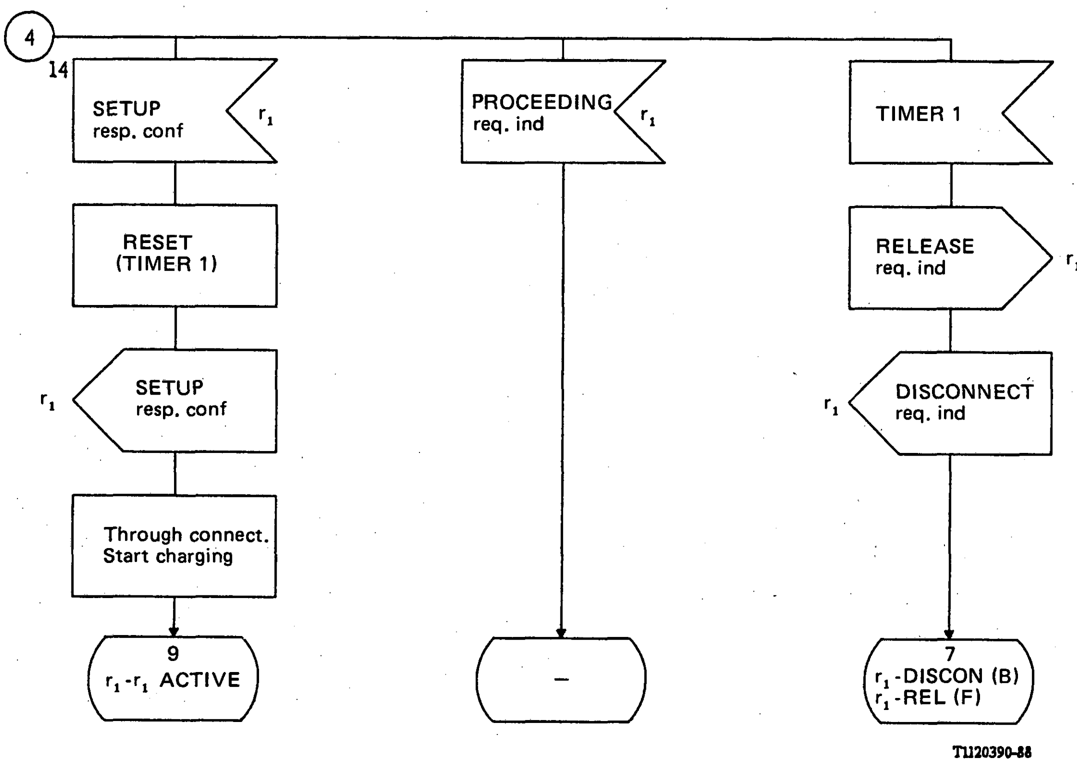
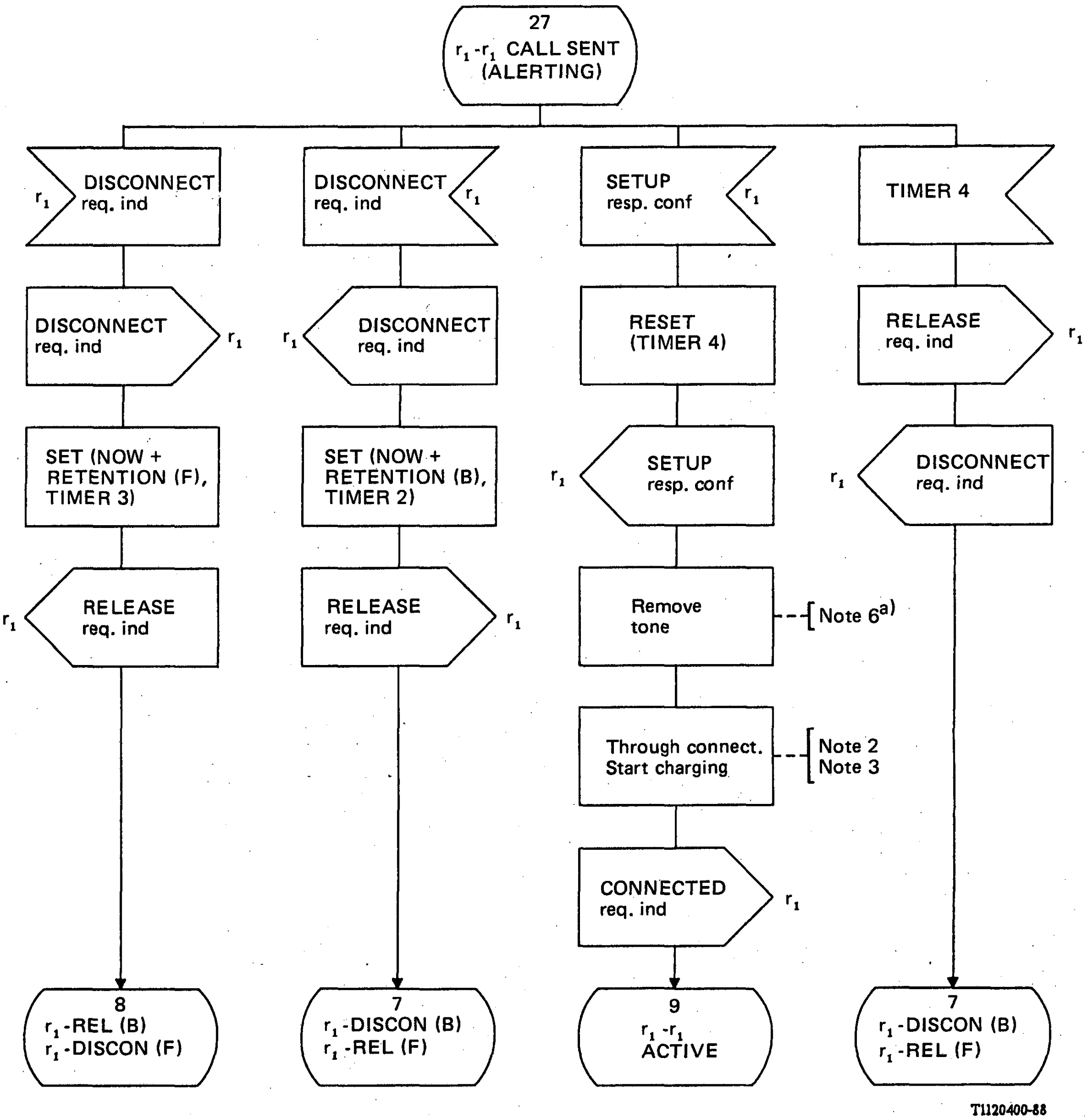


FIGURE 2-9/Q.71 (Sheet 15 of 19)

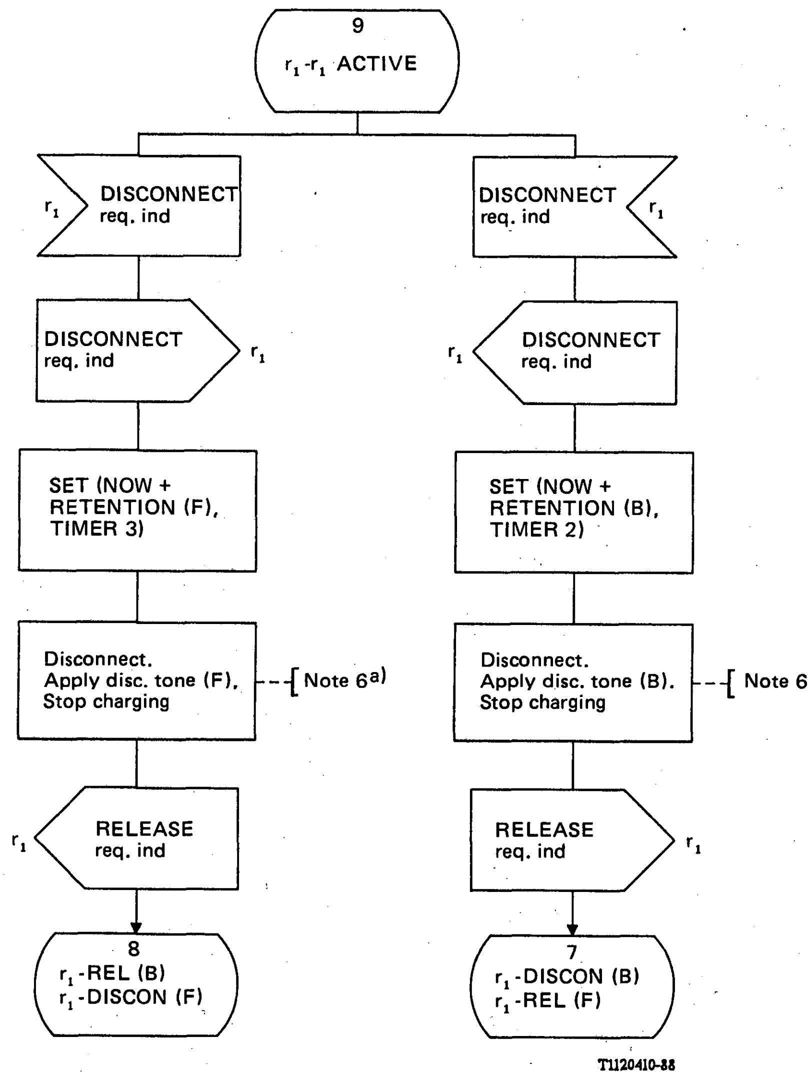
CC functional entity (r_1-r_1) *(cont.)*



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 16 of 19)

CC functional entity (r_1-r_1) *(cont.)*



a) The notes are found after Figure 2-6/Q.71.

FIGURE 2-9/Q.71 (Sheet 17 of 19)

CC functional entity (r_1-r_1) *(cont.)*

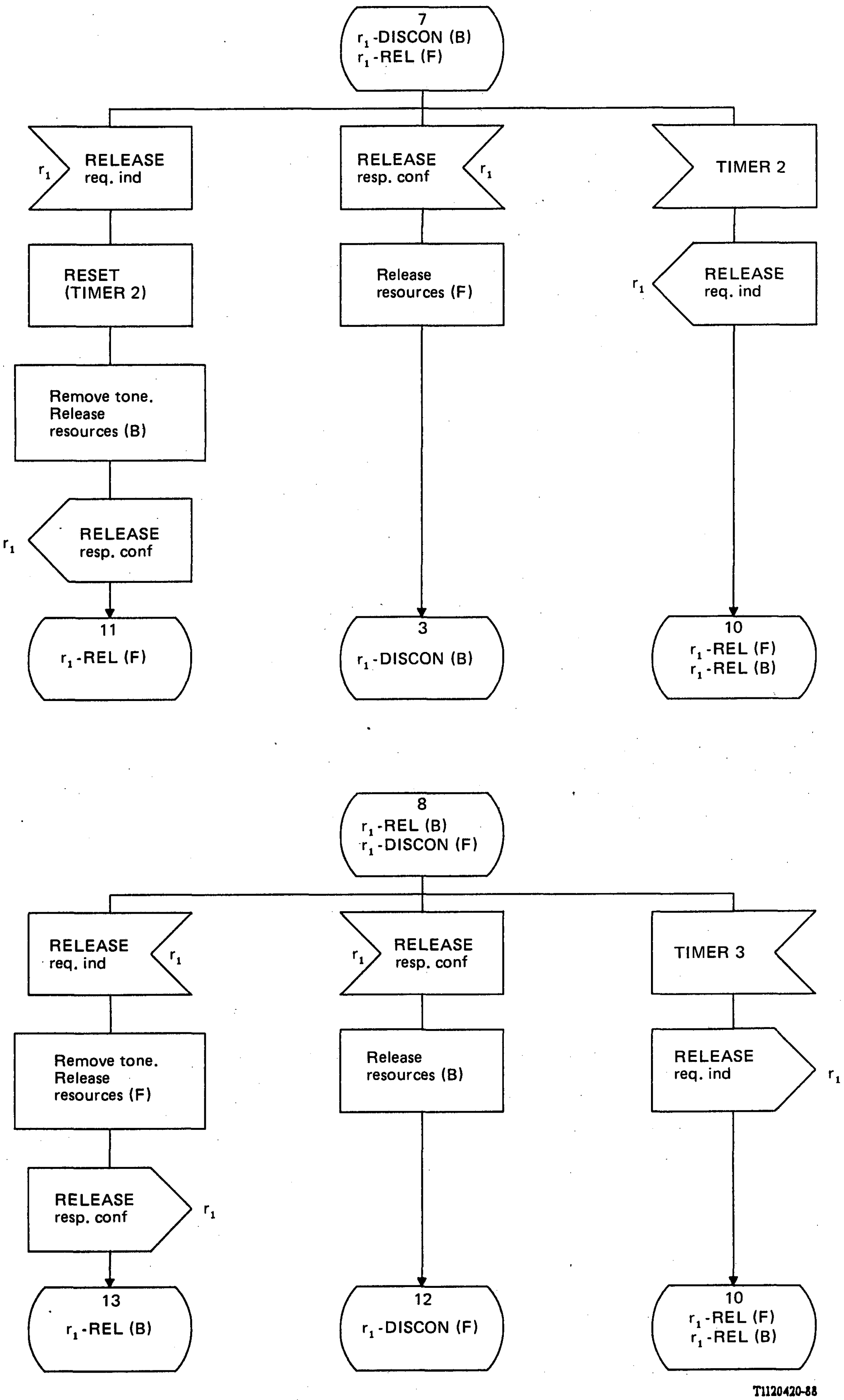


FIGURE 2-9/Q.71 (Sheet 18 of 19)

CC functional entity (r_1-r_1) *(cont.)*

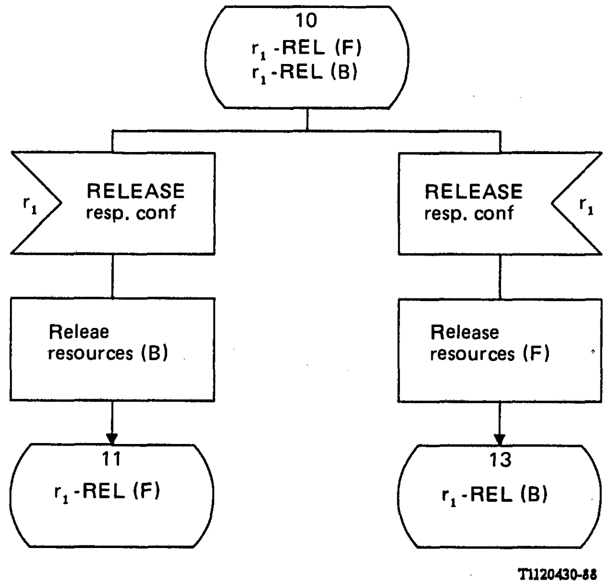


FIGURE 2-9/Q.71 (Sheet 19 of 19)

CC functional entity (r_1-r_1) *(cont.)*

2.4 *Functional entity actions*

Functional entities are assumed to have the basic capabilities required to properly perform their assigned functions in the ISDN (e.g. synchronism, signalling capabilities, etc.). In addition, the actions that occur at the functional entities during call processing stages for providing services described in this Recommendation have been given reference numbers and brief descriptions. The reference numbers are shown on the information flow diagrams and on SDL diagrams. The detailed list of descriptions of actions, together with references to the information flow diagrams, follow:

Reference number — *Actions*

211 *Process service request*

- Receive, analyze and acknowledge (as required) user's SETUP.req
- Interact with user to accumulate information
- Select network access resource
- Formulate call SETUP req.ind

Connect

- Establish connection as required

221 *Perform originating screening*

- Receive and react to SETUP req.ind from the CCA
- Analyze the service request
- Identify the calling terminal, terminal characteristics and user priority level, if any
- Verify the user's authorization, capabilities and availability of appropriate resources
- Establish call reference

Process attempt

- Reserve incoming resources
- Analyze information (called number, routing requirements, etc.)
- Determine connection elements type, outgoing resource (or virtual circuit), other resources (echo control, pads, etc.), charging treatment, network management controls in effect and any other elements involved in call setup.
- Select path through entity
- Reserve outgoing resource and any other required resources
- Formulate PROCEEDING req.ind and SETUP req.ind
- Start call control timing, as required

223 *Through connect*

- Establish through connection as required (see Note 1 to Figures 2-2/Q.71 through 2-9/Q.71)

224 *Through connect*

- Receive and react to SETUP resp.conf
- Establish through connection as required (see Note 2 to Figures 2-2/Q.71 through 2-9/Q.71)
- Formulate SETUP resp.conf

Start charging

- Start charging timing (see Note 3 to Figures 2-2/Q.71 through 2-9/Q.71)

225 *Start timer*

- Receive and react to REPORT req.ind
- Start user-answer timer
- Formulate REPORT (Alerting) req.ind

231 *Process attempt*

- Receive and analyze SETUP req.ind
- Establish call reference
- Reserve incoming resources
- Analyze called number, routing information, network management and/or priority information
- Determine connection elements type, outgoing resource, neet for other resources
- Select and reserve outgoing resource, other resources as required and path through the entity
- Formulate SETUP req.ind

232 *Through connect*

- Establish through connection as required (see Note 1 to Figures 2-2/Q.71 through 2-9/Q.71)

Reference number	*Actions*

241 *Perform terminating screening*

- Receive and analyze SETUP req.ind
- Reserve incoming resources
- Analyze service request, called number and any routing information
- Identify the called line(s), called terminal characteristics, any priorities and resources required
- Verify called user's authorization/capabilities
- Establish call reference

Process attempt

- Select and reserve outgoing resource, other resources and path through entity
- Formulate SETUP req.ind including requested service indication

243 *Through connect*

- Establish through connection, if required (see Note 1 to Figures 2-2/Q.71 through 2-9/Q.71)
- Start user-response timer

244 *Apply ringing tone*

- Receive and react to REPORT (Alerting) req.ind
- Apply ringing tone, if required, to resource toward calling user (see Note 6 to Figures 2-2/Q.71 through 2-9/Q.71)
- Formulate REPORT req.ind

245 *Remove ringing tone*

- Receive and react to SETUP resp.conf
- If applied, remove ringing tone
- Establish through connection if not done in Ref. 243 (see Note 2 to Figures 2-2/Q.71 through 2-9/Q.71)
- Formulate SETUP resp.conf

251 *Process attempt*

- Receive and react to SETUP req.ind
- Analyze service request
- Identify called user
- Verify compatibility of called user terminal
- Reserve resources
- Send SETUP.ind to called user
- Formulate REPORT (Alerting) req.ind

252 *Connect*

- Receive and react to CONNECTED req.ind
- Establish connection

311 *Disconnect*

- Recognize user DISCONNECT.req
- Formulate DISCONNECT req.ind
- Disconnect resources

Reference number	Actions

312 *Release resources*

- Receive and react to RELEASE req.ind
- Release resources – both directions

321 *Disconnect*

- Receive and react to DISCONNECT req.ind
- Disconnect resources
- Formulate RELEASE req.ind

Stop charging

- Stop charging per Note 3 to Figures 2-2/Q.71 through 2-9/Q.71

322 *Release resources*

- Receive and react to RELEASE resp.conf
- Release resources in direction of incoming RELEASE resp.conf

323 *Release resources*

- Receive and react to RELEASE resp.conf
- Release resources in direction of incoming RELEASE resp.conf

331 *Disconnect*

- Receive and react to RELEASE req.ind
- Disconnect resources
- Formulate RELEASE req.ind

Release resource

- Release resource in direction of incoming RELEASE req.ind
- Formulate RELEASE resp.conf

332 *Release resources*

- Receive and react to RELEASE resp.conf
- Release resources in direction of incoming RELEASE resp.conf

341 *Disconnect*

- Receive and react to RELEASE req.ind
- Disconnect resources
- Formulate DISCONNECT req.ind

Apply disconnect tone

- If used, apply disconnect tone to resource toward user (see Note 6 to Figures 2-2/Q.71 through 2-9/Q.71)

Release resources

- Release resources in direction of incoming RELEASE req.ind
- Formulate RELEASE resp.conf

342 *Remove tone*

- Receive and react to RELEASE req.ind
- If applied, remove tone

Release resources

- Release resources in direction of incoming RELEASE req.ind
- Formulate RELEASE resp.conf

351 *Process demand*

- Receive and react to DISCONNECT req.ind
- Initiate action to send DISCONNECT.ind to user

352 *Disconnect*

- Receive and react to DISCONNECT.req from user
- Disconnect resources

353 *Release resources*

- Receive and react to RELEASE resp.conf
- Release resources – both directions

411 *Process demand*

- Receive and react to DISCONNECT req.ind
- Initiate action to send DISCONNECT.ind to user

412 *Disconnect*

- Receive and react to DISCONNECT.req from user
- Disconnect resources
- Formulate RELEASE req.ind

413 *Release resources*

- Receive and react to RELEASE resp.conf
- Release resources – both directions

421 *Disconnect*

- Receive and react to RELEASE req.ind
- Disconnect resources
- Formulate DISCONNECT req.ind

Stop charging

- Stop charging per Note 3 to Figures 2-2/Q.71 through 2-9/Q.71

Apply disconnect tone

- If used, apply disconnect tone to resource toward user (see Note 6 to Figures 2-2/Q.71 through 2-9/Q.71)

Release resources

- Release resource in direction of incoming RELEASE req.ind
- Formulate RELEASE resp.conf

422 *Remove tone*

- Receive and react to RELEASE req.ind
- If applied, remove tone

Reference number	Actions

Release resources

– Release resources in direction of incoming RELEASE req.ind

– Formulate RELEASE resp.conf

431 *Disconnect*

– Receive and react to RELEASE req.ind

– Disconnect resources

– Formulate RELEASE req.ind

Release resources

– Release resources in direction of incoming RELEASE req.ind

– Formulate RELEASE resp.conf

432 *Release resource*

– Receive and react to RELEASE resp.conf

– Release resource in direction of incoming RELEASE resp.conf

441 *Disconnect*

– Receive and react to DISCONNECT req.ind

– Disconnect resources

– Formulate RELEASE req.ind

442 *Release resource*

– Receive and react to RELEASE resp.conf

– Release resource in direction of incoming RELEASE resp.conf

443 *Release resource*

– Receive and react to RELEASE resp.conf

– Release resource in direction of incoming RELEASE resp.conf

451 *Disconnect*

– Recognize user DISCONNECT.req

– Formulate DISCONNECT req.ind

– Disconnect resources

452 *Release resources*

– Receive and react to RELEASE req.ind

– Release resources – both directions

– Formulate RELEASE resp.conf

2.5 *Additional FEAs required for digit-by-digit call setup cases:*

Under study.

2.6 *Allocation of functions to physical entities*

The functional model relates to functions involved in handling a single call or call attempt. The scenarios in Table 2-2/Q.71 identify the roles a physical device (e.g., exchange, NT2, terminal equipment, etc.) may play in handling that call or call attempt. A specific physical device may fulfill different roles in different scenarios, e.g., a local exchange may provide both CCA and CC capabilities. (See scenario D.)

TABLE 2-2/Q.71

Physical allocation of functions

Scenario \ Functional entities	CCA	r_1 CC	r_2 CC	r_2 CC	r_1 CCA
A – ISDN public network	TE	LE	TR	LE	TE
B – NT2 access to public ISDN (Note 2)	TE / NT2	NT2 / LE	TR	LE	TE
C – Single node call	TE	LE		LE	TE
D – Stimulus access to ISDN	LE	LE	TR	LE	TE
E – Stimulus egress from ISDN	TE	LE	TR	LE	LE
F – Stimulus access and egress to/from ISDN	LE	LE	TR	LE	LE
G – Stimulus access via private network	NT2	LE	TR	LE	LE

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Note 1 – Entities connected by dashed line are the same physical entity.

TE	Terminal equipment	LE	Local exchange
NT2	Network termination 2	TR	Transit exchange

Note 2 – In scenario B, the NT2 provides the CC function of the TE and appears to be a CCA to the LE (e.g., when the NT2 is a PABX).

3 In-call modification procedures for alternate speech/unrestricted information transfer service

Under study.

SECTION 3

SUPPLEMENTARY SERVICES

Recommendation Q.80

INTRODUCTION TO STAGE 2 SERVICE DESCRIPTIONS FOR SUPPLEMENTARY SERVICES

1 Introduction

The purpose of this Recommendation is to provide an introduction to the Stage 2 service descriptions for supplementary services, given in Recommendations Q.81-87.

2 Cross-references

The work in Recommendations Q.81-87 is based on the Stage 1 service descriptions given in the I.251-257-Series Recommendations (see Annex A). They are coordinated with the Stage 2 service description for basic calls, given in Recommendation Q.71, and were developed according to the methodology given in Recommendation Q.65.

3 Relationships among supplementary services

3.1 *Call diversion services*

Recommendation I.252, §§ 2-5, defines a set of supplementary services called "Call Diversion Services". This set consists of the Call Forwarding supplementary services and the Call Deflection supplementary service. This section describes how these services relate to each other and describes the different network routing techniques which may be used to provide these services. It begins with the latter topic.

3.1.1 *Network Routing Techniques*

Figure 1/Q.80 gives an overview of the Call Diversion services and illustrates the network routing techniques that may be used for these services.

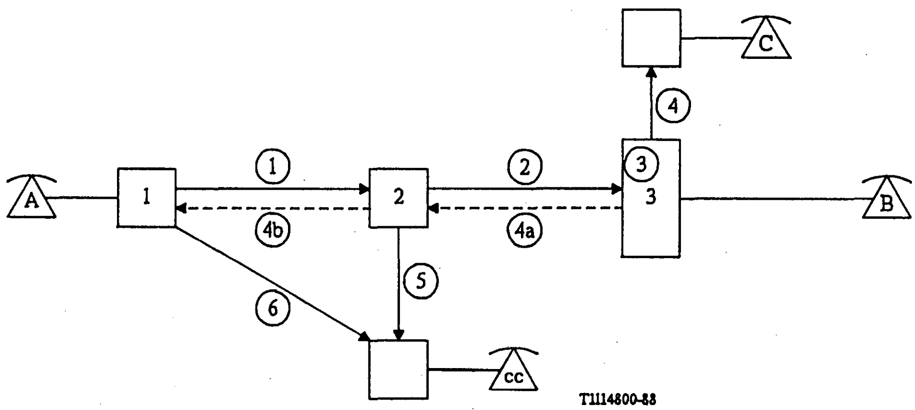
Referring to Figure 1/Q.80, a Call Diversion occurs if User A calls User B who has subscribed to one of the Call Diversion services, and the call processing for that service (described below) determines that the call should be sent to User C.

If User C is relatively close to User B, then it would be reasonable for User B's serving switch to simply switch the call to User C (i.e. act like a transit switch as if User A had called User C directly). This technique is called "forward switching".

If User C is not close to User B (e.g. User CC in Figure 1/Q.80), then it might be reasonable for User B's serving switch to ask that a previous switch in the call path (e.g. Switch 2) to re-route the call. This is called "(partial) rerouting". If User B's serving switch asks that User A's switch (i.e. Switch 1) re-route the call, this is called "(full) rerouting".

Note 1 – The choice of network routing technique is the prerogative of each network provider and may be determined by factors other that geographical distance.

Note 2 – The analogy to a transit switch is not totaly correct. In general, User A will be charged for the connection to User B, and User B will be charged for the connection to User C.



1, 2 Original call (A → B)
3 Call processing
4 Forward switching
4a, 5 (Partial) rerouting
4a, 4b, 6 (Full) rerouting

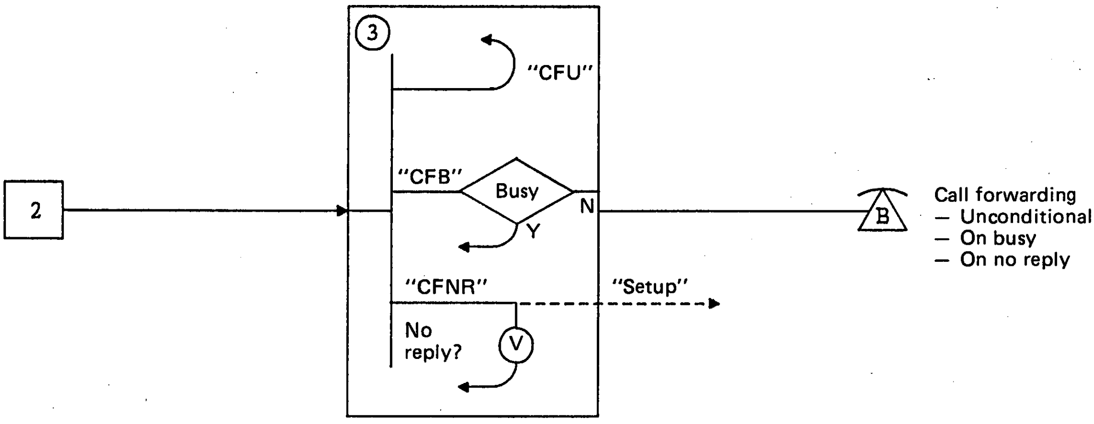
FIGURE 1/Q.80

Network routing techniques

3.1.2 *Call processing*

In Call Forwarding, the decision to divert the call is made by the serving switch, either because it has been instructed (by a previous interaction with the served user) to forward all calls, or to forward any calls that meet busy, or those that meet No Reply. (See Figure 2/Q.80). (Details of the call processing for Call Forwarding are given in Recommendations Q.82, § 2, § 3 and § 4).

In Call Deflection, the decision to divert the call is made by the served user, upon receipt of an incoming call indication. (*Note* – Care should be taken not to confuse Call Deflection with a possible architecture for Call Forwarding which places the "forwarding detection" entity in the served user's equipment. In Call Deflection, the actual user is involved in deciding whether to divert the call). (Details of the call processing for Call Diversion are expected to be provided early in the next study period.)



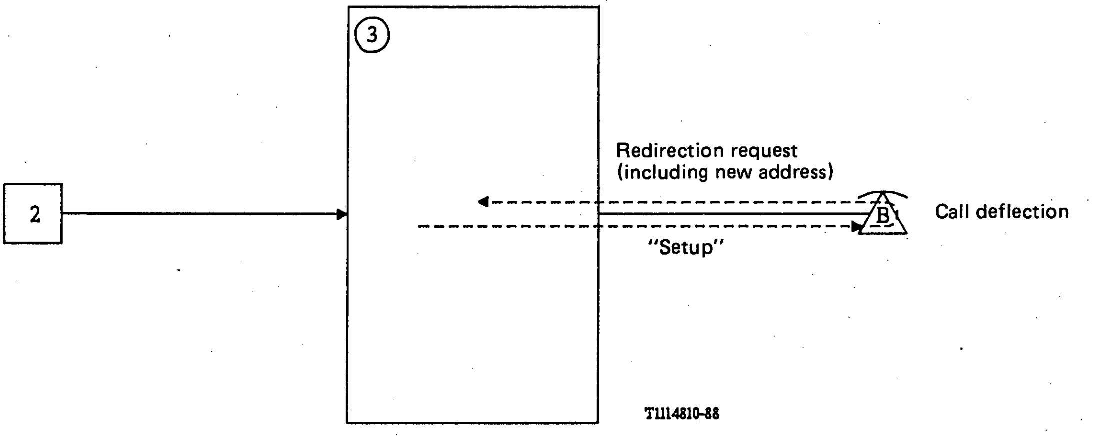


FIGURE 2/Q.80

Call processing

ANNEX A

(to Recommendation Q.80)

Cross-reference list of Stage 1 and Stage 2 Recommendations on supplementary services[1)]

Stage 2		*Based on Stage 1 given in:*
Q.80	*Introduction to Stage 2 service description for supplementary services*	
Q.81	*Number identification supplementary services*	*I.251*
§ 1	Direct dialling in	I.251, § 1
(§ 2)	Multiple subscriber number	I.251, § 2
§ 3	CLIP	I.251, § 3
§ 4	CLIR	I.251, § 4
§ 5	COLP	I.251, § 5
§ 6	COLR	I.251, § 6
(§ 7)	Malicious call ID	(I.251, § 7)
(§ 8)	Sub-addressing	(I.251, § 8)

1) Parentheses "( )" around a § of a Recommendation number implies that the § may not appear in the 1988 CCITT Recommendations.

Stage 2		Based on Stage 1 given in:
Q.82	*Call offering supplementary services*	*I.252*
(§ 1)	Call transfer	I.252, § 1
§ 2	Call forwarding busy	I.252, § 2
§ 2	Call forwarding no reply	I.252, § 3
§ 2	Call forwarding unconditional	I.252, § 4
(§ 3)	Call deflection	(I.252, § 5)
§ 4	Line hunting	I.252, § 6
Q.83	*Call completion supplementary services*	*I.253*
§ 1	Call waiting	I.253, § 1
§ 2	Call hold	I.253, § 2
(§ 3)	CCBS	(I.253, § 3)
(*Q.84*)	*Multiparty supplementary services*	*I.254*
(§ 1)	Conference calling	I.254, § 1
(§ 2)	Three-party	I.254, § 2
Q.85	*"Community of interest" supplementary services*	*I.255*
§ 1	Closed user group	I.255, § 1
(§ 2)	ISDN networking services	(I.255, § 2)
	Private numbering plan	
Q.86	*Charging supplementary services*	*I.256*
§ 1	Credit card calling	I.256, § 1
§ 2	Advice of charge	I.256, § 2
(§ 3)	Reverse charging	(I.256, § 3)
Q.87	*Additional information transfer supplementary services*	*I.257*
§ 1	User-to-user signalling	I.257, § 1

Recommendation Q.81

NUMBER IDENTIFICATION SUPPLEMENTARY SERVICES

1 Direct dialling in (DDI)

1.1 *Definition*

direct dialling in (DDI) enables a user to call directly another user on a ISPBX or other private system without attendant intervention.

1.2 *Description*

1.2.1 *General description*

A part of the ISDN number, which is significant to the user, is passed to the user. This supplementary service is based on the use of the ISDN number and does not include sub-addressing.

Note 1 – A similar method to select a terminal on a passive bus is described in the Stage 1 description of the supplementary service MSN.

Note 2 – The caller may or may not find the ISDN number in the public directory.

Recommendation E.164 provides the flexibility for Administrations to use national numbering plans of fixed or variable number lengths. This flexibility also applies to DDI numbers, i.e. even within a given PABX DDI numbers of different lengths may appear.

The number of digits used by a PABX supporting the DDI feature is not necessarily known by their serving local exchange nor by any other entity of the public network.

The DDI number (fixed or variable length) is sent en-bloc or by over-lap sending from the exchange to the PABX or other private system which finally and automatically establishes a connection to the destination without the assistance of an operator.

1.2.2 *Qualifications on the applicability to telecommunication services*

No restrictions.

1.3 *Derivation of a functional model* (Step 1)

1.3.1 *Functional model description*

Two functional models are used to show the different requirements of DDI.

Functional model 1 represents the situation where DDI is used to address a terminal on a single ISPBX connected to the public network.

Functional model 2 describes the situation where DDI is used to address a terminal within a private network consisting of several PBXs.

Although functional model 1 can be seen as a special application of model 2 it is preferred to describe the two models independently to show different situations more clearly.

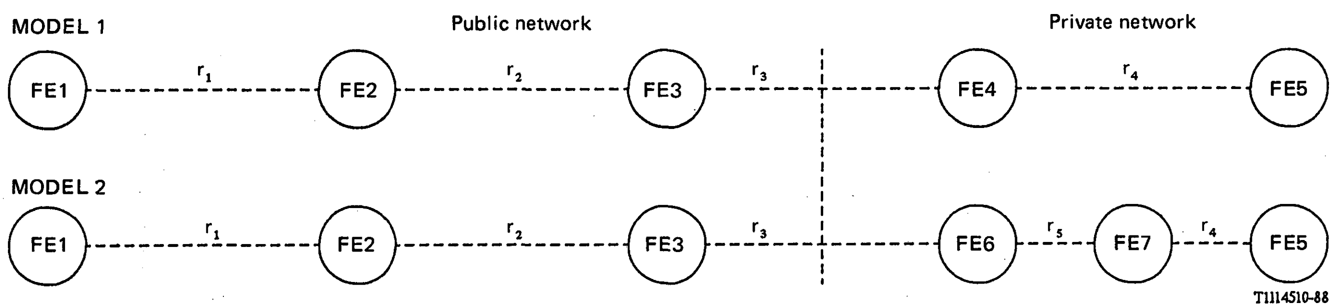


FIGURE 1-1/Q.81

Two functional models for DDI

1.3.2 *Description of the functional entities*

FE1: Call control agent of the calling user

FE2: Call control entity of the calling user

FE3: DDI Access control to the private network (located in the public network)

FE4: DDI Service control for the called user and access control in the private network

FE5: Call control agent of the called user

FE6: DDI Access control in the private network

FE7: DDI Service control in the private network for the called user.

1.3.3 *Relationship to basic service*

The call setup procedures in the public network are mainly the same as for the basic service.

FE1 and FE2 therefore have the same functionality as CCA and CC. r_1 and r_2 correspond to r_1 and r_2 in the basic service.

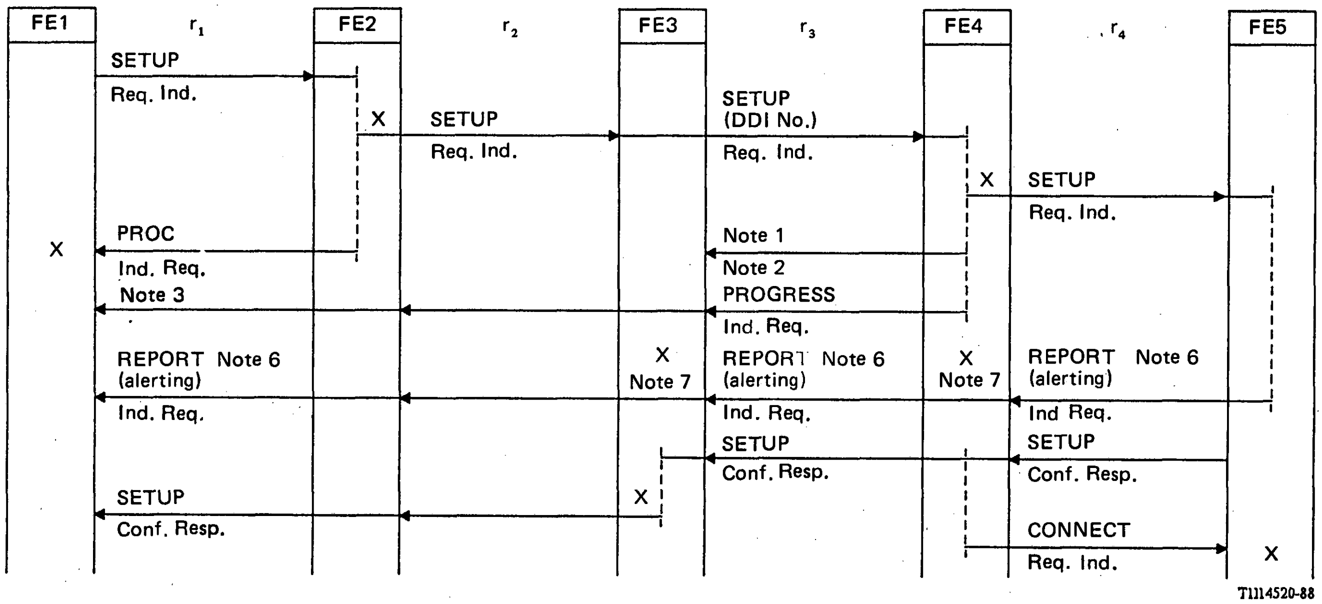
FE3 includes specific functionality of DDI in the relationship r_3.

FE4, FE6 and FE7 are entities in a private network that are only specified here as far as they are influenced by r_3. The same applies for r_4 and r_5.

1.4 *Information flow diagrams* (Step 2)

1.4.1 *Diagrams*

The diagrams for model 1 are shown in Figure 1-2/Q.81.



X Through connection of the switch

FIGURE 1-2/Q.81

En bloc sending to an ISDN terminal on a PABX

1.4.1.1 *Diagrams for model 2*

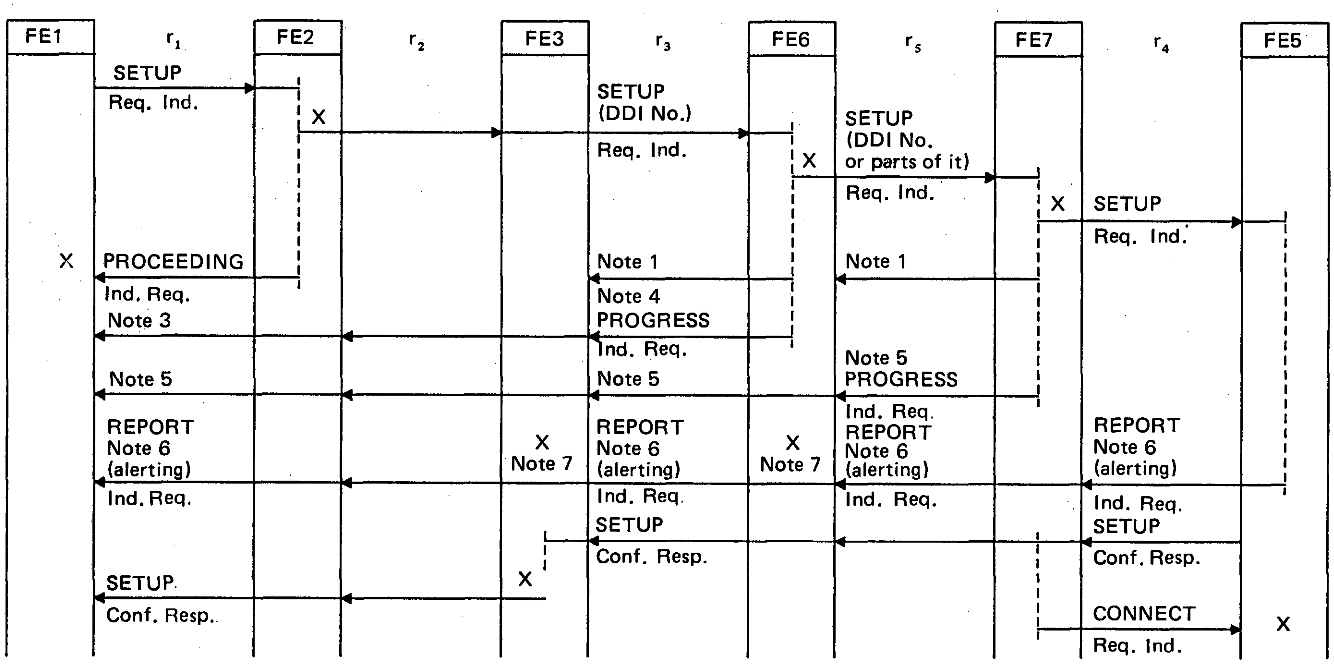


FIGURE 1-3/Q.81

En bloc sending to a private network

Notes to Figures 1-2/Q.81 and 1-3/Q.81

Note 1 – Optional signalling information which may be used to acknowledge seizure and/or for B channel negotiation.

Nota 2 – Optional signalling information which may be used to indicate complete address information.

Note 3 – If not already sent, this signalling information may be sent to the originating user to indicate complete address information.

Note 4 – If the PABX recognizes the receipt of complete address information, this signalling information may be sent.

Note 5 – On receipt of complete address information, this signalling information may be generated by the sub-PABX. If already sent by the PABX, it will not be transferred to the originating user.

Note 6 – Instead of ALTERTING, a CONNECT signalling information may be sent directly in case of an automatically responding terminal.

Note 7 – Optional early switch through backward transmission path.

1.4.2 *Definitions*

The definitions for ACK, ADDRESS INFO, PROCEEDING, REPORT and SETUP are the same as for the basic service.

1.4.2.1 *Meaning of [PROGRESS]*

PROGRESS can be sent from the entity serving the called user to indicate that sufficient ADDRESS INFO was received to address a user terminal or access line. It is an unconfirmed information flow.

1.4.2.2 *Information content of [PROGRESS]*

B-channel information in r_3 if not yet included in a previous sent information element.

1.5 *SDL diagrams of functional entities* (Step 3)

SDL diagrams are provided for FE3 covering the aspects of both functional models and giving the relation between r_2 and r_3. FE1 and FE2 are, as said, already covered by the basic procedures so that all aspects of DDI, that are relevant for the public network, are covered in these diagrams.

In the SDL diagrams only those procedures are described that deviate from the basic procedures.

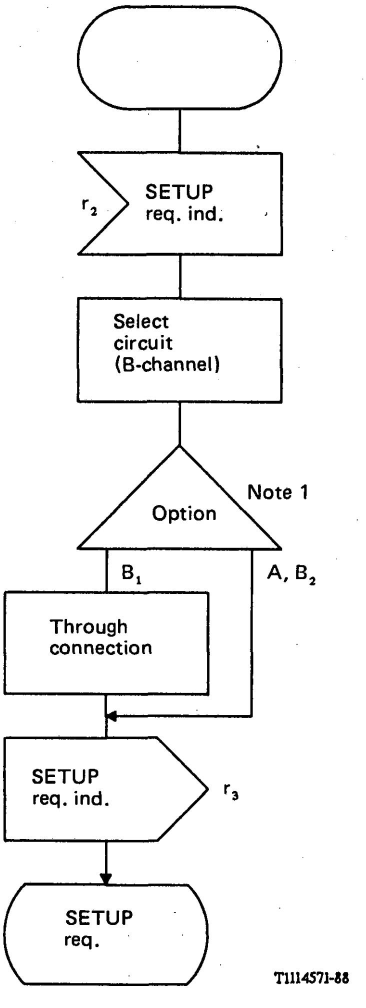


FIGURE 1-4/Q.81 (Sheet 1 of 3)

DDI functions in FE3

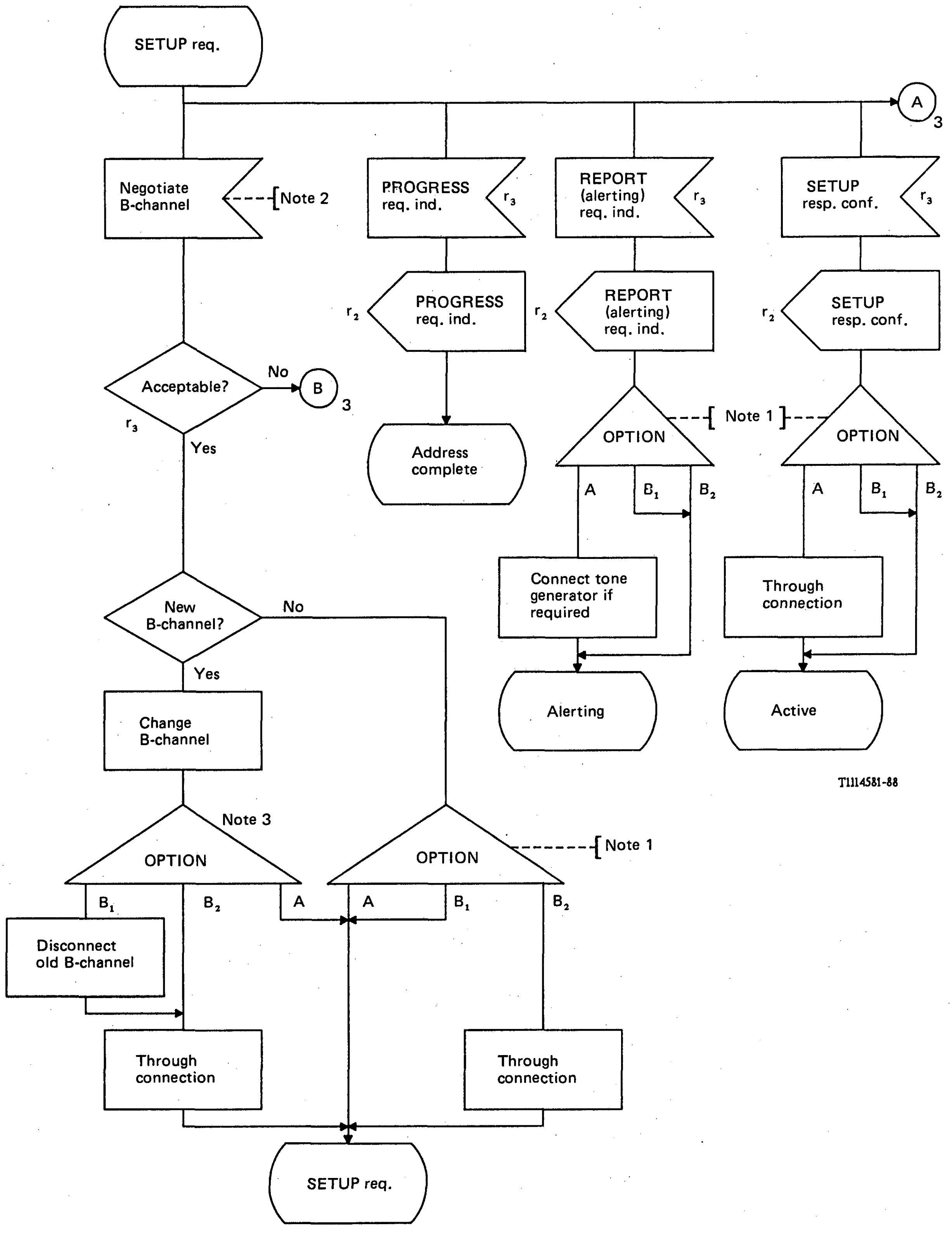


FIGURE 1-4/Q.81 (Sheet 2 of 3)

DDI functions in FE3

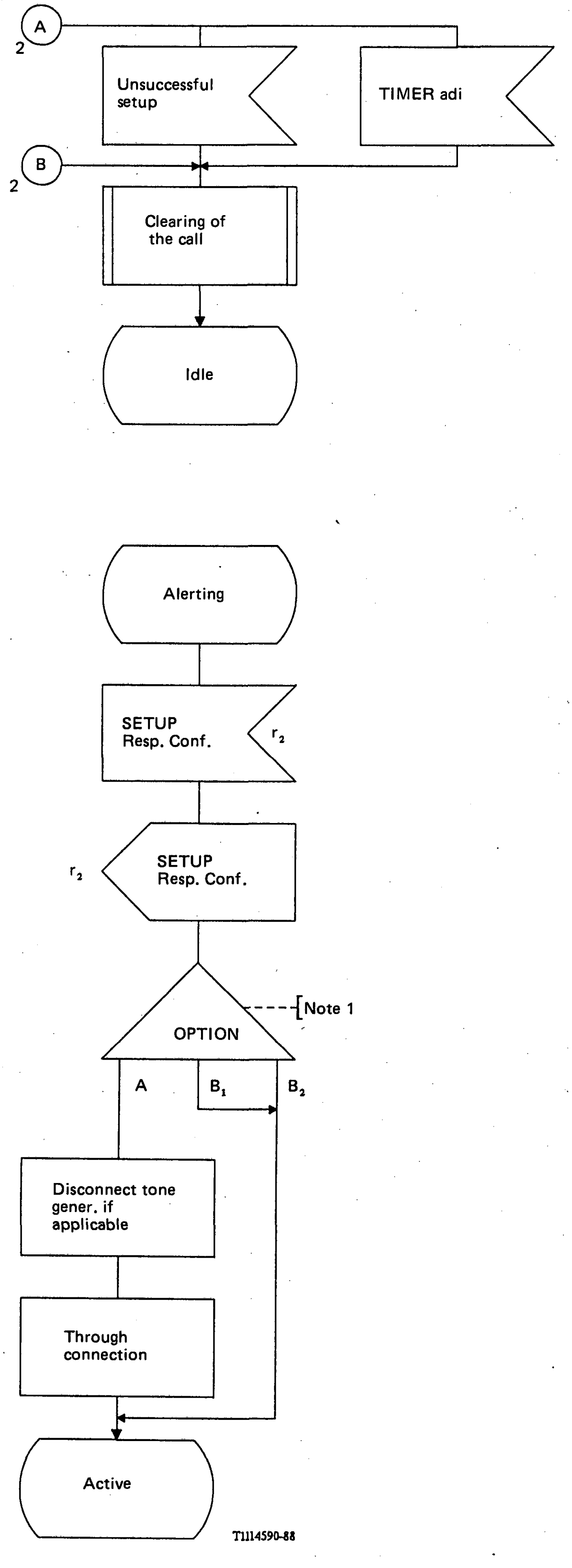


FIGURE 1-4/Q.81 (Sheet 3 of 3)

DDI functions in FE3

Notes to Figure 1-4/Q.81 (sheets 1 to 3)

Note 1 – Through connection is generally only done when the setup confirmation is received from the called user. This is described in option A.

In specific national applications through connection may already be done in an earlier point in time. This is covered in options B1 or B2 and requires further considerations.

Note 2 – Negotiation of a B channel is not necessarily an independent information flow. It can be combined with the first backward information flow that is required for call control. This information flow can be PROGRESS, REPORT (alerting) or SETUP.

1.6 *Functional entity actions* (Step 4)

1.6.1 *Specific actions in FE3*

1.6.1.1 *Channel selection*

Negotiation for the selection of a B-channel will be permitted between the network and the PABX. The selection procedure is as follows:

a) in the SETUP Request, the network will indicate one of the following:
   1) channel is indicated, no acceptable alternative; or
   2) channel is indicated, any alternative is acceptable; or
   3) any channel is acceptable.

b) In cases 1) and 2), if the indicated channel is acceptable and available, the PABX selects it for the call.

   In case 2), if the PABX cannot grant the indicated channel, it selects any other available B-channel and identifies that channel in the first information sent in response to the SETUP Indication.

   In case 3), the PABX selects any available B-channel and identifies that channel in the first information sent in response to the SETUP Indication.

c) If no channel identification information element is present in the first response, the B-channel indicated in the SETUP Request will be assumed.

   If the B-channel indicated in the first response is unacceptable to the network, it will clear the call.

d) When a B-channel has been selected by the PABX that channel may be connected by the PABX.

e) In case 1), if the indicated B-channel is not available, or in cases 2), 3), if no B-channel is available and the PABX cannot proceed with the offered call, the PABX clears the call.

The preferred solution for B-channel selection is alternative 1): B-channel is selected by exchange B.

1.6.1.2 *Through connection*

The general time for through connection in FE3 is, when setup is confirmed by the called user. This prevents fraudulent use of the connection without charging.

As a consequence of this procedure all tones and announcements during call setup have to be generated in the public network.

As an alternative some network providers may allow for an early through connection.

1.6.2 *Specific actions in FE6 and FE7*

1.6.2.1 *Through connection*

In case of an ISDN terminal or sub-PABX connected to the PABX, the through connection of the B-channel in the PABX is done with the sending of SETUP to the terminal/sub-PABX. In the sub-PABX the through connection is done with the sending of SETUP to the terminal. In the terminal the through connection is done at the receipt of CONNECT ACKNOWLEDGE from the PABX/sub-PABX.

In case of an analogue terminal connected to the ISDN PABX/sub-PABX the through connection of the B-channel in the terminal is done with the sending of CONNECT to the ISDN PABX/sub-PABX. In the ISDN PABX/sub-PABX the through connection is done at the receipt of SETUP Confirmation from the terminal. Note that this case is for further study.

1.7 *Allocation of functional entities to physical locations*

The mapping between functional entities and their possible physical locations is given in the following matrix.

Scenario \ Functional entities	FE1	FE2	FE3	FE4	FE5	FE6	FE7
Call to ISPBX	TE	LE	LE	NT2	TE	–	–
Call to private network	TE	LE	LE	–	TE	NT2	NT2

2 Multiple subscriber number

Under study.

3 Calling Line Identification Presentation (CLIP)

3.1 *General*

calling line identification presentation (CLIP) is a supplementary service offered to the called party which provides the calling party's ISDN number, possibly with sub-address information, to the called party.

3.2 *Description*

3.2.1 *General description*

When CLIP is applicable and activated, the network provides the called party with the number of the calling party at call setup on all incoming calls.

The calling party number may be accompanied by a sub-address.

The network should be capable of transmitting at least 15 digits (maximum length of an ISDN number). In addition, if provided by the calling party, the network should be capable of transmitting a sub-address. The length of the sub-address is defined in the relevant Recommendation.

The network to which the calling party belongs should attempt to ensure that enough digits are transmitted to enable the called party to return the call, based on the calling number presented.

3.2.2 *Specific terminology*

None identified.

3.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

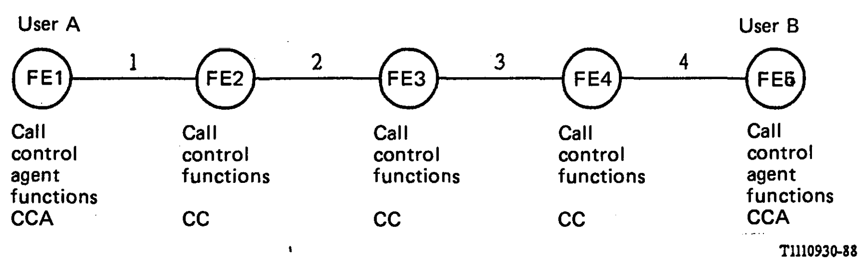
It is to be noted that in the Telematic services, an exchange of terminal identification (TID) occurs at a higher layer subsequent to a successful call establishment.

For Telematic services this supplementary service shall consist only of the access number of the calling party and this shall be provided by the network. For other non-voice services this supplementary service is for further study. The presentation of the CLI by Telematic terminals and by other non-voice terminals is for further study.

3.3 *Derivation of a functional model*

This part of the description is common with the service calling line identification restriction since this service has some impact on calling line identification presentation.

The model used for illustrating the calling line identification services procedures is given below:



3.4 *Information flow diagrams*

The calling line identity information needed to provide the calling line identification services is normally carried in the messages used to establish the call.

The calling line identity will be delivered to the called party by his local exchange and/or ISPBX during the call establishment if the calling line identity is available and presentation is allowed.

If calling line identity is not available in the destination local or transit exchange at call request, the exchange may optionally request the calling line identity from the originating local exchange.

The specifications of functions for Calling Line Identification include adaptions for private network implementations (in a full private network environment) and mobile network implementations. Private Network/ Public ISDN interworking situations are for further study.

The calling line identity is made up of a number of information units:

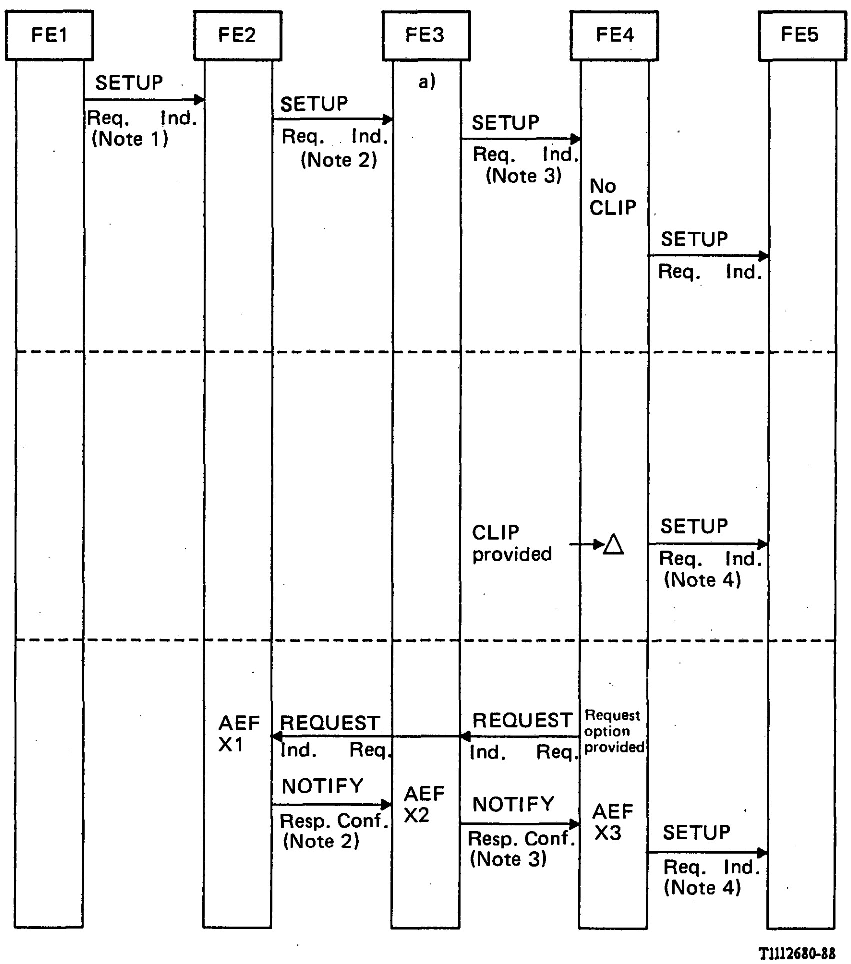
- the subscriber's national (ISDN) number, or
- private network (ISDN) number, or
- international ISDN number and possibly other indications only for international calls, or
- partial number (optional) (Note 1);
- optionally, sub-address information, if explicitly provided by the calling user;
- numbering plan identification;
- type of address.

In addition to the calling identity the subscriber may be given the following information:

- Presentation indicator (PI) showing:
  a) presentation allowed, or
  b) presentation restricted, or
  c) number not available due to interworking (Note 2)
- Screening indicator (SI) showing:
  a) user provided, verified and passed, or
  b) network provided

Note 1 – For international calls the partial number may be the international prefix and the country code. For national calls the partial number may be the trunk prefix and the area code.

Note 2 – The technical solutions for the various interworking arrangements with dedicated networks have not been detailed in this document.



a) In case of a national call this setup is sent to a national trunk exchange or LE-B; FE3 is not needed.

FIGURE 3-1/Q.81

Calling line identification presentation (CLIP) – Stage 2
Information flows for combined public and private configurations

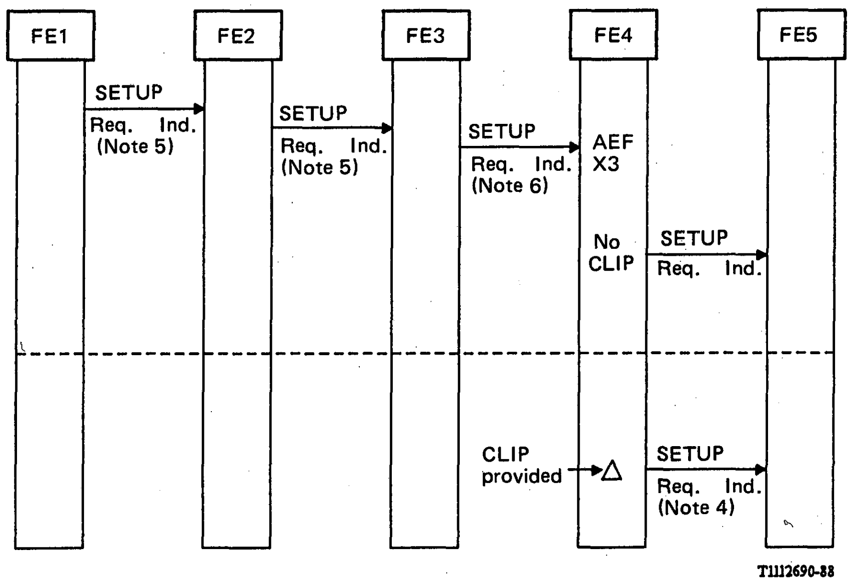


FIGURE 3-2/Q.81

Calling line identification presentation (CLIP) – Stage 2
Private network

Notes to Figures 3-1/Q.8 and 3-2/Q.81

Note 1 – The information flow contains:

- no information (should not be permitted for DDI-ISPBX in some networks);
- part of the subscriber number (extension number, selection on a passive bus);
- subscriber number;
- national number indicators;
- international number (for mobile application);
- numbering plan identification;
- type of address;
- presentation indicator (optional). Optional: sub-address.

Note 2 – The information flow contains:

- national number;
- if present: sub-address;
- international number;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided, verified and passed);
- type of address;
- numbering plan identification.

Note 3 – The information flow contains:

- international number;
- no information (e.g. presentation restriction)
- if present: sub-address;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided, verified and passed);
- type of address;
- numbering plan identification.

Note 4 – The information flow contains:

- no information;
- national number (for national calls);
- international number (for international calls);
- if present: sub-address;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided, verified and passed);
- type of address;
- numbering plan identification.

Note 5 – The information flow contains:

- no information;
- part of the extension number (e.g. selection on a passive bus);
- extension number or private network number;
- optional: sub-address;
- type of address;
- numbering plan identification.

Note 6 – The information flow contains:

- extension number or private network number;
- if present: sub-address;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided, verified and passed);
- type of address;
- numbering plan identification.

3.5 *SDL diagrams for functional entities*

FE2 – Determination of the calling line identity – originating side

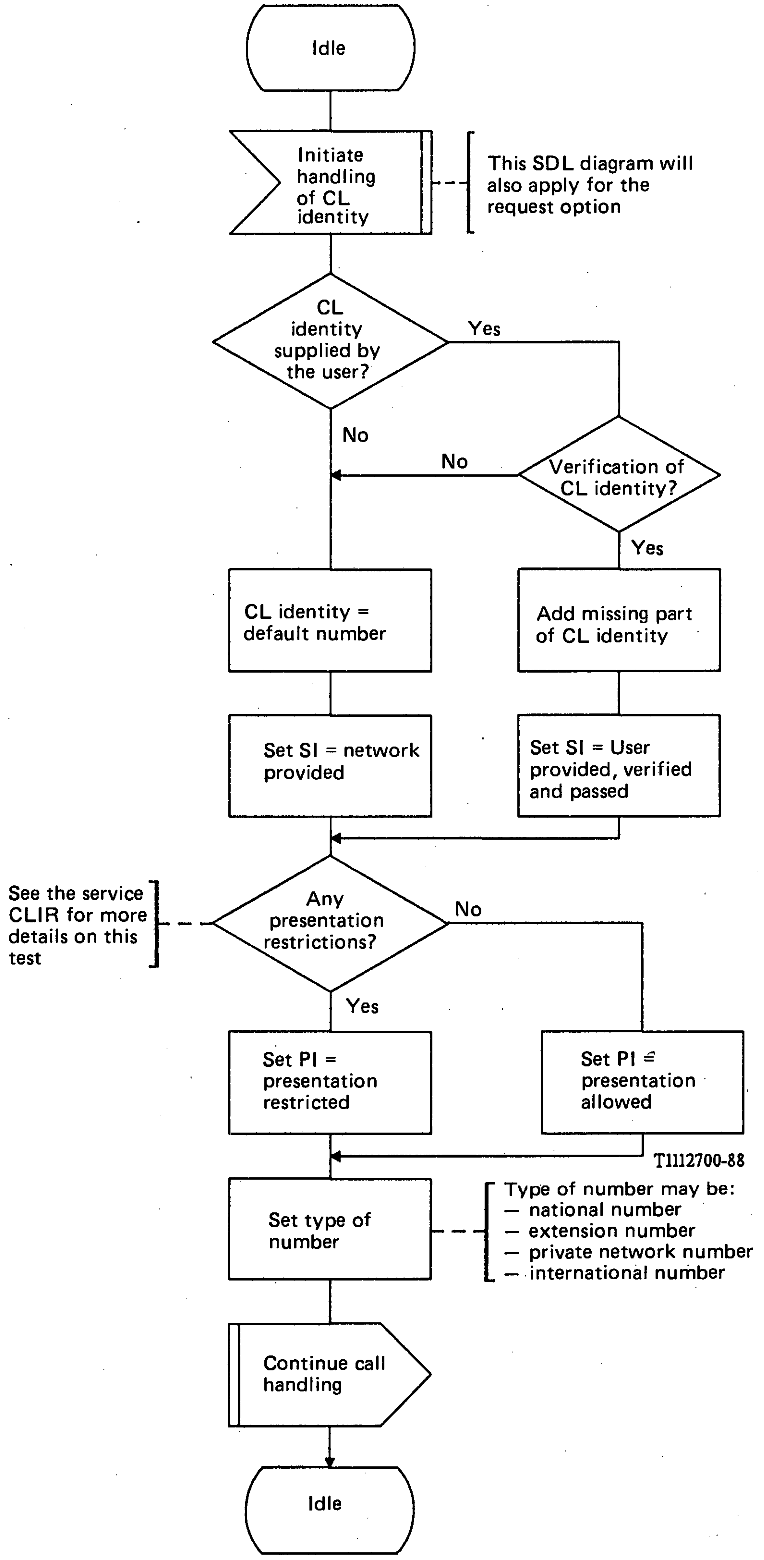
The ability of an ISDN component to determine the calling line identity and if present, the sub-address. In public network the calling line identity is the national ISDN number, in private network the private network number and in mobile network the international ISDN number.

FE3 – Determination of the international calling line identity

The ability of an ISDN component to determine the international calling line identity and if present, the sub-address.

FE4 – Determination of the calling line identity – destination side

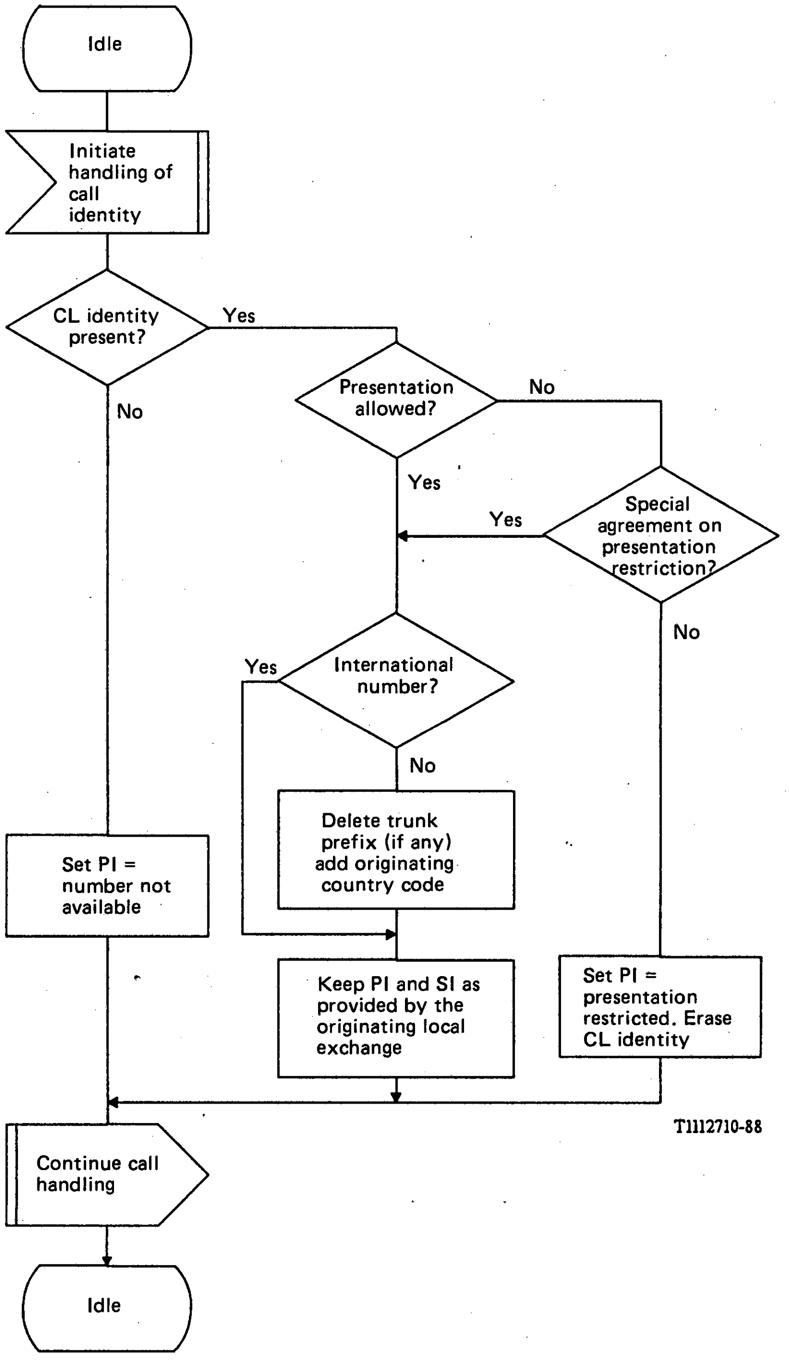
The ability of an ISDN component to determine the calling line identity and if present, the sub-address. In some networks the calling line identity given to an extension user connected to an ISPBX shall include outgoing prefix if the call is originated or passed through the public network.



CL Calling line
PI Presentation indicator
SI Screening indicator

FIGURE 3-3/Q.81

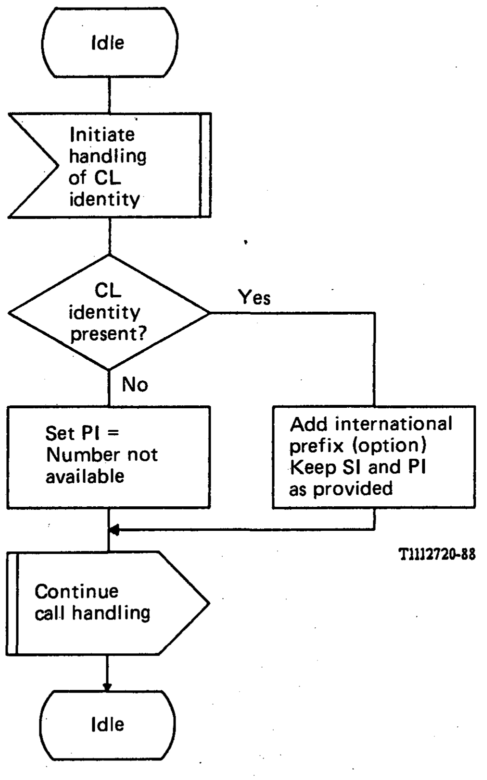
FE2



CL Calling line
PI Presentation indicator
SI Screening indicator

FIGURE 3-4/Q.81 (Sheet 1 of 2)

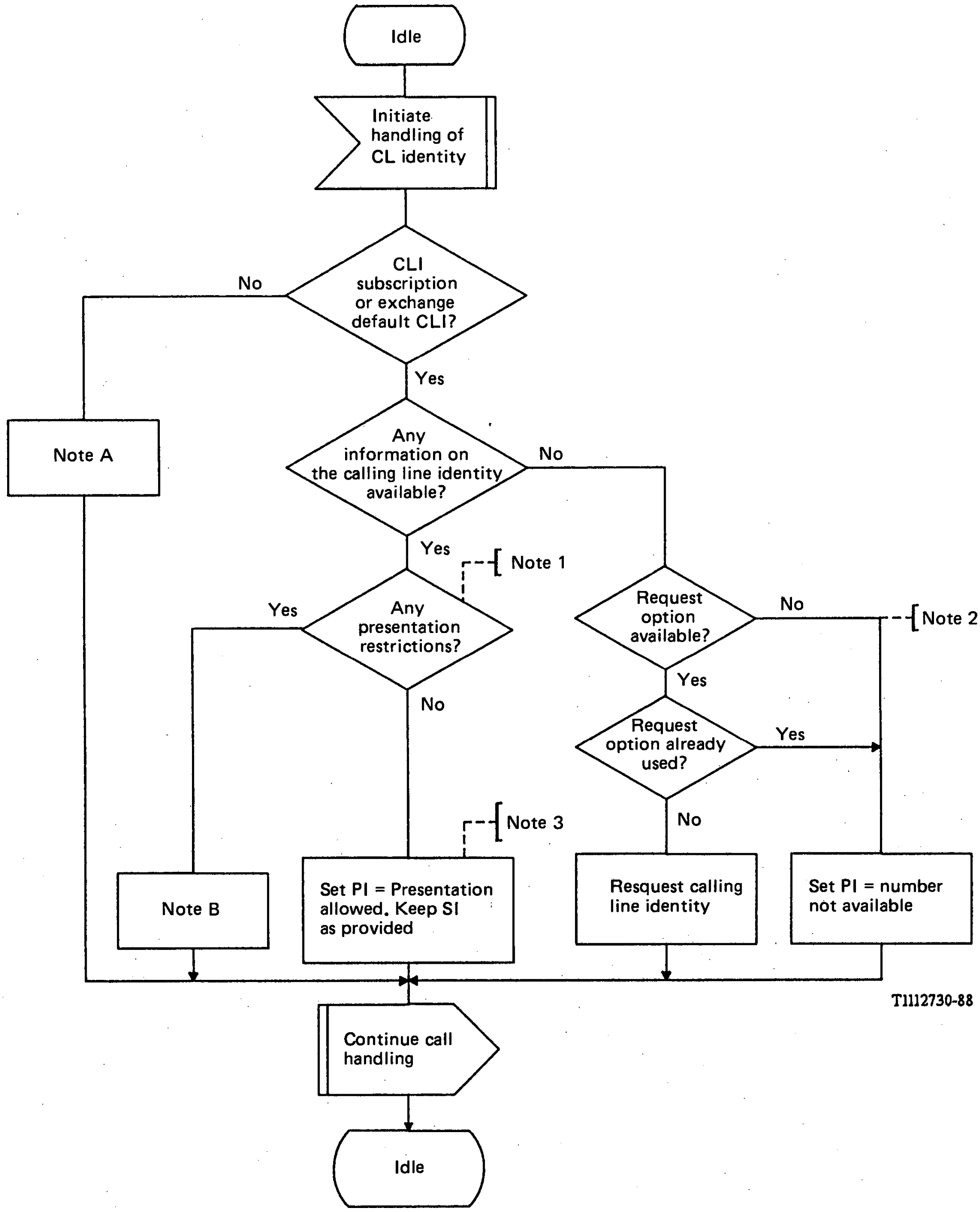
FE3



CL Calling line
PI Presentation indicator
SI Screening indicator

FIGURE 3-4/Q.81 (Sheet 2 of 2)

FE3



CL Calling line
PI Presentation indicator
SI Screening indicator

FIGURE 3-5/Q.81

FE4

Notes to Figure 3-5/Q.81

Note A – No information about the identity of the calling party is sent to the called party.

Note B – Set PI – Presentation restricted, address information will not be presented to the called party.

Note 1 – Presentation may be restricted due to national regulations or presentation restriction.

Presentation restriction may be overridden due to the called party's category (e.g. police).

Note 2 – The request option is not supported by private networks (CL identity is always included). The request option is not defined by Study Group XVIII.

Note 3 – In the case where the address information is not available due to interworking, only the indicators are presented to the user.

3.6 *Functional entity actions*

3.6.1 *Functional entity actions for FE2*

- Check if calling line identity is provided from the user;
- verify (and complete) calling line identity;
- set PI and SI;
- set type of number.

3.6.2 *Functional entity actions for FE3*

- check if calling line identity may be passed between Administrations;
- at the originating side: provide international number;
- at the destination side: add international prefix.

3.6.3 *Functional entity actions for FE4*

- check CLIP subscription;
- check if calling line identity is provided from FE3;
- request the calling line identity (optional);
- check for CLIR and if presentation is allowed pass CLI to FE5.

3.7 *Allocation of functional entities to physical location*

Scenario \ Functional entity	FE1	FE2	FE3	FE4	FE5
National call	TE	LE		LE	TE
International call	TE	LE	TR	LE	TE
Call between NT2s	NT2	LE	(TR)	LE	NT2
Call between NT2-TE	NT2	LE	(TR)	LE	TE
National private network	TE	NT2		NT2	TE
International private network	TE	NT2	TR/NT2	NT2	TE

Note – (TR) means that this functional entity is included in the case of international calls.

4 **Calling Line Identification Restriction (CLIR)**

4.1 *General*

calling line identification restriction (CLIR) is a supplementary service offered to the calling party to restrict presentation of the calling party's ISDN number and sub-address to the called party.

4.2 *Description*

4.2.1 *General description*

When CLIR is applicable and activated the originating node provides the destination node with a notification that the calling party's ISDN number and any sub-address information is not allowed to be presented to the called party. In this case no calling party number is included in the call offering to the called party's installation.

Note – When CLIR is subscribed to, some network providers may not wish to send the originating identity of the calling customer to other network providers.

Calling line identification restriction includes two options:

i) presentation restriction for all calls;

ii) temporary presentation restriction.

The presentation indicator is included in the SETUP req. ind. Information Flow received from the calling user. When no indicator is present a default value is used as follows.

The presentation indicator is stored in the public network (local exchange) as a default value for each user. The default value may be "presentation allowed" or "presentation restricted". This default value may be changed *only* by the network provider.

The first option is considered a minimum implementation.

The second option gives the calling user a possibility on a per call basis to override the default presentation indicator value stored in the public network. This option may be available on a subscription basis or generally.

4.2.2 *Specific terminology*

None identified.

4.2.3 *Qualifications on the applicability to telecommunication services*

None identified; i.e., this supplementary service is applicable to all telecommunication services.

The service calling line identification restriction has impact on the service calling line identification presentation, and therefore, the rest of the description is common for the two services. This part is presented in the CLIP description.

5 Connected Line Identification Presentation (COLP)

5.1 *General*

connected line identification presentation (COLP) is a supplementary service offered to the calling party which provides the connected party's ISDN-number to the calling party.

5.2 *Description*

5.2.1 *General description*

When COLP is applicable and activated, the network provides the calling party with the number of the connected party when the called party responds positively to the incoming call. The network should be capable of transmitting at least 15 digits (maximum length of an ISDN number).

5.2.2 *Specific terminology*

None identified.

5.2.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

It is to be noted that in the Telematic services, an exchange of Terminal Identification (TID) occurs at a higher layer subsequent to a successful call establishment.

For Telematic services, this supplementary service shall consist only of the access number of the connected party and this shall be provided by the network. For other non-voice services, this supplementary service is for further study. The presentation of the COLI by Telematic terminals and by other non-voice terminals is for further study.

5.3 *Derivation of a functional model*

This part of the description is common with the service Connected Line Identification Restriction (COLR) since this service has some impact on Connected Line Identification Presentation.

The model used for illustrating the "Connected Line Identification Services" procedures is given in Figure 5-1/Q.81 below.

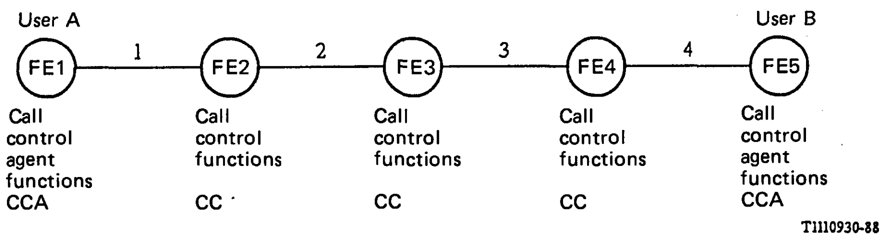


FIGURE 5-1/Q.81

Model for connected line identification services

5.4 *Information flow diagrams*

The Connected Line Identity information needed to provide the Connected Line Identification Services is normally carried in the messages indicating that the call has been answered.

The original Connected Line Identity will be delivered to the calling party by his local exchange and/or ISPBX when the call enters the active state if the Connected Line Identity is available and presentation is allowed.

If Connected Line Identity is not available in the originating local or transit exchange at call connection time, the exchange may optionally request the Connected Line Identity from the destination local exchange.

The specifications of functions for COLP include adaptions for private network applications (in a full private network environment) and mobile network applications. Private Network/Public ISDN interworking situations are for further study.

The Connected Line Identity is made up of a number of information units:

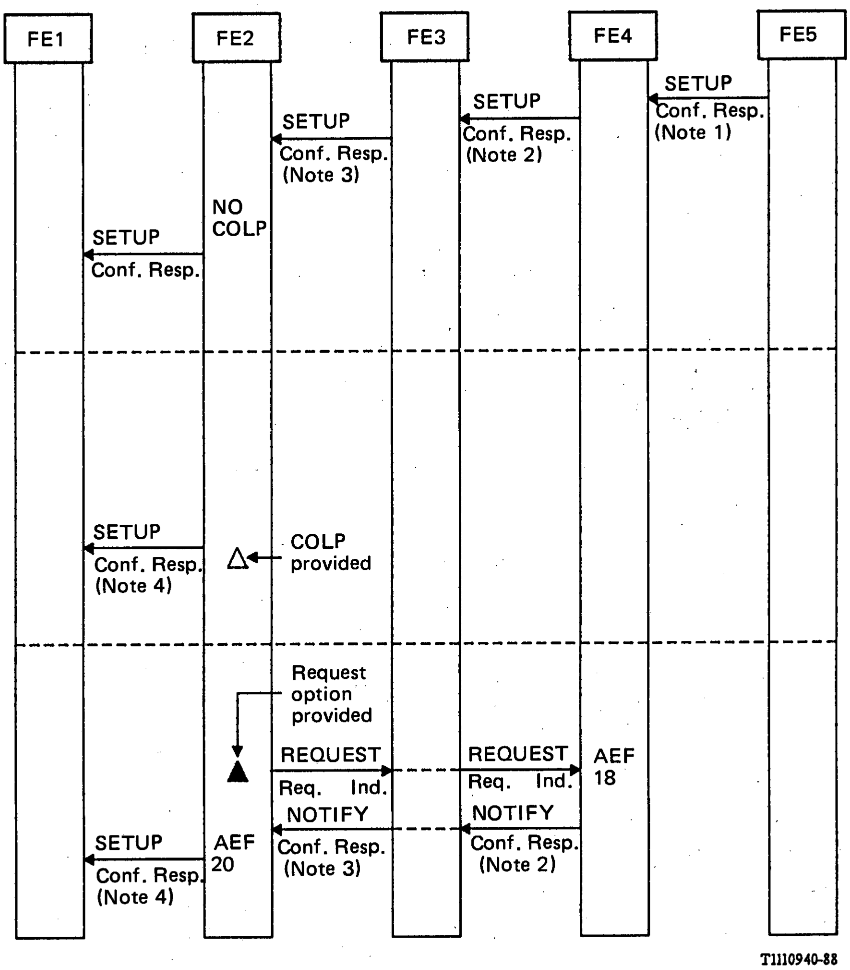
- the subscriber's national (ISDN) number, or
- private network number, or
- international ISDN-number and possibly other indications only for international calls, or
- partial number (optional) (Note 1);
- optionally, sub-address information, if explicitly provided by the calling user;
- numbering plan identification;
- type of address.

In addition to the Connected Line Identity, the subscriber may be given the following information:

- Presentation Indicator showing:
  - a) presentation allowed, or
  - b) presentation restricted, or
  - c) number not available due to interworking (Note 2);
- Screening indicator showing:
  - a) User provided, verified and passed, or
  - b) network provided.

Note 1 – For international calls, the partial number may be the international prefix and the country code. For national calls, the partial number may be the trunk prefix and the area code.

Note 2 – The technical solutions for the various interworking arrangements with dedicated networks have not been detailed in this Recommendation.



In case of a national call, the FE3 is not needed.

FIGURE 5-2/Q.81

Information flows for combined public and private configurations

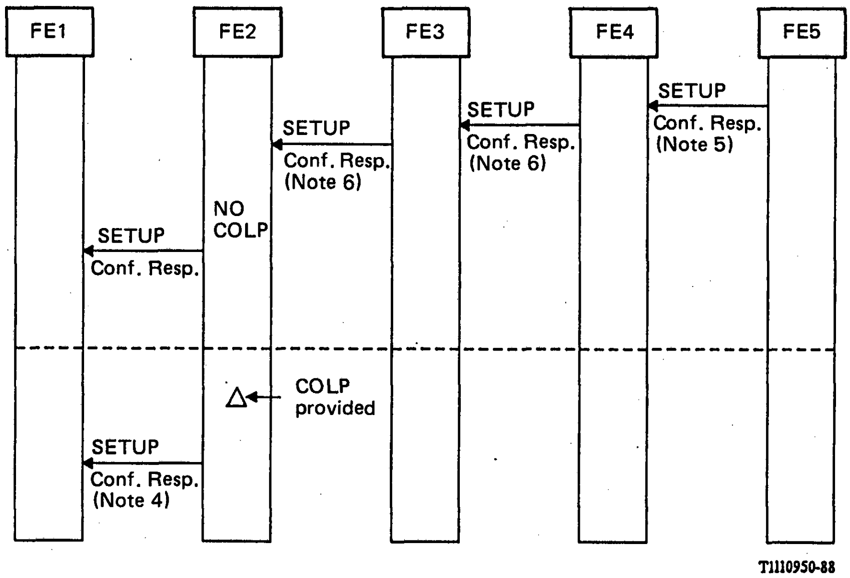


FIGURE 5-3/Q.81

Information flows for private network configurations

Notes to Figures 5-2/Q.81 and 5-3/Q.81

Note 1 – The information flow contains:

- no information (should not be permitted for DDI-ISPBX in some networks);
- part of the subscriber number (extension number, selection on a passive bus);
- subscriber number;
- national number;
- international number (for mobile applications);
- numbering plan identification;
- type of address;
- presentation indicator;
- optional: sub-address.

Note 2 – The information flow contains:

- national number;
- if present: sub-address;
- international number;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided, verified and passed);
- type of address;
- numbering plan identification.

Note 3 – The information flow contains:

- international number;
- no information (e.g., presentation restriction);
- *if* present: sub-address;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided);
- type of address;
- numbering plan identification.

Note 4 – The information flow contains:

- no information (depending on indicators);
- national number (for national calls);
- international number (for international calls);
- if present: sub-address;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (network provided/subscriber provided, verified and passed);
- type of address;
- numbering plan identification:

Note 5 – The information flow contains:

- no information;
- part of the extension number (e.g., selection on a passive bus);
- extension number or private network number;
- optional: sub-address;
- type of address;
- numbering plan identification.

Note 6 – The information flow contains:

- extension number or private network number;
- if present: sub-address;
- presentation indicator (allowed/restricted/not available due to interworking);
- screening indicator (private network provided/user provided, verified and passed);
- type of address;
- numbering plan identification.

5.5 *SDL diagrams for functional entities*

FE4 – Determination of the Connected Line Identity – Destination side

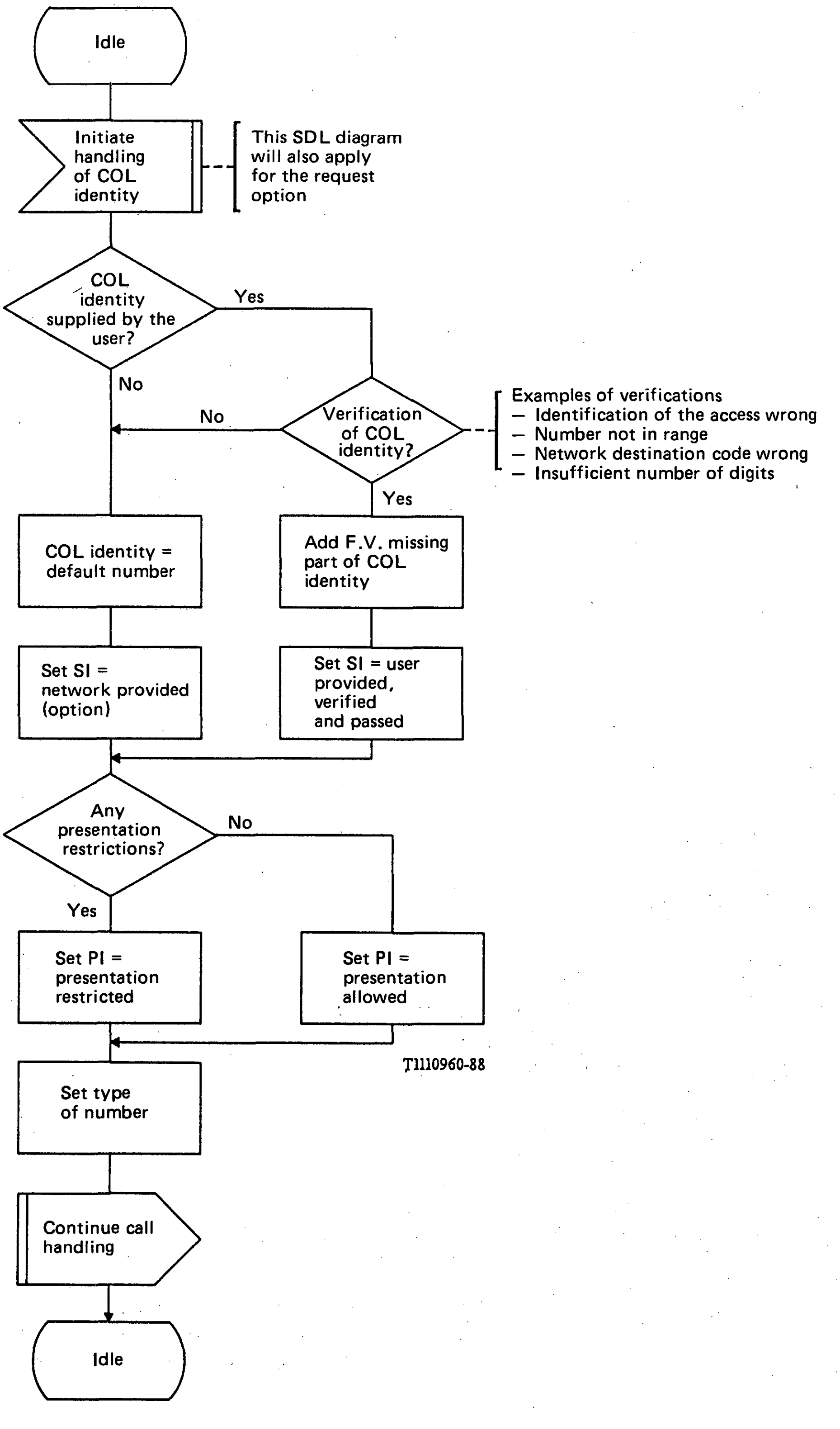
The ability of an ISDN component to determine the Connected Line Identity and if present, the sub-address. The Connected Line Identity may contain prefixes. In public network, the Connected Line Identity is the national ISDN Number, in private network the private Network Number and in mobile network the International ISDN Number.

FE3 – Determination of the International Connected Line Identity

The ability of an ISDN component to determine the International Connected Line Identity and if present, the sub-address.

FE2 – Determination of the Connected Line Identity – Originating side

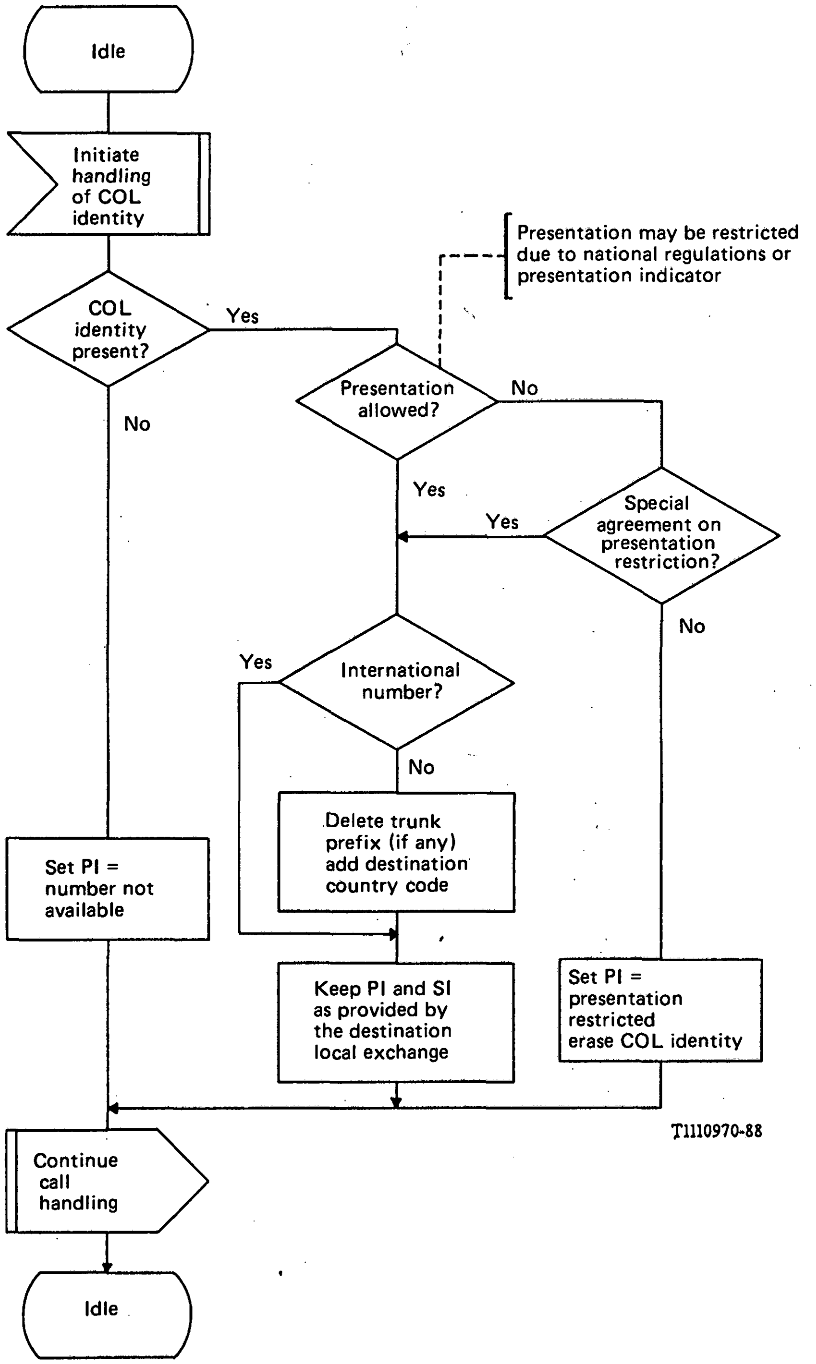
The ability of an ISDN component to determine the Connected Line Identity and if present, the sub-address. In some networks, the Connected Line Identity sent to an extension connected to an ISPBX shall contain the outgoing prefix.



COL Connected line
PI Presentation indicator
SI Screening indicator

FIGURE 5-4/Q.81

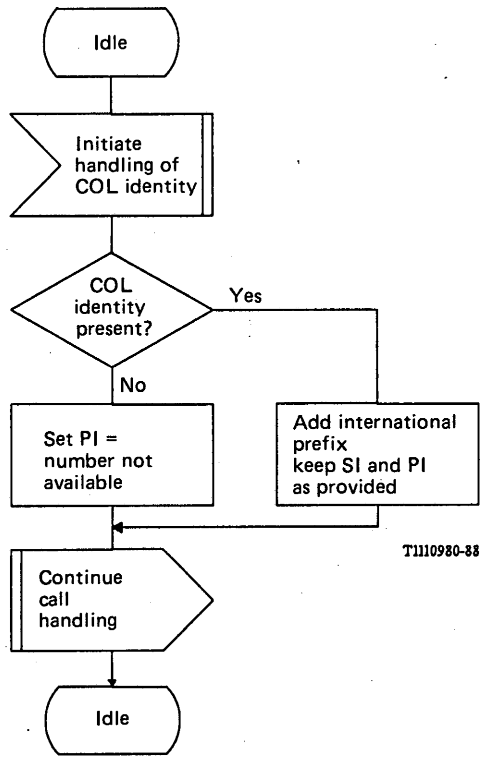
FE4 – Determination of the connected line identity – destination side



COL Connected line
PI Presentation indicator
SI Screening indicator

FIGURE 5-5/Q.81 (Sheet 1 of 2)

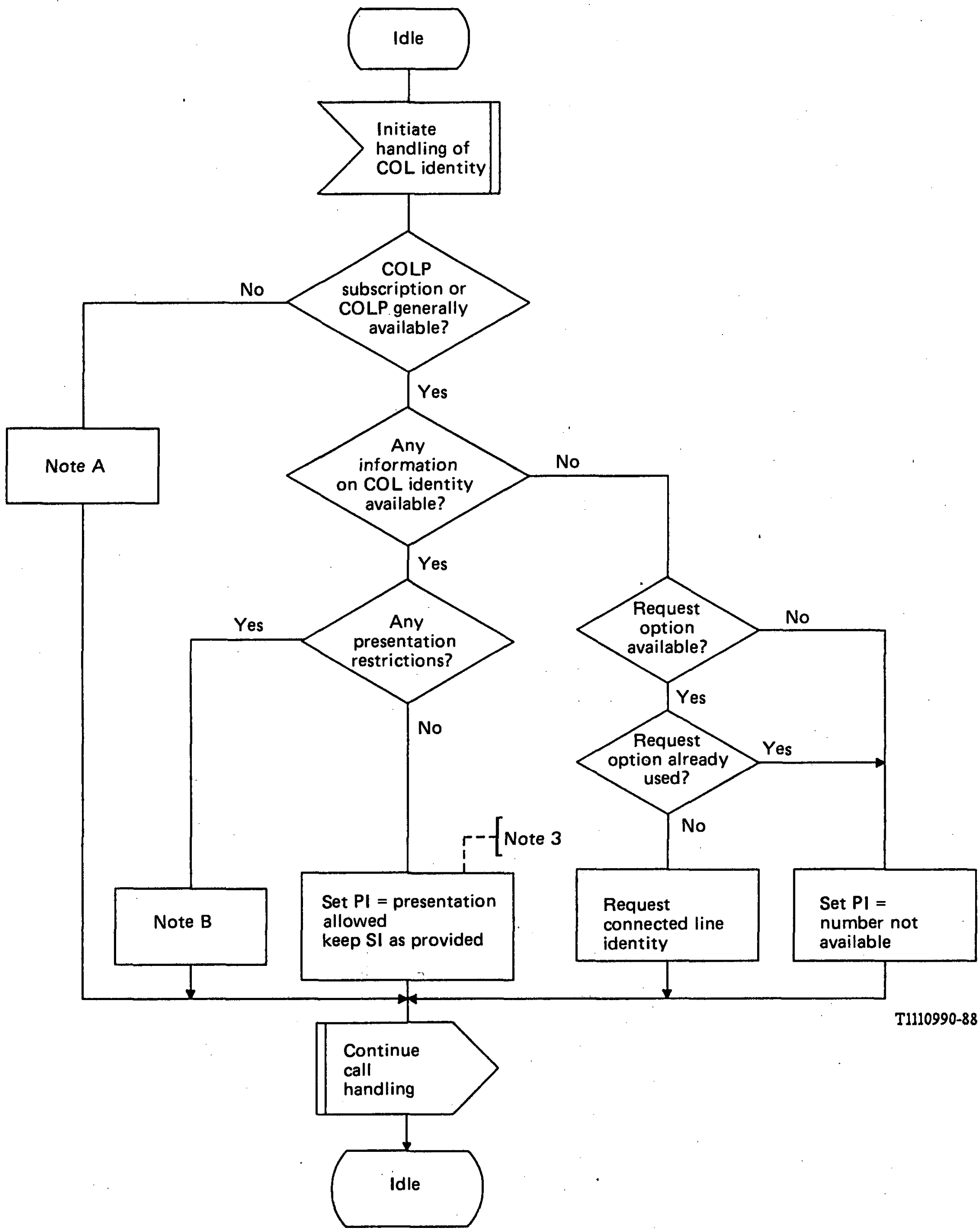
FE3 – Determination of the international connected line identity



COL Connected line
PI Presentation indicator
SI Screening indicator

FIGURE 5-5/Q.81 (Sheet 2 of 2)

FE3 – Determination of the international connected line identity



COL Connected line
COLP Connected line identification presentation
PI Presentation indicator
SI Screening indicator

FIGURE 5-6/Q.81

FE2 – Determination of the connected line identity – originating side

Notes to Figure 5-6/Q.81

Note A – No information about the connected line. Identity is sent to the calling party.

Note B – Set IP presentation restricted. Address information will not be presented to the calling party.

Note 1 – Presentation may be restricted or overridden due to national regulations or presentation restriction.

Presentation restriction may be overridden due to the called party's category (e.g. police).

Note 2 – The request option is not supported by private networks.

Note 3 – In the case where the address information is not available due to interworking, only the indicators are presented for the user.

5.6 *Functional entity actions*

5.6.1 *Functional entity actions for FE2*

- check COLP subscription;
- check if Connected Line is provided;
- request Connected Line Identify (optional);
- check for COLR and if presentation allowed, pass COLI to FE1.

5.6.2 *Functional entity actions for FE3*

- check if Connected Line Identity may be passed between administrations;
- at the destination side: provide international number;
- at the originating side: add international prefix.

5.6.3 *Functional entity actions for FE4*

- check if Connected Line Identity is provided from the user;
- verify (and complete) Connected Line Identity;
- set PI and SI;
- set type of number.

5.7 *Allocation of functional entities to physical location*

Scenario \ Functional entity	FE1	FE2	FE3	FE4	FE5
National call	TE	LE		LE	TE
International call	TE	LE	TR	LE	TE
Call between NT2s	NT2	LE	(TR)	LE	NT2
Call between NT2-TE	NT2	LE	(TR)	LE	TE
National private network	TE	NT2		NT2	TE
International private network	TE	NT2	TR/NT2	NT2	TE

Note – (TR) means that this functional entity is included in the case of international calls.

6 Connected Line Identification Restriction (COLR)

6.1 *General*

connected line identification restriction (COLR) is a supplementary service offered to the connected party to restrict presentation of the connected party's ISDN number to the calling party.

6.2 *Description*

6.2.1 *General description*

When COLR is applicable and activated, the destination node provides the originating node with a notification that the connected party's ISDN number is not allowed to be presented to the calling party. In this case no connected party number is included in the call connected information to the calling party's installation.

Note – When COLR is subscribed to, some network providers may not wish to send the identity of the connected customer to other network providers.

Detailed descriptions of functions and information flows

Connected line identification restriction includes two options:

i) presentation restriction for all calls;

ii) temporary presentation restriction.

The presentation indicator is included in the SETUP conf. resp. Information Flow received from the called user. When no indicator is present, then a default value is used as follows.

The presentation indicator is stored in the public network (local exchange) as a default value for each user. The default value may be "presentation allowed" or "presentation restricted". This default value may be changed *only* by the network provider.

The first option is considered a minimum implementation.

The second option gives the user who receives (and accepts) the call, a possibility on a per call basis to override the default presentation indicator value stored in the public network. This option may be available on a subscription basis or generally.

The service connected line identification restriction has impact on the service connected line identification presentation, and therefore, the rest of the description is common for the two services. This part is presented in the COLP description.

6.2.2 *Specific terminology*

None identified.

6.2.3 *Qualifications on the applicability to telecommunications services*

None identified; i.e., this supplementary service is applicable to all telecommunication services.

7 Malicious call identification

Under study.

CALL OFFERING SUPPLEMENTARY SERVICES

1 Call transfer

Under study.

2 Call forwarding services

2.1 *Introduction*

2.1.1 *General*

This Recommendation includes stage 2 descriptions for the three versions of call forwarding services given below, when implemented using the "forward switching" network routing algorithm described in Recommendation Q.80.

The following descriptions are for further study:

- re-routing case as described in Recommendation Q.80;
- the optional notification to be sent to the calling user A when the value of the subscription option "calling user receives notification that his call has been forwarded" is "yes, with forwarded-to-user number";
- the optional notification to be sent to the served user B_m when the value of the subscription option "served user receives notification that his call has been forwarded" is "yes, with call offering information".

Further details and definitions of the stage 1 description, i.e., the service description as seen from the user, can be found in Recommendation I.252.

2.1.2 *Definitions*

call forwarding unconditional (CFU)

Call forwarding unconditional (CFU) permits a user to have the network send all incoming calls, or just those associated with a specific basic service, addressed to the served user's ISDN number to another number. The served user's originating service is unaffected. If this service is activated, calls are forwarded no matter what the condition of the termination. Other call forwarding services provide call forwarding based on condition, e.g. call forwarding busy (CFB) and call forwarding no reply (CFNR).

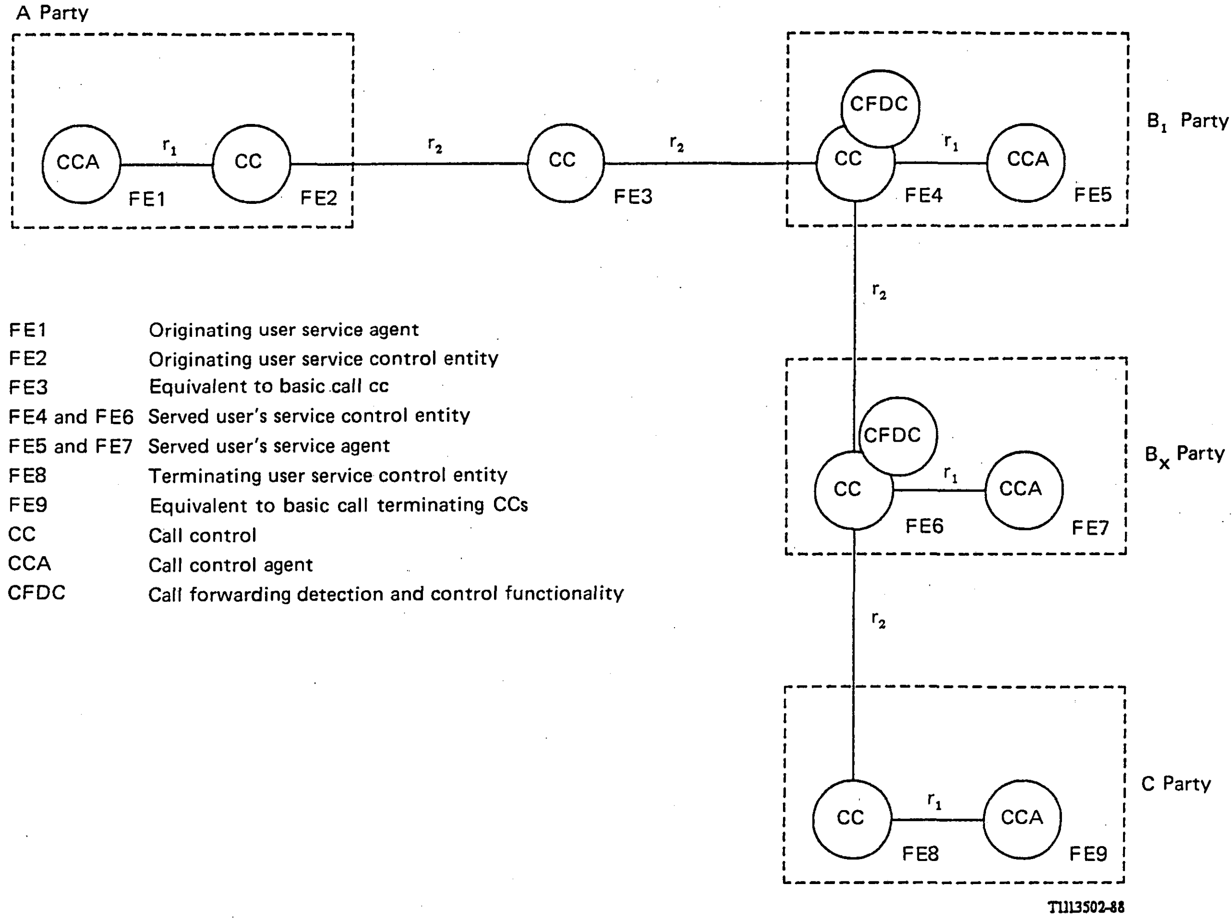
call forwarding busy (CFB)

Call forwarding busy (CFB) permits a served user to have the network send all incoming calls, or just those associated with a specific basic service, which meet busy and are addressed to the served user's ISDN number to another number. The served user's originating service is unaffected.

call forwarding no reply (CFNR)

Call forwarding no reply (CFNR) permits a served user to have the network send all incoming calls, or just those associated with a specific basic service, which meet no reply and are addressed to the served user's ISDN number to another number. The served user's originating service is unaffected.

2.2 *Call forwarding setup and release*



Note – This scenario assumes that A party calls B_1 party, who forwards the call to B_2 party, ..., B_m party, ..., B_x party. The final receiver of the call is C party.

FIGURE 2-1/Q.82

Functional entity model

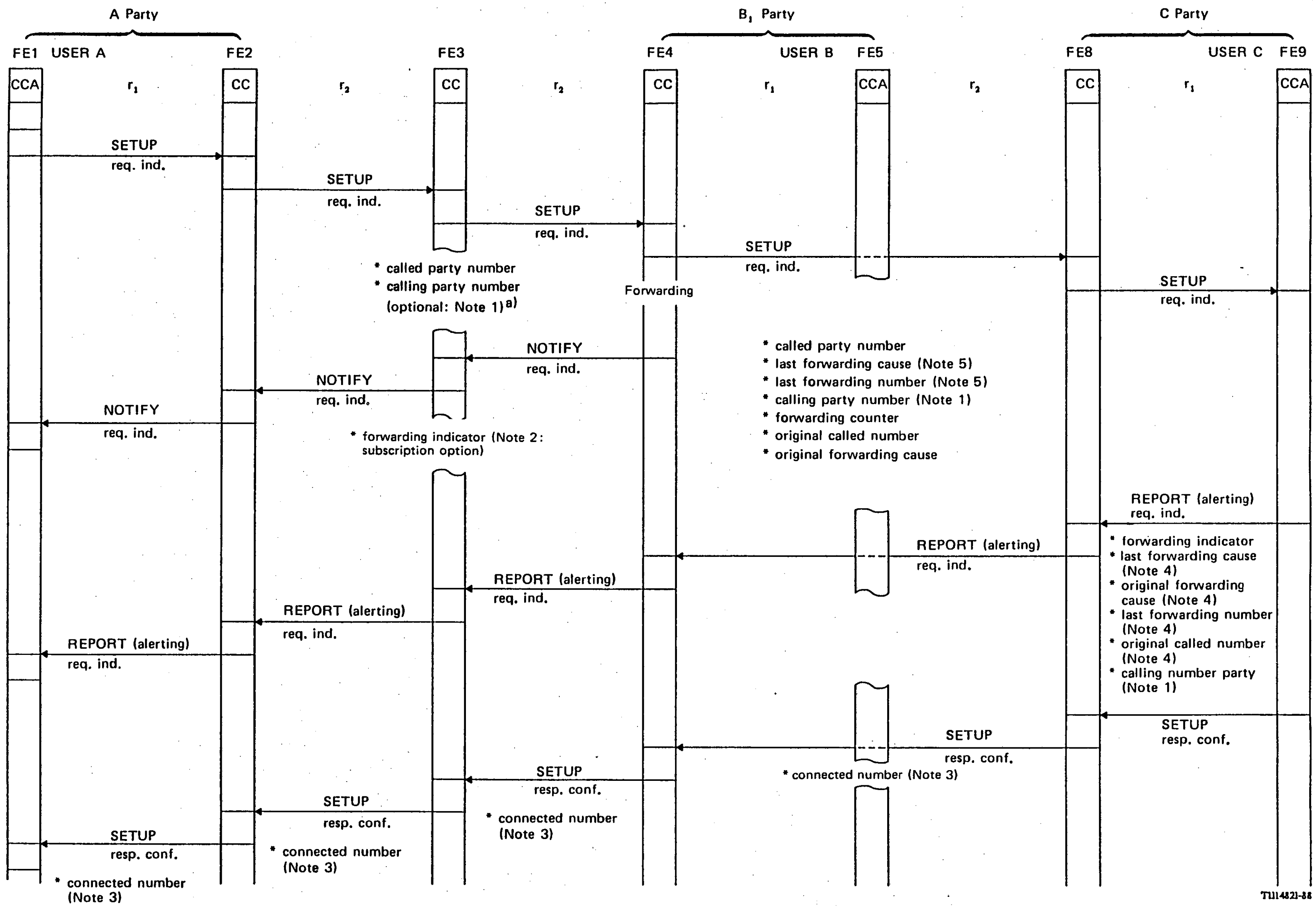
2.2.1 *Information flow diagrams*

Call forwarding unconditional and for "network determined user busy": Figure 2-2/Q.82.

Call forwarding for "user determined user busy": Figure 2-3/Q.82.

Call forwarding on no reply: Figure 2-4/Q.82.

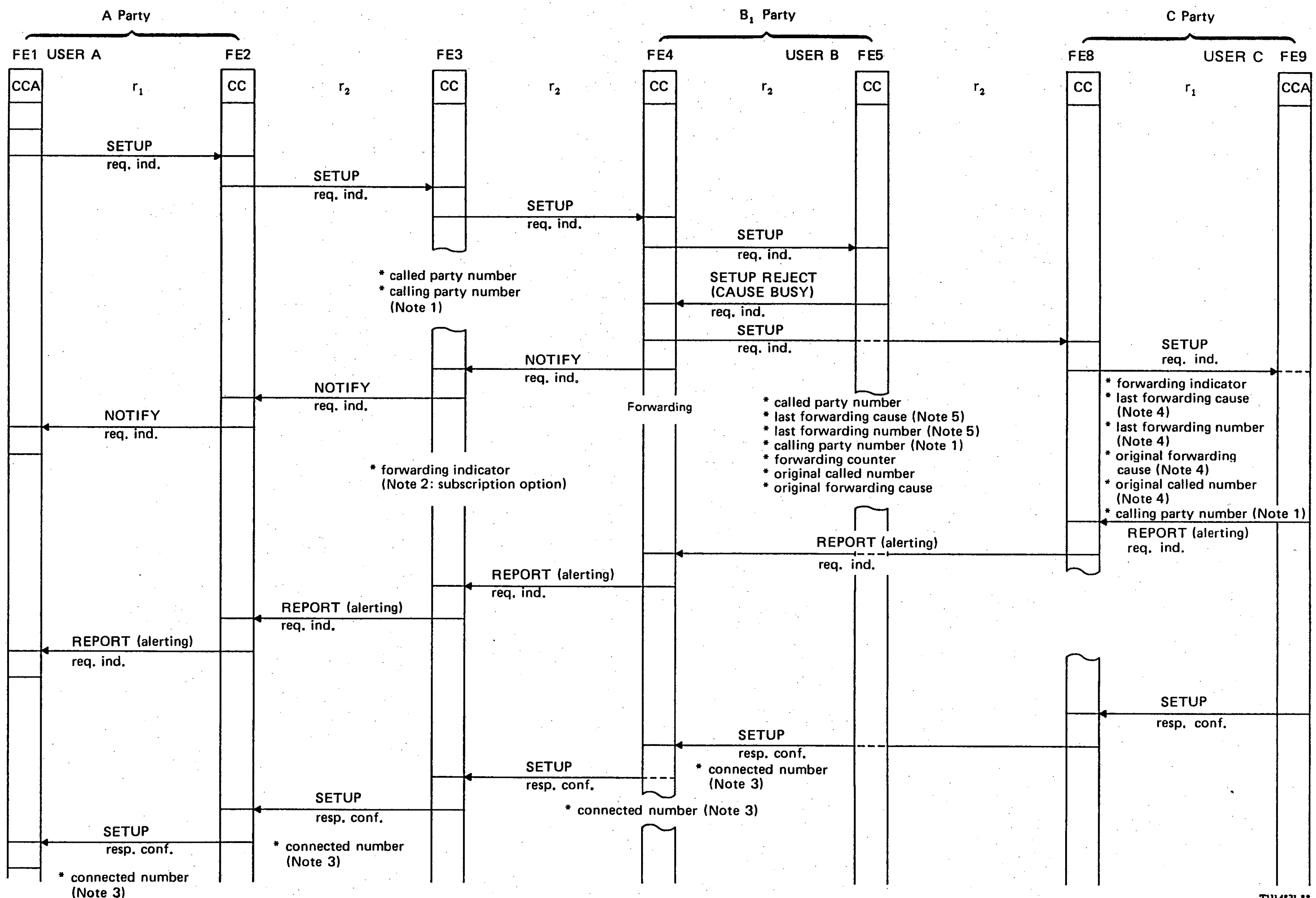
Call forwarding disconnect procedure (including advice of charge): Figure 2-5/Q.82.



The notes to Figures 2-2 to 2-4/Q.82 are found after sheet 1 of Figure 2-4/Q.82.

FIGURE 2-2/Q.82

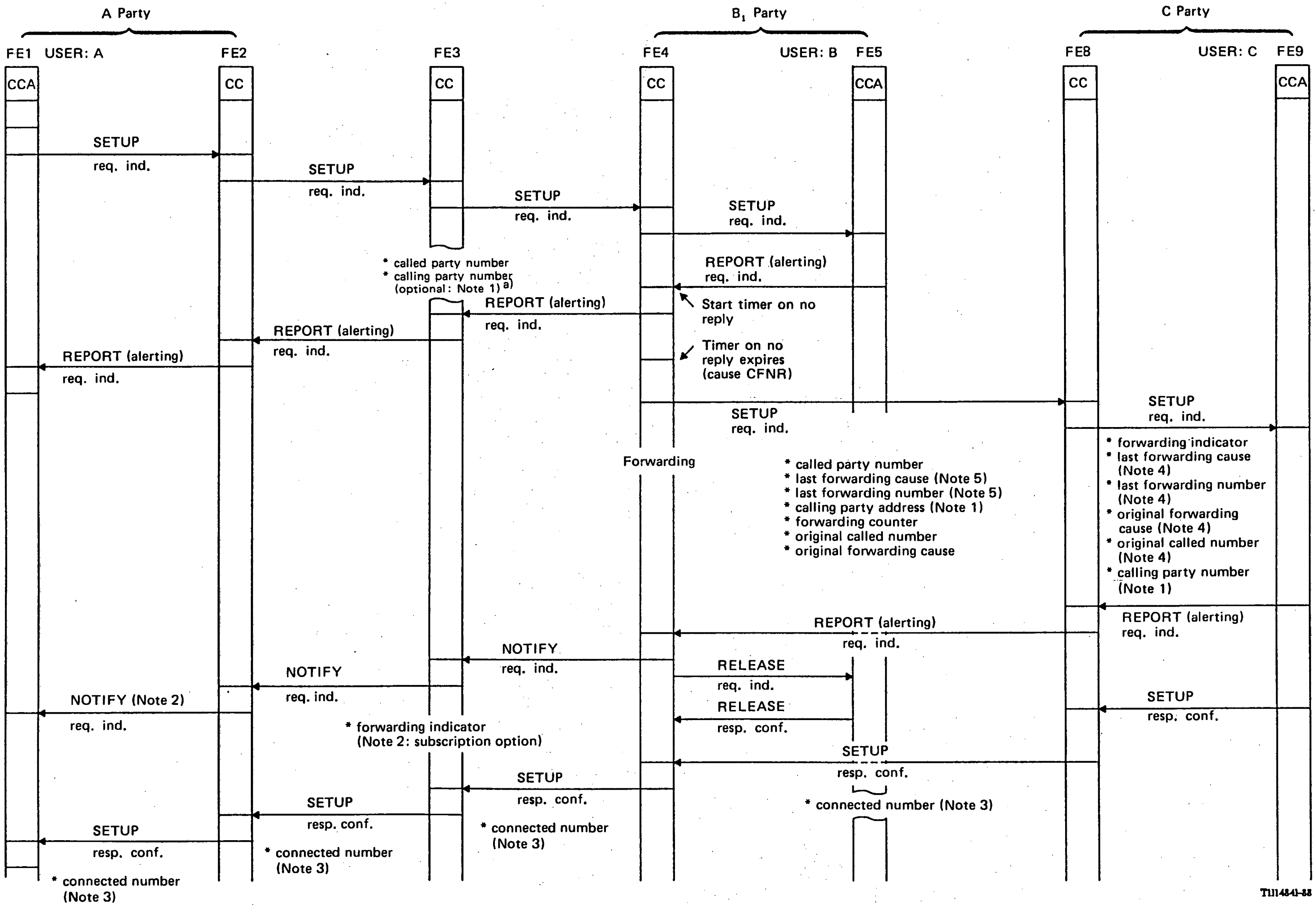
Call forwarding unconditional and for "network determined user busy" using forward switches



a) The notes to Figures 2-2 to 2-4/Q.82 are found after sheet 1 of Figure 2-4/Q.82.

FIGURE 2-3/Q.82

Call forwarding for "user determined busy", using forward switching



a) The notes to Figures 2-2 to 2-4/Q.82 are found after sheet 1 of Figure 2-4/Q.82.

FIGURE 2-4/Q.82 (Sheet 1 of 4)

Call forwarding on no reply, using forward switching. Normal case

Notes related to Figures 2-2 to 2-4/Q.82

Note 1 – The calling party number and the last forwarding number should be included if required by the "calling line identification presentation" supplementary service.

Note 2 – The notification should be sent only if the B-party subscribes to the "calling user receives notification that his call has been forwarded" subscription option.

Note 3 – The connected number is included if required by the "connected line Identification presentation/restriction" supplementary service.

Note 4 – The forwarded-to-user will receive this information depending on his notification option, the availability of this information from the network and possible presentation restrictions.

Note 5 – This parameter may be omitted between FE4 and FE6 in order to limit the number of parameters to be passed in the network (see Table 2-6/Q.82, Note 1).

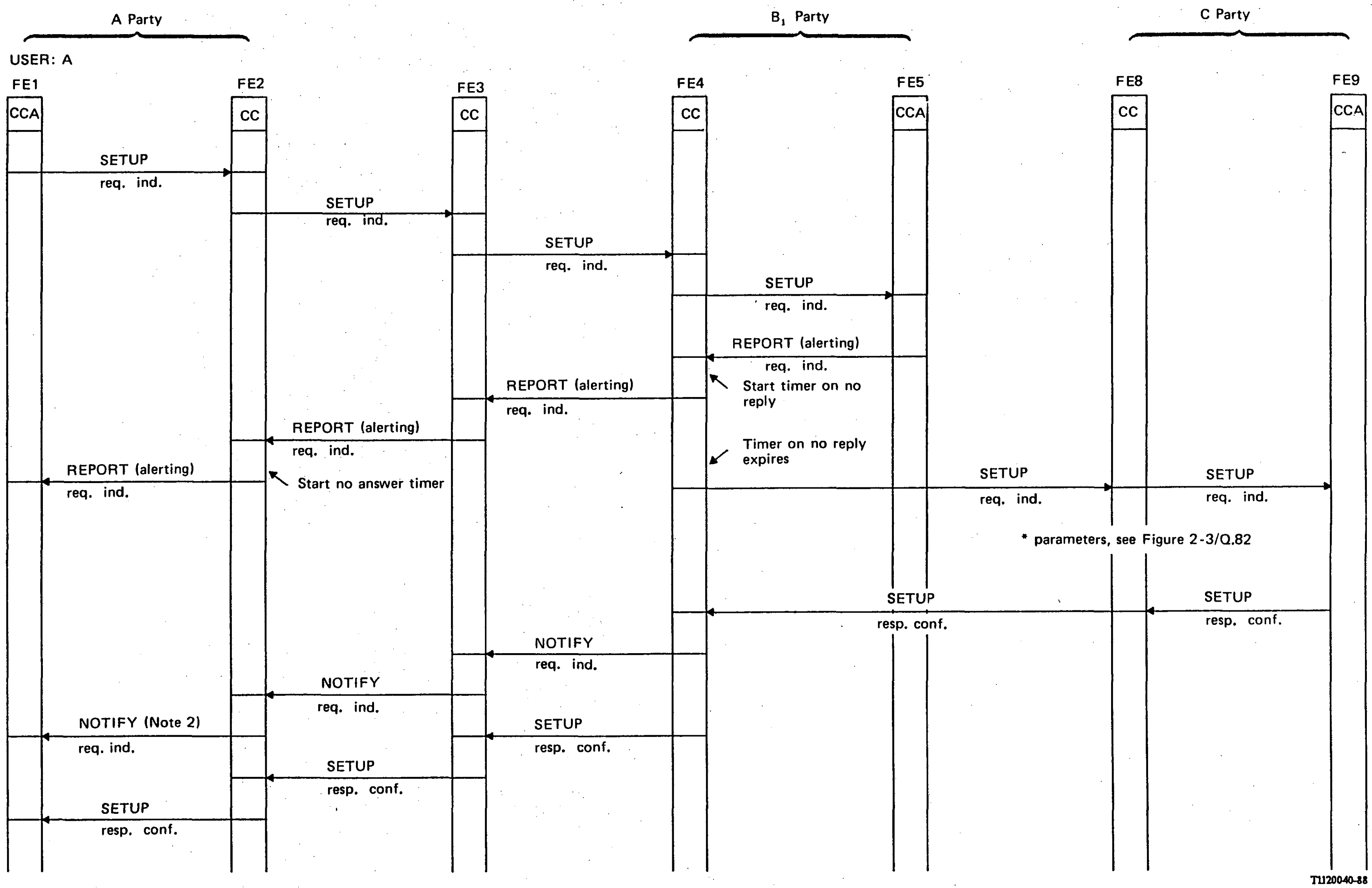


FIGURE 2-4/Q.82 (Sheet 2 of 4)

Call forwarding on no reply - C party has automatic answering

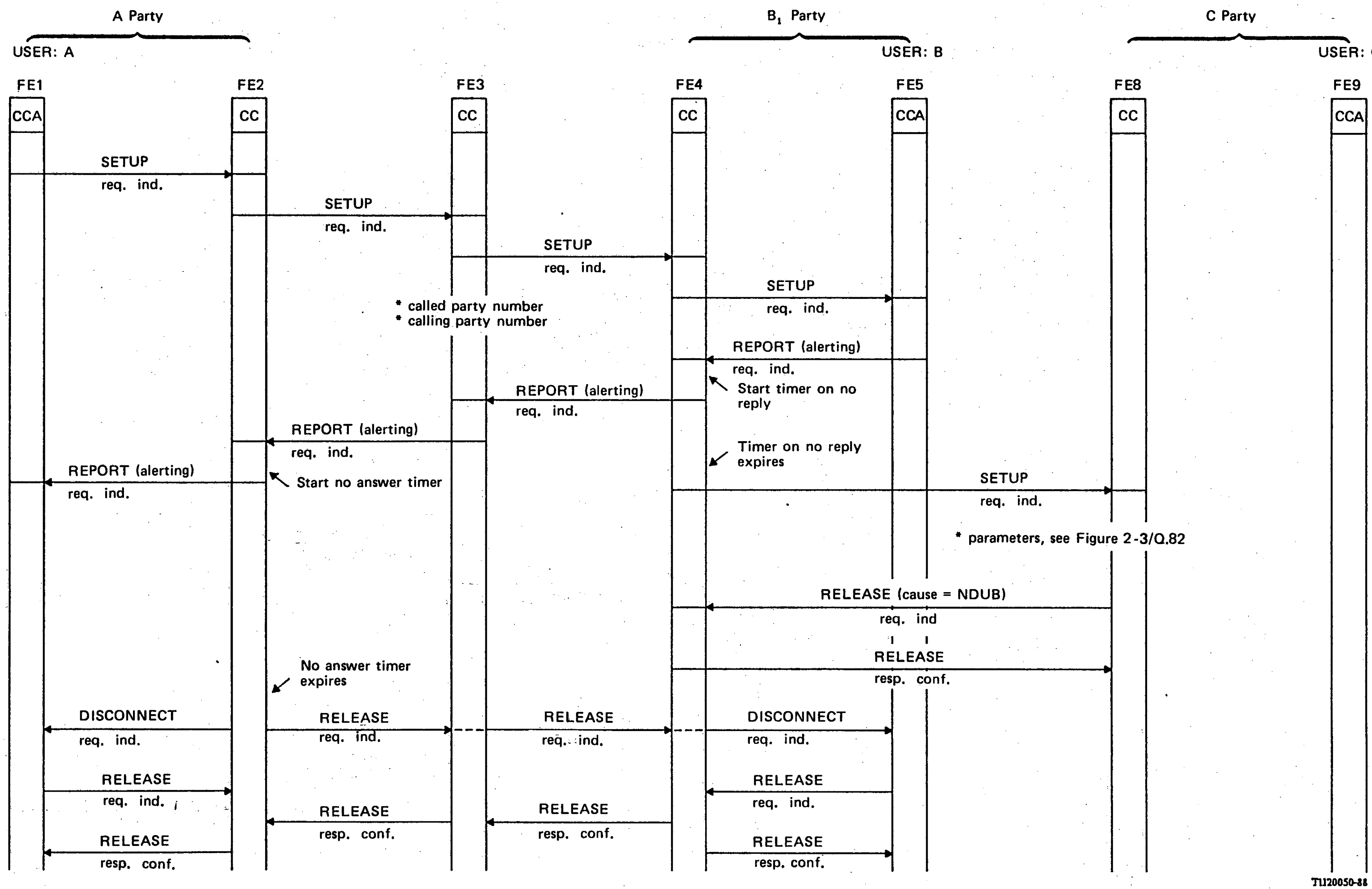


FIGURE 2-4/Q.82 (Sheet 3 of 4)

Call forwarding on no reply, using forward switching C party network determined user busy

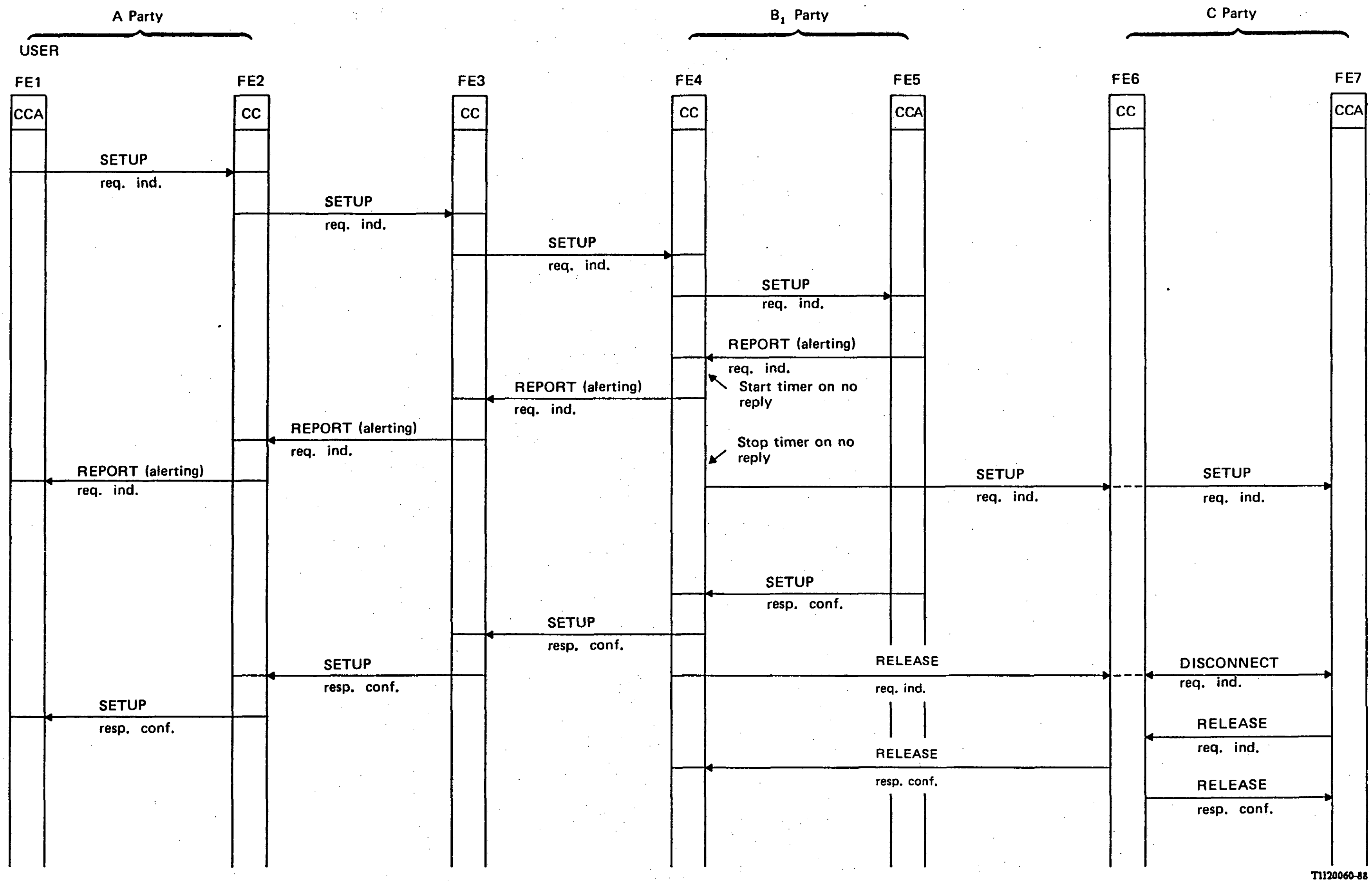
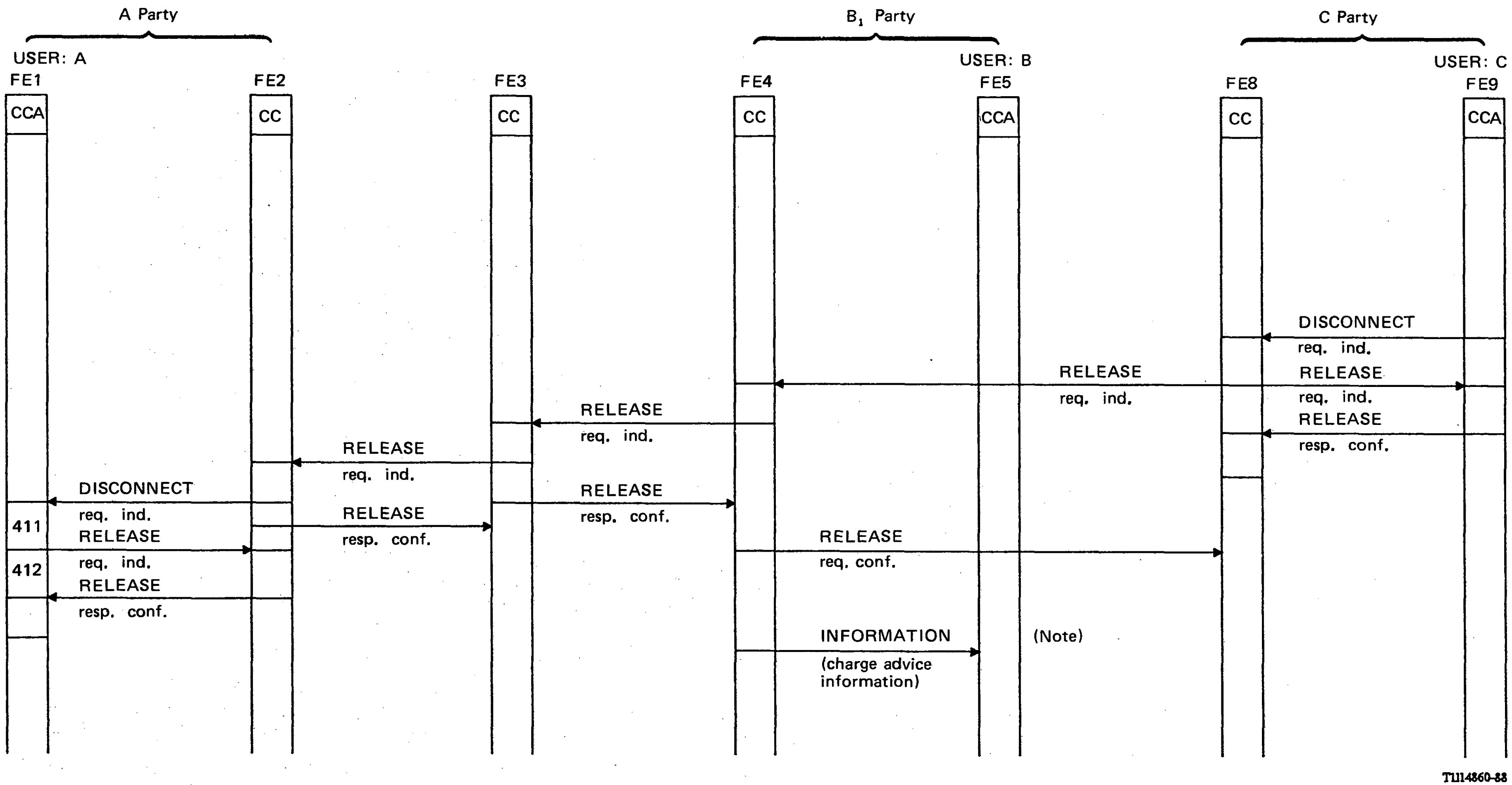


FIGURE 2-4/Q.82 (Sheet 4 of 4)

Call forwarding on no reply - B party answers before C party

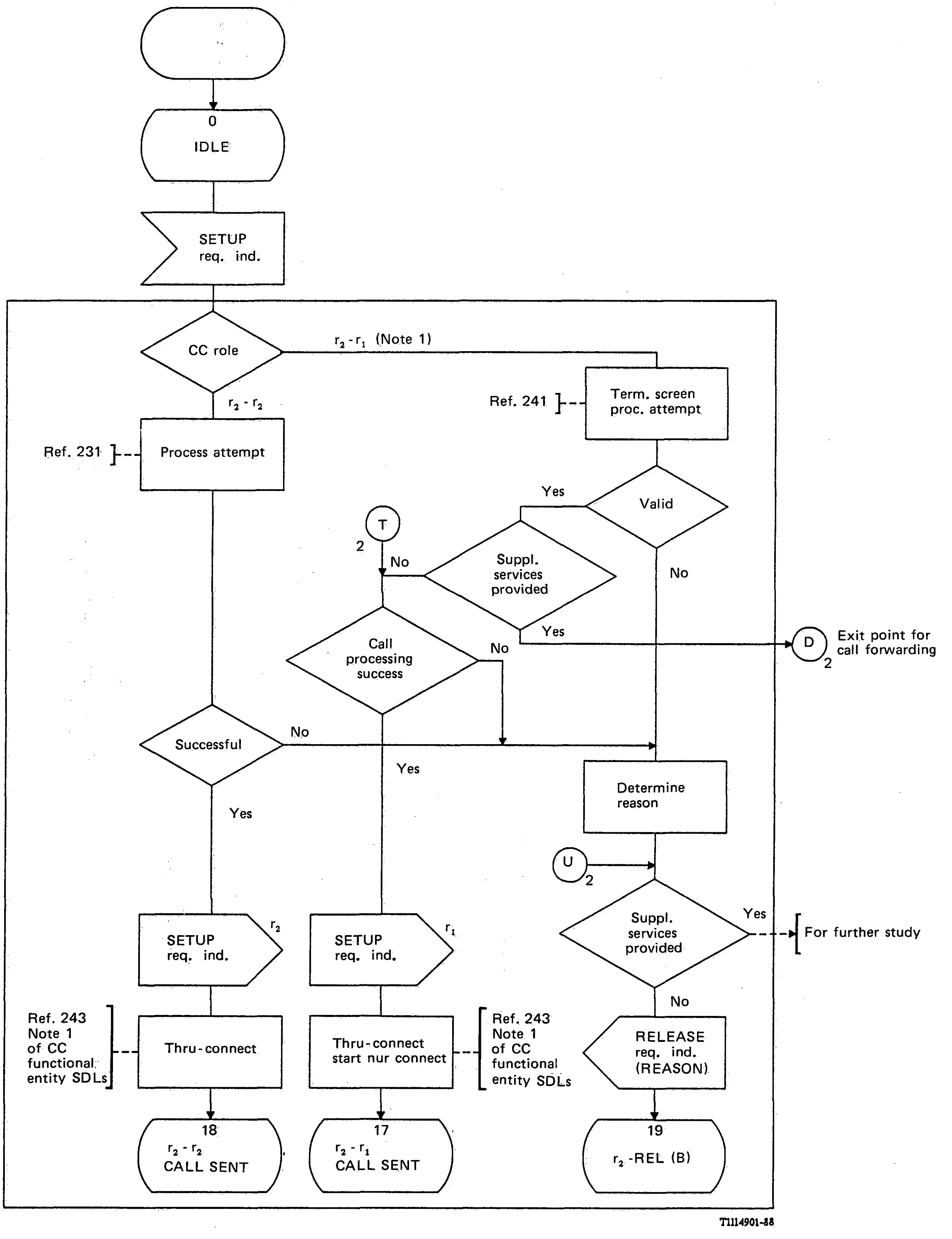


Note – Included if Advice of Charge supplementary service is activated.

FIGURE 2-5/Q.82

Call forwarding disconnect procedure (including Advice of Charge)

2.2.2 *SDL diagram for FE4/FE6/FE8*



Note 1 – In the case of FE4, FE6, FE8 always this branch will apply.

FIGURE 2-6/Q.82 (Sheet 1 of 8)

FE4/FE6/FE8 call forwarding

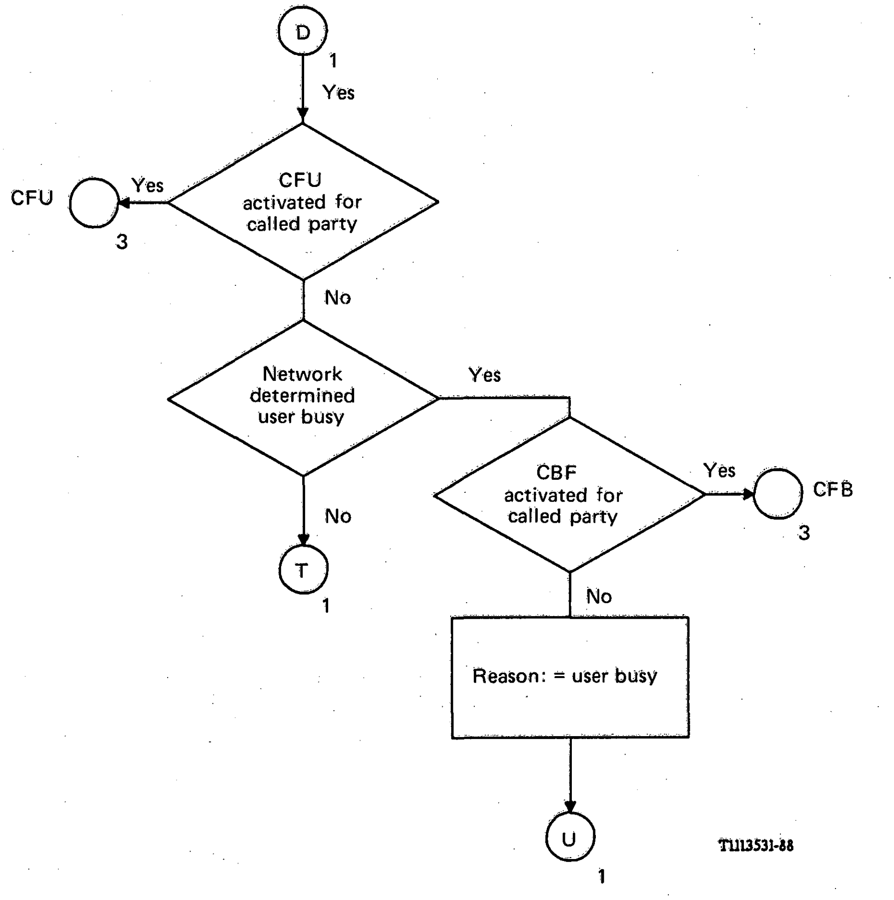
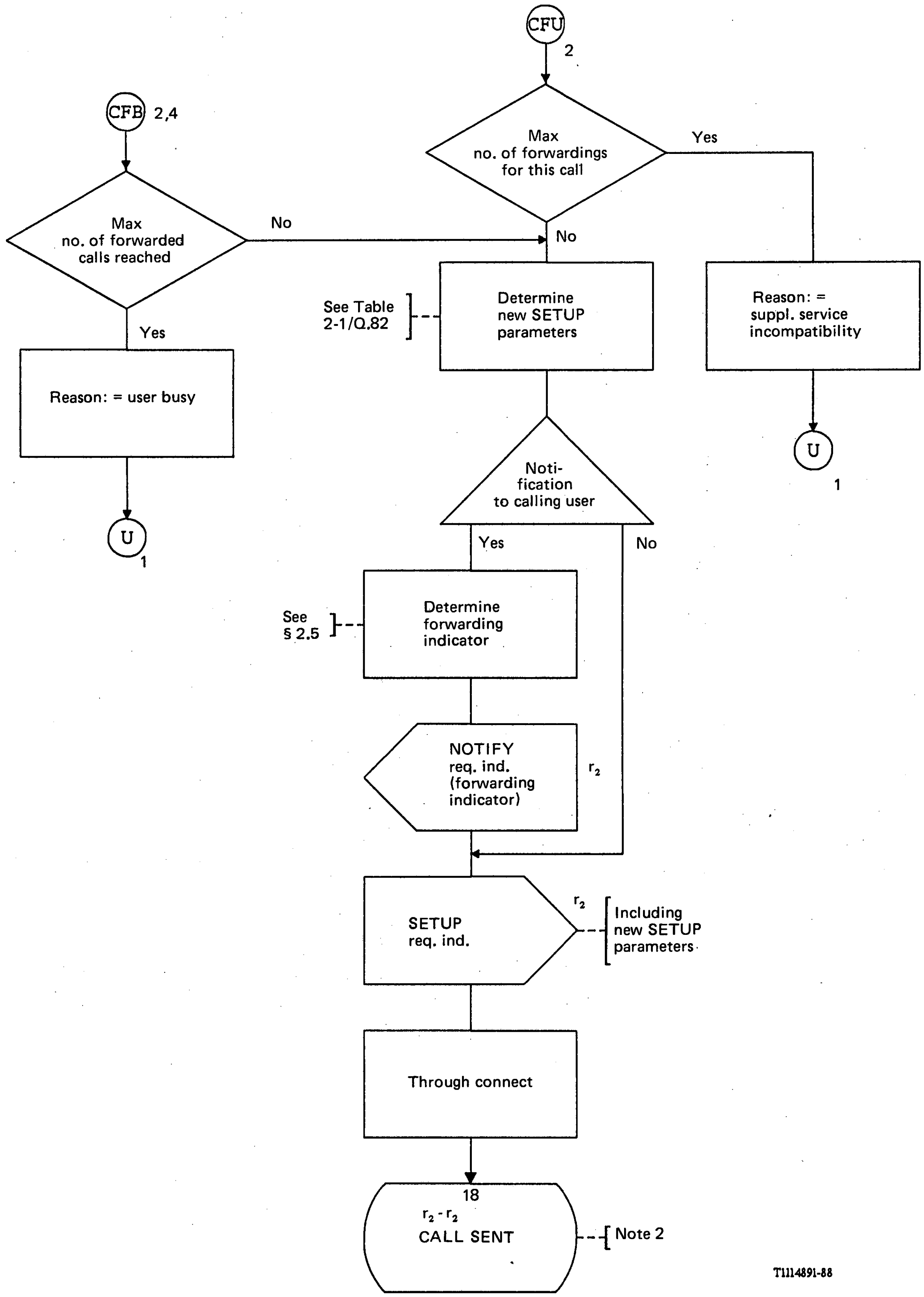


FIGURE 2-6/Q.82 (Sheet 2 of 8)

FE4/FE6/FE8 call forwarding



Note 2 – Further call handling as for basic call, but some additional functions (e.g. for charging) may be required.

FIGURE 2-6/Q.82 (Sheet 3 of 8)

FE4/FE6/FE8 call forwarding

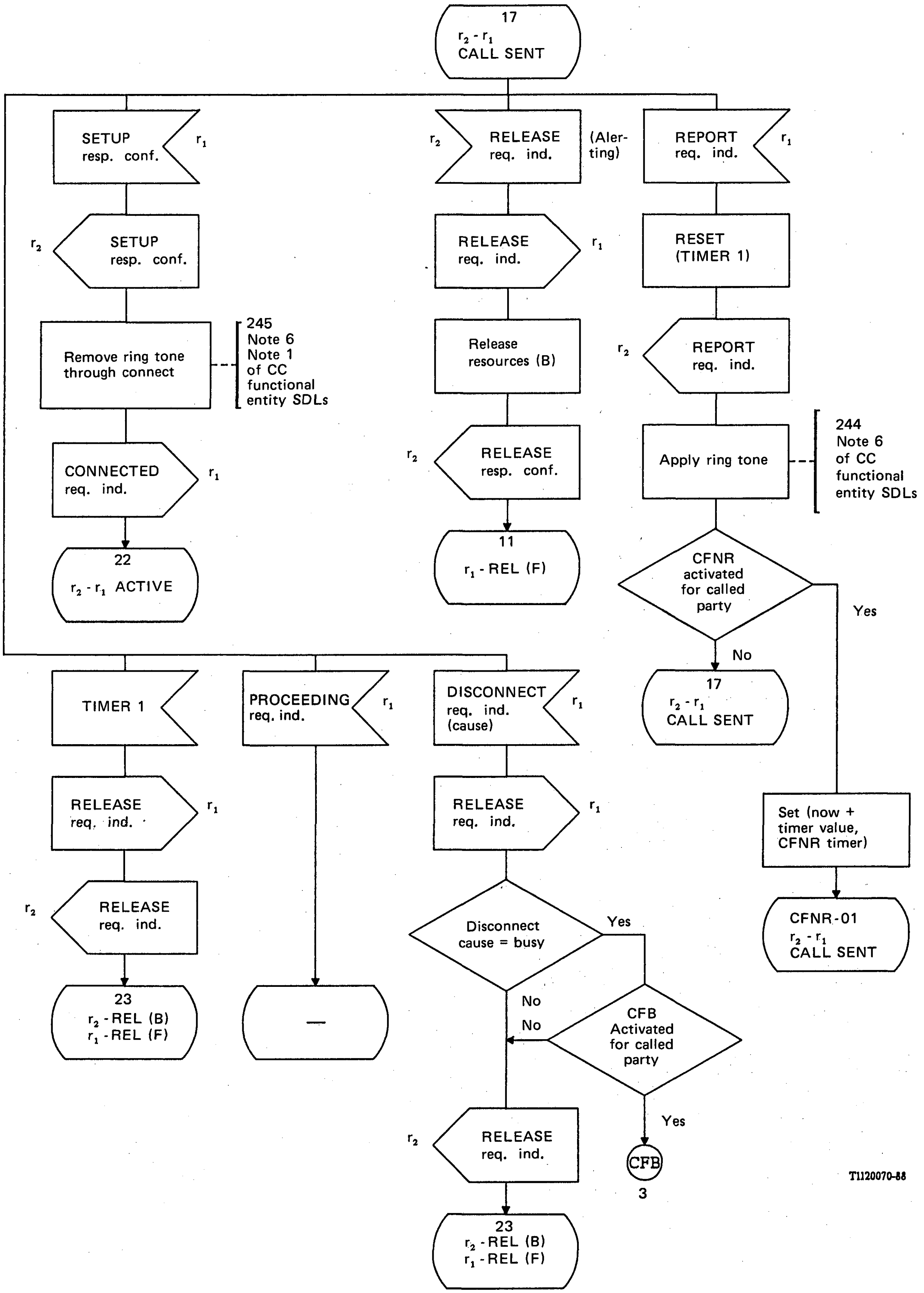


FIGURE 2-6/Q.82 (Sheet 4 of 8)

FE4/FE6/FE8 call forwarding

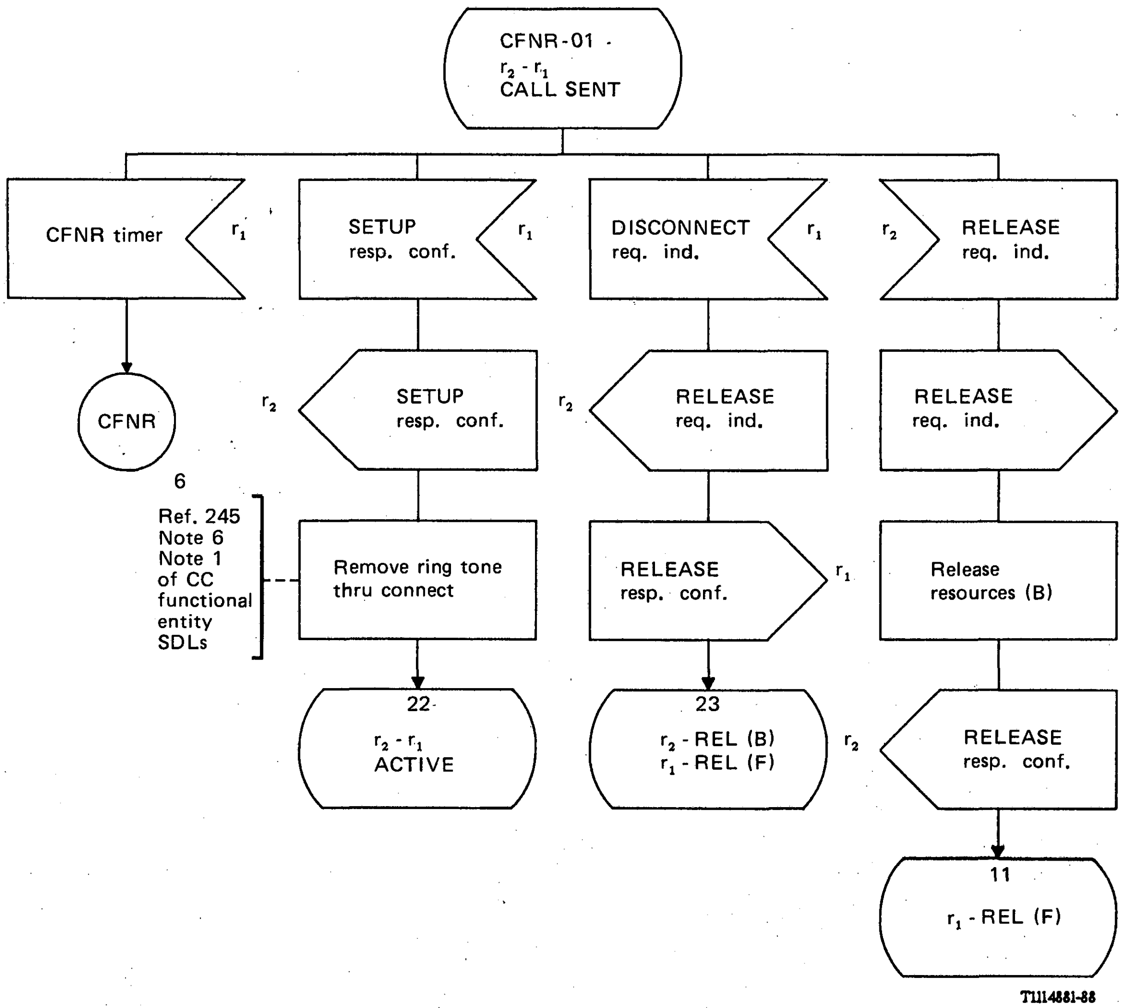


FIGURE 2-6/Q.82 (Sheet 5 of 8)

FE4/FE6/FE8 call forwarding

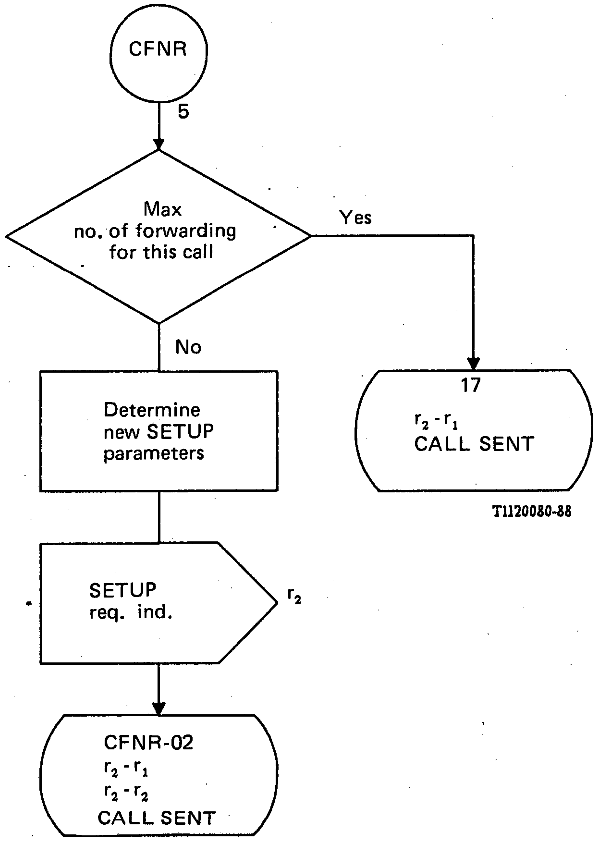
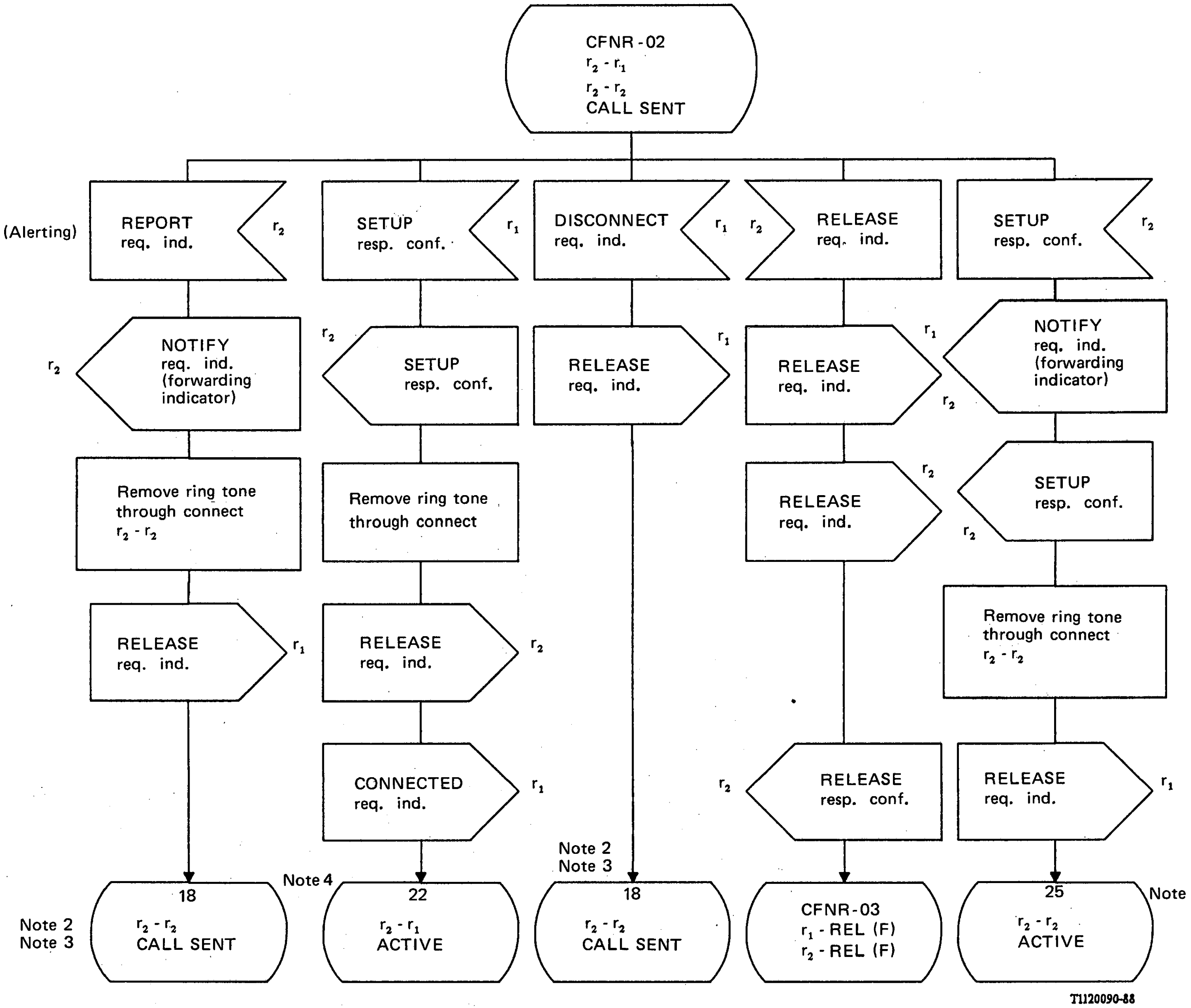


FIGURE 2-6/Q.82 (Sheet 6 of 8)

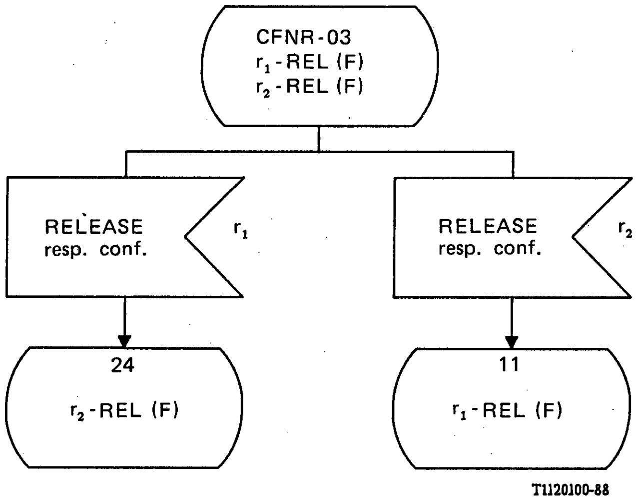
FE4/FE6/FE8 call forwarding



Note 2 – See Sheet 3 of 8.
Notes 3, 4 – See Sheet 8 of 8.

FIGURE 2-6/Q.82 (Sheet 7 of 8)

FE4/FE6/FE8 call forwarding



Note 3 — Resources associated with the r_1 relationship are released on receipt of RELEASE resp. conf. from r_1.

Note 4 — Resources associated with the r_2 relationship are released on receipt of RELEASE resp. conf. from r_2.

FIGURE 2-6/Q.82 (Sheet 8 of 8)

FE4/FE6/FE8 call forwarding

2.2.3 *SDL diagrams for other FEs*

These are not explicitly shown since they are equal to basic services (CC or CCA) SDLs with small additions which can be easily derived from the information flow diagrams.

2.2.4 *Definition of individual information flows*

Refer to information indicated in the Notes related to Figures 2-2 to 2-5/Q.82 and § 2.2.5.

2.2.5 *Multiple diversion address handling*

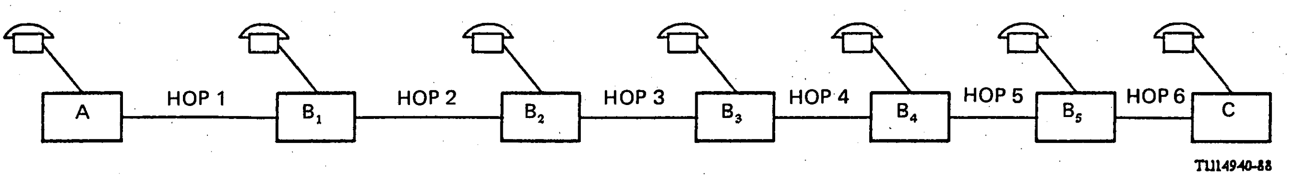


FIGURE 2-7/Q.82

TABLE 2-1/Q.82

Information carried in the SETUP req. ind

Parameter	HOP 1	HOP 2	HOP 3	HOP 4	HOP 5	HOP 6
Calling party number	A	A	A	A	A	A
Called party number	B_1	B_2	B_3	B_4	B_5	C
Last forwarding number		B_1 Note 1	B_2	B_3	B_4	B_5
Original call number		B_1	B_1	B_1	B_1	B_1
Forwarding counter		1	2	3	4	5
Last forwarding cause		$V(B_1)$ Notes 1, 2	$V(B_2)$ Note 2	$V(B_3)$ Note 2	$V(B_4)$ Note 2	$V(B_5)$ Note 2
Original forwarding cause		$V(B_1)$ Note 2	$V(B_1)$ Note 2	$V(B_1)$ Note 2	$V(B_1)$ Note 2	$V(B_1)$ Note 2

Note 1 – May be omitted to limit the number of parameters being passed in the network.

Note 2 – $V(B_1)$ indicates the reason for diversion from party B_1 with a value (V) equal to: unknown/not available, user busy, no reply or unconditional when diversion occurs.

TABLE 2-2/Q.82

Information in the backward direction

Parameter	HOP 1	HOP 2	HOP 3	HOP 4	HOP 5	HOP 6
Notification from		B_1	B_2	B_3	B_4	B_5
Forwarded-to-number from		For further study				

2.2.6 *Functional entity actions*

1) Functional entity actions for FE1
   - Receive indications relating to the service from FE2.
2) Functional entity actions for FE2
   - Receive indications relating to the service from FE4 and forward them to FE1.
3) Functional entity actions for FE3
   - No functional entity actions uniquely relating to this service are identified for FE3.
4) Functional entity actions for FE4/FE6
   - Store call information and user's service allocation and state.
   - Run periodic timers specific to the service.
   - Stimulate forward basic call setups to nominated numbers when service is active.
   - Increment service call counts and forward to next FE4/6.
   - Stimulate release procedures at service call count limit.
   - Receive and implement user's service requests from FE5/7.
   - Determine information to be notified backwards to other users.
5) Functional entity actions for FE5/FE7
   - Receive indications relating to the service from FE4/6.
   - Receive and forward user's service requests to FE4/5.
6) Functional entity actions for FE8
   - Receive and increment forward call counter.
     (*Note* – This is an attribute of FE4/6.)
   - Send forwarding indicators relating to the service of FE9 (this would be an attribute to FE6).
7) Functional entity actions for FE9
   - Receive indications relating to the service from FE8.

2.3 *Possible allocation of functional entities to physical locations*

	A PARTY			B_1 PARTY		B_x PARTY		C PARTY	
	FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8	FE9
Scenario 1	TE	LE	TR	LE	TE	LE	TE	LE	TE

Other scenarios are for further study.

2.4 *Interactions with other supplementary services*

The interaction with supplementary services, such as calling line identification, connect-test line identification and advice of charge have been considered; interactions with other supplementary services are for further study.

2.5 *Terminology and abbreviations*

Abbreviations used:

CFU	Call forwarding unconditional
CFB	Call forwarding on busy
CFNR	Call forwarding on no reply
CD	Call deflection
CC	Call control
CCA	Call control agent
FE	Functional entity
TE	Terminal equipment
LE	Local exchange
TR	Transit exchange
NDUB	Network determined user busy
UDUB	User determined user busy

Terminology:

Original called number:
The number the originating party dials.

Connected line number:
The number of the final destination.

Forwarding number:
The number of the served user, i.e. the subscriber who initiates the forwarding service and from where the call has been forwarded.

Forwarded-to-number:
The number to which a call has been forwarded.

Forwarding indicator:
Indicator showing that call has been forwarded and indicating whether or not this information should be given to calling party.

3 Call deflection

Under study.

4 Line hunting

4.1 *Introduction*

4.1.1 *Definition*

Line hunting is a supplementary service which enables incoming calls to a specific ISDN number to be distributed over a group of interfaces.

Note – Expansion of the line hunting service to cover the case of hunting on available ISDN numbers or addresses, rather than on interfaces is a possible extension of the service.

4.1.2 *Description*

This description covers the form of line hunting which applies to interfaces within one node. It is an anticipated further extension to enable the group of interfaces available for selection to be distributed over more than one node.

The selection of an interface within a node is performed on the basis of the hunting algorithm used. (Where hunting is extended over more than one node the network routing techniques used to extend the selection to the next node may be similar to that used for the call forwarding supplementary service, though applied by the Administration. The precise description of multi-node line hunting is for further study.)

An access belonging to a line hunting group may also be addressed using an individual ISDN number. Facilities associated with the individual number are not affected by line hunting.

4.2 *Definition of the functional model*

The additional functionality required for line hunting, over that of the basic service, is confined to a single node, as seen in Figure 4-1/Q.82.

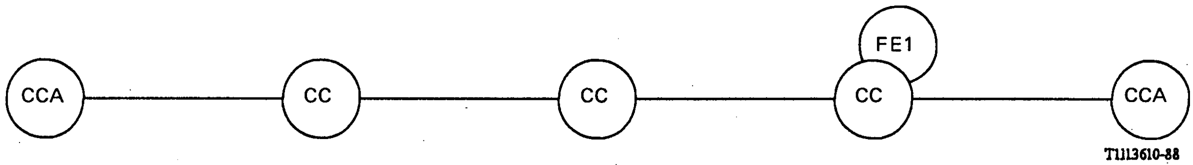


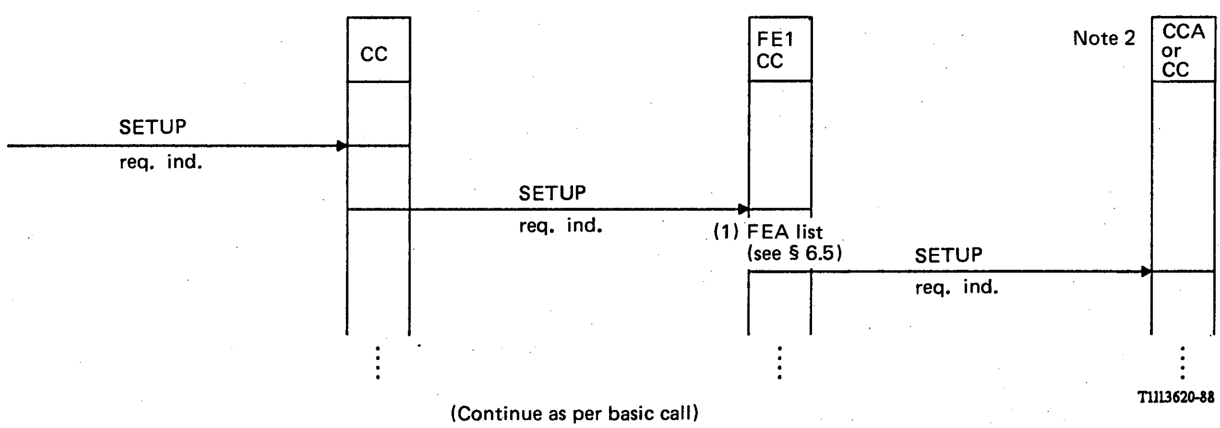
FIGURE 4-1/Q.82

Relationship of line hunting to basic service

4.3 *Information flow*

4.3.1 *Flow for single node hunting*

For the single node case, the information flows are those defined for the basic call as shown in Figure 4-2/Q.82. No information flows arise as a result of the hunting action.



Note 1 – Only those entities directly involved in line hunting are shown.

Note 2 – The selected access may be to a CC or a CCA.

FIGURE 4-2/Q.82

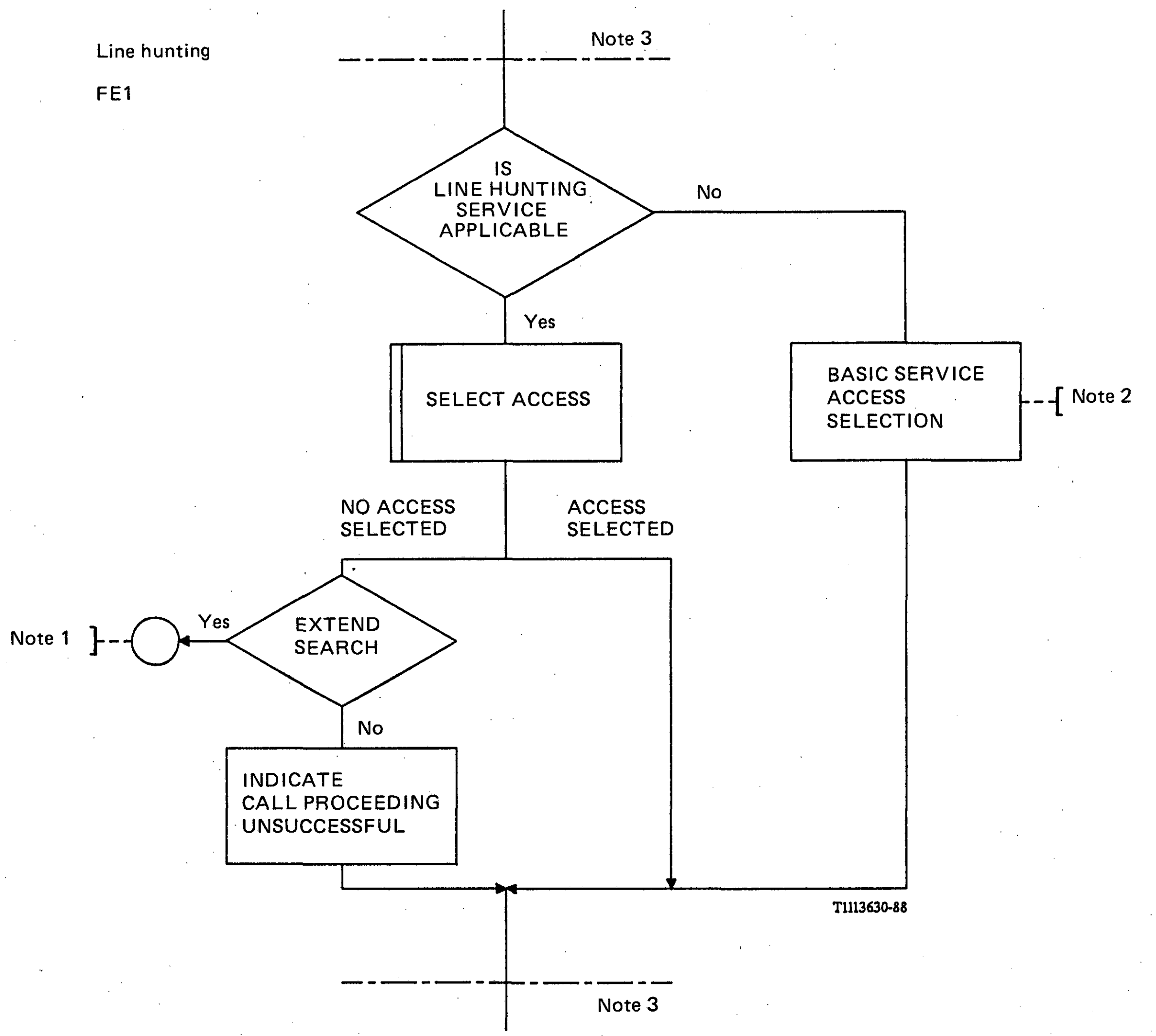
Information flows for line hunting

4.3.2 *Flow for multi-node hunting*

This is for further study.

4.4 *SDL diagrams*

The SDL diagrams for the entity FE1 are shown in Figure 4-3/Q.82 and Figure 4-4/Q.82.



Note 1 – For further study.

Note 2 – This process is described within the basic service description.

Note 3 – This SDL is executed within the "Term. Screen. Process Attempt" process boxes at reference points 241, 241A in the basic call SDL.

FIGURE 4-3/Q.82

SDL1 for line hunting

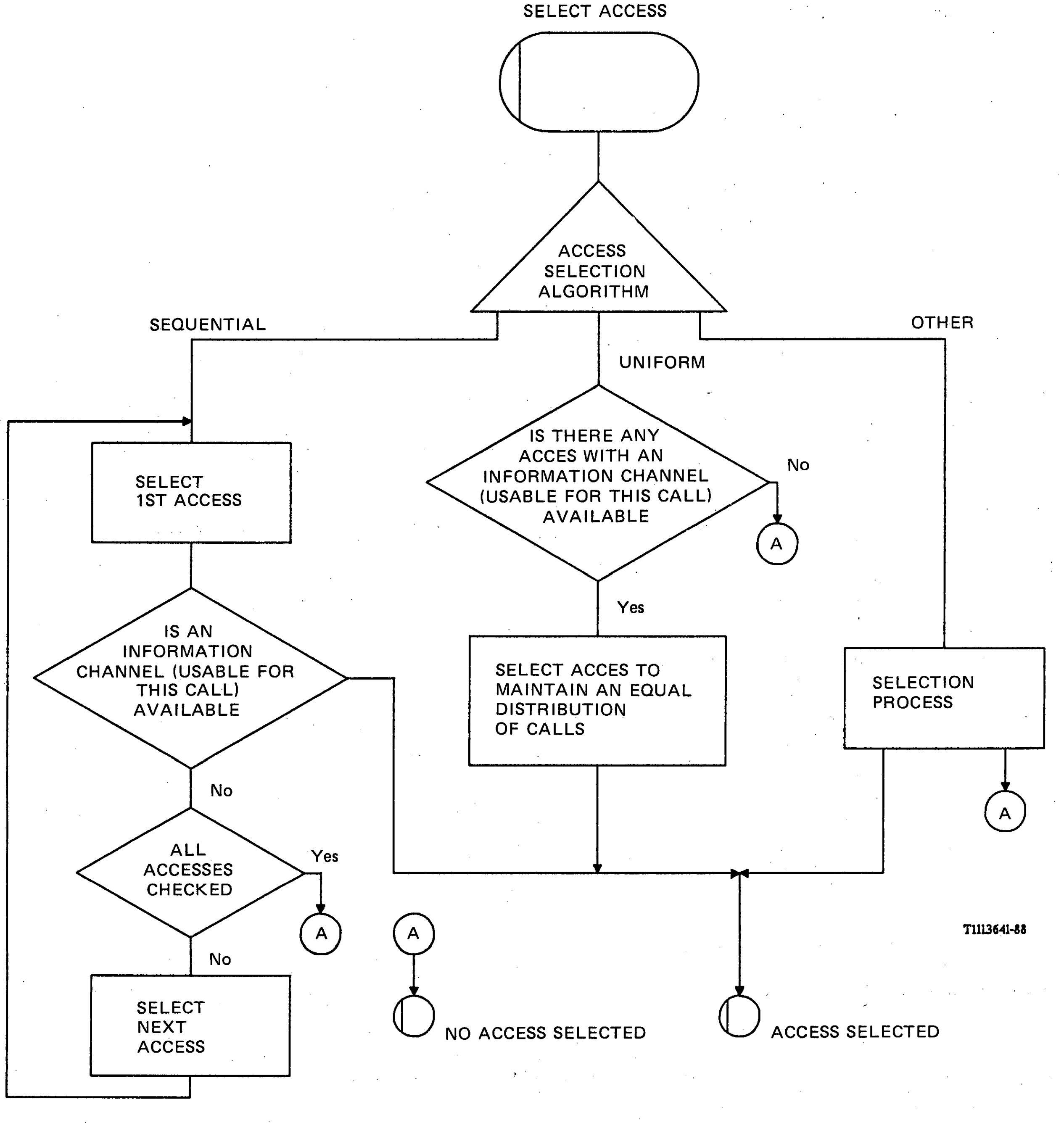


FIGURE 4-4/Q.82

SDL2 for line hunting

4.5 *Functional entity actions*

4.5.1 *Single node hunting*

The FEAs attributed to entity FE1, the line hunting entity, indicated by (1) on the information flow diagram are as follows:

- determine hunting algorithm;
- select free interface.

4.5.2 *Multi-node line hunting*

FEAs, in addition to the single node FEAs, which are required for hunting over more than one node are for further study.

4.6 *Physical locations for functional entities*

The scenarios which apply to line hunting are shown in Table 4-1/Q.82.

TABLE 4-1/Q.82

Possible line hunting scenarios

Scenario \ Functional entities	CCA	CC	CC	CC/FE1	CC	CCA
1) Basic rate access	TE	LE	TR	LE	–	TE
2) Basic rate access	TE	LE	TR	NT2	–	TE
3) Primary rate access	TE	LE	TR	LE	NT2	TE

Recommendation Q.83

CALL COMPLETION SUPPLEMENTARY SERVICES

1 Call waiting

1.1 *General*

This Recommendation provides information on the functions in ISDN entities and the information flows between the entities which are required to provide the call waiting supplementary service.

The **call waiting supplementary service** will permit a subscriber to be notified of an incoming call (as per basic call procedures) with an indication that no interface information channel is available.

The user then has the choice of accepting, rejecting or ignoring the waiting call (as per basic call procedures).

1.2 *Description*

1.2.1 *General description*

The ISDN call waiting service allows notification to subscriber B of the incoming call to be out-of-band and this is the assumed case for this definition. In addition, as a service provider option audible in-band indications may be provided.

Where this option is provided, the application of in-band indications, in relation to particular call types and channels, is for further study. Where applied, tones should be in accordance with Recommendation E.180.

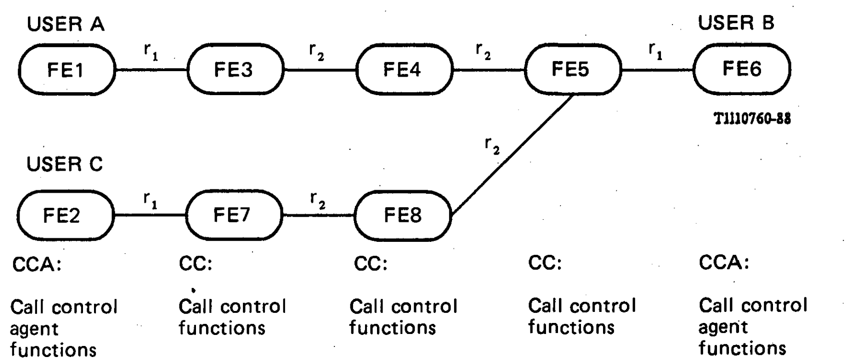
The maximum number of calls that can be handled (e.g. active, held, alerting, waiting) for each ISDN number on a given interface is specified at subscription time.

1.2.2 *Qualifications on the applicability to telecommunication services*

This supplementary service is considered meaningful when applied to the telephony teleservice, speech and 3.1 kHz audio bearer services. Furthermore, it may also be meaningful when applied to other services.

1.3 *Derivation of the functional model for call waiting service*

The model used for illustrating the call waiting supplementary service procedures is given below:



CCA is the functional entity that serves the user and is responsible for initiating functional requests and interacting with the network. CC is the functional entity within the network that cooperates with its peers to provide the services requested by CCA.

r_1 and r_2 are relationships between functional entities wherein information flows occur in order to process call attempts on service requests.

1.4 *Information flow diagrams*

This paragraph contains the information flow diagram for the successful sequences of call waiting.

The following flow diagrams are identified:

- Figure 1-1/Q.83: call waiting notification: case 1;
- Figure 1-2/Q.83: call waiting notification: case 2;
- Figure 1-3/Q.83: call waiting notification: case 3;
- Figure 1-4/Q.83: call waiting acceptance by clearing the A call: case 1;
- Figure 1-5/Q.83: call waiting acceptance by clearing the A call: case 2;
- Figure 1-6/Q.83: call waiting acceptance by holding the A call: case 1;
- Figure 1-7/Q.83: call waiting acceptance by holding the A call: case 2;
- Figure 1-8/Q.83: call waiting rejection;
- Figure 1-9/Q.83: call waiting cancellation.

1.4.1 *Call waiting terminology*

Throughout the stage 2 description the following terminology will be used:

i) Subscriber B: This is the subscriber who is provided by the network with call waiting service on a particular interface.

ii) User at B: This is the one user who reacts to the call waiting at B.

iii) User C: This is the user who has originated a call to B which causes the call waiting service to be invoked.

iv) One user at A: This represents a user who is engaged in a call with a user at B (this call can be in any state).

v) Information channel control: A terminal that has information channel control is active on a call, is alerting for an incoming call, has an outgoing call in a state following or including the outgoing call proceeding state, or has a call on hold with reservation.

1.4.2 *Call waiting procedures with successful outcome*

The call waiting procedures with successful outcome are hereafter described by means of generic information flow diagrams.

1.4.2.1 *Call waiting notification*

The call waiting notification procedures are given in Figures 1-1/Q.83 to 1-3/Q.83.

Two categories are identified:

i) Figures 1-1/Q.83 and 1-2/Q.83 describe the case where the served user is notified of an incoming call and the network requires an interface channel to his user access and it has detected that all information channels are in use (no information channel available).

ii) Figure 1-3/Q.83 describes the case where the served user is notified of an incoming call and the network requires an interface channel to his user access and it has detected that an existing free information channel, which is the only compatible terminal, is in the busy condition (information channel available).

The following procedures are valid for call waiting with no information channel available.

When an incoming call from a user C arrives at the functional entity controlling the access at B and encounters the channel's busy condition and the network determined user busy conditions do not result, then the call shall be offered to B by means of the Setup procedure with the "no information channel" indicated.

The following actions will be taken by the terminals connected to the user B access:

i) Incompatible terminals will not react.

ii) Terminals not presently controlling the information channel that are compatible with the incoming call will respond by initiating the release procedure indicating a no information circuit/channel available condition.

iii) Terminals presently controlling the information channel that do not support the call waiting service and are compatible with the incoming call will respond either by initiating the release procedure indicating a user busy condition or by acting as incompatible terminals (e.g. no reaction).

iv) Terminals presently controlling the information channel that support the call waiting service and that are compatible with the incoming call will respond by initiating the call progress (reporting) procedure and will give a local alert to the human user by giving an audible and/or visual (in-band) indication.

When a positive response is received from the terminals at B within the normal basic call period, that (those) user(s) is (are) being informed about the incoming call, then the calling user at C will be given an indication that the called user(s) is (are) being informed. This will be performed by the network at the B side by sending of the ringing tone; some networks may instead generate a special call waiting tone, provided the bearer capability is either speech or audio 3.1 kHz. In addition, optionally, a call waiting out of band indication may be sent to the C user.

Case 1: Both B Channels busy, one terminal controlling a B Channel supports call waiting.

Figure 1-1/Q.83 shows the generic information flow diagram for call waiting notification when the incoming call from user C is delivered at the user B access by broadcast data link without available information channels.

The following user B access terminals are assumed:

- TE1: Being a compatible terminal not supporting call waiting occupying channel B_1 and having a call reference CR1. This terminal is assumed to be located in FE6.
- TE2: Being a compatible terminal not presently controlling the information channel. This terminal is assumed to be located in FE6′.
- TE3: Being a compatible terminal supporting call waiting, occupying channel B_2 and having a call reference CR2. This terminal is assumed to be located in FE6″.

The new incoming call from C is assumed to have a call reference CR3.

Case 2: Both B Channels busy, both terminals controlling the B Channels support call waiting.

Figure 1-2/Q.83 shows the generic information flow diagram for call waiting notification when the incoming call from user C is delivered at the user B access by broadcast data link without available information channels.

The following user B access terminals are assumed.

- TE1: Being a compatible terminal supporting call waiting occupying channel B_1 and having a call reference CR1. This terminal is assumed to be located in FE6.
- TE2: Being a compatible terminal not presently controlling the information channel. This terminal is assumed to be located in FE6′.
- TE3: Being a compatible terminal supporting call waiting, occupying channel B_2 and having a call reference CR2. This terminal is assumed to be located in FE6″.

The new incoming call from C is assumed to have a call reference CR3.

Case 3: One B Channel busy, the terminal controlling the busy B Channel supporting call waiting.

Figure 1-3/Q.83 shows the generic information flow diagram for call waiting notification when the incoming call from user C is delivered at the user B access by broadcast data link with an available information channel, but the only compatible terminal is presently controlling an information channel.

If the thus compatible terminal has call waiting facilities available, it alerts its user (audible or visible indication) and notifies the network (REPORT). The user then can decide whether to accept the waiting call or not.

1.4.2.2 *Call waiting acceptance*

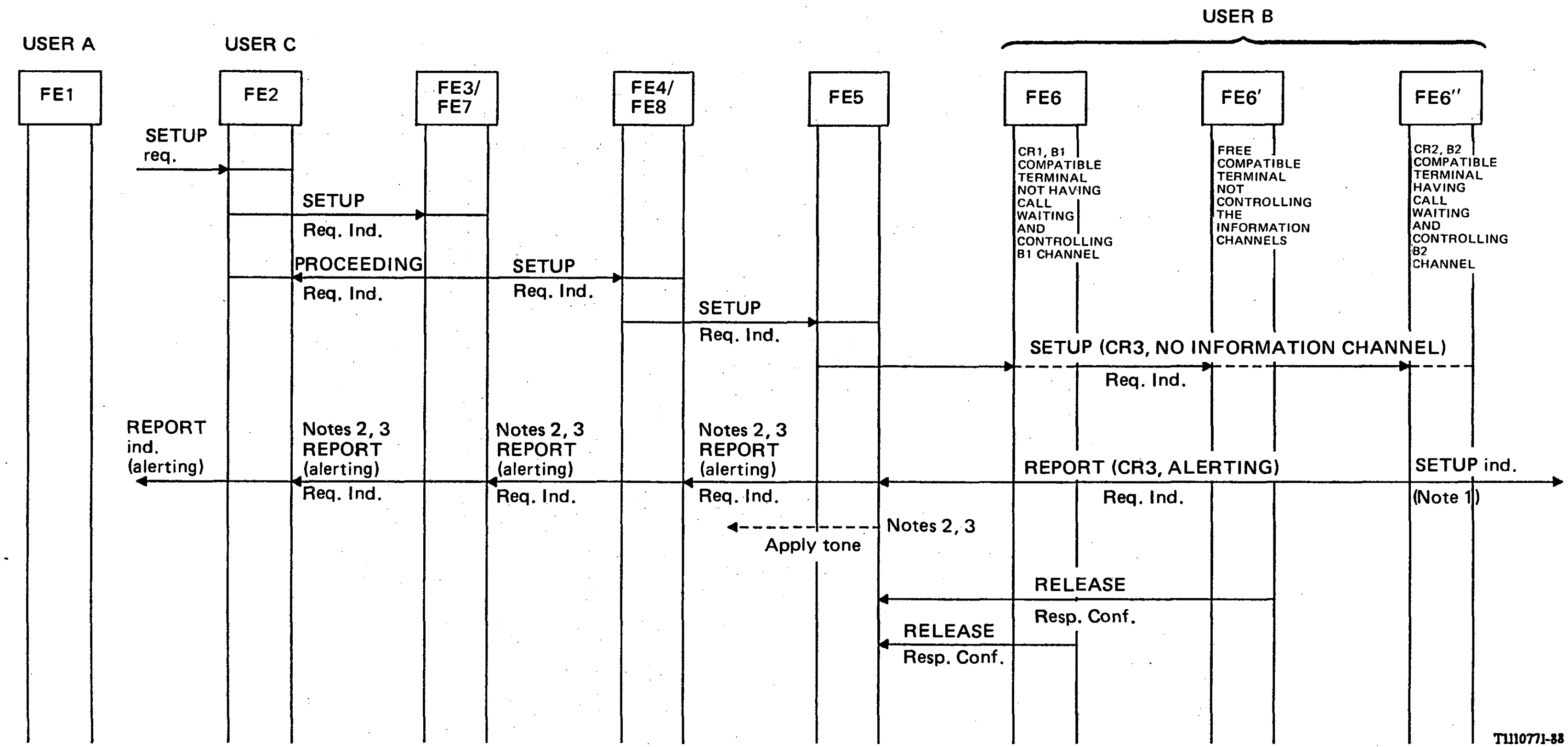
If a user at B requests, within a specified period, to connect to the waiting call, two procedures may be required by user B with regard to the active call with a user at A.

i) Procedure one will terminate the specified active call with a user at A, while the call between a user at C and the user at B is completed in the normal manner (see Figures 1-4/Q.83 and 1-5/Q.83).

ii) Procedure two will place the specified active call with a user at A into a held state, while the call between a user at C and the user at B will be completed in the normal manner. The previously active call between a user at A and the user at B is put into the held state. From this state other supplementary services, for example, three party service may be used (see Figures 1-6/Q.83 and 1-7/Q.83).

   This acceptance provokes the initiation of a Hold sequence by the terminal to the network. The network will hold the previous call between a user at A and the user at B, while the waiting call from a user at C will be connected by a Setup response/confirm sequence.

   Since more than one terminal controlling the information channels can respond positively to a call waiting offering, the network will subsequently apply a clear procedure to the remaining terminals having responded positively after having received the Setup response/confirmation order.



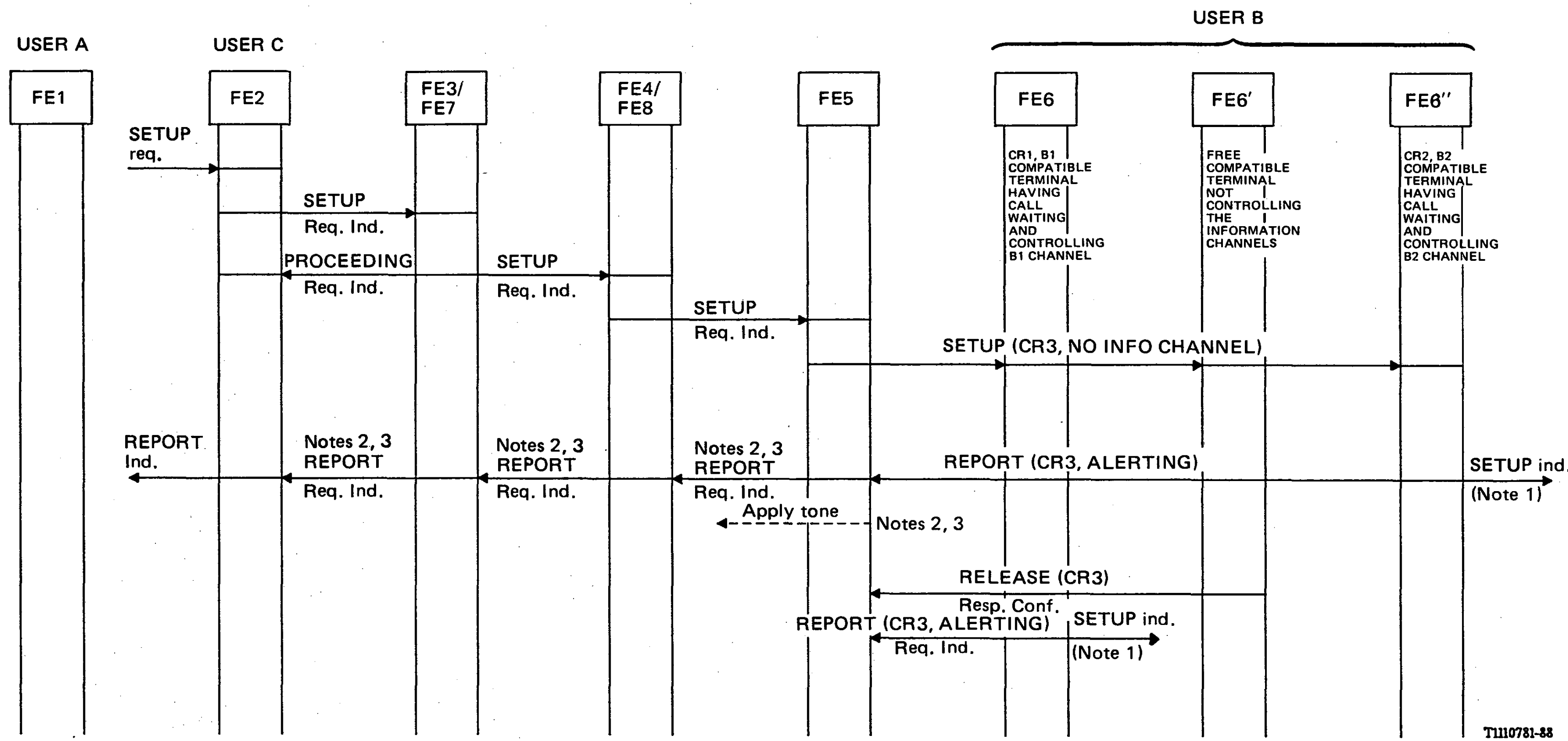
Note 1 – Call waiting audible and/or visual indication.

Note 2 – No answer timer is started, this timer specifies the period the network will wait for a response, from party B, to the offered call from User C.

Note 3 – An optional call waiting notification is given to the User C.

FIGURE 1-1/Q.83

Call waiting notification (case 1)



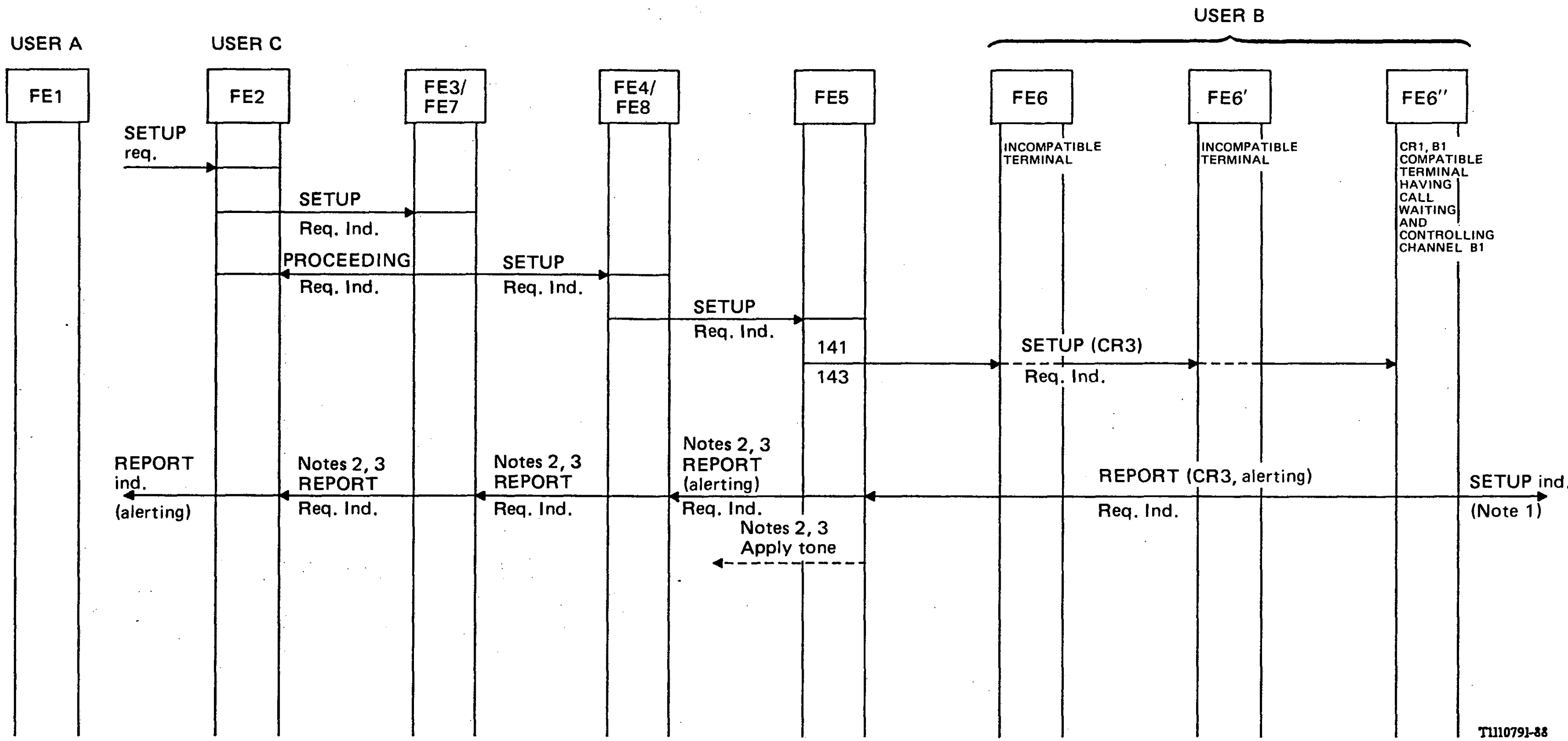
Note 1 – Call waiting audible and/or visual indication.

Note 2 – No answer timer is started, this timer specifies the period the network will wait for a response, from party B, to the offered call from User C.

Note 3 – An optional call waiting notification is given to the User C.

FIGURE 1-2/Q.83

Call waiting notification (case 2)



Note 1 – Call waiting audible and/or visual indication.

Note 2 – No answer timer is started, this timer specifies the period the network will wait for a response, from party B, to the offered call from User C.

Note 3 – An optional call waiting notification is given to the User C.

FIGURE 1-3/Q.83

Call waiting notification (case 3)

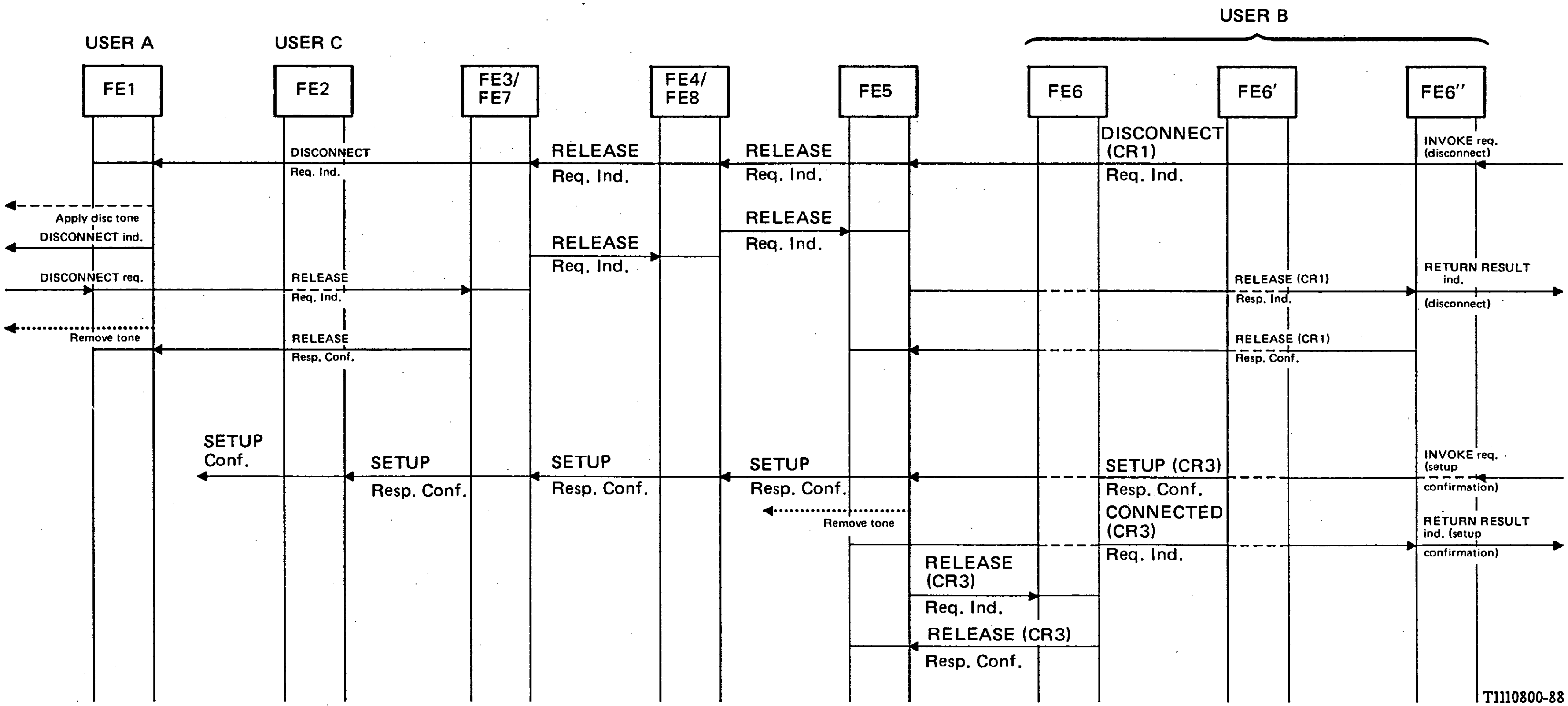


FIGURE 1-4/Q.83

Call waiting acceptance (clearing A-call): case 1

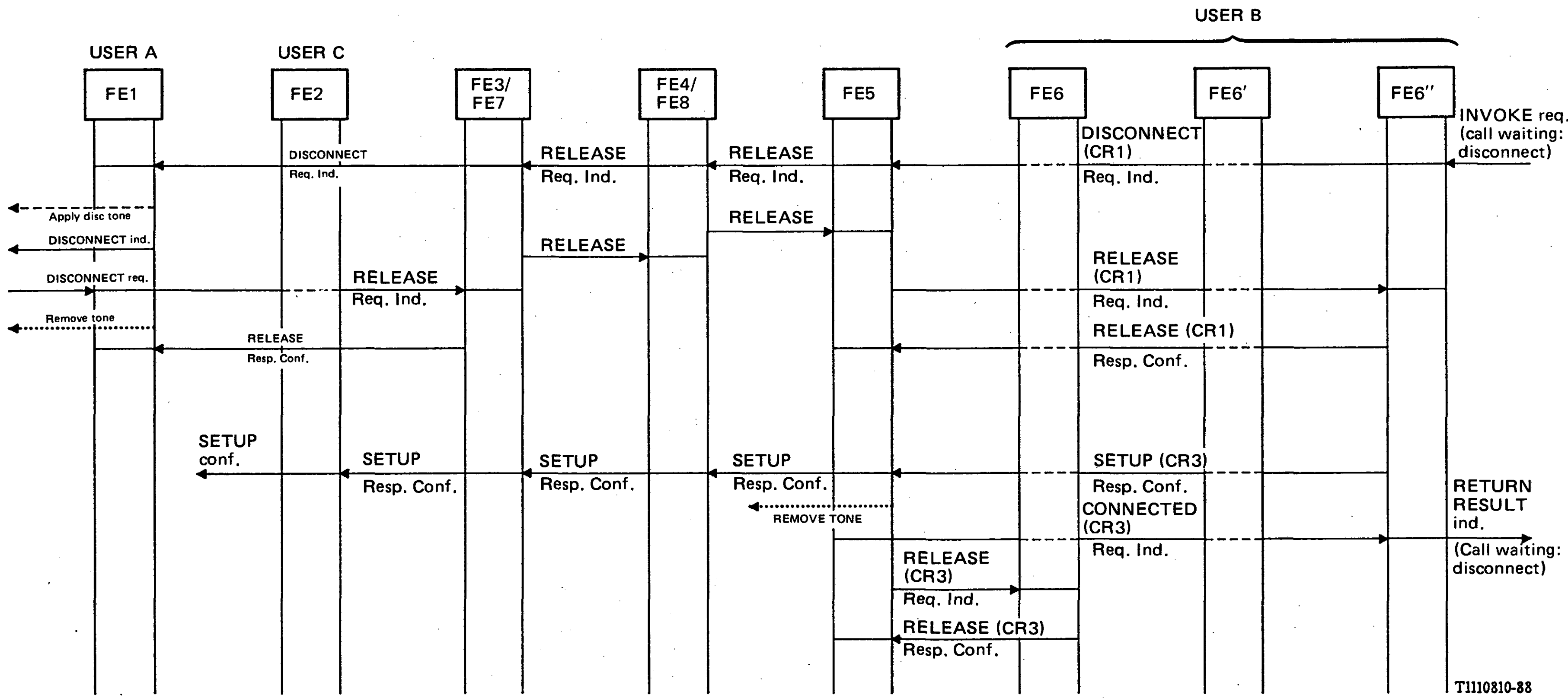


FIGURE 1-5/Q.83

Call waiting acceptance (clearing A-call): case 2

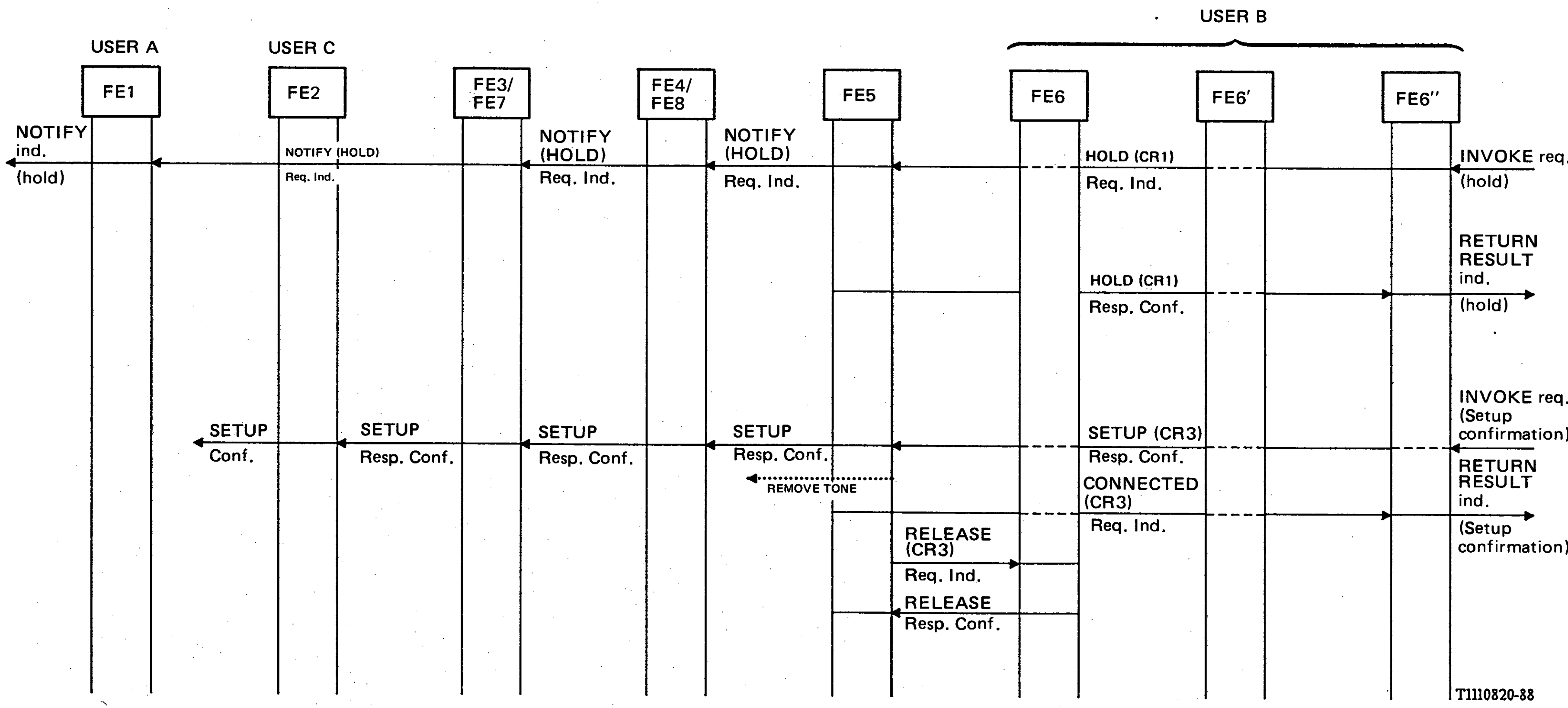


FIGURE 1-6/Q.83

Call waiting acceptance (holding A-call): case 1

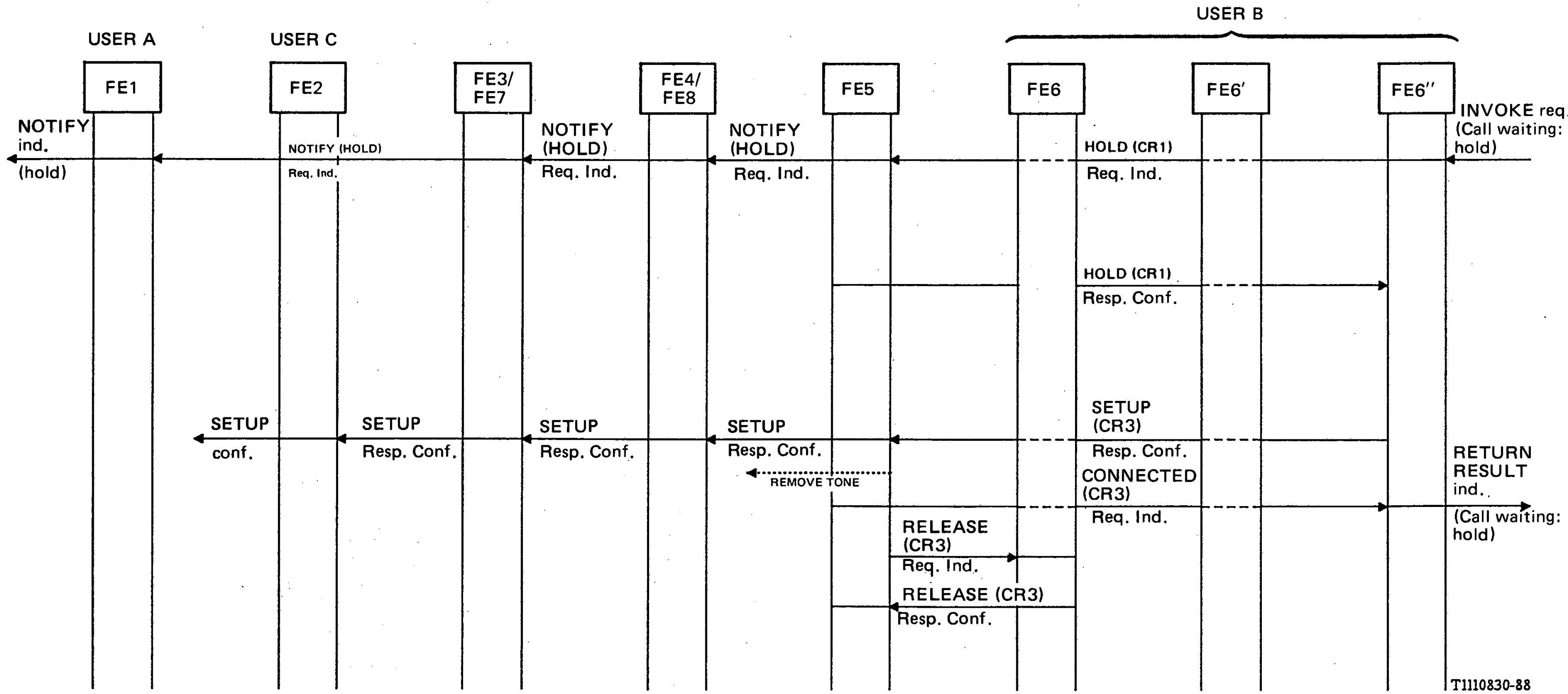


FIGURE 1-7/Q.83

Call waiting acceptance (holding A-call): case 2

1.4.2.3 *Call waiting rejection*

The user at B can also, within the specified period, reject the new incoming call from user C. In this case, call clearing procedures (see Figure 1-8/Q.83) will apply at the basic access interface.

If the terminals controlling the information channels have initiated the Report (alerting) procedures, the network will wait after the reception of the first release sequence from a terminal for the possible reaction of the other terminal. If all the users reject the waiting call, the network shall initiate the clearing of the call indicating the user determined busy condition of the called users to the calling user C.

1.4.2.4 *Call waiting notification ignored*

If the specified period expires without any acceptance from B of the incoming call, then the network shall inform B of this situation and also inform C that this call cannot be connected.

Normal release applies to the call attempt from C by sending an appropriate clearing indication to the calling user (see Figure 1-9/Q.83).

A rejection of the waiting call by one terminal will not stop the call waiting timer, as another terminal may accept the waiting call within the specified period.

1.5 *SDL diagrams for functional entities*

This section contains the SDL diagrams for the network function entity FE5. The entire SDL is a variation of the basic call r_2-r_1 CALL SENT state.

The relationships "r_1" and "r_2" have been deleted in functional entity FE5 between functional entities FE4 (r_2) and FE6 (r_1). (See § 1.3.)

1.6 *Functional entity actions*

The functional entity actions are identical to the actions required for the circuit mode switched bearer services speech, 3.1 kHz audio unrestricted and alternate speech/unrestricted information transfer.

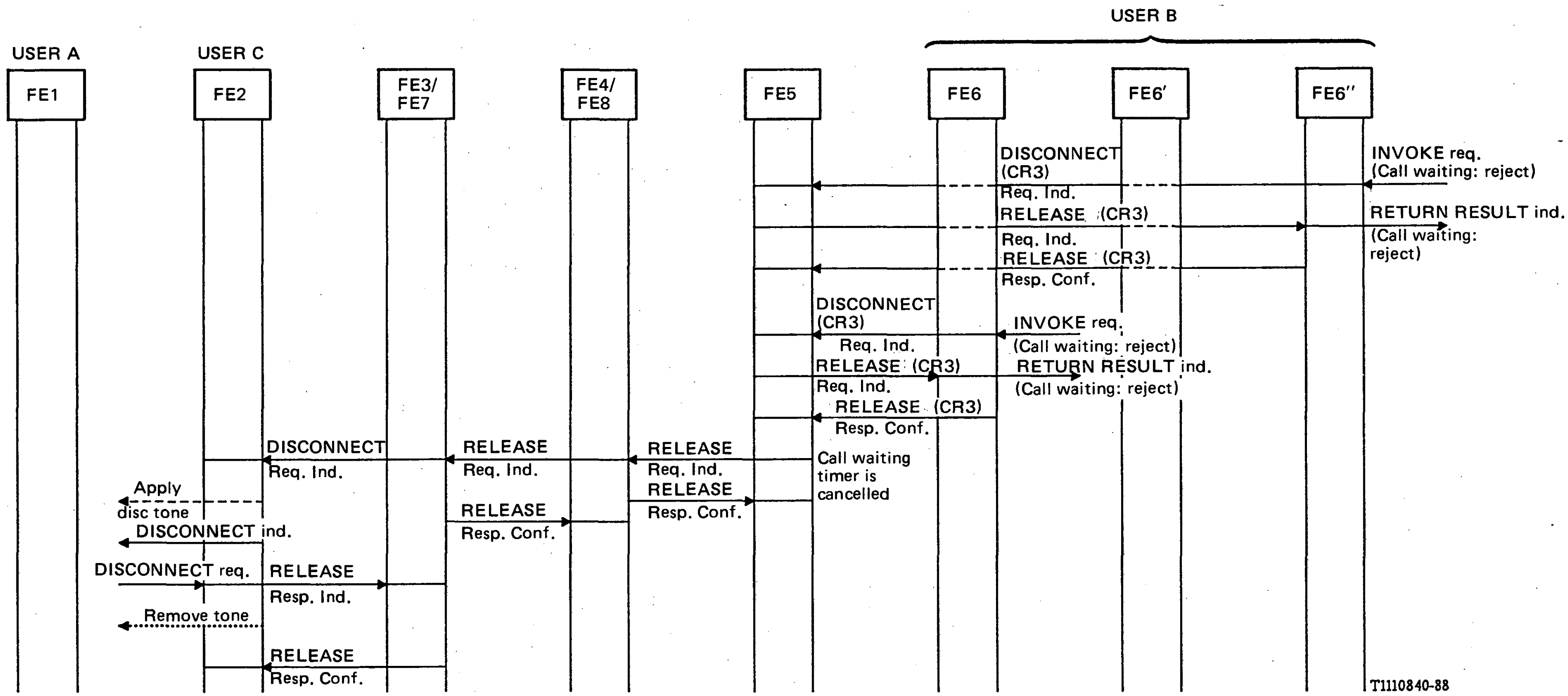


FIGURE 1-8/Q.83

Call waiting rejection

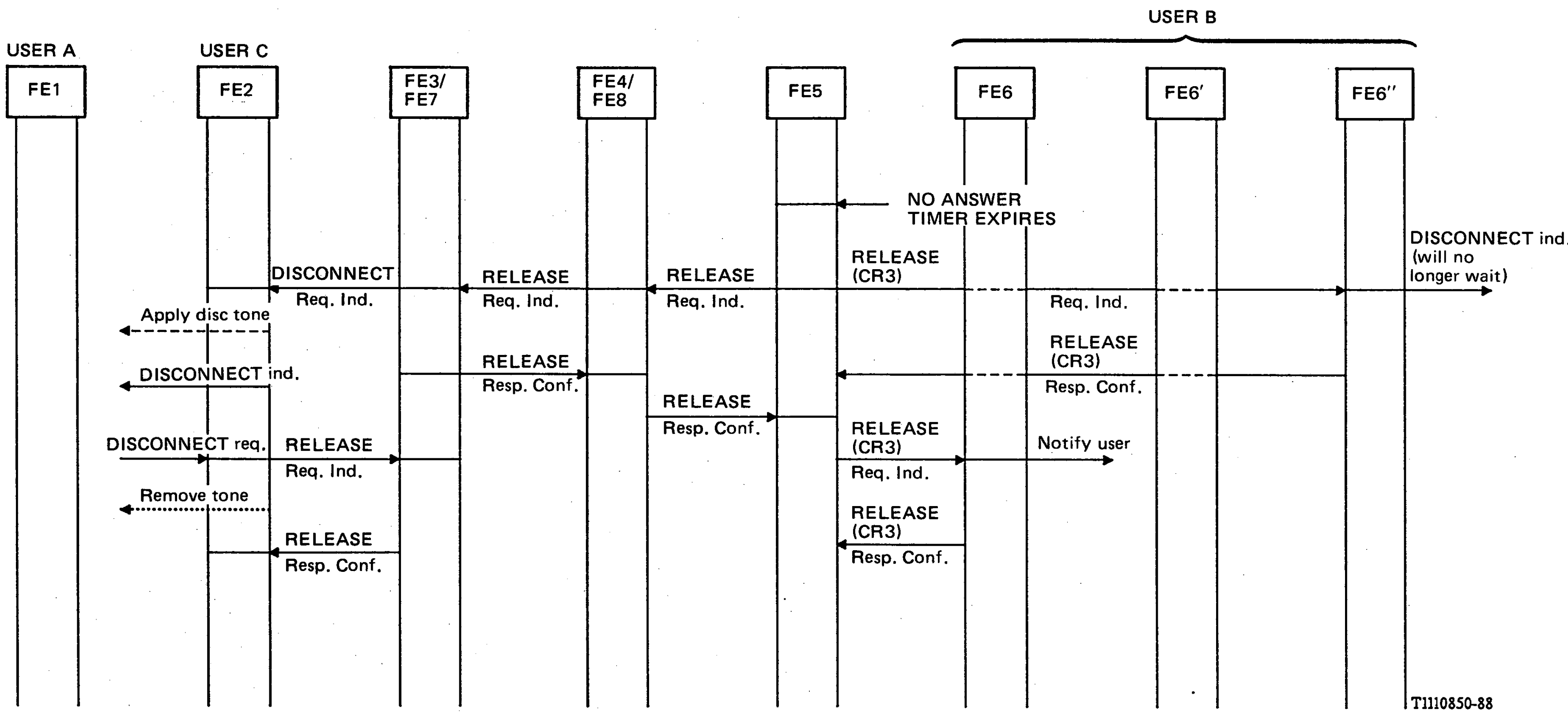
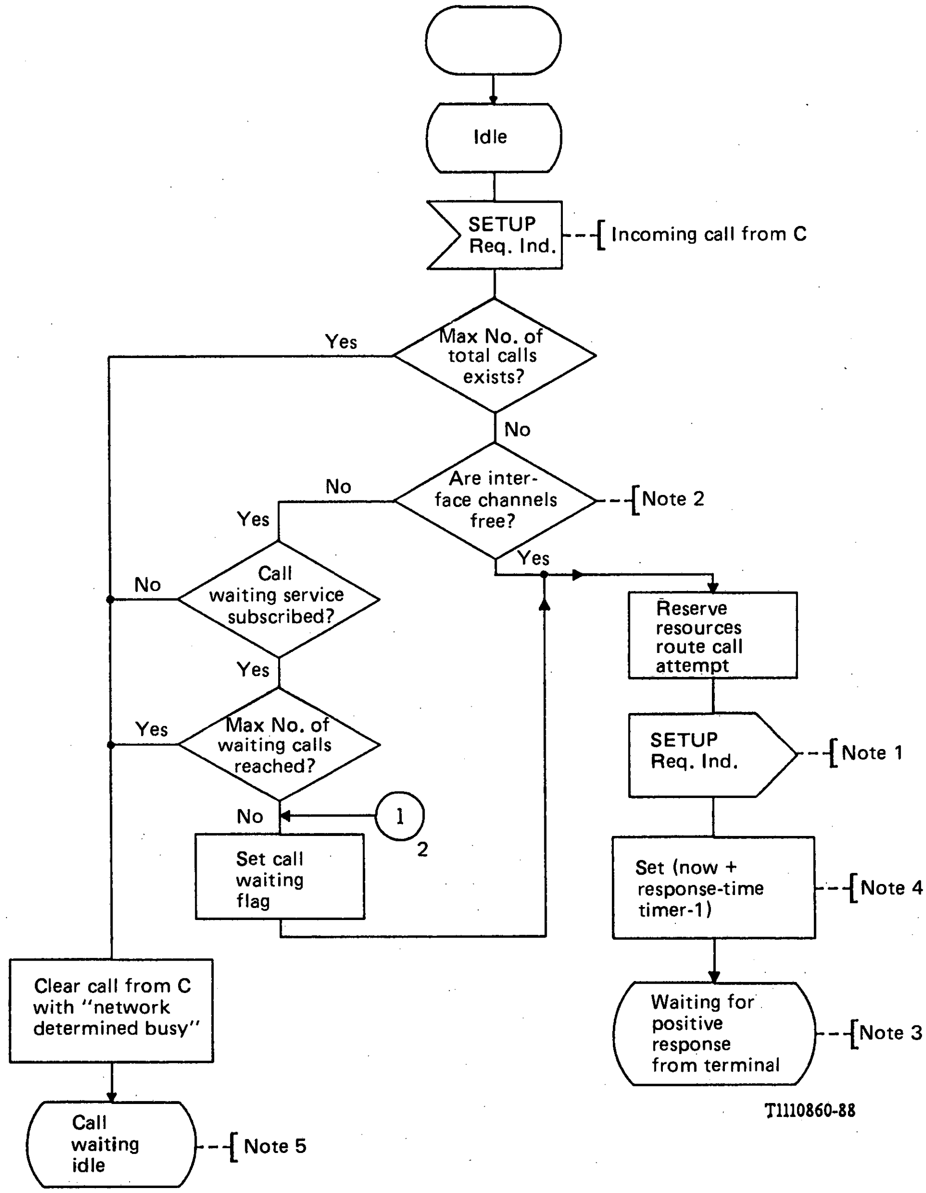


FIGURE 1-9/Q.83

Call waiting notification ignored



Note 1 – If the call waiting flag is set then the "no information channel" indication should be included. When not set, normal call offering procedures apply. Depending on the terminal configuration the set up message will be delivered by point-to-point or by broadcast data link.

Note 2 – When user network interface channels are free and the call waiting service is subscribed, some implications may occur with regard to channel negotiation procedure complications, in particular with exclusive channel negotiation.

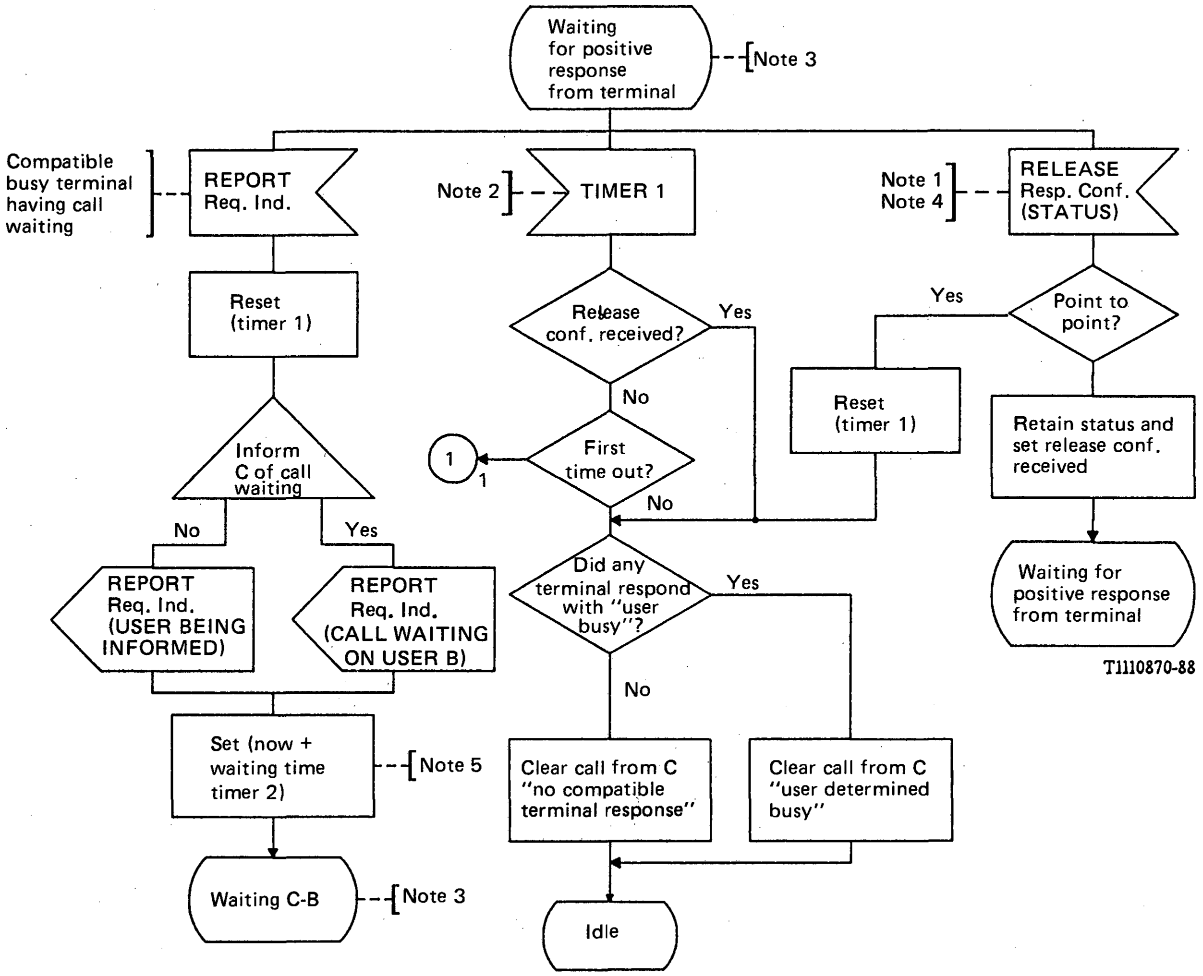
Note 3 – This is a substate of the "$r_2 - r_1$ CALL SENT" state of the basic service description.

Note 4 – This timer is the same as for the basic call service.

Note 5 – Other possible supplementary services may apply; e.g. CCBS, CFB.

FIGURE 1-10/Q.83 (Sheet 1 of 7)

Call waiting process FE5



Note 1 — Optionally compatible busy terminals not having call waiting may not respond.

Note 2 — Timer 1 expiration is dependent on terminal configuration being either point-to-point or broadcast link.

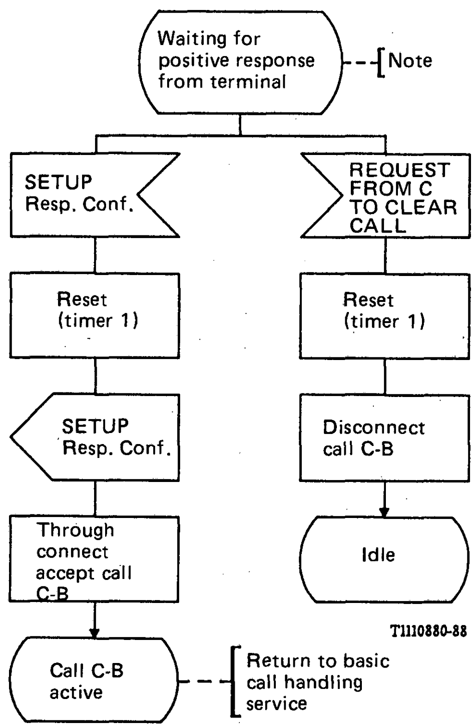
Note 3 — This is a substate of the "$r_2 - r_1$ CALL SENT" state of the basic service description.

Note 4 — The status may either indicate "USER BUSY" (for compatible busy terminals not having call waiting); or "no-circuit-or-channel available" (for free compatible terminal).

Note 5 — If the call waiting flag is not set this is the normal call service supervision timer which controls the time-out for Report (Alert) without receipt of the setup confirmation, and specifies the period the network will wait for a response, from party B, to the offered call from user C.

FIGURE 1-10/Q.83 (Sheet 2 of 7)

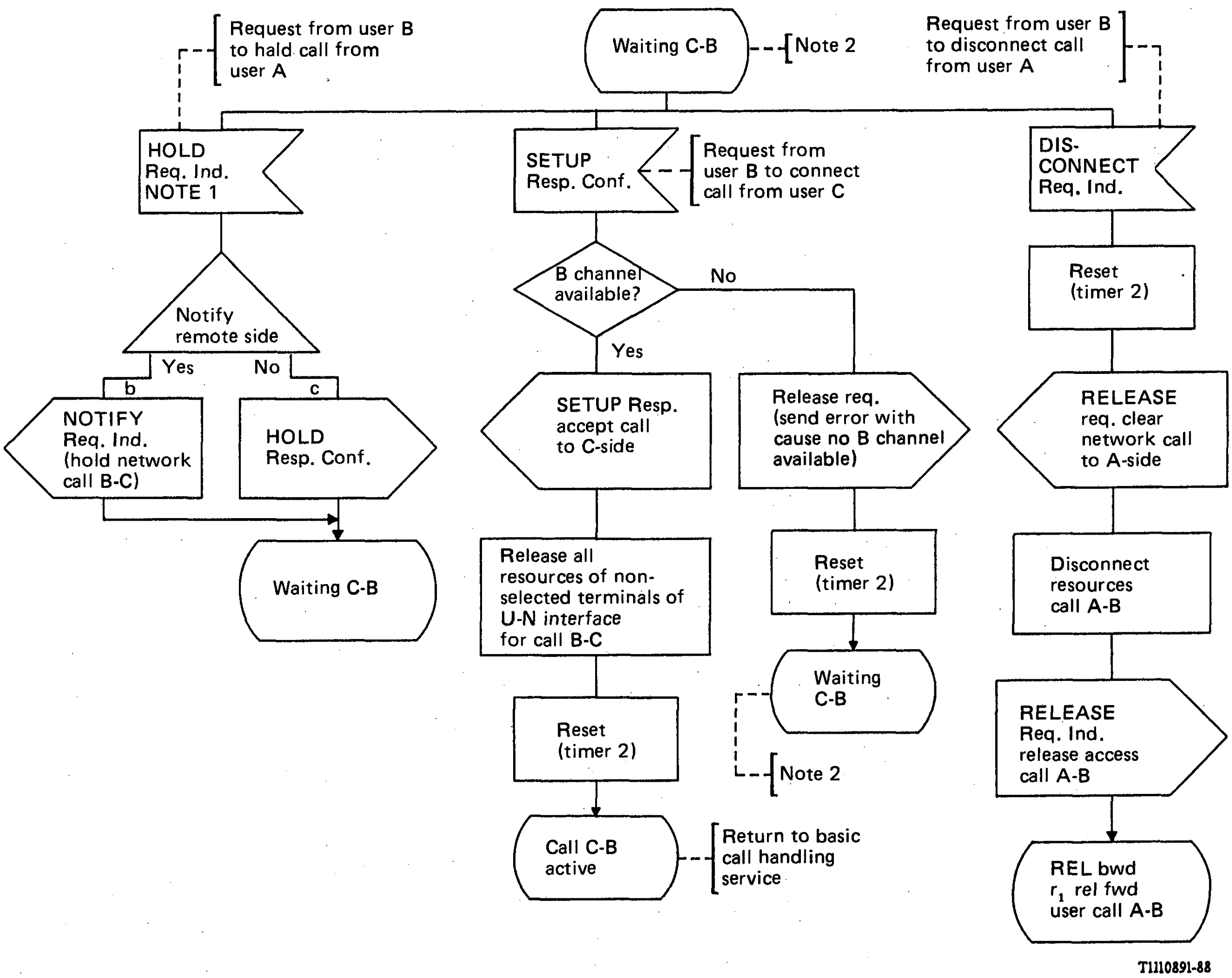
Call waiting process FE5



Note – This is a substate of the "$r_2 - r_1$ CALL SENT" state of the basic service description.

FIGURE 1-10/Q.83 (Sheet 3 of 7)

Call waiting process FE5



Note 1 – Timer 2 is not stopped and supervises the receipt of the consequent setup confirmation.

Note 2 – This is a substate of the "$r_2 - r_1$ CALL SENT" state of the basic service description.

FIGURE 1-10/Q.83 (Sheet 4 of 7)

Call waiting process FE5

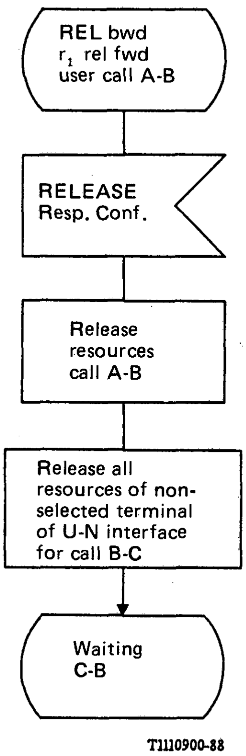
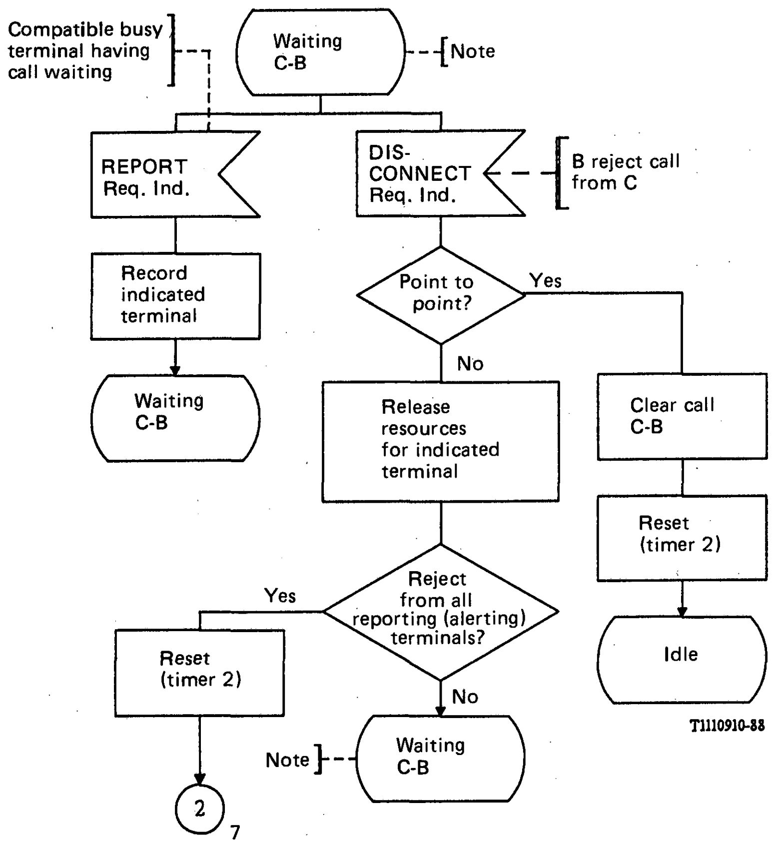


FIGURE 1-10/Q.83 (Sheet 5 of 7)

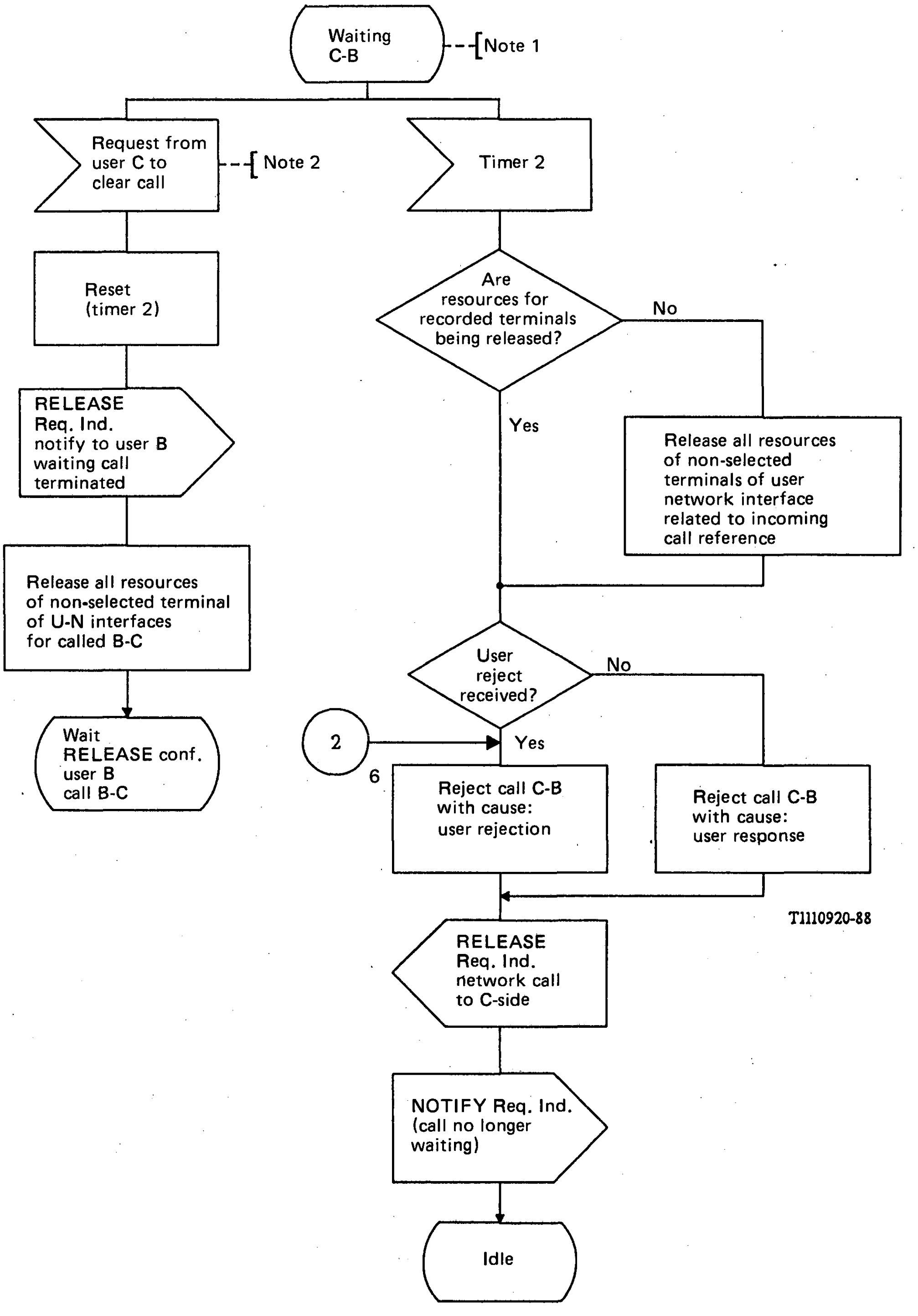
Call waiting process FE5



Note – This is a substate of the "r_2 - r_1 CALL SENT" state as described in the basic service description.

FIGURE 1-10/Q.83 (Sheet 6 of 7)

Call waiting process FE5



Note 1 – This is a substate of the "$r_2 - r_1$ CALL SENT" state as described in the basic service description.

Note 2 – This is an "R2 DISCONNECT IND" signal.

FIGURE 1-10/Q.83 (Sheet 7 of 7)

Call waiting process FE5

1.7 *Allocation of functional entities to physical locations*

The following allocation of functional entities to physical locations of the call waiting supplementary service are applicable:

i) *Case 1*

FE1	FE3	FE4	FE5	FE6
FE2 <ACCESS>	FE7 <NETWORK>	FE8 <NETWORK>	LE <ACCESS>	TE
TE	LE	TR		

FE1, FE2 and FE6 are the functional entities which represent the users of the call waiting supplementary service (e.g. may be physically located in TE or NT2 equipment). FE1 represents user A, FE2 user C and FE6 user B. FE6 is the service requesting terminal and FE1 and FE2 the remote terminals.

FE3, FE4, FE5, FE7 and FE8 are the functional entities which represent the network functions.

FE5 represents the network access providing exchange, FE4 and FE8 the transit exchanges, FE3 and FE7 the remote local exchanges.

ii) *Case 2*

FE1	FE3	FE4	FE5	FE6
FE2 <ACCESS>	FE7 <NETWORK>	FE8 <ACCESS>	NT2 <ACCESS>	TE
TE	LE	LE (PRA)	(BA)	

FE1, FE2, FE5 AND FE6 are the functional entities which represent the users of the call waiting supplementary service. FE1 represents user A, FE2 user C.

FE6 is the service requesting terminal while FE5 represents the service providing NT2.

FE3, FE4, FE7 and FE8 are the functional entities which represent the local network functions.

iii) *Case 3*

FE1	FE3	FE4	FE5	
FE2 <ACCESS>	FE7 <ACCESS>	FE8 <NETWORK>	LE <ACCESS>	FE6
TE	NT2	LE		

FE1, FE2, FE3, FE6 and FE7 are the functional entities which represent the users of the call waiting supplementary service. FE1 and FE3 represent user A, FE2 and FE7 represent user C while FE6 represents user B.

FE6 is the service requesting terminal, FE1 and FE2 the remote terminals and FE3 and FE7 the remote NT2s.

FE4, FE5 and FE8 are the functional entities which represent the local network functions.

iv) *Case 4*

FE1	FE3	FE4	FE5	
FE2 <ACCESS>	FE7 <NETWORK>	FE8 <ACCESS>	NT2 <ACCESS>	FE6
NT2	LE	LE		

FE1, FE2, FE5 and FE6 are the functional entities which represent the users of the call waiting supplementary service. FE1 represents user A, FE2 user C and FE5 and FE6 user B, FE6 being the service requesting terminal.

FE5 being the service providing NT2 and FE1 and FE2 the remote terminals.

FE3, FE4, FE7 and FE8 are the functional entities which represent the local network functions.

v) *Case 5*

FE1	FE3	FE4	FE5
FE2 <ACCESS>	FE7 <NETWORK>	FE8 <ACCESS>	TE
TE/NT2	LE		

FE1, FE2 and FE5 are the functional entities which represent the users of the call waiting supplementary service. FE1 represents user A, FE2 user C and FE5 and FE6 user B, FE5 is as well as the service requesting as the service providing terminal while FE1 and FE2 are the remote terminals/NT2s.

FE3, FE4, FE7 and FE8 are the functional entities which represent the local network functions.

2 Call hold

2.1 *Introduction*

References: CCITT Recommendation I.253, § 2, Call hold (Stage 1) Service description.

This paragraph includes treatment of the network options as described in the Stage 1 service description. Specifically, (1) optional notification to the held party indicating that the call has been placed on hold, and (2) optional notification to the held party that a call has been retrieved.

2.1.1 *Definition*

The **call hold service** allows a user to interrupt communications on an existing call/connection[1] and then subsequently, if desired, re-establish communications. A B Channel[2] may or may not be reserved after the communication is interrupted to allow the origination or possible termination of other calls. Reservation must be provided by the service provider as a user option. The Call Hold service includes the Retrieve operation which re-establishes communication on a B Channel between the served user and the held party.

2.2 *Definition of functional model*

2.2.1 *Functional model description*

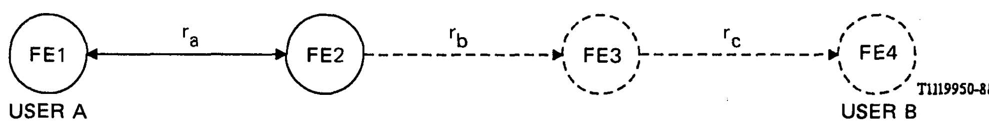


FIGURE 2-1/Q.83

Functional model

r, along with its subscripts, represents different information flow relationships between functional entities. FE3 and FE4 are shown as dashed circles to represent their optional nature in the context of the Call Hold Service.

2.2.1.1 *Description of functional entity 1*

Functional entity 1 supports the following functionality:

1) access the service providing capabilities of functional entity 2 by way of functional service requests (e.g., hold request, retrieve request);

2) receive functional indications relating to the call from functional entity 2 and relay them to the "user" of the call (e.g., hold confirmation, retrieve confirmation).

2.2.1.2 *Description of functional entity 2*

Functional entity 2 supports the following functionality:

1) receive the functional service requests from functional entity 1 and relay them into the network (e.g., receive the hold request from functional entity 1 and relay an optional notification of the held call toward user B);

2) perform the holding function (functional entity action 201);

3) send functional indications relating to the call to functional entity 1 (e.g., hold confirmation, retrieve confirmation);

4) reserve an information channel, if reservation is subscribed to (functional entity action 203);

5) perform reservation management (functional entity action 204);

6) perform the retrieve function (functional entity action 202).

---

[1] The applicability of the hold service a "call" versus a "connection" requires further study.

[2] The applicability of this service definition to other access resources (e.g., H-channels, logical channels) for other services requires further study.

2.2.1.3 *Description of functional entity 3*

Functional entity 3 supports the following functionality:

1) receive the optional notification of call hold and the optional notification of retrieval and relay them toward functional entity 4;
2) identify the call at the FE3/FE4 interface that the optional notifications apply to (functional entity action 205).

2.2.1.4 *Description of functional entity 4*

Functional entity 4 supports the following functionality:

1) receive the optional notification of call hold and the optional notification of retrieval and inform (relay them to) user B.

2.2.2 *Relationship to basic service*

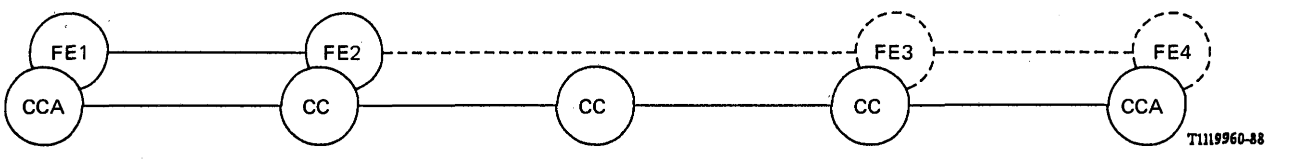


FIGURE 2-2/Q.83

Relationship to basic service

The call control agent (CCA) is the functional entity that serves the user and is responsible for initiating functional requests and interacting with the network. Call control (CC) is performed by functional entities within the network to provide the services requested by the CCA.

2.3 *Information flow description*

2.3.1 *Information flow diagram for successful operation*

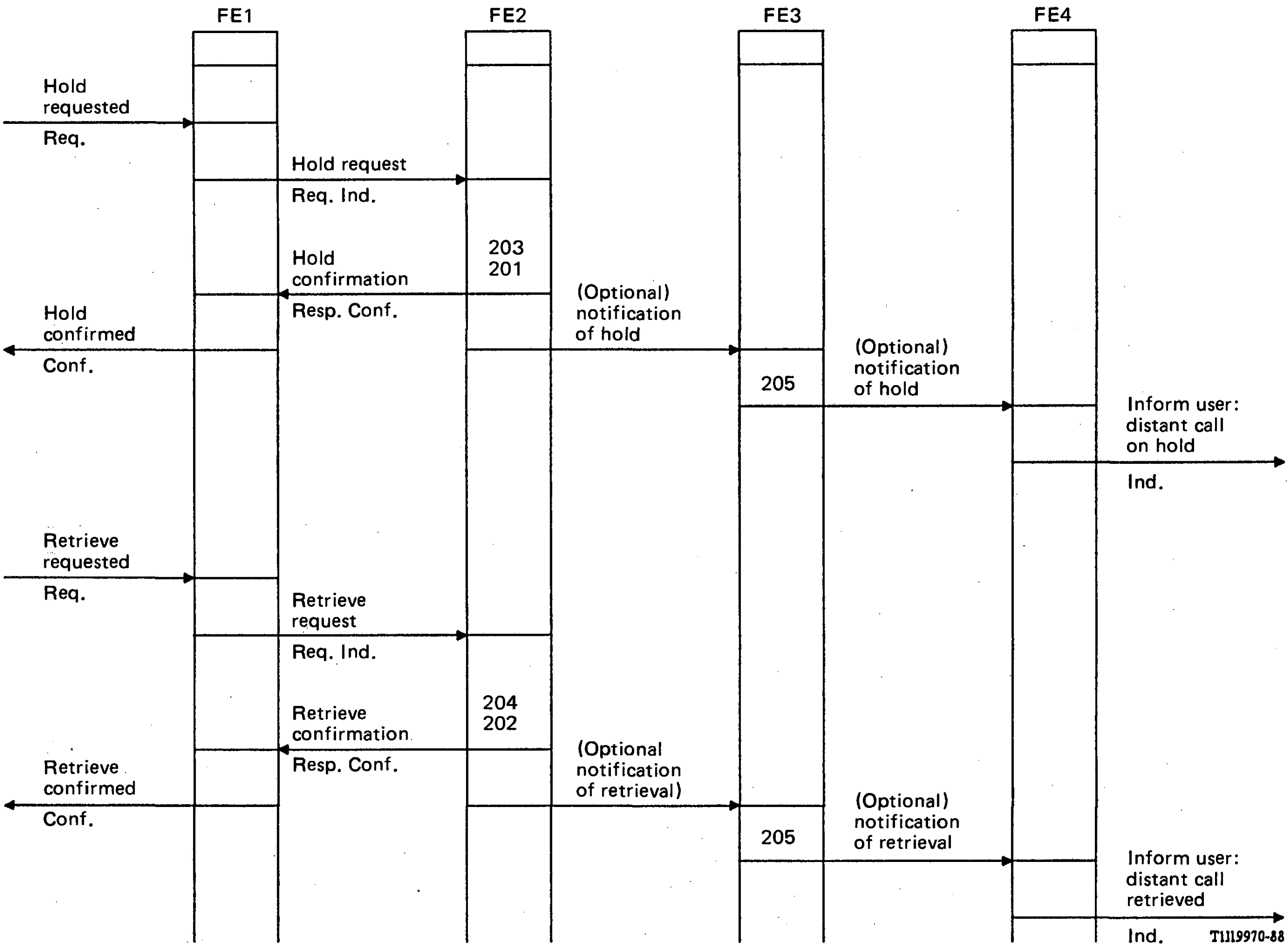


FIGURE 2-3/Q.83

Information flow diagram for call hold service

2.3.2 *Definition of individual information flows*

2.3.2.1 *Hold request*

2.3.2.1.1 *Meaning of hold request*

Hold request is the information sent from FE1 to FE2 to request that a call be placed on hold by the network.

2.3.2.1.2 *Information content for hold request*

The following information is contained in the hold request:

– an identifier of the call to which the hold request applies.

2.3.2.2 *Hold confirmation*

2.3.2.2.1 *Meaning of hold confirmation*

Hold confirmation is the information sent from FE2 to FE1 that confirms that a call has been put on hold for the user by the network.

2.3.2.2.2 *Information content for hold confirmation*

The following information is contained in the hold confirmation:

– an identifier of the call to which the hold confirmation applies.

2.3.2.3 *(Optional) notification of hold*

2.3.2.3.1 *Meaning of (optional) notification of hold*

(Optional) notification of hold is the information sent from FE2 towards B indicating that the call between FE1 and FE2 has been placed on hold.

2.3.2.3.2 *Information content for (optional) notification of hold*

The following information is contained in the (optional) notification of hold:

– an identifier of the call to which the (optional) notification of hold applies.

2.3.2.4 *Retrieve request*

2.3.2.4.1 *Meaning of retrieve request*

Retrieve request is the information sent from FE1 to FE2 to request the reconnection of a held call.

2.3.2.4.2 *Information content for retrieve request*

The following information is contained in the retrieve request:

– an identifier of the call to which the retrieve request applies;
– an optional indication that:
  1) any channel is acceptable for retrieval, or
  2) a specified channel is preferred for retrieval, or
  3) a specified channel is exclusively required for retrieval.

2.3.2.5 *Retrieve confirmation*

2.3.2.5.1 *Meaning of retrieve confirmation*

Retrieve confirmation is the information sent from FE2 to FE1 that confirms that communications was able to be re-established and that the held call is now reconnected. If an optional indication concerning the B channel over which communications was to have been re-established was included in the retrieve request, then the retrieve confirmation serves as an acknowledgement that retrieval was carried out as requested.

2.3.2.5.2 *Information content for retrieve confirmation*

The following information is contained in the retrieve confirmation:

– an identifier of the call to which the retrieve confirmation applies;
– an identifier of the channel over which the held call is reconnected.

2.3.2.6 *(Optional) notification of retrieval*

2.3.2.6.1 *Meaning of (optional) notification of retrieval*

(Optional) notification of retrieval is the information sent from FE2 towards B indicating that the B channel between FE1 and FE2 has been reconnected.

2.3.2.6.2 *Information content for (optional) notification of retrieval*

The following information is included in the (optional) notification of retrieval:

- an identifier of the call to which the (optional) notification of retrieval applies.

2.4 *Functional entity actions*

- 201 – Perform the holding function
- 202 – Perform the retrieve function
- 203 – Perform the reservation function
- 204 – Perform the reservation management to insure that:

  When a user (as identified by a terminal, other possibilities for further study) places a call on hold and reservation applies, a B channel should always be available on that user's interface for the user to retrieve that call from hold; or setup, retrieve, or connect to another call. One B channel should be kept available for the user as long as the user: (i) has one or more calls on hold with reservation and, (ii) is not currently connected to any other call. That is, the network should not reserve more than one B channel for a user, regardless of how a user is defined (as identified by a terminal, other possibilities for further study).
- 205 – identify the call at the FE3/FE4 interface that the optional notifications apply to.

2.5 *SDL diagrams for functional entities*

The SDL diagrams for functional entities 1, 2, 3 and 4 are shown in Figures 2-4/Q.83, 2-5/Q.83, 2-6/Q.83 and 2-7/Q.83.

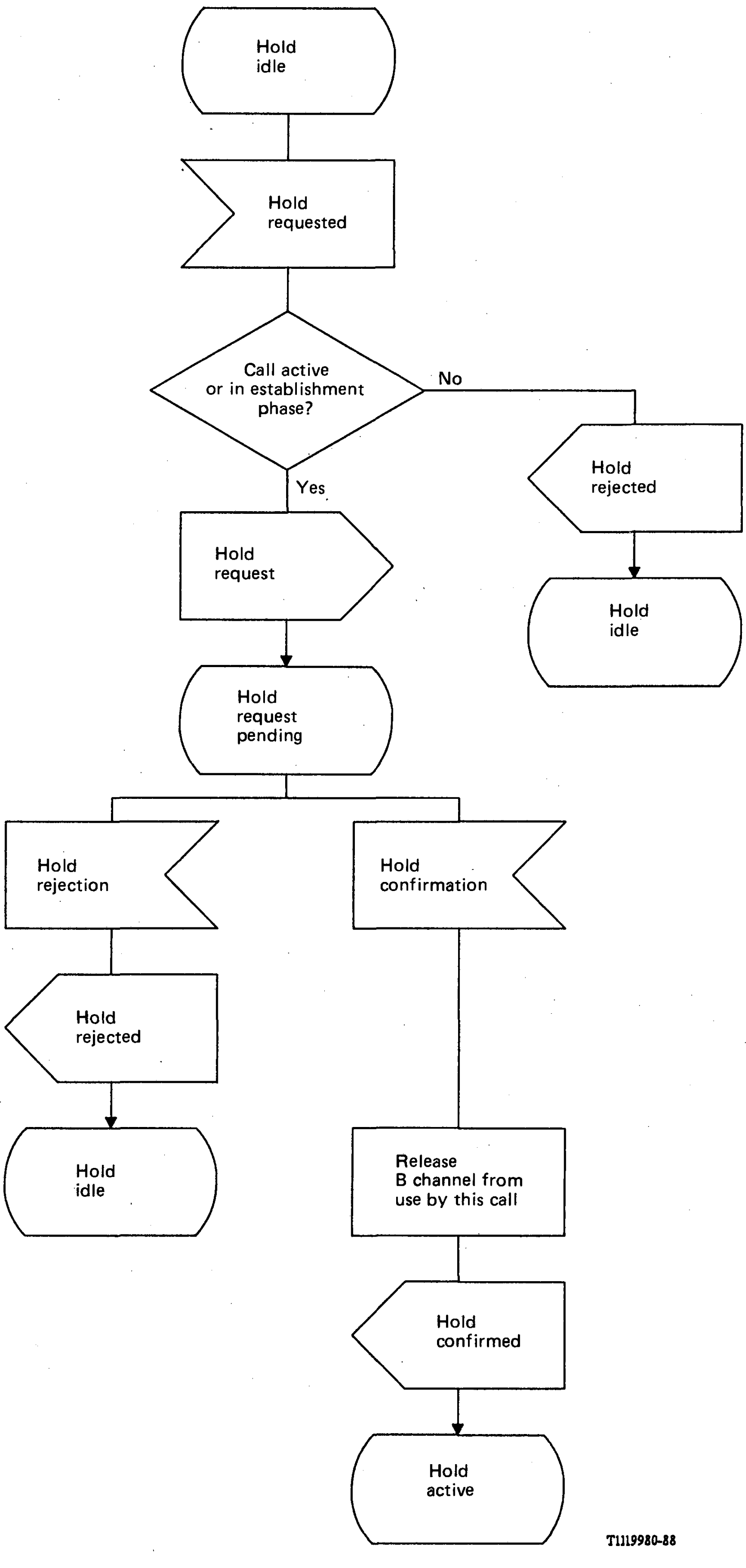


FIGURE 2-4/Q.83 (Sheet 1 of 2)

FE1

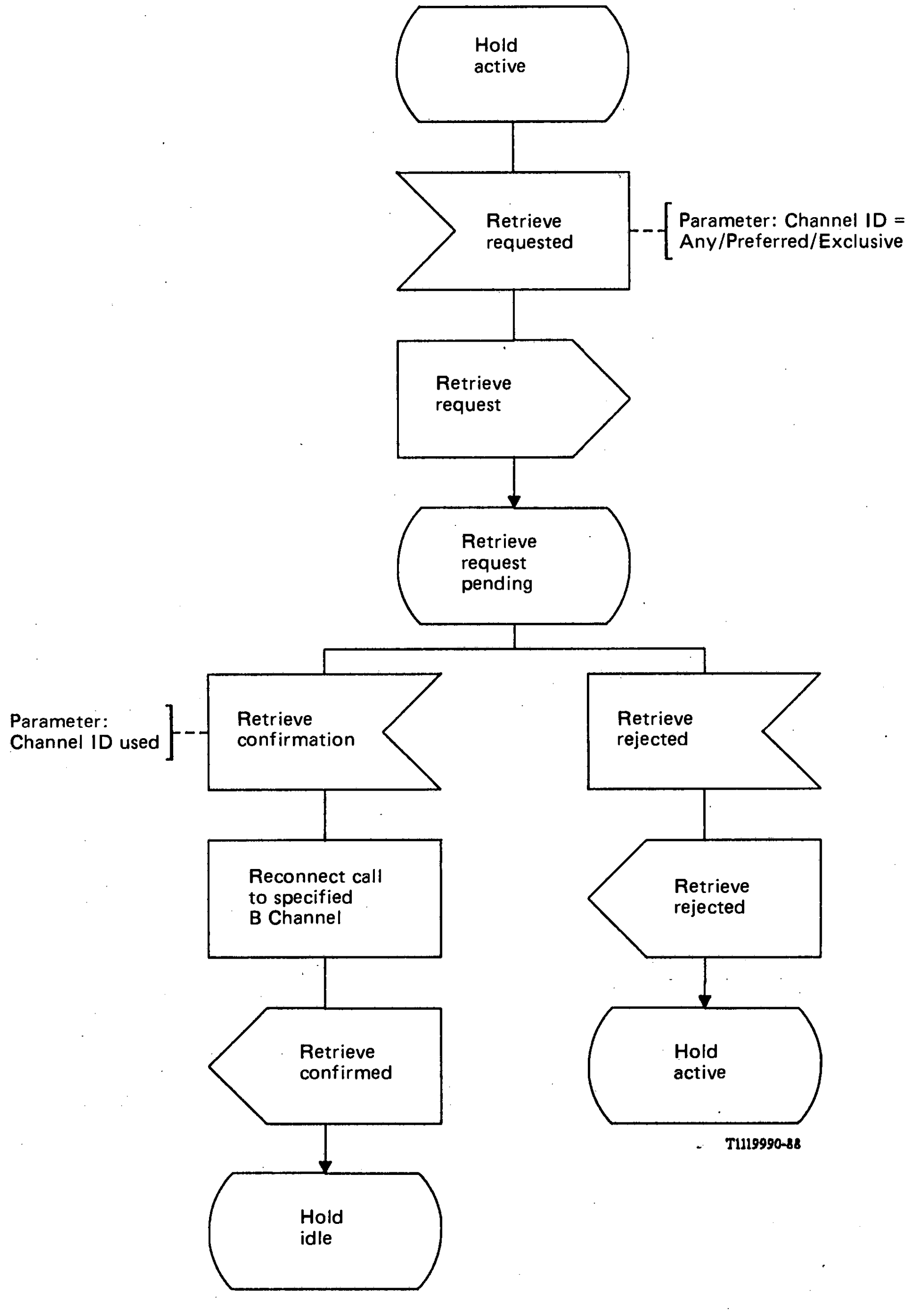


FIGURE 2-4/Q.83 (Sheet 2 of 2)

FE1

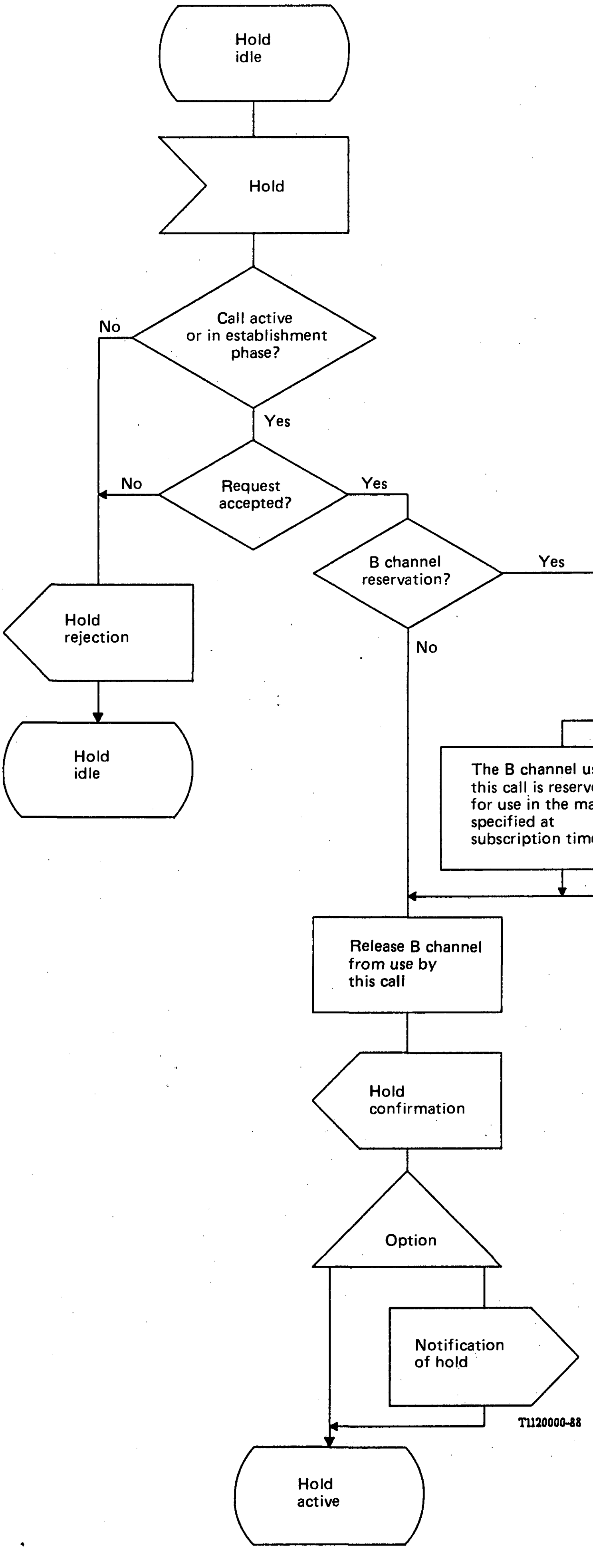


FIGURE 2-5/Q.83 (Sheet 1 of 2)

FE2

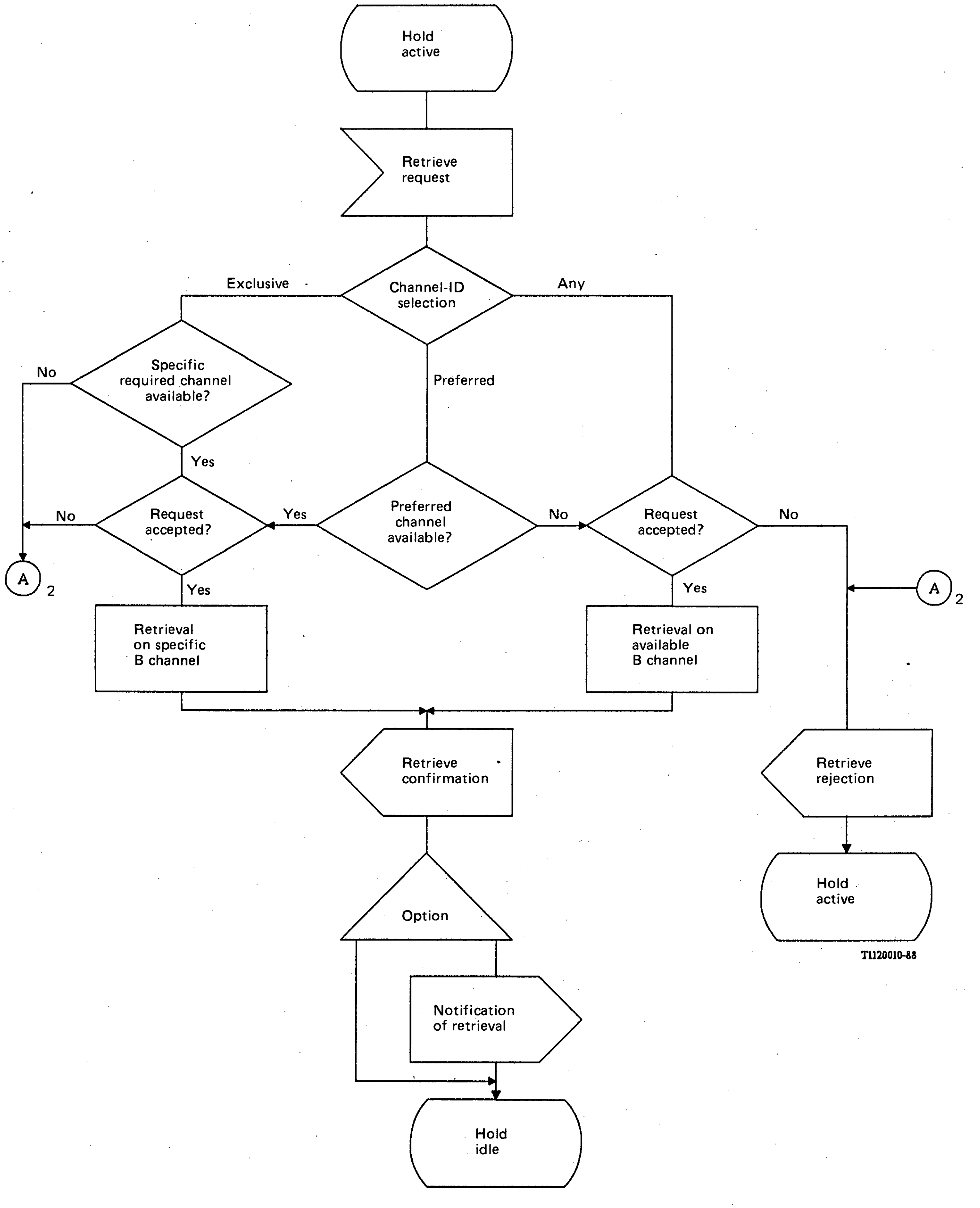


FIGURE 2-5/Q.83 (Sheet 2 of 2)

FE2

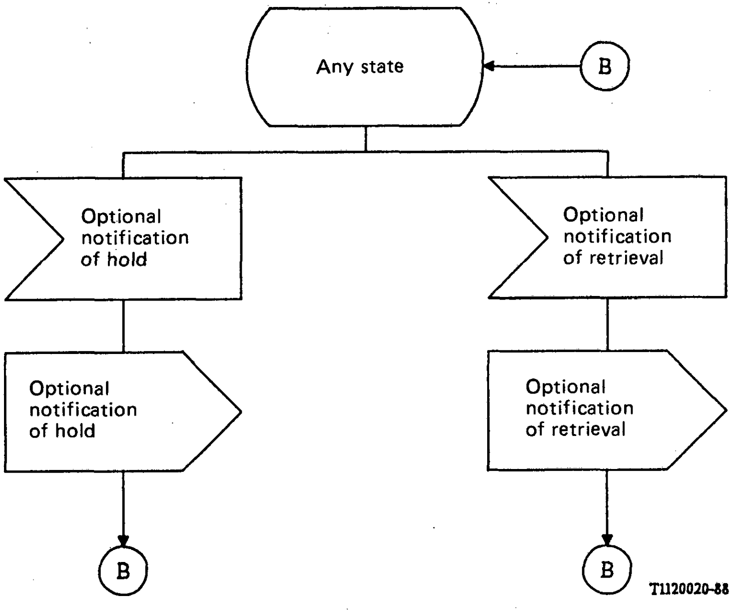


FIGURE 2-6/Q.83

FE3

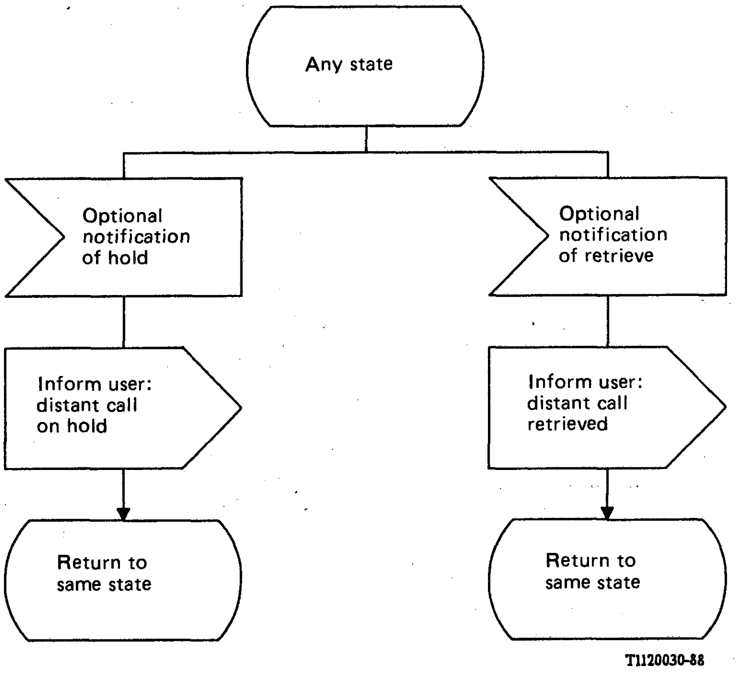


FIGURE 2-7/Q.83

FE4

2.6 *Network physical allocation scenarios*

	FE1	FE2	FE3	FE4
Scenario 1	TE	LE	LE	TE
Scenario 2	TE	NT2	NT2	TE
Scenario 3	TE	LE	NT2	TE
Scenario 4	TE	NT2	LE	TE

3 Completion of call to busy subscriber

Under study.

Recommendation Q.85

COMMUNITY OF INTEREST SUPPLEMENTARY SERVICES

1 Closed user group

1.1 *Introduction*

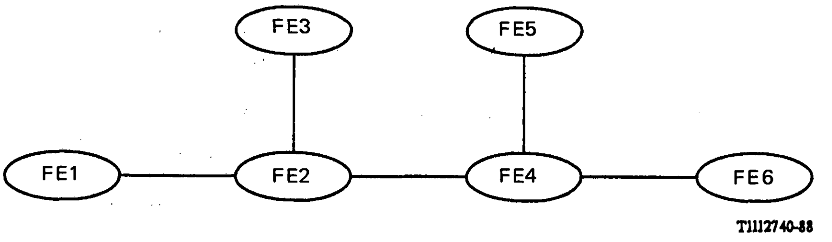
The supplementary service closed user group (CUG) makes provision for a group of users to meet security requirements of certain applications by providing restrictions, which prevent non-members from reaching these applications.

The basic facility provides, via the ISDN, the CUG members with controlled intercommunication exclusively amongst themselves and denies access into or outside the group. This facility can be extended to include outgoing and/or incoming access for specified CUG members.

1.2 *Definition of functional model*

1.2.1 *Functional model description*

The high level functional model for the CUG service contains the network addressable functional entities described in Figure 1-1/Q.85.



FE1 Originating CUG agent
FE2 Outgoing CUG determination
FE3 Outgoing CUG control
FE4 Incoming CUG determination
FE5 Incoming CUG control
FE6 Destination CUG agent

FIGURE 1-1/Q.85

CUG service functional model

1.2.2.1 *Outgoing CUG determination entity (FE2)*

It has the ability:

- to identify a CUG call;
- to check the CUG subscription of the calling user;
- to access the outgoing CUG control entity.

1.2.2.2 *Outgoing CUG control entity (FE3)*

It performs:

- the validation checks of CUG information of a calling user;
- the conversion of the CUG index to an interlock code.

1.2.2.3 *Incoming CUG determination entity (FE4)*

It has the ability:

- to identify a CUG call;
- to check the CUG subscription of the called user;
- to access the incoming CUG control entity.

1.2.2.4 *Incoming CUG control entity (FE5)*

It performs:

- the conversion of the interlock code to CUG index;
- the validation checks of CUG information of a called user (including the compatibility with the called user class – CUG IA – in case of an ordinary incoming call).

Note – FE3 and FE5 are coupled in the sense that they handle a common set of data (interlock codes).

1.2.3 *Relationship to basic service*

Refer to § 1.6 for the physical location of each entity residing in Figure 1-2/Q.85.

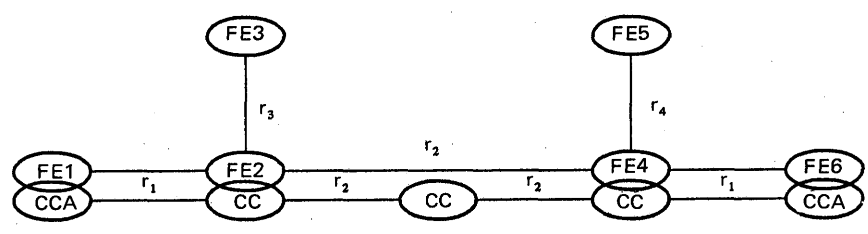
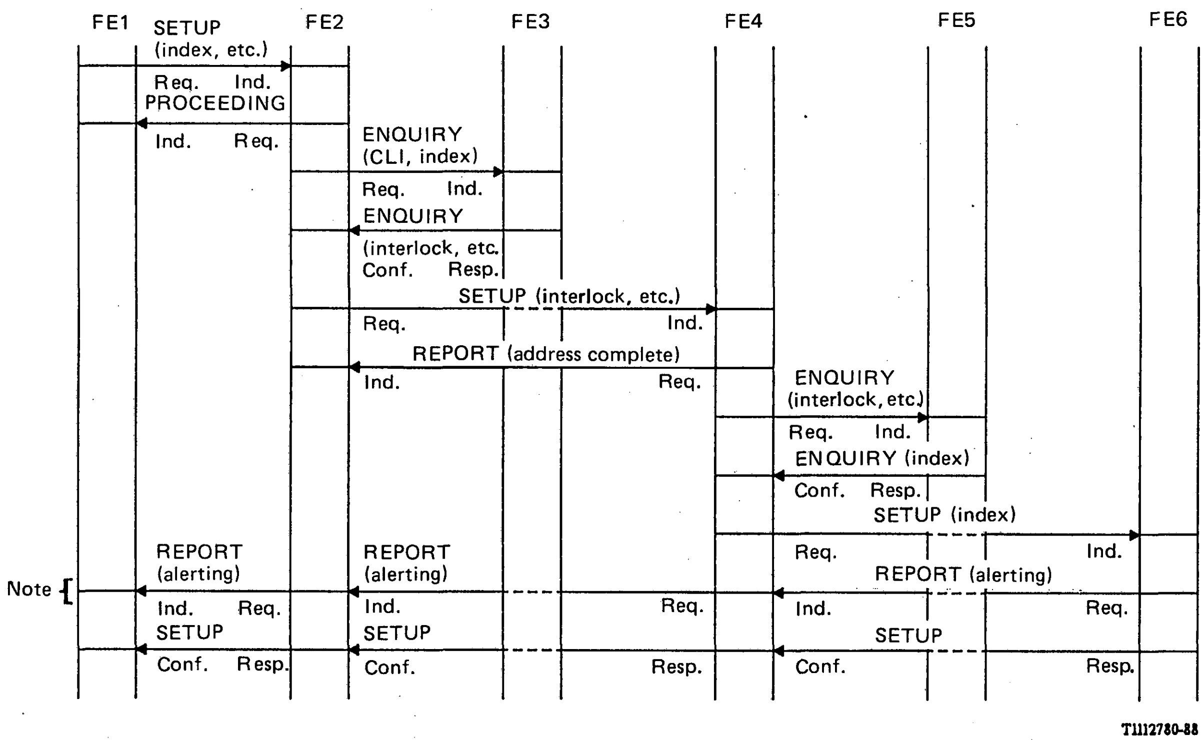


FIGURE 1-2/Q.85

Relationship to basic service model
First case: type A of scenario

1.3 *Information flow description*

1.3.1 *Information flow diagrams*



Note — This information flow may be omitted.

FIGURE 1-3/Q.85

Successful CUG calls

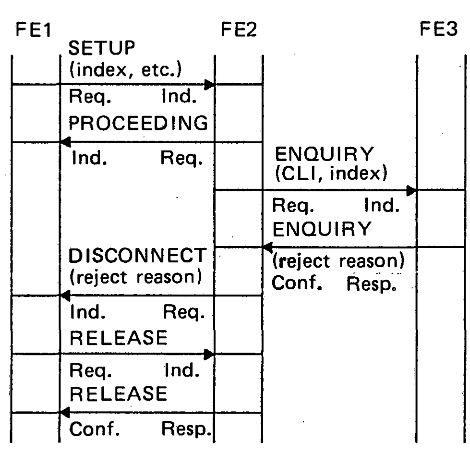


FIGURE 1-4/Q.85

Unsuccessful CUG calls - Case 1

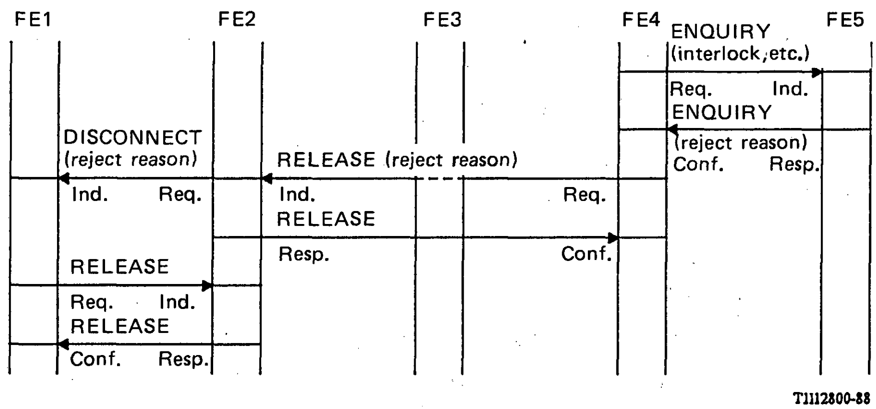


FIGURE 1-5/Q.85

Unsuccessful CUG calls - Case 2

1.3.2 *Definition of individual information flows*

The parameters that are carried on the information flows in the successful case are as follows:

1.3.2.1 SETUP (FE1-FE2) – In addition to called party number and CLI

– nothing, or
– index, or
– index + OA indication.

1.3.2.2 ENQUIRY (FE2-FE3) – Carries the same information as SETUP (FE1-FE2) except called party number.

1.3.2.3 ENQUIRY (FE3-FE2):

– nothing, or
– interlock code, or
– interlock code + OA indication.

1.3.2.4 SETUP (FE2-FE4) – In addition to called party number

– nothing, or
– interlock code, or
– interlock code + OA indication.

1.3.2.5 ENQUIRY (FE4-FE5) – Carries exactly the same information as SETUP (FE2-FE4).

1.3.2.6 ENQUIRY (FE5-FE6):

– nothing, or
– index, or
– index + OA indication.

1.4 *Functional entity actions*

FE1 – A user initiates call SETUP request with the CUG index code (when a preferential CUG is used, no index code is designated).

FE2 – identify a CUG call and receive CUG information,
– CUG subscription check of the calling user.

FE3 – Outgoing validation check:

1) CUG index code check of a calling user (when no index code is designated, preferential CUG is used);

2) outgoing barring check within CUG;when any logical contradiction is detected in the above procedure, a call is rejected (see Table 1-1/Q.85).

– conversión of the index code to an interlock code.

FE4 – identify an incoming CUG call and receive CUG information;

– CUG subscription check of the called user.

FE5 – incoming validation check:

1) incoming barring check within CUG;

2) if interlock codes do not match between a calling user and a called user, a call is rejected;

3) ordinary incoming call check (CUG IA); when any logical contradiction is detected in the above procedure, a call is rejected (see Table 1-2/Q.85).

– an index code corresponding to the designated interlock code is extracted from CUG data of a called user.

FE6 – a user checks whether or not the designated index code exists in the index code list of his own. A user shall give proper responses.

1.5 *SDL diagrams for functional entities*

1.5.1 *FE1 originating CUG agent*

FE1 has the same SDL diagram as the CCA FE (basic call) except that the SETUP information flow to the FE2 must carry additional information (index or index + OA or nothing).

1.5.2 *FE2 outgoing CUG determination*

Refer to the Figure 1-6/Q.85.

1.5.3 *FE3 outgoing CUG control*

Refer to Figure 1-7/Q.85.

1.5.4 *FE 4 incoming CUG determination*

Refer to Figure 1-8/Q.85.

1.5.5 *FE5 incoming CUG control*

Refer to Figure 1-9/Q.85.

1.5.6 *FE6 destination in CUG agent*

FE6 has the same SDL diagram as the CCA FE (basic call) except that the SETUP information flow to the FE6 must carry additional information (index or index + OA mark or nothing).

1.5.7 *Basic call hooks*

See Figure 1-10/Q.85.

TABLE 1-1/Q.85

CUG interpretation table (outgoing side)

	Calling user class: CUG	CUG + OA (E)	CUG + OA (I)	pCUG	SETUP presentation: CUG with index OA = OFF	CUG with index OA = ON	CUG with index OA = ON	No. CUG INFO. Ordinary subcriber	
Calling user is a CUG user	Yes				Specified CUG [a]	Specified CUG [a]	Rejected	Rejected	EF3
		Yes			Specified CUG [a]	Specified CUG with OA [b]	Ordinary call	Rejected	
			Yes		Specified CUG with with OA [a]	Specified CUG with OA [b]	Ordinary call	Ordinary call	
	Yes			Yes	Specified CUG [a]	Specified CUG [a]	pCGU [a]	pCGU [a]	
		Yes		Yes	Specified CUG [a]	Specified CUG with OA [b]	pCUG with OA [b]	pCUG [b]	
			Yes	Yes	Specified CUG with OA [a]	Specified CUG with OA [a]	Specified with OA [a]	pCUG with OA [b]	
	Calling user is NOT CUG				REJECT			Ordinary call	EF2

a) In case of OCB (CUG), a call is rejected.

b) In case of OCB (CUG), a call is interpreted as an ordinary call.

OA (E) Outgoing access explicit

AS (IM) Outgoing access implicit

OA Outgoing access allowed

OCB Outgoing access barred within the CUG

pCUG Preferential call

Note 1 – When an illegal index code is received, the outgoing call is rejected.

Note 2 – All the user classes are not necessarily supported by all the networks. User classes to be supported are network dependent.

TABLE 1-2/Q.85

CUG checking in incoming side

<table>
<tr><td rowspan="3">Called user's class
SETUP presentation</td><td colspan="4">Called user is CUG</td><td rowspan="3">Called user is not CUG</td></tr>
<tr><td colspan="2">CUG with or without pCUG</td><td colspan="2">CUG IA with or without pCUG</td></tr>
<tr><td>No ICB</td><td>ICB</td><td>No ICB</td><td>ICB</td></tr>
<tr><td rowspan="2">CUG</td><td>M (1)</td><td rowspan="2">REJ</td><td>M (1)</td><td rowspan="2">REJ</td><td rowspan="2">REJ</td></tr>
<tr><td>NM REJ</td><td>NM REJ</td></tr>
<tr><td rowspan="2">CUG and OA</td><td>M (1)</td><td rowspan="2">REJ</td><td>M (2)</td><td rowspan="2">(3)</td><td rowspan="2">(3)</td></tr>
<tr><td>NM REJ</td><td>NM (3)</td></tr>
<tr><td>Ordinary</td><td>REJ</td><td>REJ</td><td>(3)</td><td>(3)</td><td>(3) [a]</td></tr>
</table>

[a] Performed in FE4.

ICB Incoming access barred within CUG

Note 1 – Since CUG OA user class is not concerned in the incoming case, it is not shown in the above list. It shall be regarded that CUG OA user class is the same as class CUG, and CUG OA/IA is the same as user class CUG IA in this table.

Most of the table is performed in FE5.

Note 2 – (1)-(3) shows CUG parameter to be used in the SETUP to the called user.

(1): CUG (index),

(2): CUG + OA (index + OA mark AS),

(3): No CUG (ordinary call).

Note 3 – ICB means incoming calls barred within the CUG. The interpretation logic is changed in this case as shown in each column in the table.

For example:

No ICB	ICB
M (1)	REJ

This means that when the interlock codes are matched and no ICB is applied for the CUG, then (1) is used. However, when ICB is applied for the CUG, the incoming call is rejected even if interlock codes are matched.

Note 4 – M means that the interlock code is matched with the CUG of the called user.

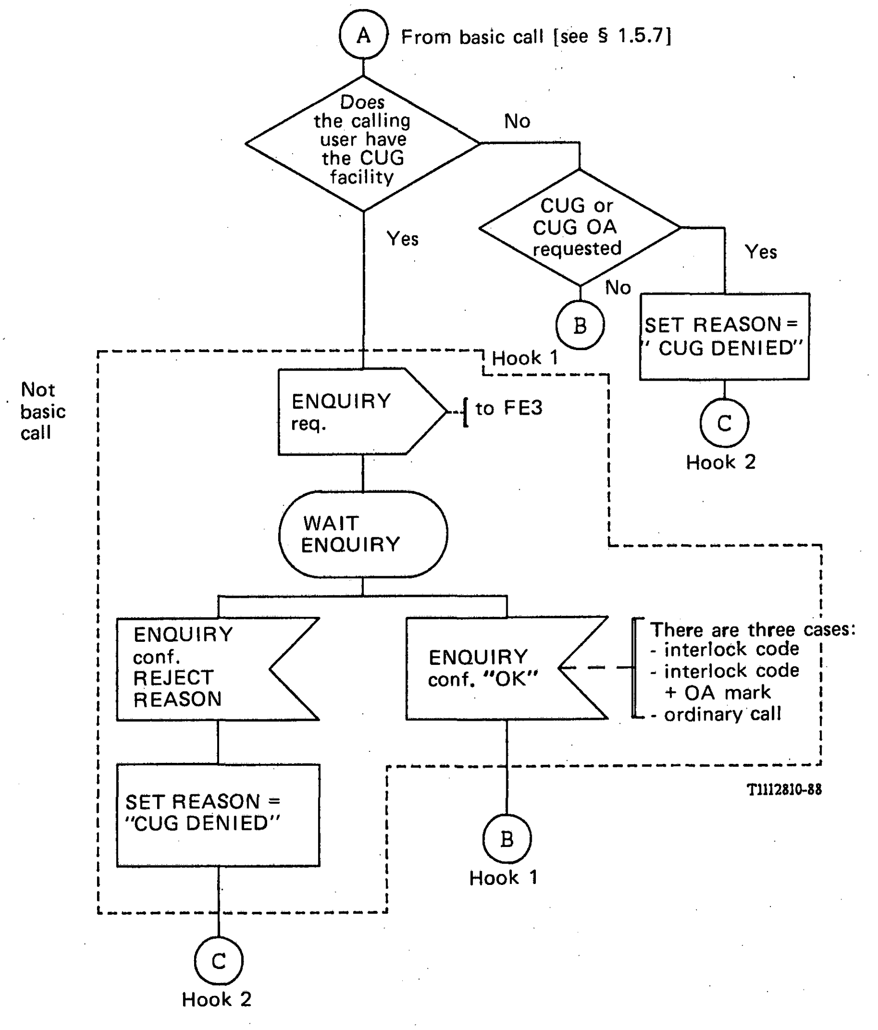
Note 5 – NM means " not matched".

Note 6 – REJ means that an incoming call is rejected.

Note 7 – Interpretation logic, e.g.:

$$\begin{bmatrix} \text{M} \\ (3) \end{bmatrix}$$

means that when matched with CUG, no CUG selection facility field is set in the SETUP to the called user.



Hooks: back to basic call (see § 1.5.7).

FIGURE 1-6/Q.85

SDL diagram for FE2

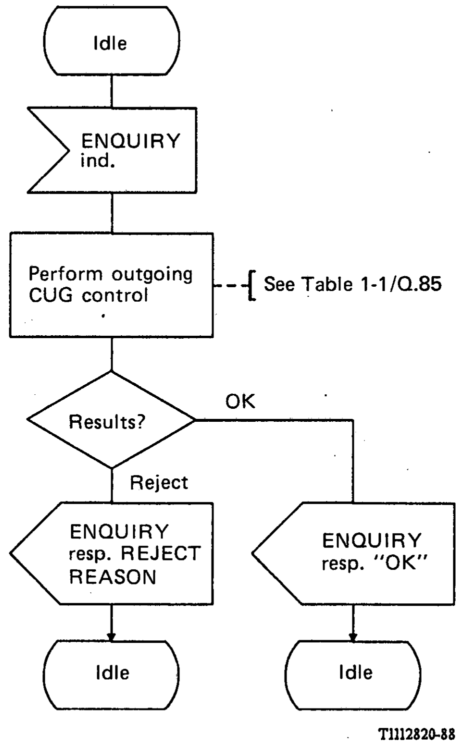


FIGURE 1-7/Q.85

FE3

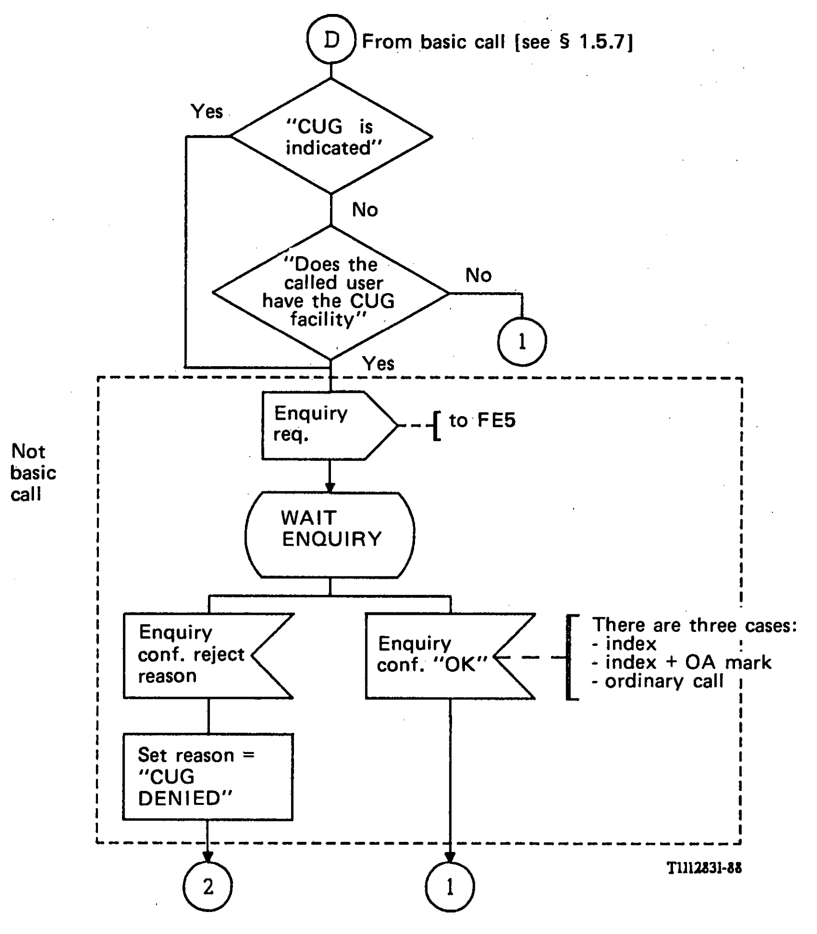


FIGURE 1-8/Q.85 (Sheet 1 of 2)

FE4

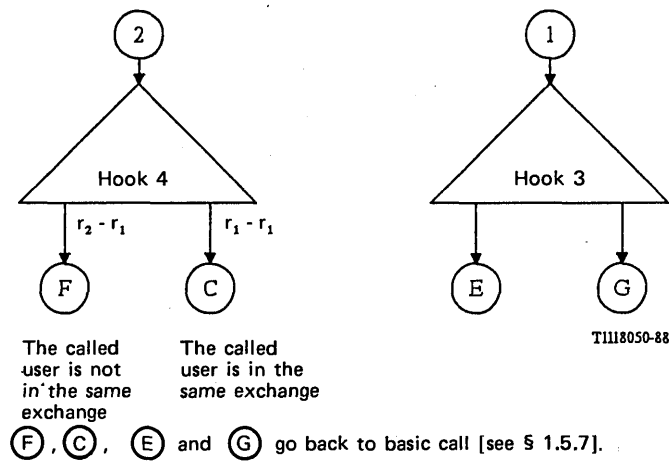


FIGURE 1-8/Q.85 (Sheet 2 of 2)

FE4

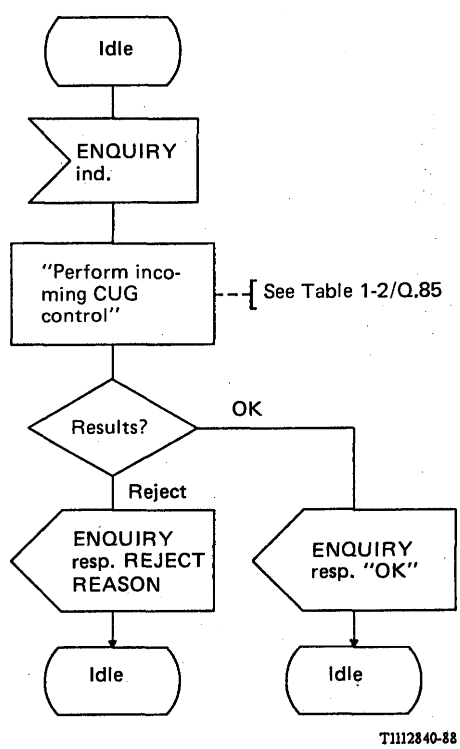
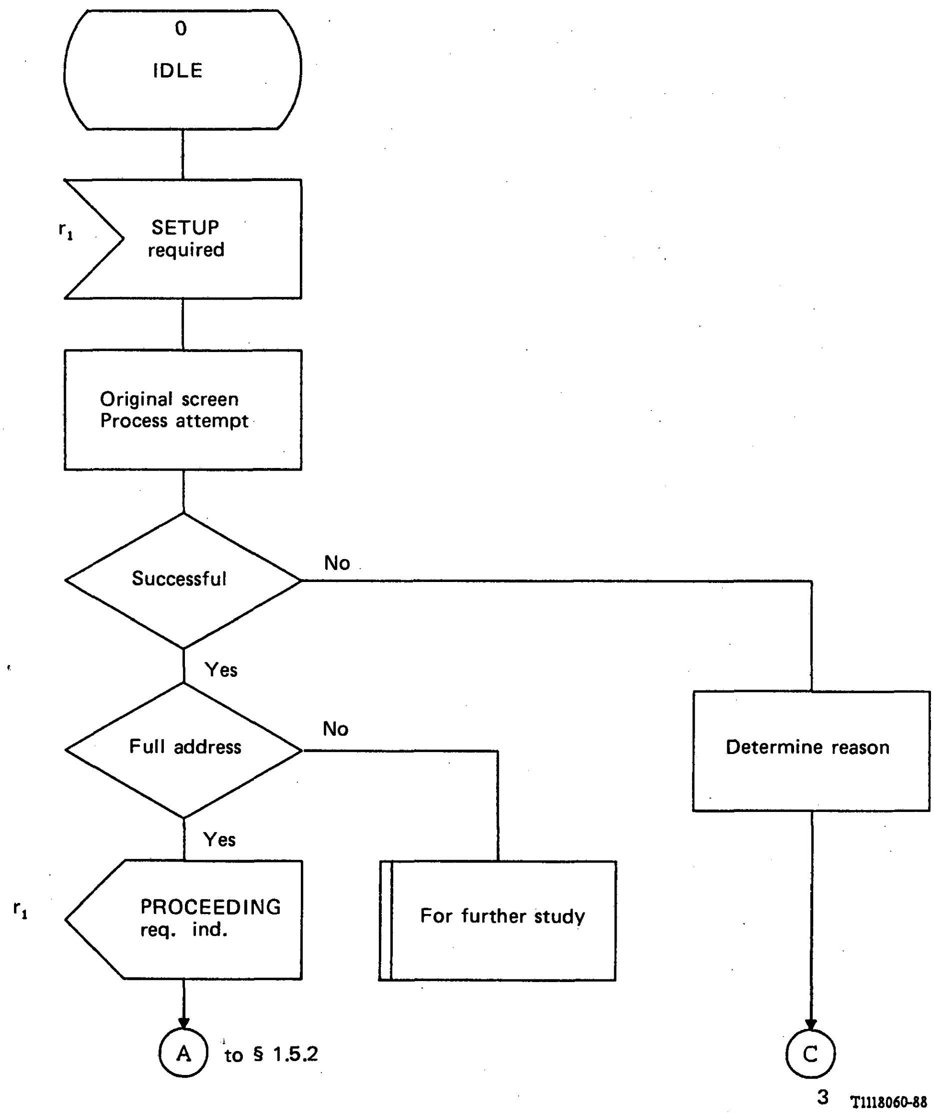


FIGURE 1-9/Q.85

FE5



Note – If cause of call failure is to be conveyed by in-band tones, a B Channel must be established.

FIGURE 1-10/Q.85 (Sheet 1 of 5)

CC functional entity (r_1-r_i) i = 1, 2
(based on Recommendation Q.71)

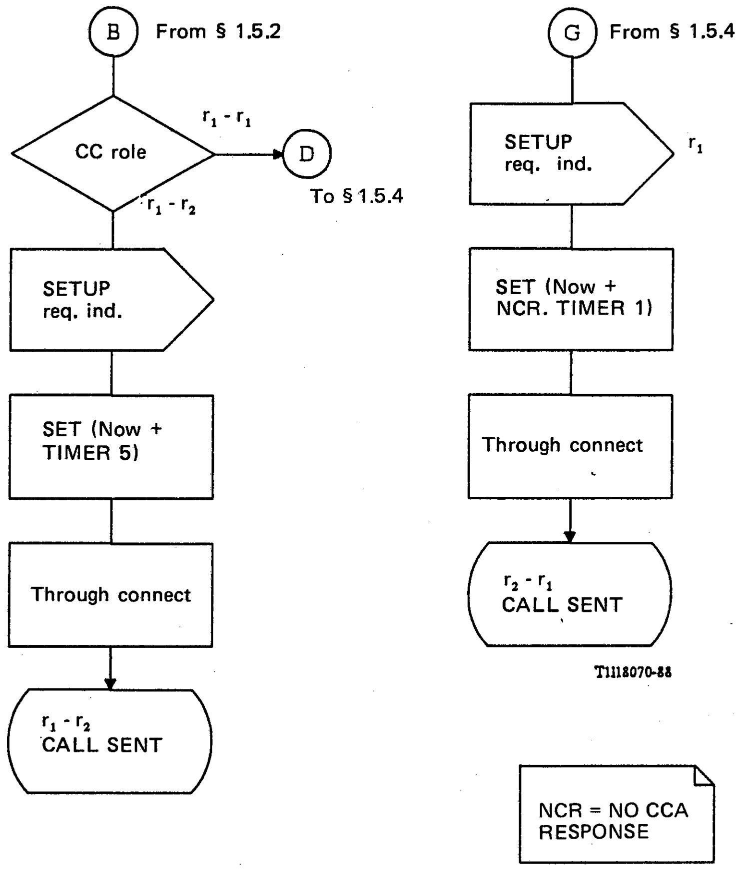


FIGURE 1-10/Q.85 (Sheet 2 of 5)

CC functional entity (r_1-r_i) i = 1, 2
(based on Recommendation Q.71)

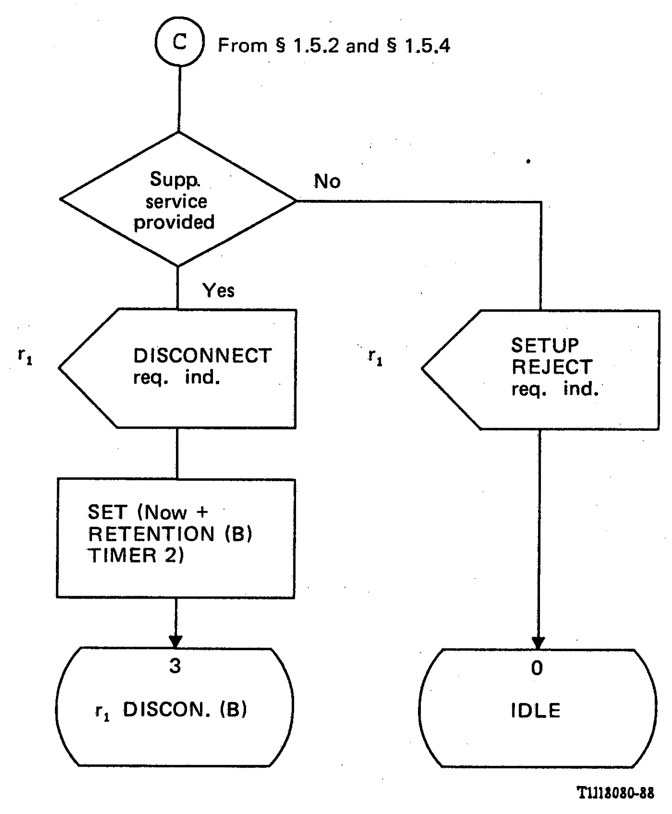


FIGURE 1-10/Q.85 (Sheet 3 of 5)

CC functional entity (r_1-r_i) i = 1, 2
(based on Recommendation Q.71)

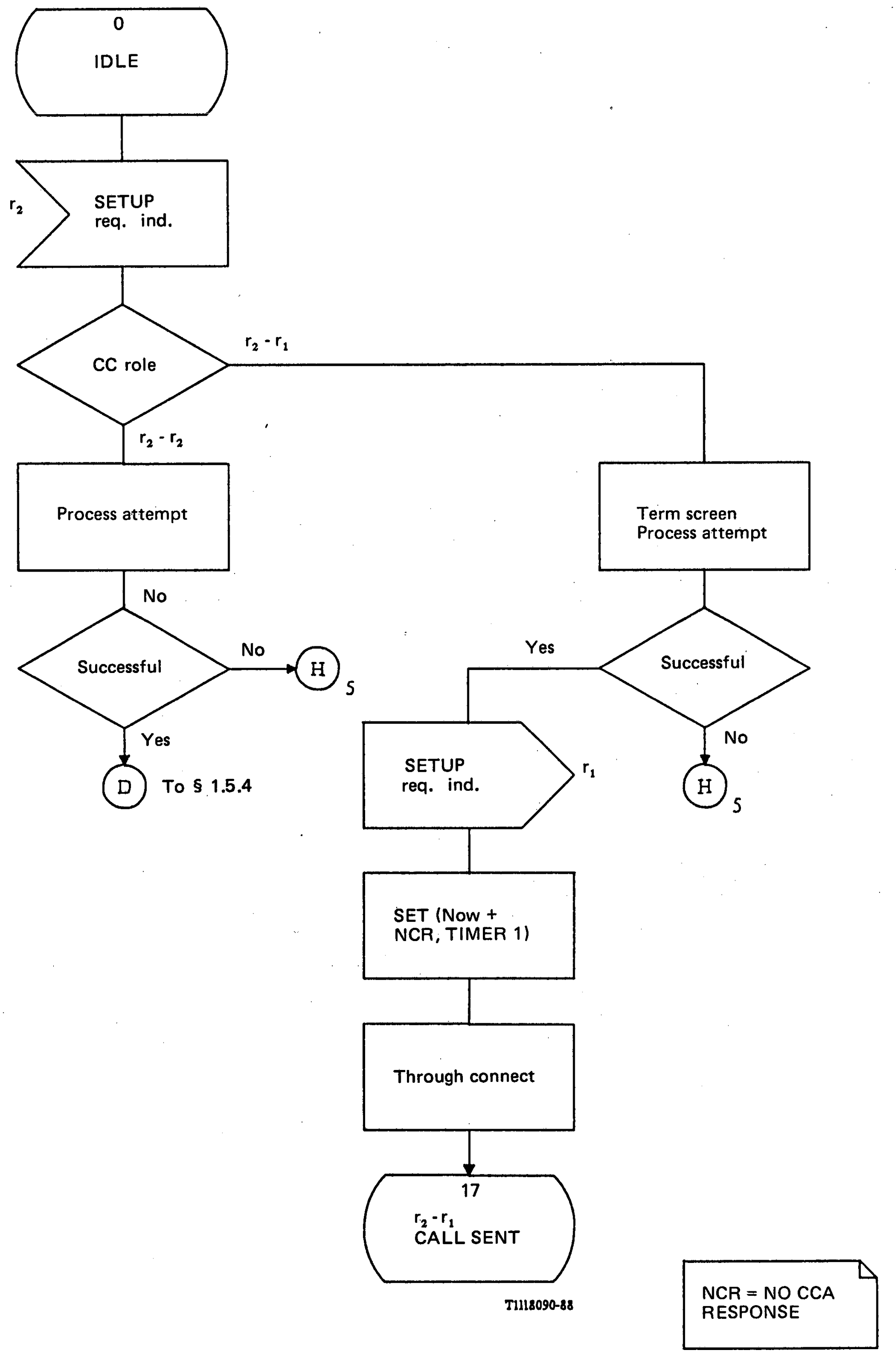


FIGURE 1-10/Q.85 (Sheet 4 of 5)

CC functional entity (r_2-r_i) i = 1, 2
(based on Recommendation Q.71)

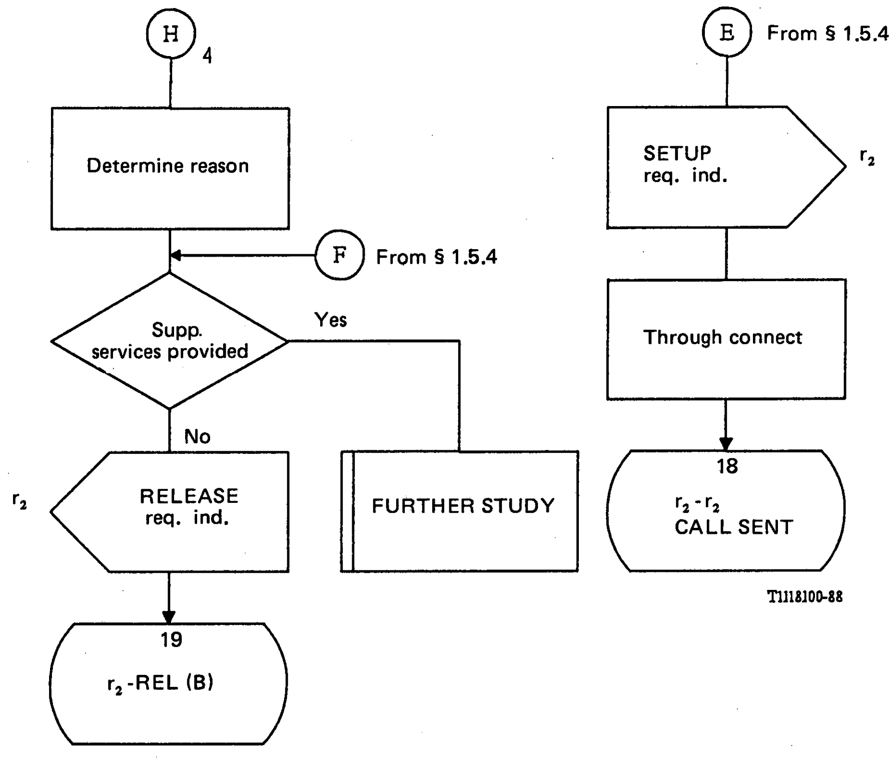


FIGURE 1-10/Q.85 (Sheet 5 of 5)

CC functional entity (r_2-r_i) i = 1, 2 (based on Recommendation Q.71)

1.6 *Network physical allocation scenarios*

TABLE 1-3/Q.85

Network physical allocation scenario A

	FE1	FE2	FE3	FE4	FE5	FE6
A.1	TE/NT2	LE1	LE1	LE2	LE2	TE/NT2
A.2	TE/NT2	LE1	DB1	LE2	DB1	TE/NT2
A.3	TE/NT2	LE1	DB1	LE2	DB2	TE/NT2
A.4	TE	NT2A	NT2A	NT2A	NT2B	TE

The *network scenario A.1* represents the decentralized approach of the CUG service implementation.

The *network scenario A.2* describes the fully centralized approach with a unique data base (DB1).

The *network scenario A.3* describes a centralized approach with two data bases (DB1 and DB2).

In *the network scenario A.4,* the CUG service is handled in the NT2s and then the network is transparent for this service.

CHARGING SUPPLEMENTARY SERVICES

1 Credit card calling service

Under study.

2 Advice of charge supplementary service (AOC)

advice of charge is a service allowing the user paying for a call to be informed of usage-based charging information. This service is not meant to replace the charge meeting inside the network which is considered to be the correct one in all cases.

This service may include one or more of the following cases:

a) charging information at the end of a call;

b) charging information during a call;

c) charging information at call setup time.

2.1 *General*

2.1.1 *Charging information at the end of the call*

The possibility for a user to receive charging information for a call when the call is released.

2.1.2 *Charging information during a call*

The possibility for a user to receive charging information for a call during the active phase of the call.

2.1.3 *Charging information at call setup time*

The possibility for a user to receive information about the charging rates at call setup time and possible change of charging rates during the call.

2.2 *Description*

2.2.1 *Charging information at the end of a call*

2.2.1.1 *General description*

This case of the supplementary service provides the user with charging information for a call when the call is released. The charging information may consist of a number of information units such as:

- case of advice of charge
  - charging at the end of a call
- type of charging
  - free of charge
  - charged amount information
    - used number of charging units
    - used duration
    - used volume
    - used number of times (Note)

- charging rate information
  - price per time unit and time units
  - price per volume unit and volume units
  - price per number of times unit and number of times unit
  - duration per charging unit and charging units
  - volume per charging unit and charging units
  - number of time units per charging unit and charging units

  Note – Number of times should be used, e.g. to charge a certain number of supplementary service invocations.
- usage charge element
  - registration
  - call attempt
  - invocation
  - duration
  - volume
  - network processing
- billing identification
  - normal charging
  - reverse charging
  - credit card charging

The selection of these values is a national matter.

2.2.1.2 *Specific terminology*

Not applicable.

2.2.1.3 *Qualifications on the applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

2.2.2 *Charging information during a call*

2.2.2.1 *General description*

This case of the supplementary service provides the user with information that may be either incremental or cumulative and will be sent automatically or on request.

The charging information may consist of a number of information units such as:

- case of advice of charge (AOC)
  - incremental charging during a call, or
  - cumulative charging during a call
- type of charging
  - free of charge
  - charged amount information
    - used number of charging units
    - used duration
    - used volume
    - used number of times (Note)
  - charging rate information
    - price per time unit and time units
    - price per volume unit and volume units
    - price per number of times unit and number of times unit
    - duration per charging unit and charging units
    - volume per charging unit and charging units
    - number of time units per charging unit and charging units

  Note – Number of times should be used, e.g. to charge a certain number of supplementary service invocations.

- usage charge element
  - registration
  - call attempt
  - invocation
  - duration
  - volume
  - network processing
- billing identification
  - normal charging
  - reverse charging
  - credit card charging

2.2.2.2 *Specific terminology*

Not applicable.

2.2.2.3 *Applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

2.2.3 *Charging information at call setup time*

2.2.3.1 *General description*

This case of the supplementary service provides the user with the possibility to receive information about the charging rates at call establishment. In addition, the user will be informed if a change in charging rates takes place during the call. The charging information may consist of a number of information units such as:

- case of advice of charge
  - charging rate information
- type of charging
  - free of charge
  - charging rate information
    - price per time unit and time units
    - price per volume unit and volume units
    - price per number of times unit and number of times unit
    - duration per charging unit and charging units
    - volume per charging unit and charging units
    - number of time units per charging unit and charging units
  - usage charge element
    - registration
    - call attempt
    - invocation
    - duration
    - volume
    - network processing
  - billing identification
    - normal charging
    - reverse charging
    - credit card charging

2.2.3.2 *Specific terminology*

Not applicable.

2.2.3.3 *Applicability to telecommunication services*

This supplementary service is applicable to all telecommunication services.

2.3 *Derivation of a functional model*

The model used for illustrating the advice of charge (AOC) supplementary service is given in Figure 2-1/Q.86 below.

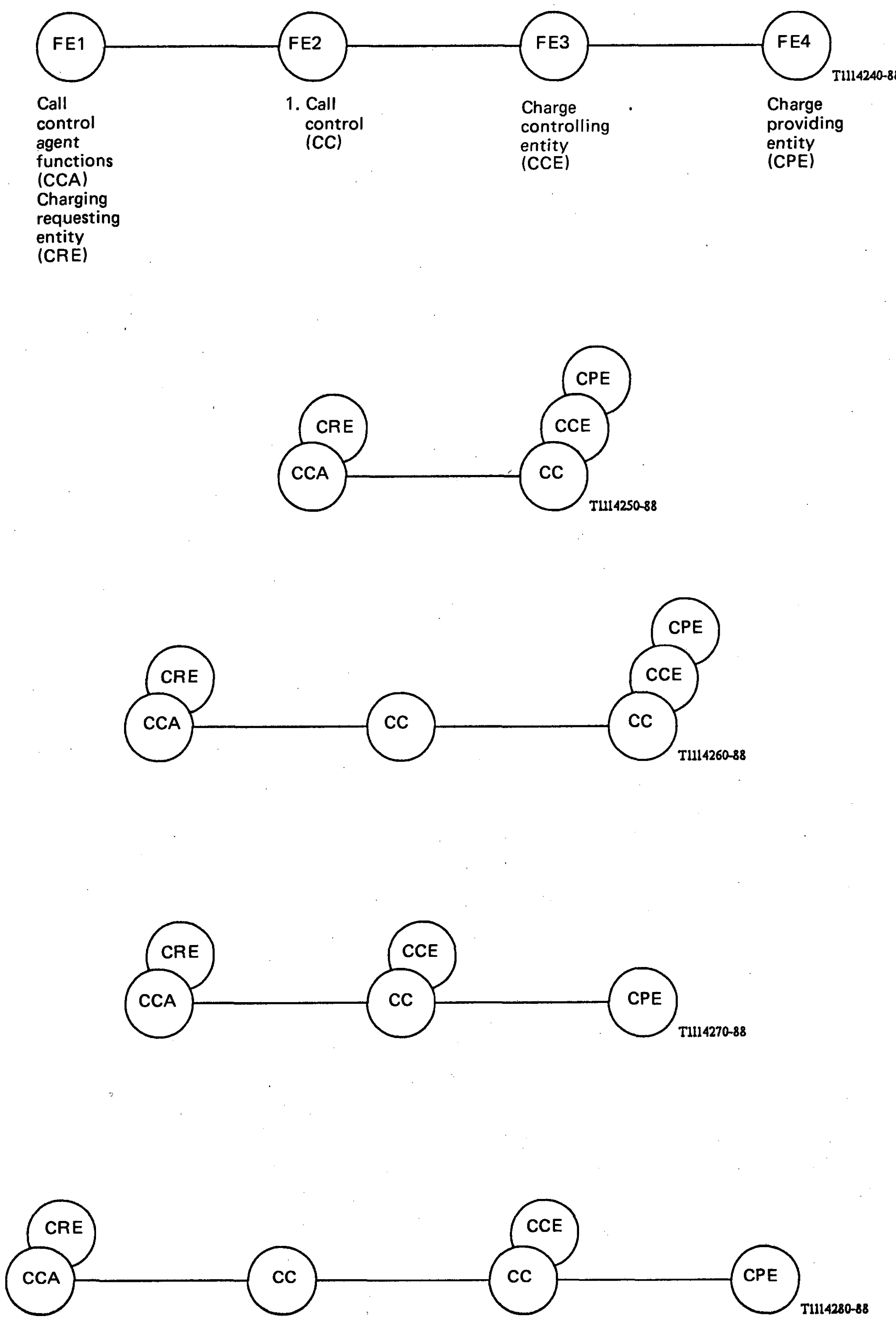


FIGURE 2-1/Q.86

Model for the advice of charge supplementary service

2.4 *Information flow diagrams*

This Recommendation does not describe which information is to be provided in each case because it is considered to be a network dependent matter whether the information is provided, e.g. as charging units or as currency units.

It is assumed that the coding of the charge advice information (CAI) is done in such a way that whenever this information is received by a user, the content shall be self explaining.

2.4.1 *Information flows for charging at the end of a call*

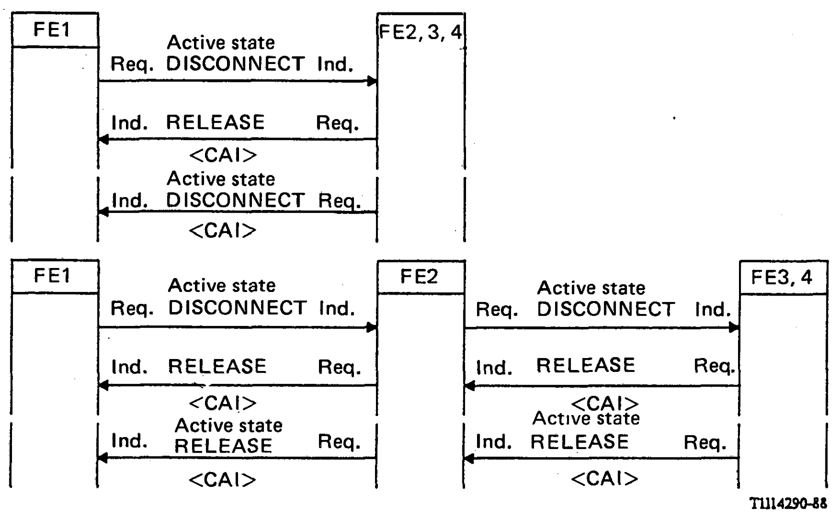
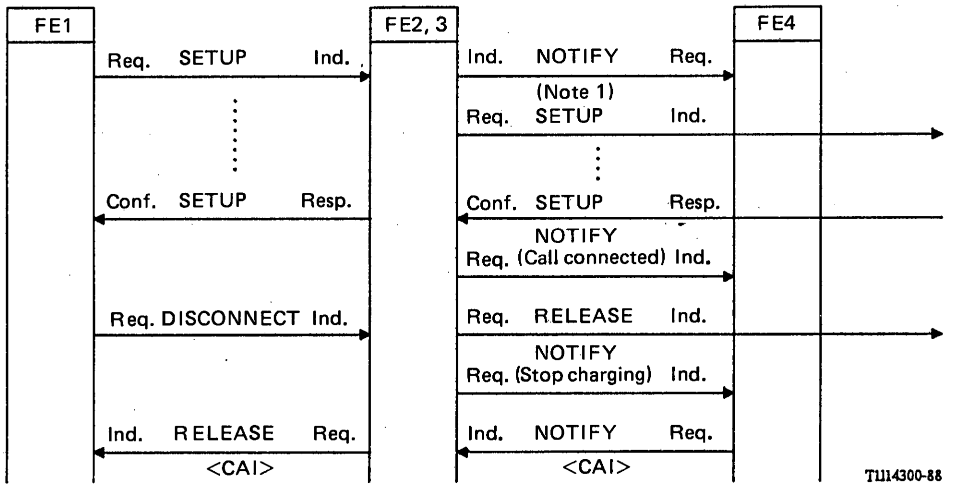
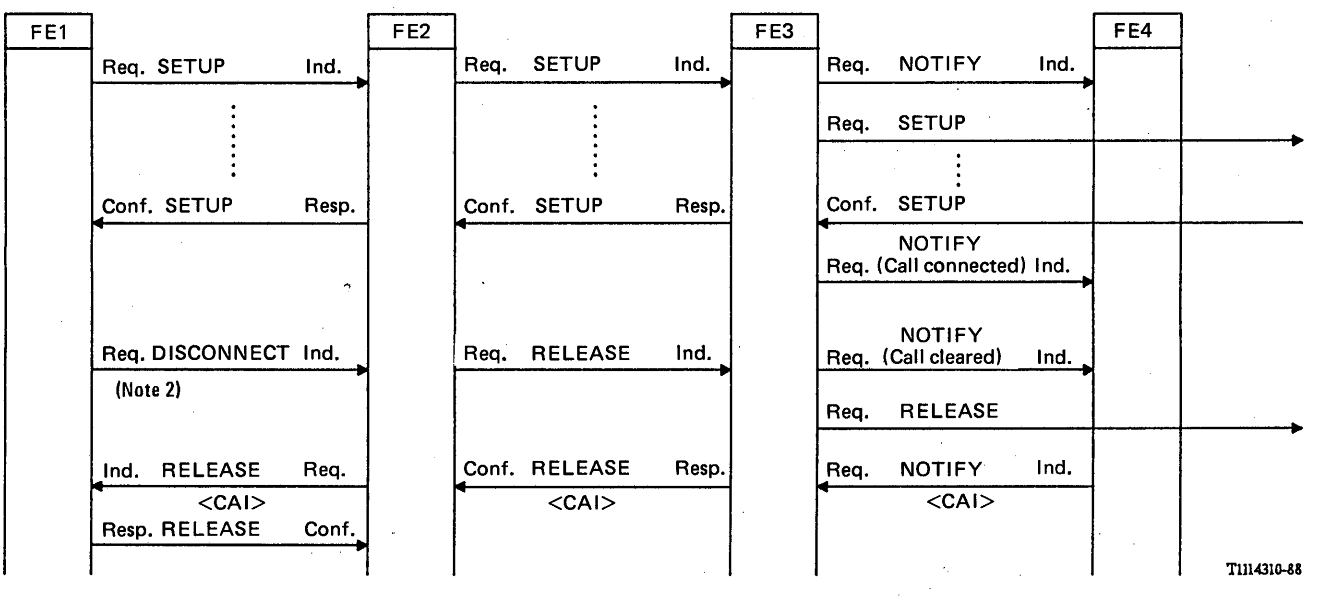


FIGURE 2-2/Q.86 (Sheet 1 of 2)

Advice of charge, functions and information flows
Transfer of charging information





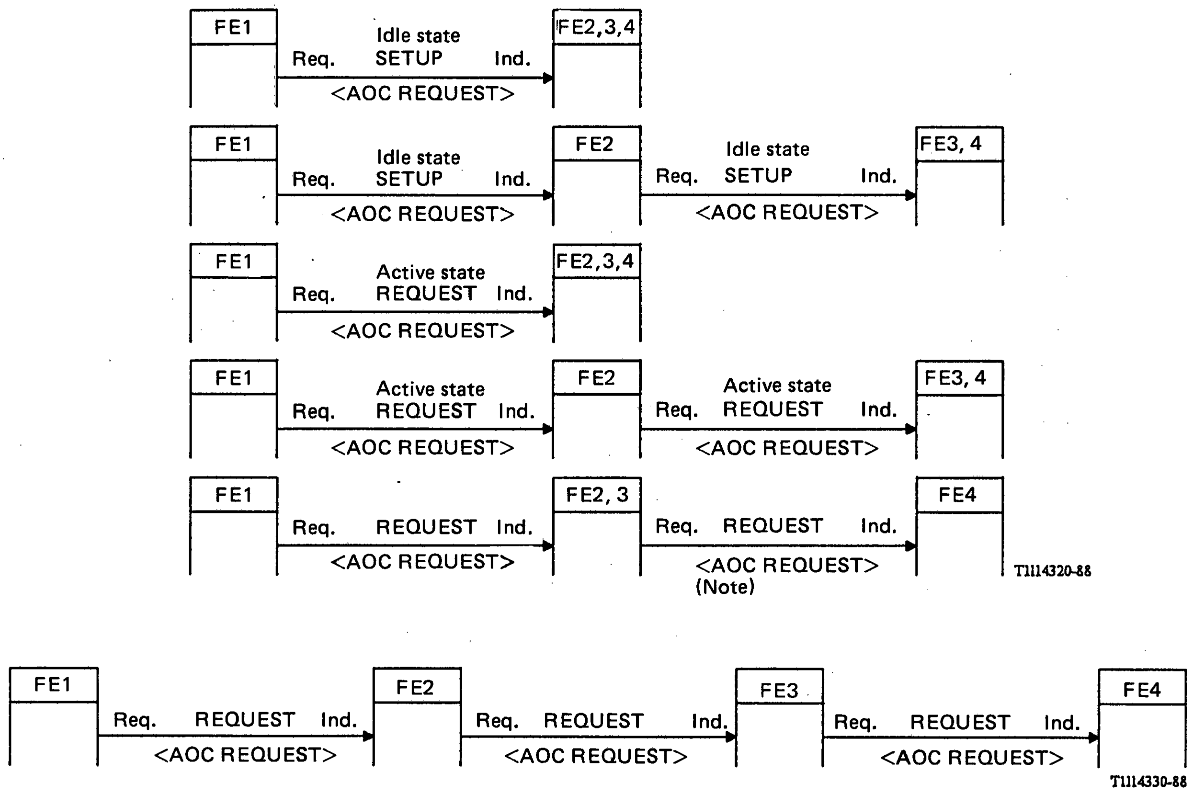
CAI Charge Advice Information

Note 1 – In this case all the necessary information to calculate the charging must be included in the request to the charging centre.

Note 2 – In the case that a call is cleared in the backward direction, the CAI is included in the DISCONNECT req. ind information flow.

FIGURE 2-2/Q.86 (Sheet 2 of 2)

Advice of charge, functions and information flows
Transfer of charging information

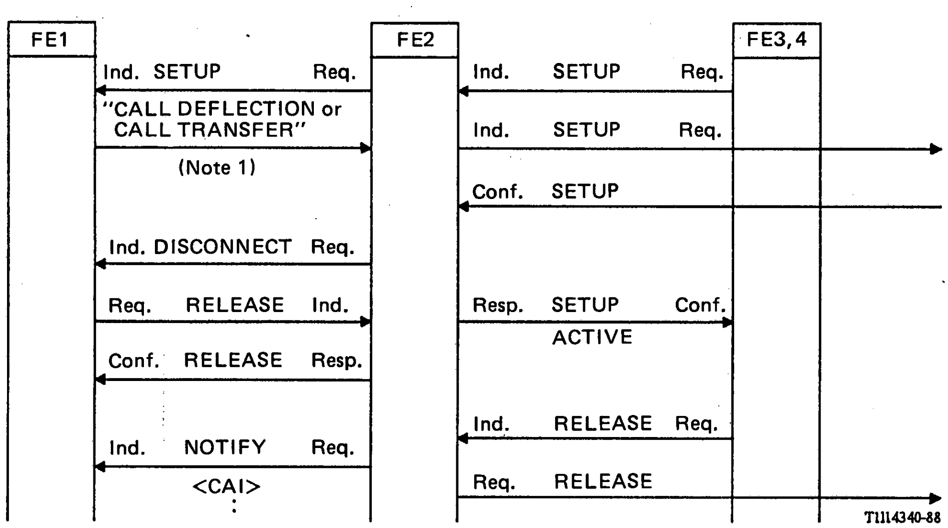


AOC Advice of Charge

Note — In this case all the necessary information to calculate the charging must be included in the request to the charging centre.

FIGURE 2-3/Q.86

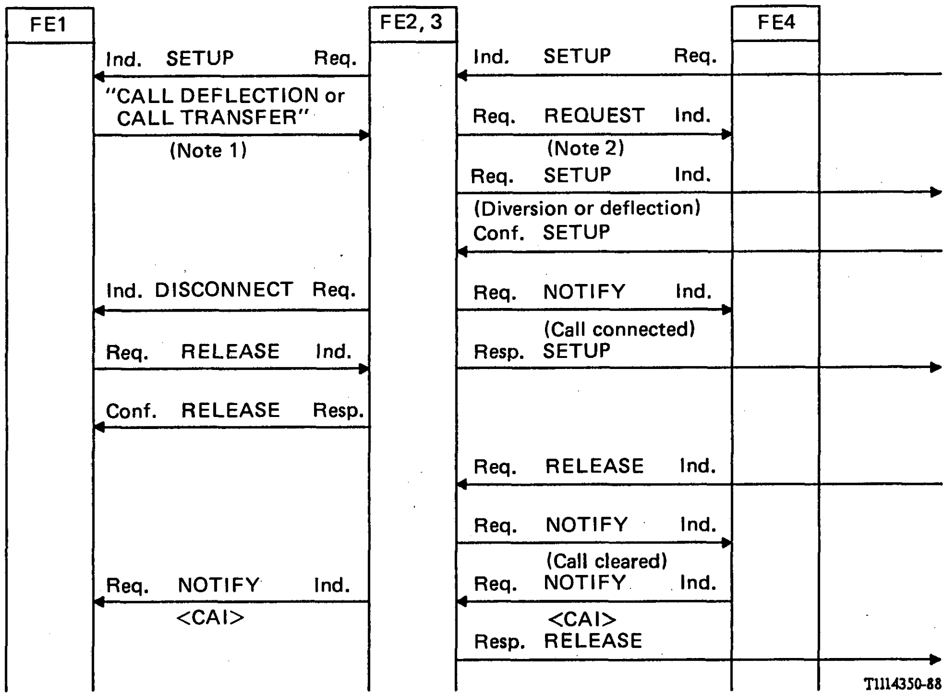
Advice of charge, functions and information flows
Request for charging information at the end of the call

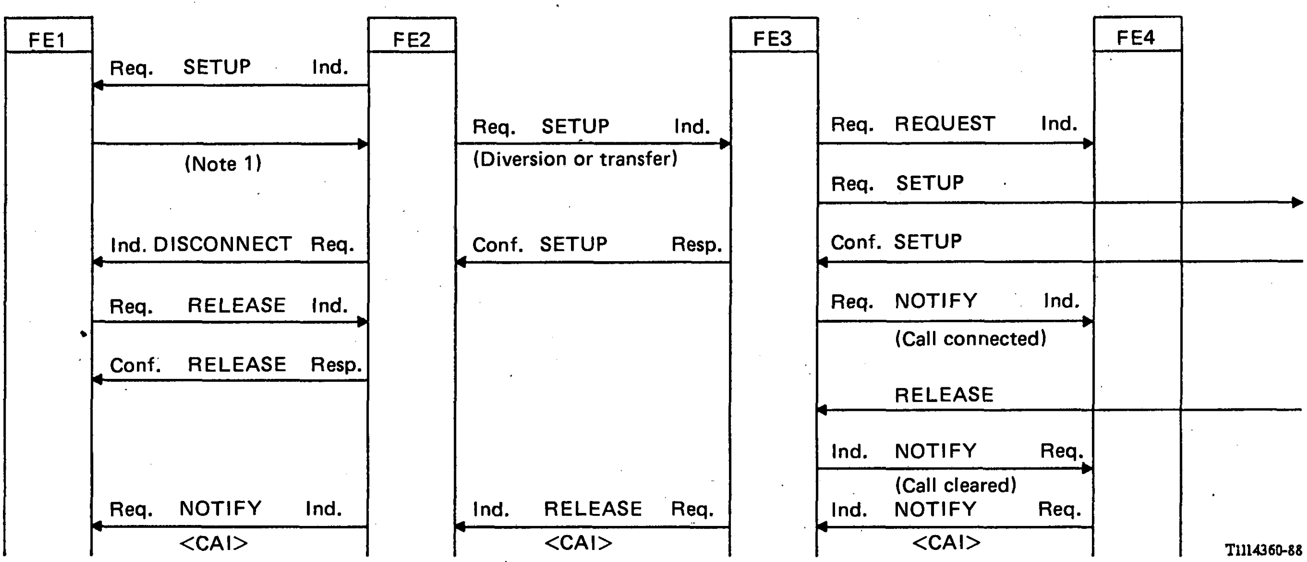


Note 1 — These signalling flows are only applicable in the cases where FE1 is charged for the deflected/transferred part of the call, and FE1 has subscribed to AOC. The detailed flows for these situations are found in the Recommendations for each of the services.

FIGURE 2-4/Q.86 (Sheet 1 of 2)

Advice of charge, functions and information flows
Information flows at call deflection and call transfer





CAI Charge Advice Information

Note 1 – For this note, see Sheet 1 of 2.

Note 2 – In this case all the necessary information to calculate the charging must be included in the request to the charging centre.

FIGURE 2-4/Q.86 (Sheet 2 of 2)

Advice of charge, functions and information flows
Information flows at call deflection and call transfer

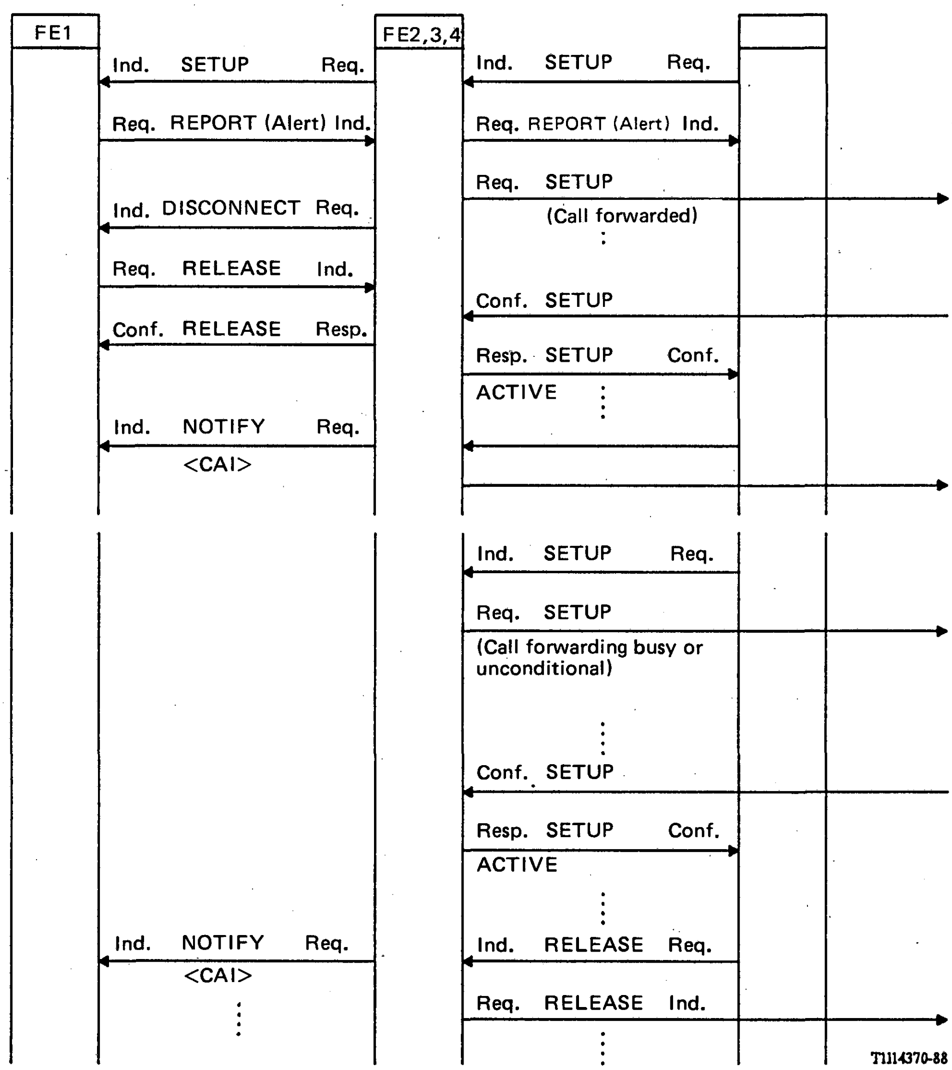


FIGURE 2-5/Q.86

Advice of charge, functions and information flows
Information flows at call forwarding

2.4.2 *Information flows for charging information during a call*

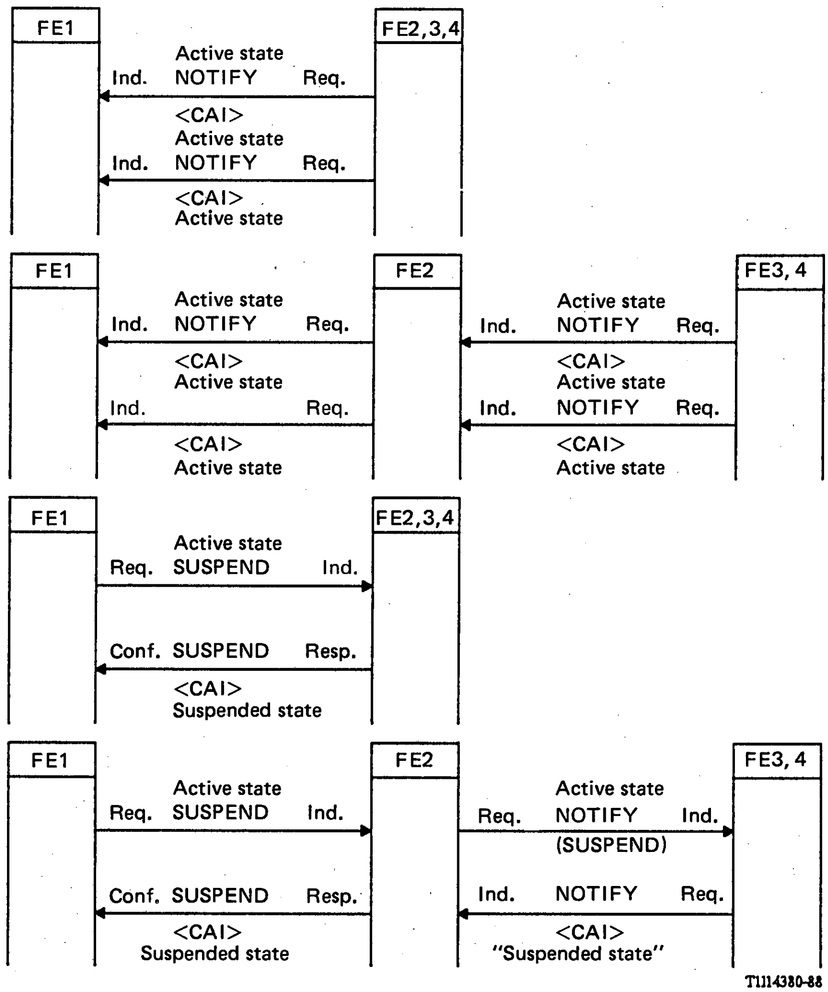
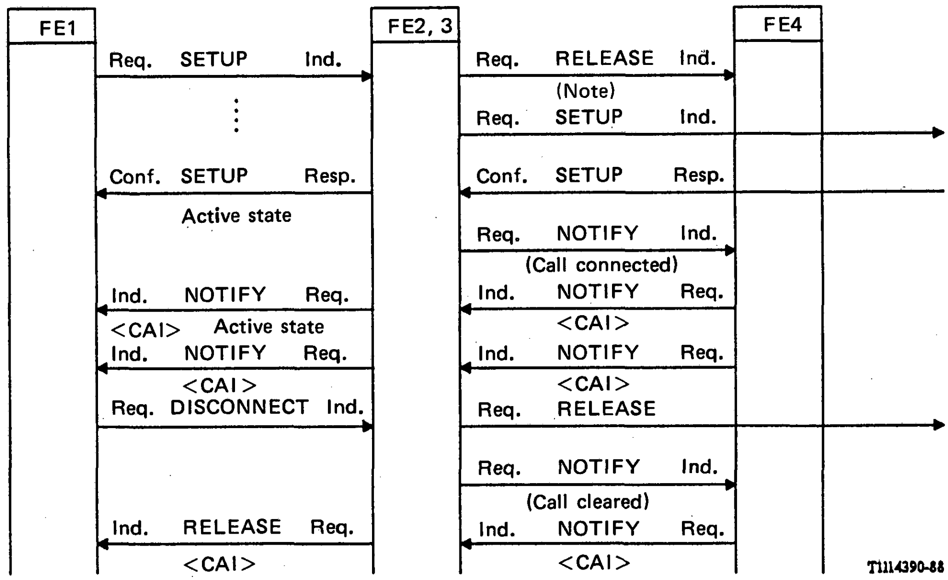
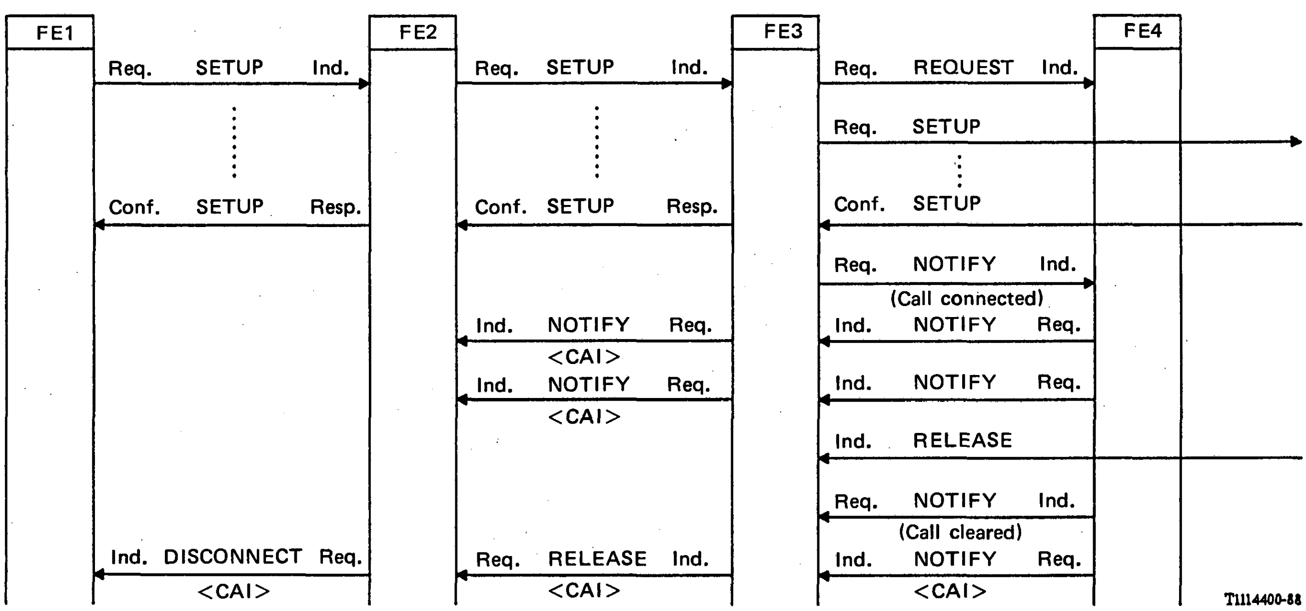


FIGURE 2-6/Q.86 (Sheet 1 of 3)

Advice of charge, functions and information flows
Transfer of charging information during the call





CAI Charge Advice Information

Note – In this case all the necessary information to calculate the charging must be included in the request to the charging centre.

FIGURE 2-6/Q.86 (Sheet 2 of 3)

Advice of charge, functions and information flows
Transfer of charging information during the call

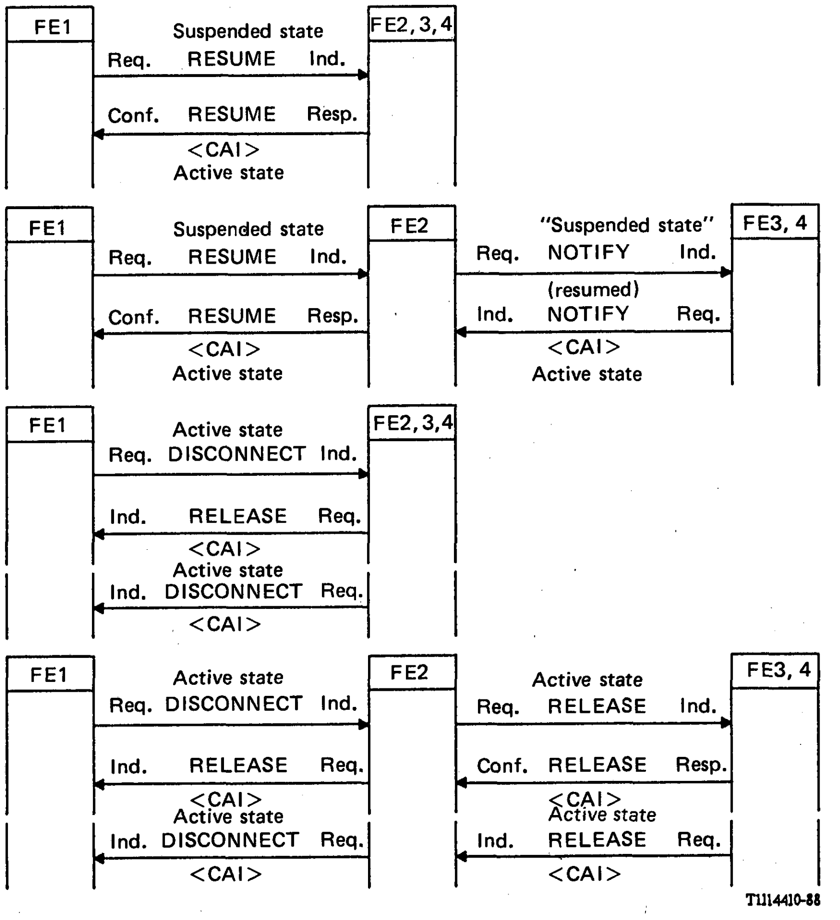
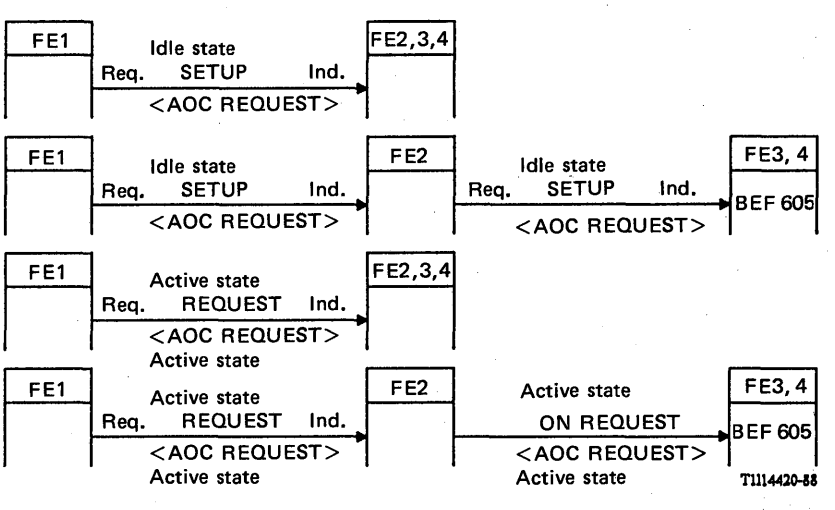


FIGURE 2-6/Q.86 (Sheet 3 of 3)

Advice of charge, functions and information flows
Transfer of charging information during the call

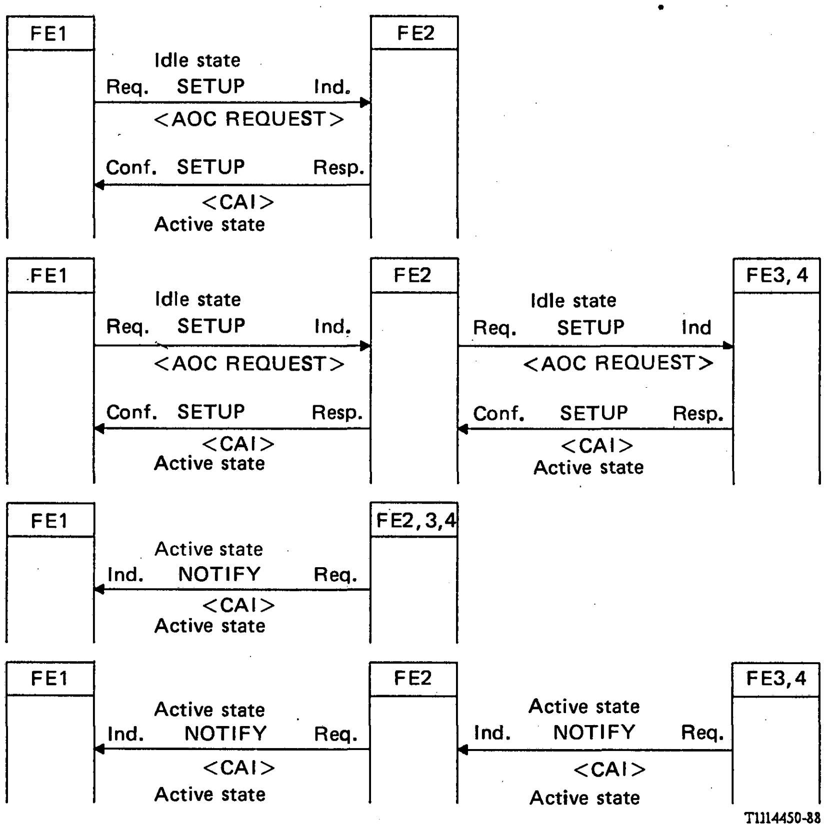


AOC Advice of Charge

FIGURE 2-7/Q.86

Advice of charge, functions and information flows
Request for charging information during the call

2.4.3 *Information flows for information about charging rates*

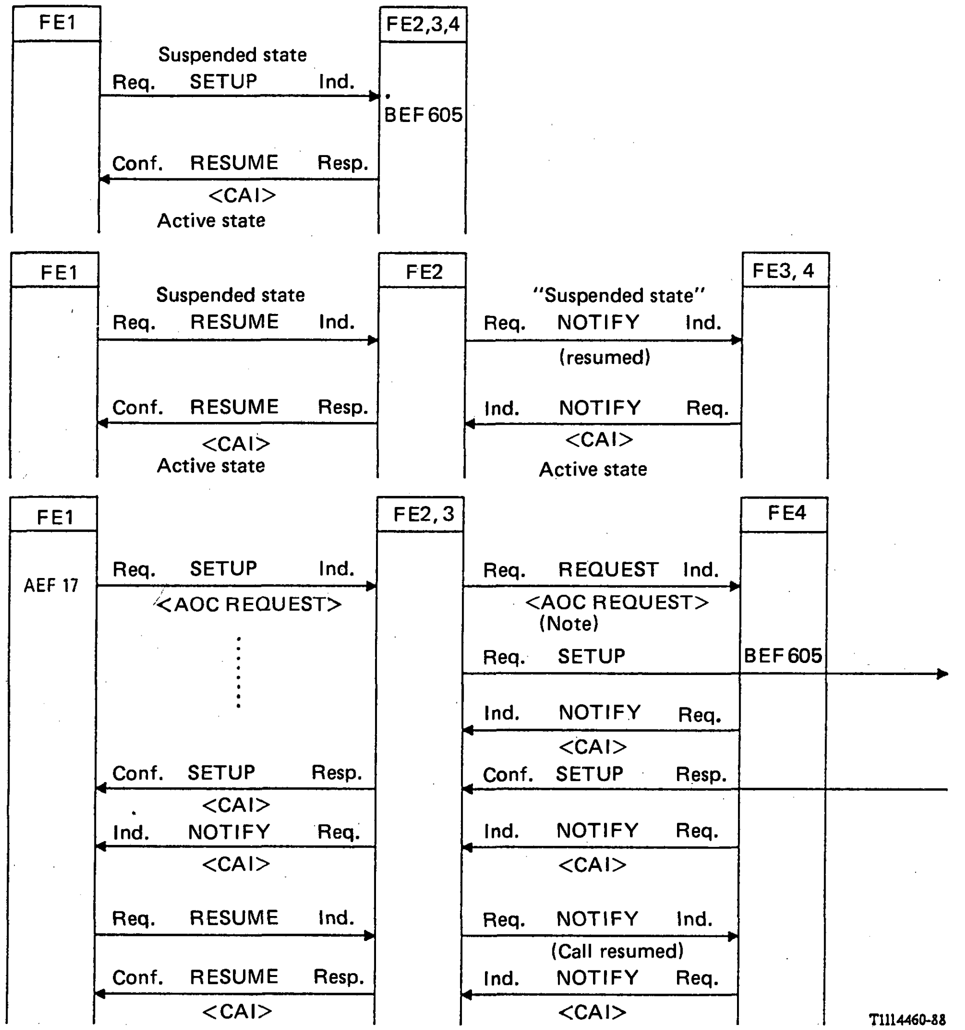


AOC Advice of Charge
CAI Charge Advice Information

Note – The <AOC REQUEST> is not needed in the cases where this service is subscribed for all calls.

FIGURE 2-8/Q.86 (Sheet 1 of 3)

Advice of charge, functions and information flows
Request and receipt of information on charging rates

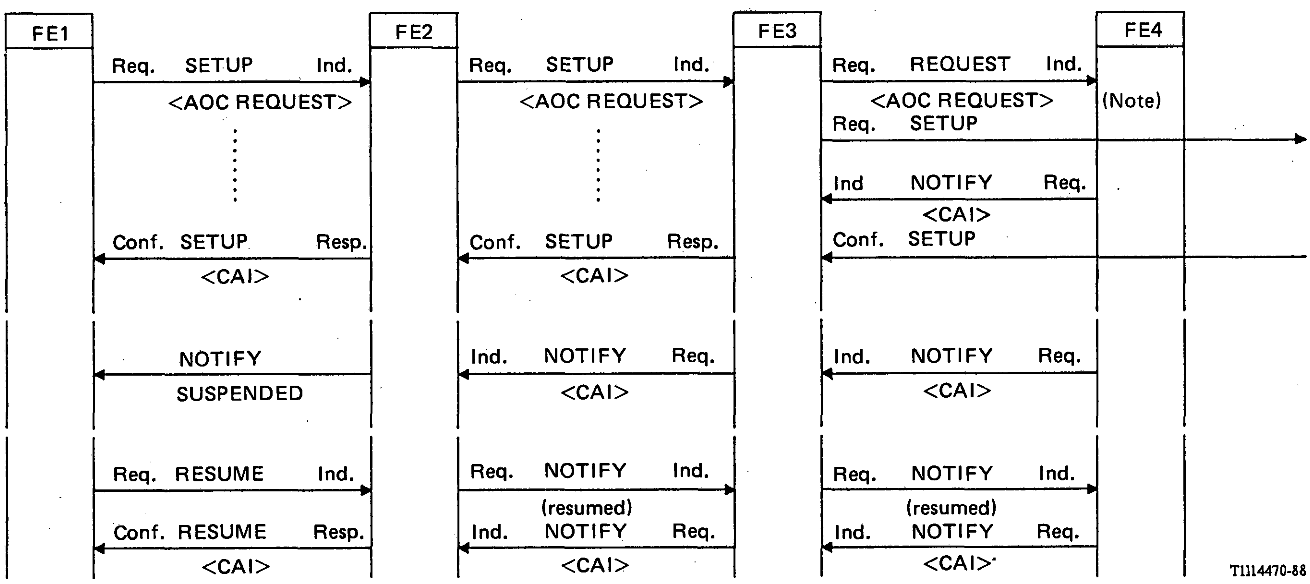


AOC Advice of Charge
CAI Charge Advice Information

Note – In this case all the necessary information to calculate the charging must be included in the request to the charging centre.

FIGURE 2-8/Q.86 (Sheet 2 of 3)

Advice of charge, functions and information flows
Request and receipt of information on charging rates

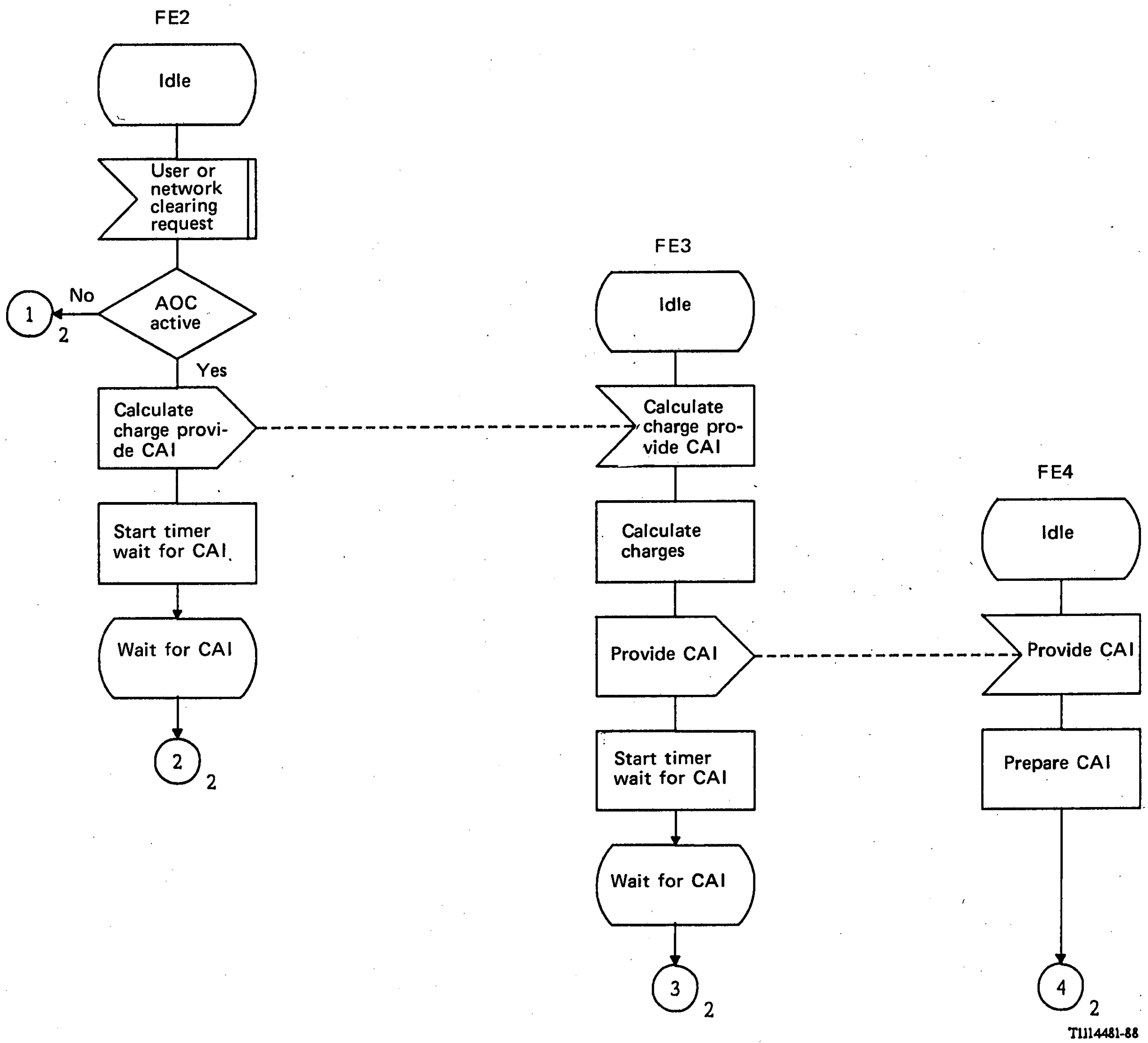


AOC Advice of Charge
CAI Charge Advice Information

Note – In this case all the necessary information to calculate the charging must be included in the request to the charging centre.

FIGURE 2-8/Q.86 (Sheet 3 of 3)

Advice of charge, functions and information flows
Request and receipt of information on charging rates



CAI Charge Advice Information

FIGURE 2-9/Q.86 (Sheet 1 of 2)

Call clearing

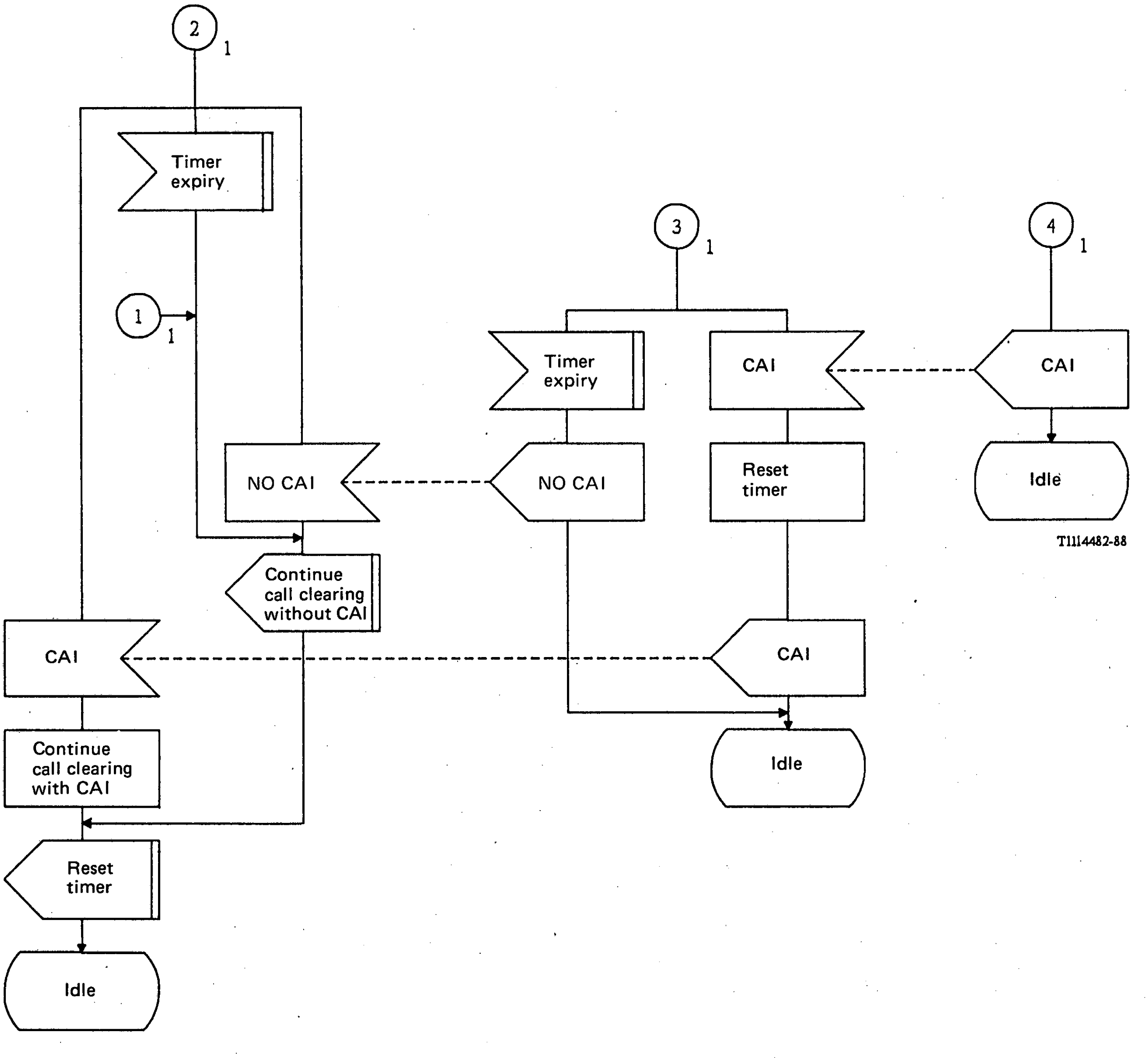


FIGURE 2-9/Q.86 (Sheet 2 of 2)

Call clearing

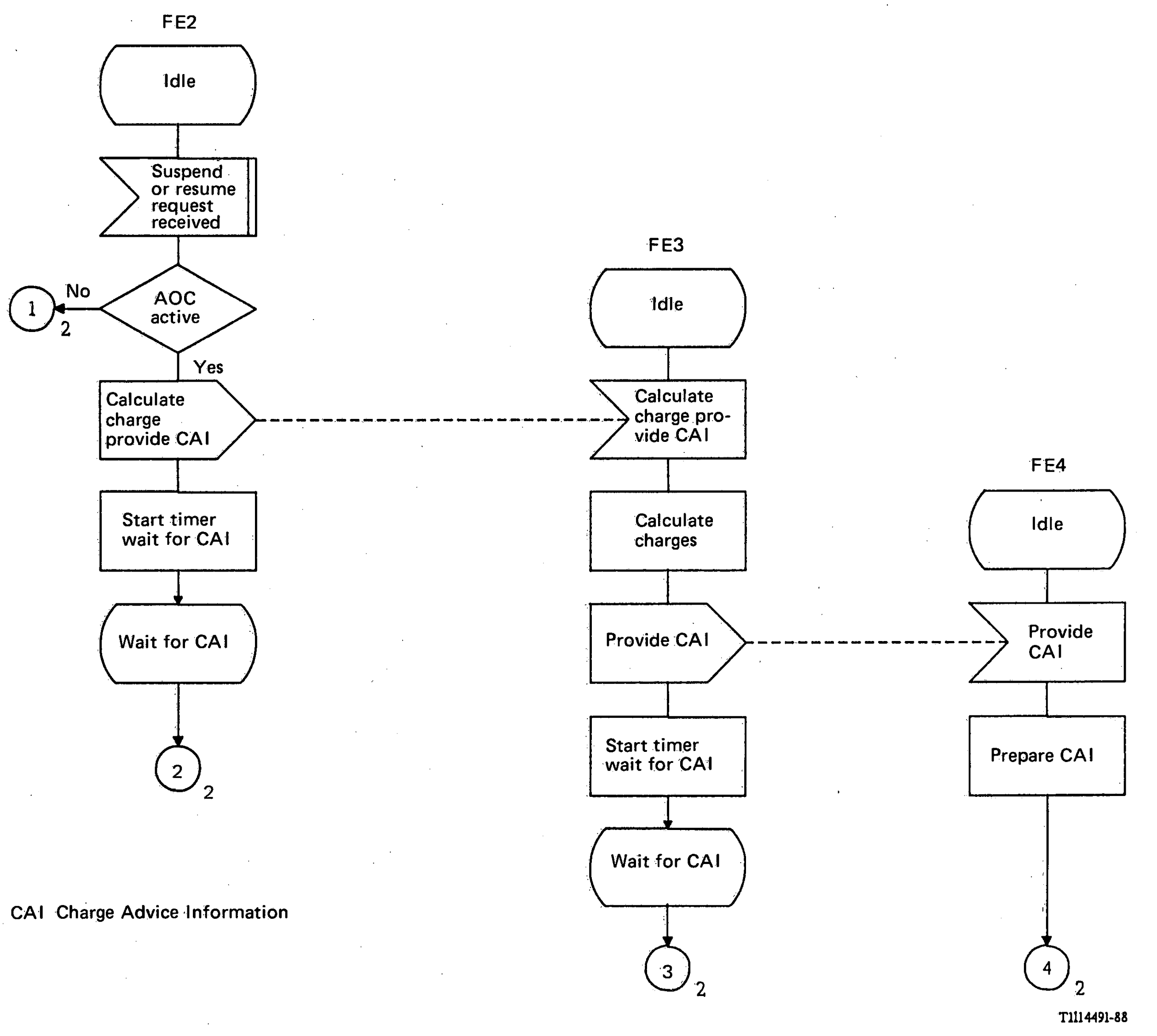


FIGURE 2-10/Q.86 (Sheet 1 of 2)

Call suspend/resume

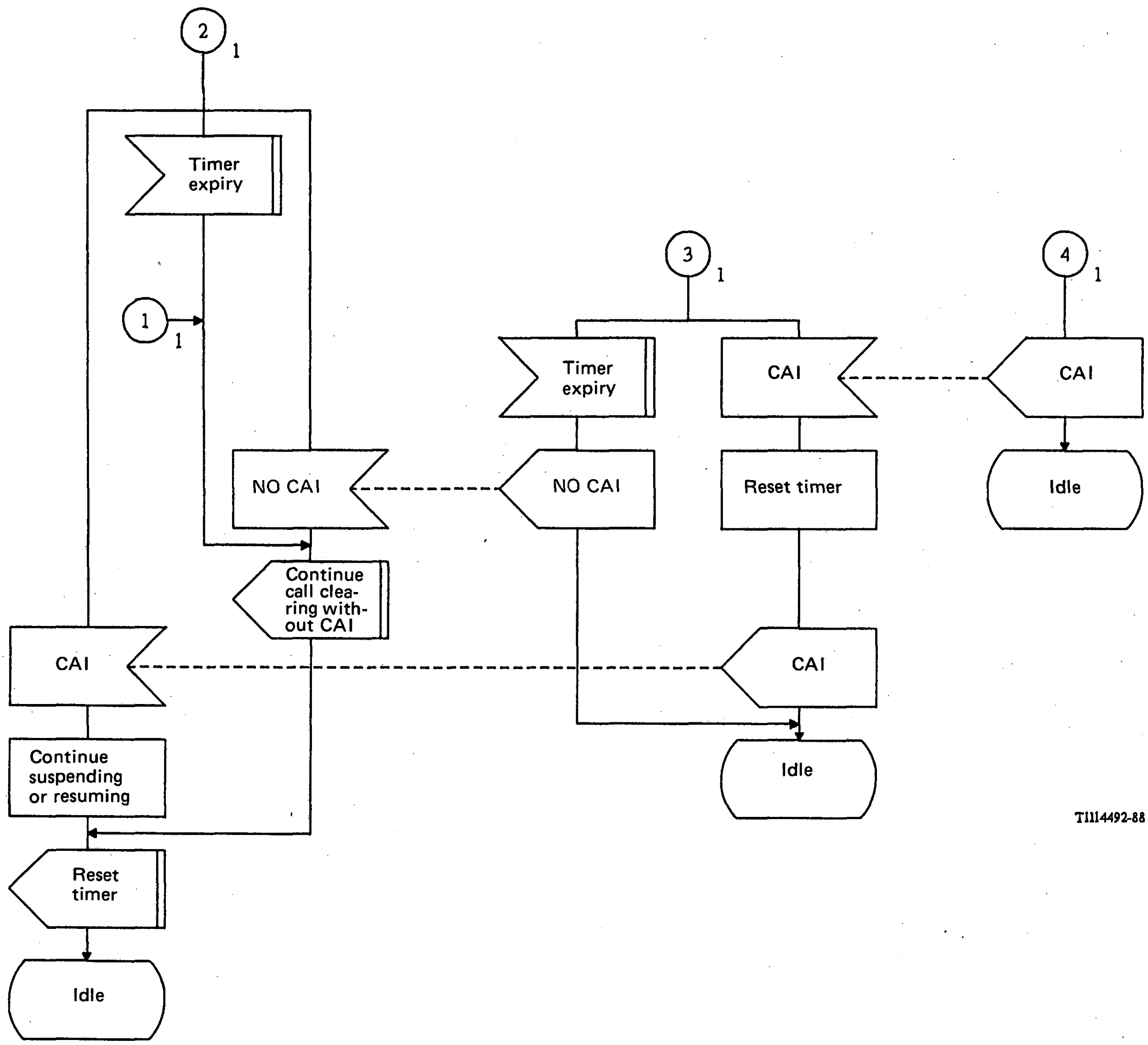


FIGURE 2-10/Q.86 (Sheet 2 of 2)

Call suspend/resume

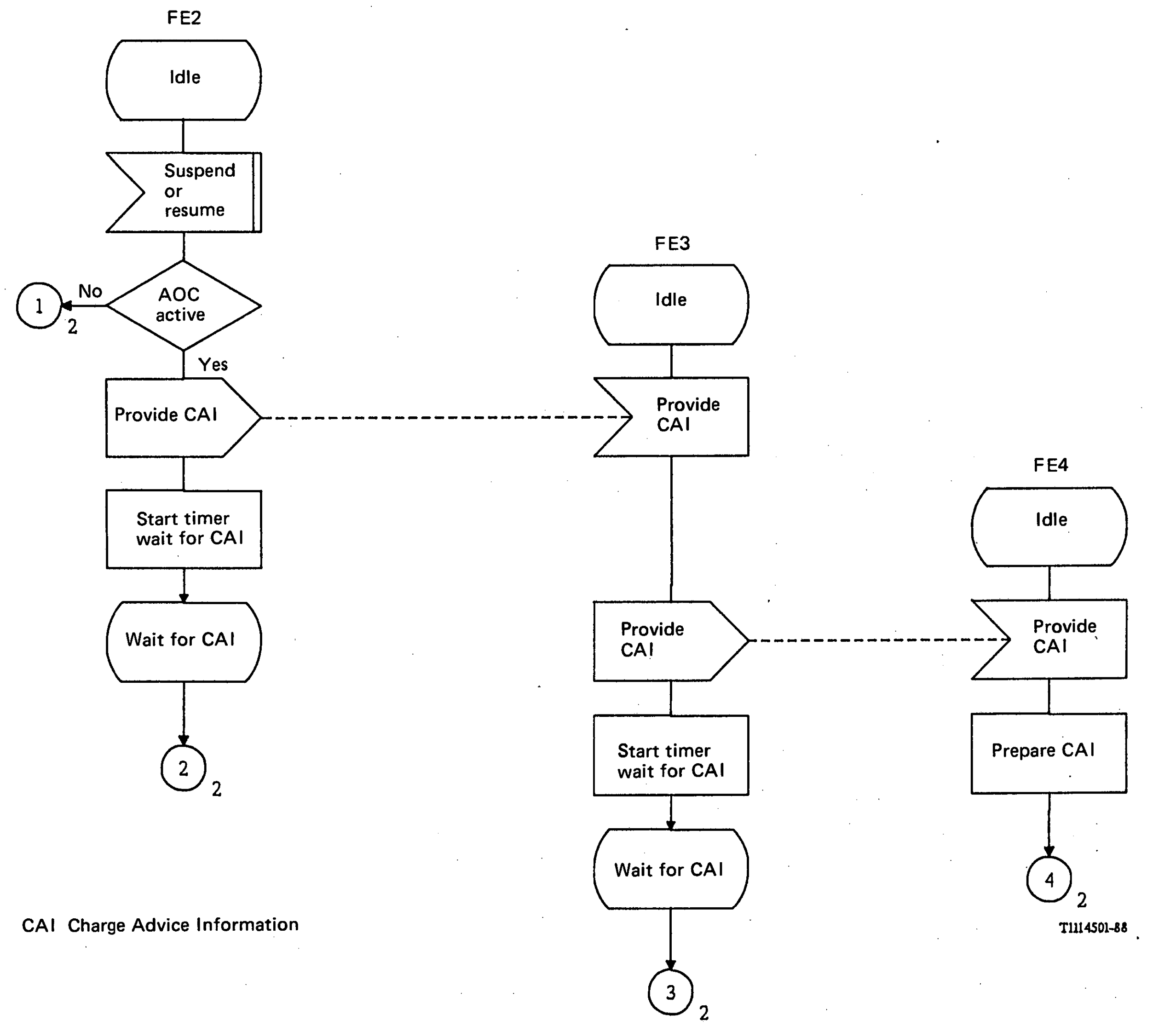


FIGURE 2-11/Q.86 (Sheet 1 of 2)

Call establishment

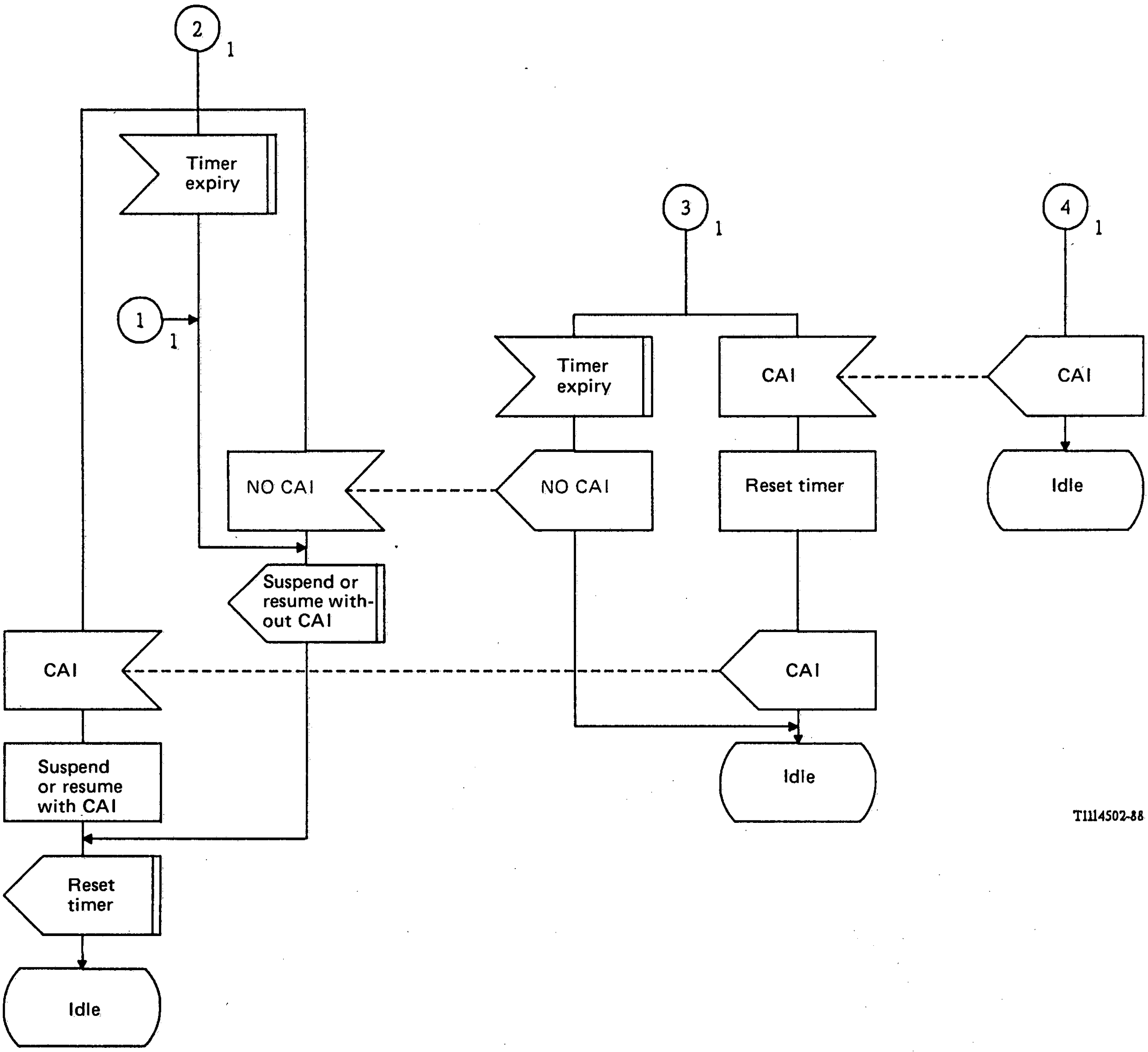


FIGURE 2-11/Q.86 (Sheet 2 of 2)

Call establishment

2.6 *Functional entity actions*

2.6.1 *Functional entity actions for FE2*

- request charging information from FE3/FE2
- send the charging information to FE1

2.6.2 *Functional entity actions for FE3*

- control the charging functions
- request charging information from FE4
- send the charging information to FE2

2.6.3 *Functions entity actions for FE4*

- provide the charging information

2.7 *Allocation of Functional entities to physical location*

TABLE 2-1/Q.86

<table>
<tr><th>Functional entity
Scenario</th><th>FE1
= CRE</th><th>FE2
= 1.CC</th><th>FE3
= CCE</th><th>FE4
= CPE</th></tr>
<tr><td rowspan="2">Charging information provided from the local exchange</td><td>TE</td><td rowspan="2" colspan="3">LE</td></tr>
<tr><td>NT2</td></tr>
<tr><td rowspan="2">Charging information provided from a transit exchange</td><td>TE</td><td rowspan="2">LE</td><td rowspan="2" colspan="2">TR</td></tr>
<tr><td>NT2</td></tr>
<tr><td rowspan="2">Charging information provided from a charging centre via the local exchange</td><td>TE</td><td rowspan="2" colspan="2">LE</td><td rowspan="2">Charging centre</td></tr>
<tr><td>NT2</td></tr>
<tr><td rowspan="2">Charging information provided from a charging centre via the transit exchange</td><td>TE</td><td rowspan="2">LE</td><td rowspan="2">TR</td><td rowspan="2">Charging centre</td></tr>
<tr><td>NT2</td></tr>
</table>

ADDITIONAL INFORMATION TRANSFER SUPPLEMENTARY SERVICES

1 ISDN user-to-user signalling services

1.1 *General*

This Recommendation provides information on the functions in ISDN entities and the information flows between the entities which are required to provide user-to-user signalling services.

The service may be used for unrestricted user signalling information in a packet manner over the D channel at the user-network interface.

1.2 *Description of service uses*

1.1.1 *General description*

The **user-to-user signalling (UUS) supplementary service** allows an ISDN user to send/receive a limited amount of information to/from another ISDN user over the signalling channel in association with a call to the other ISDN user.

Note – These procedures are applicable to user-to-user information (UUI) transfer in association with a circuit-switched telecommunication service only. Procedures to permit UUI transfer in association with other types of calls (e.g. packet bearer services) need to be investigated.

1.2.2 *Signalling information transfer*

This packet service allows two users (e.g., terminals, PABXs) in a point-to-point configuration, to communicate via the ISDN over the D channel.

Service 1 provides this capability within the basic call signalling messages. Services 2 and 3 allow this capability within additional messages. Service 2 may be sent from SETUP through SETUP confirmation (CONNECT) and Service 3 from SETUP confirmation through DISCONNECT.

1.2.3 *Service invocation*

Users indicate their intended user of a user-to-user signalling service at the time of call setup by including appropriate information in the service request sent to the network over the user/network signalling channel (D channel) or for Service 1 by including user-to-user information in the SETUP message. If the request is an explicit request at call setup, the user may mark the request essential/not essential. If the request is essential the call will be cleared by the network if any essential user-to-user service cannot be provided. Service 3 may be activated by either the calling or called user during the setup or active phase of the call.

1.3 *Derivation of the functional model for user-to-user signalling*

1.3.1 *Functional model*

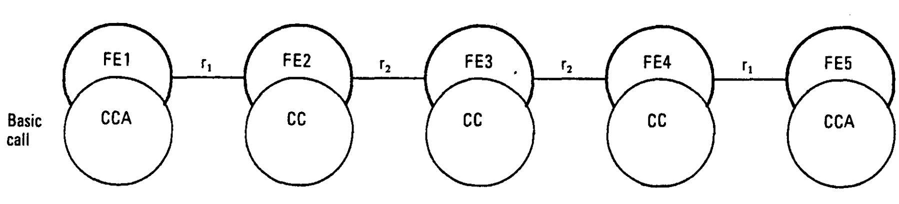


FIGURE 1-1/Q.87

Functional model

FE1 and FE5 are the functional entities that serve the users and are responsible for initiating functional requests and interacting with network: FE2, 3 and 4 are the functional entities within the network that cooperate with their peers to provide the services requestedby FE1 and /FE5. r_1 and r_2 are relationships between functional entities wherein information flows occur in order to process call attempts or service requests.

1.3.1.1 *Relationship to basic service*

Service 1 is carried across the network as part of Basic Service. Services 2 and 3 allow additional messages to be accepted and processed from specific states in the basic service model. These messages do not alter the state but require an action to take place.

1.3.1.2 *Description of the call control Agent functional entity*

The CCA functional entity supports the functionality to:

a) access the service-providing capabilities of the CC entities, using service requests to establish, manipulate and release a single call;

b) receive indications relating to the call from the CC entity and relay them to the user;

c) maintain call state information as perceived from this functional end-point of the service (i.e., a single-ended view of the call).

1.3.1.3 *Description of the call control (CC) functional entity*

The CC functional entity supports the functionality to:

a) establish, manipulate and release a single call (upon request of the CCA entity);

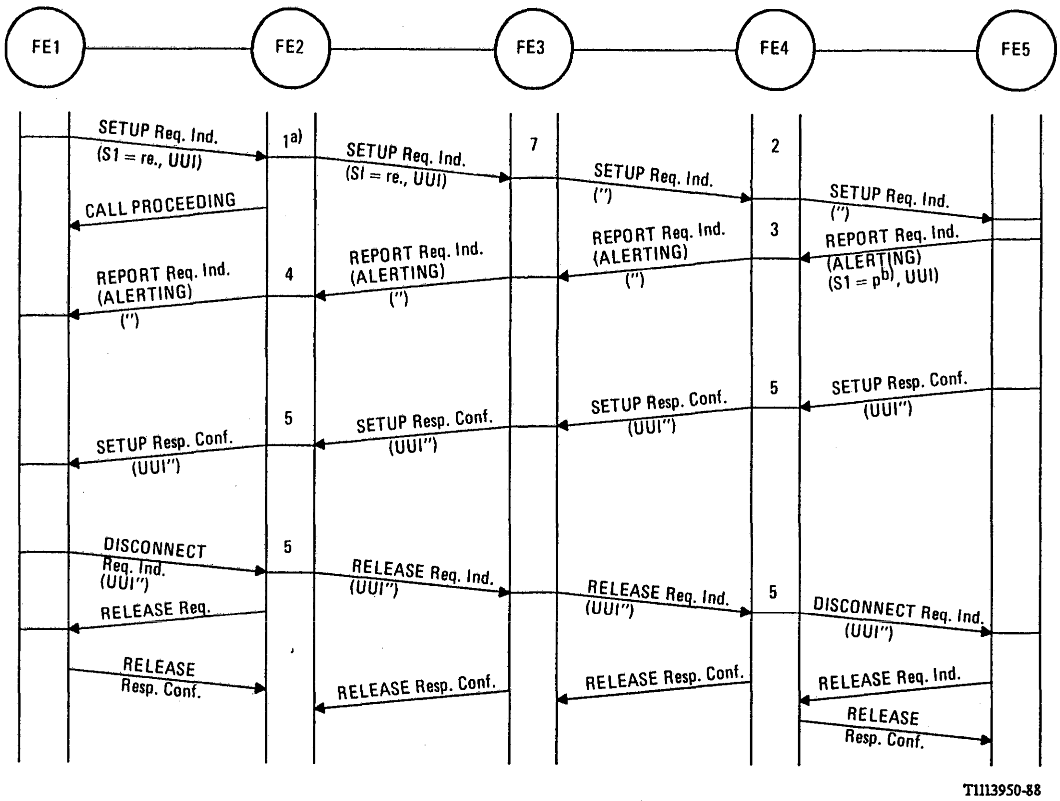
b) associate and relate the CCA entities that are involved in a particular call and/or service;

c) manage the relationship between the CCA entities involved in a call (i.e., reconcile and maintain the overall perspective of the call and/or service);

1.4 *Information flow diagrams*

Information flow diagrams for user-to-user signalling service call setup, service usage and call release are shown in Figures 1-2/Q.87 to 1-10/Q.87.

- Figure 1-2/Q.87 shows a successful use of UUS Service 1 in a point-to- point configuration;
- Figure 1-3/Q.87 shows a successful use of UUS Service 1 in a point-to- multipoint configuration;
- Figure 1-4/Q.87 shows a successful use of UUS Service 2 in a point-to- point configuration;
- Figure 1-5/Q.87 shows an unsuccessful use of UUS Service 2 in a point- to-multipoint configuration;
- Figure 1-6/Q.87 shows a successful use of UUS Service 3 requested and essential;
- Figure 1-7/Q.87 shows a successful use of UUS Service 3 requested and not essential;
- Figure 1-8/Q.87 shows a successful use of UUS Service 3 requested during the active phase;
- Figure 1-9/Q.87 shows a successful use of UUS Service 3 requested during the active phase by the called party;
- Figure 1-10/Q.87 shows a UUS service requested in a point-to-multipoint configuration.



re. Requested and essential
p. Provided

a) 1-7 are functional action entities described in § 6.

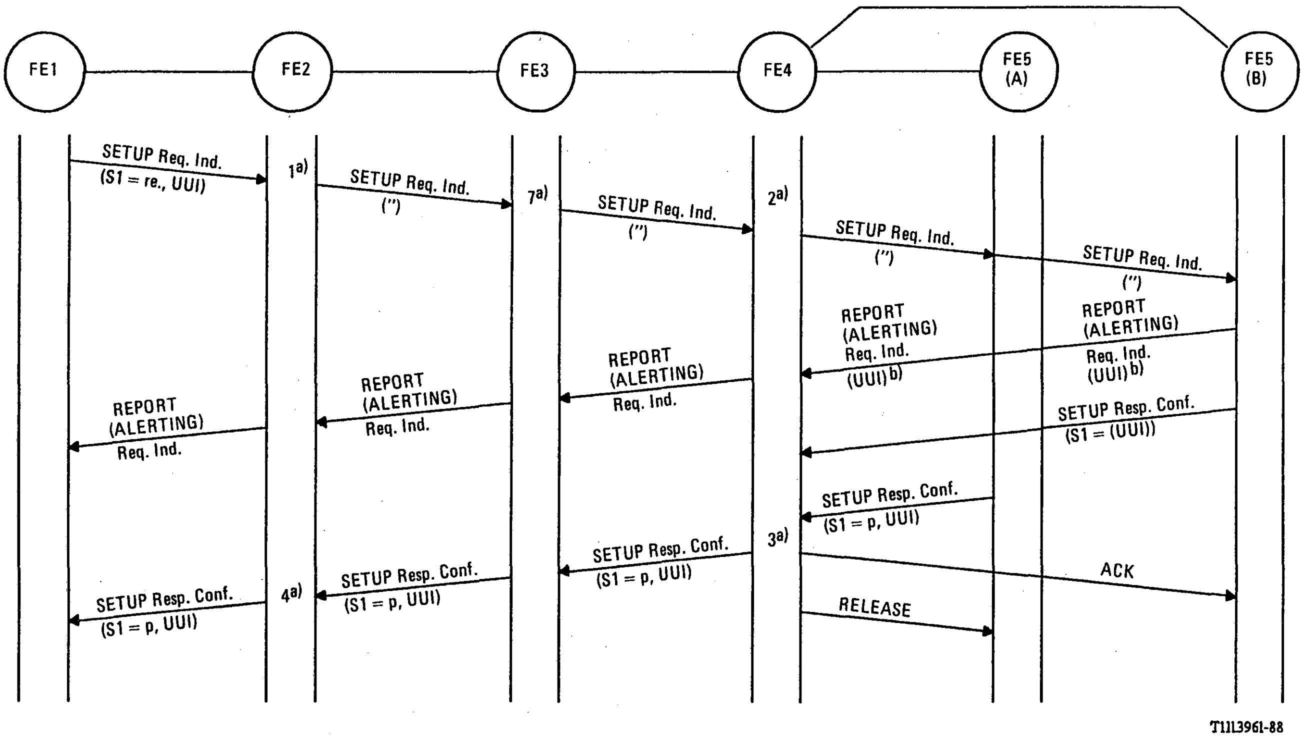
b) This indication may be included in the CONNECT/ANSWER messages.

Note — Although not shown in this Figure, the calling user is allowed to request Service 1 as non-essential (i.e., rne).

FIGURE 1-2/Q.87

UUS Service 1 - Successful case

Called user is point-to-point



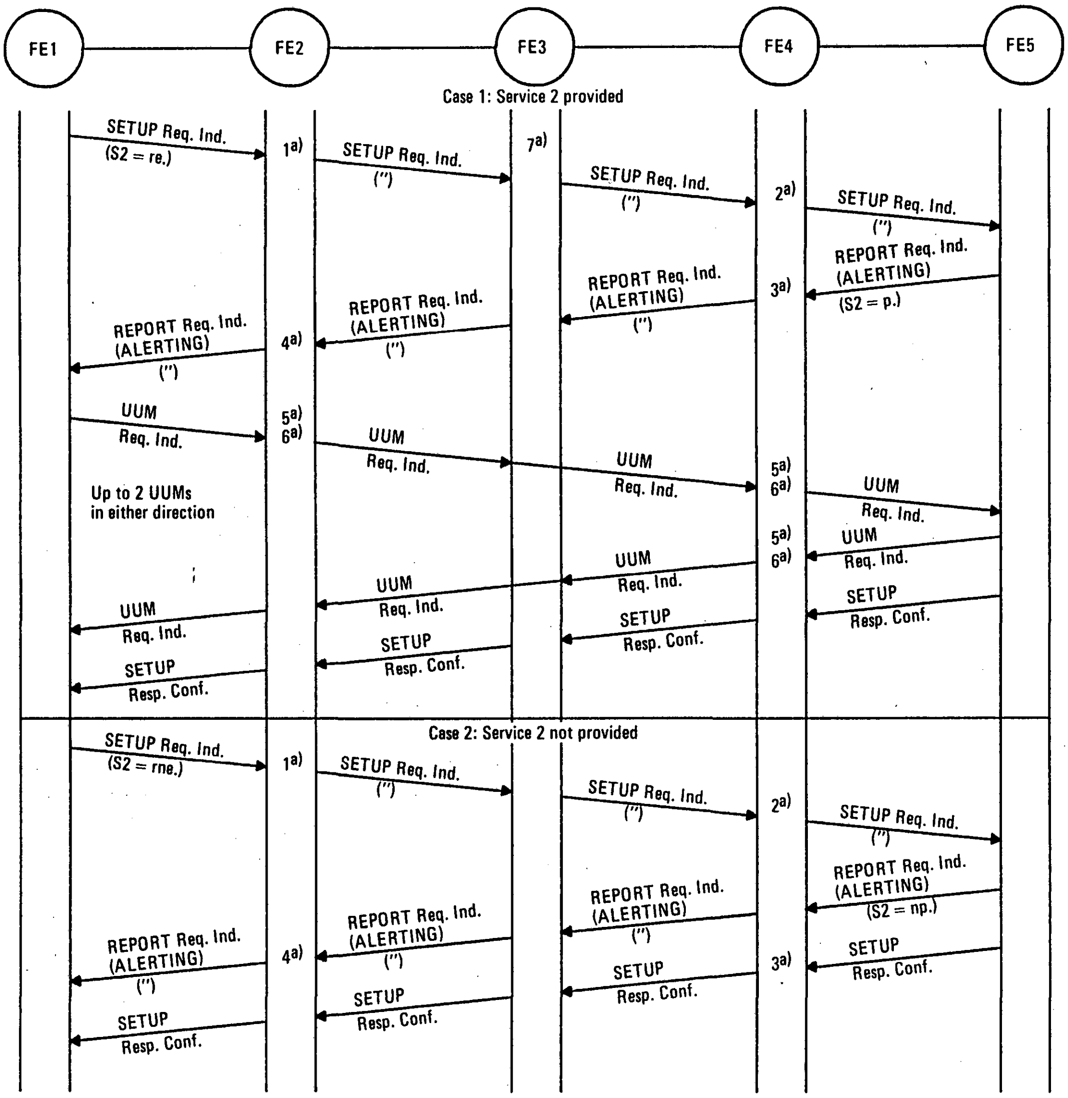
a) 1-7 are functional action entities described in § 6.

b) In case of point-to-multipoint configuration, UUI (1, 11, 411) in the ALERTING (FE5A and FE5B) and CONNECT from the non-selected FE5 (FE5A) are discarded at FE4.

FIGURE 1-3/Q.87

UUS Service 1

Called user is point-to-multipoint



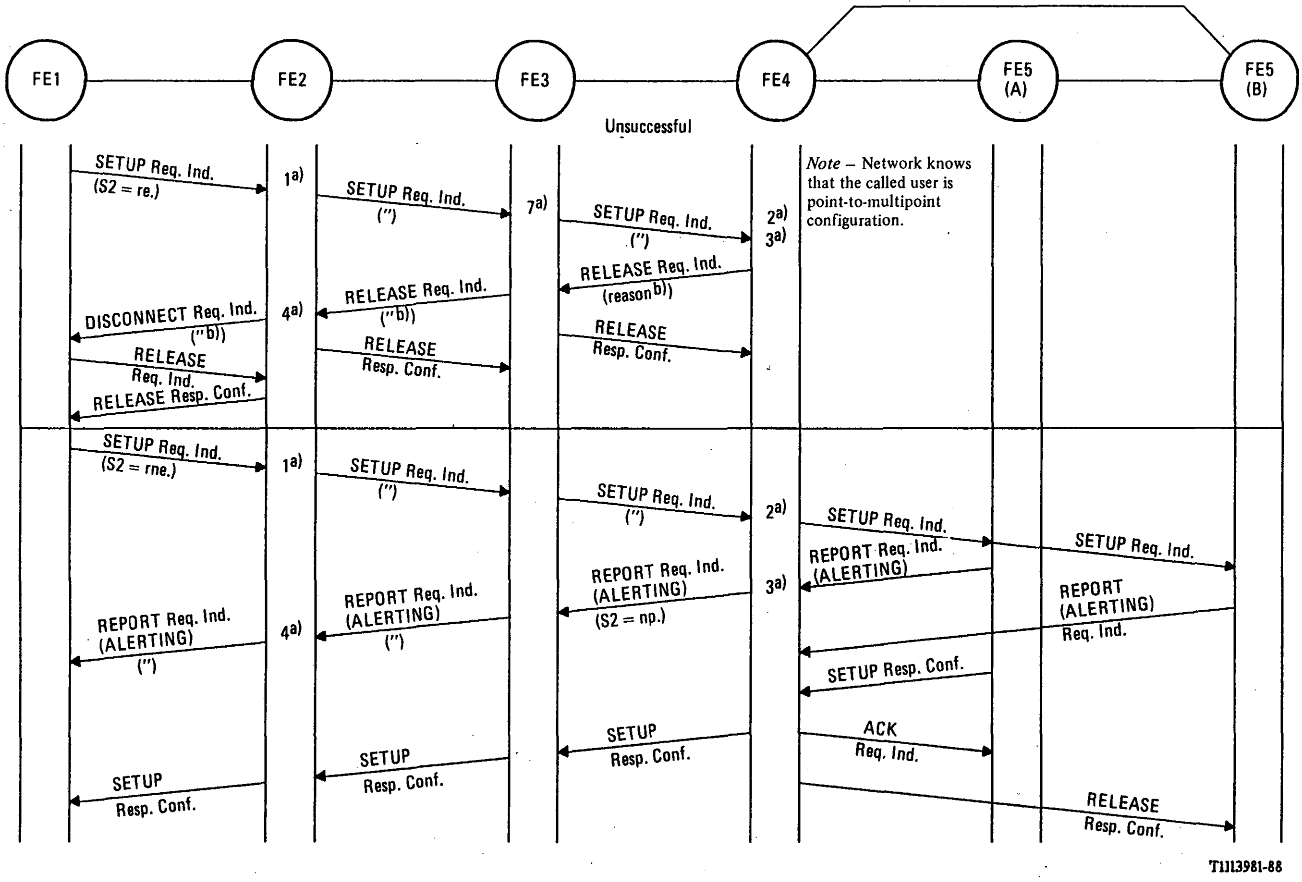
rne. Requested but not essential
np. Not provided
UUM User-to-user message

a) 1-7 are functional action entities described in § 6.

FIGURE 1-4/Q.87

UUS service 2

Called user is point-to-point



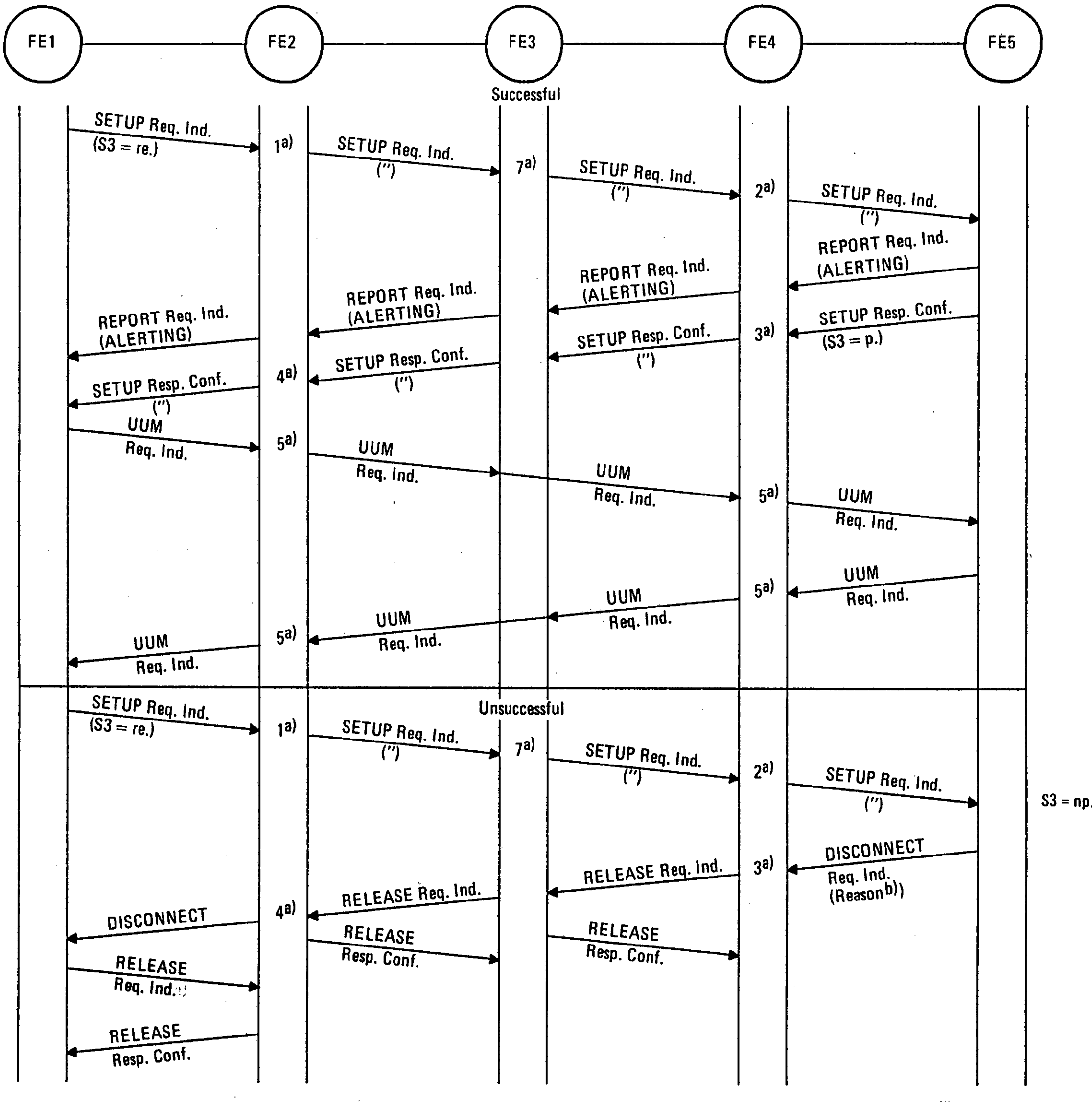
a) 1-7 are functional action entities described in § 6.

b) The reason is "UUS Service 2 cannot be provided because called party has point-to-multipoint configuration".

FIGURE 1-5/Q.87

UUS service 2

Called user is point-to-multipoint



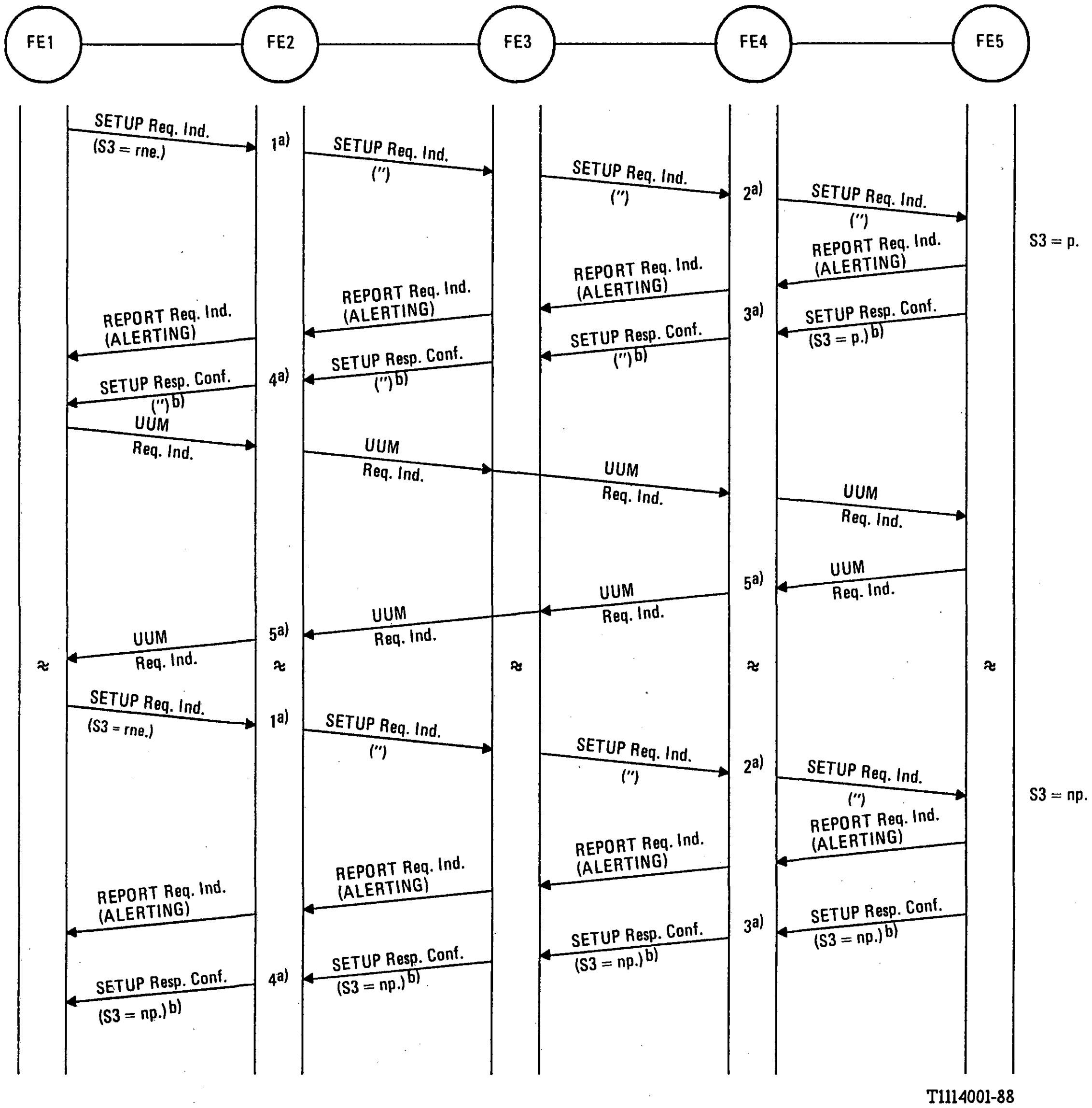
a) 1-7 are functional action entities described in § 6.

b) The reason is "this service cannot be provided by the called user".

FIGURE 1-6/Q.87

UUS service 3

S3 requested and essential



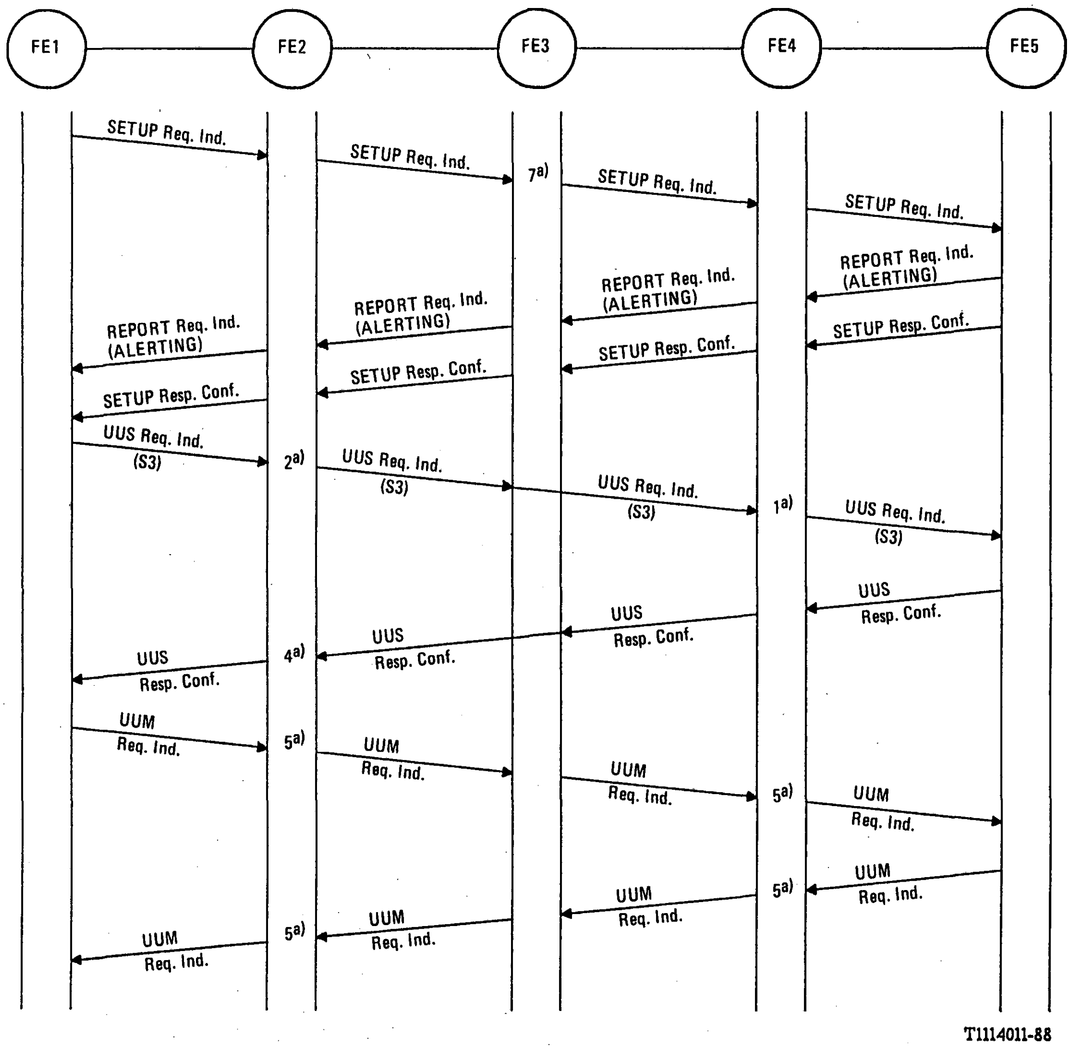
[a] 1-7 are functional action entities described in § 6.

[b] Could be sent in REPORT flow.

FIGURE 1-7/Q.87

UUS service 3

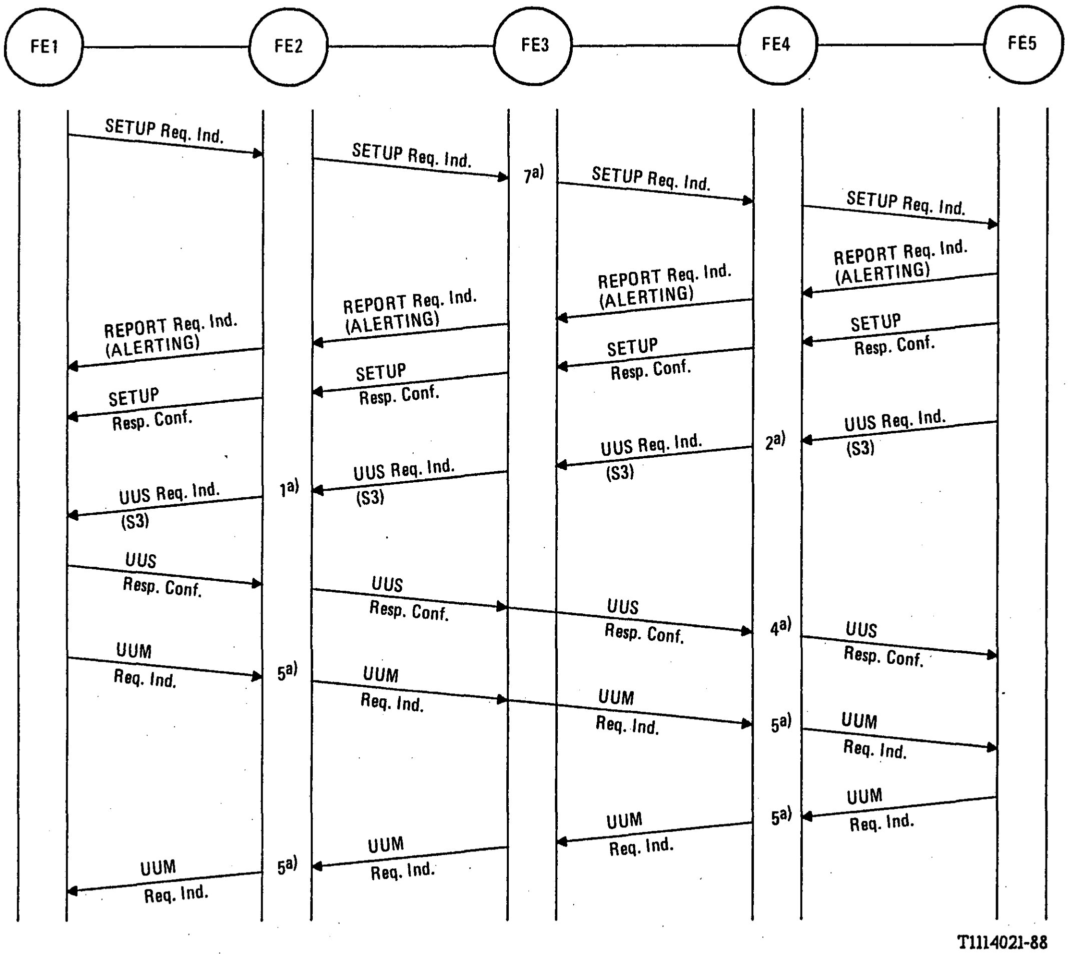
S3 requested but not essential



a) 1-7 are functional action entities described in § 6.

FIGURE 1-8/Q.87

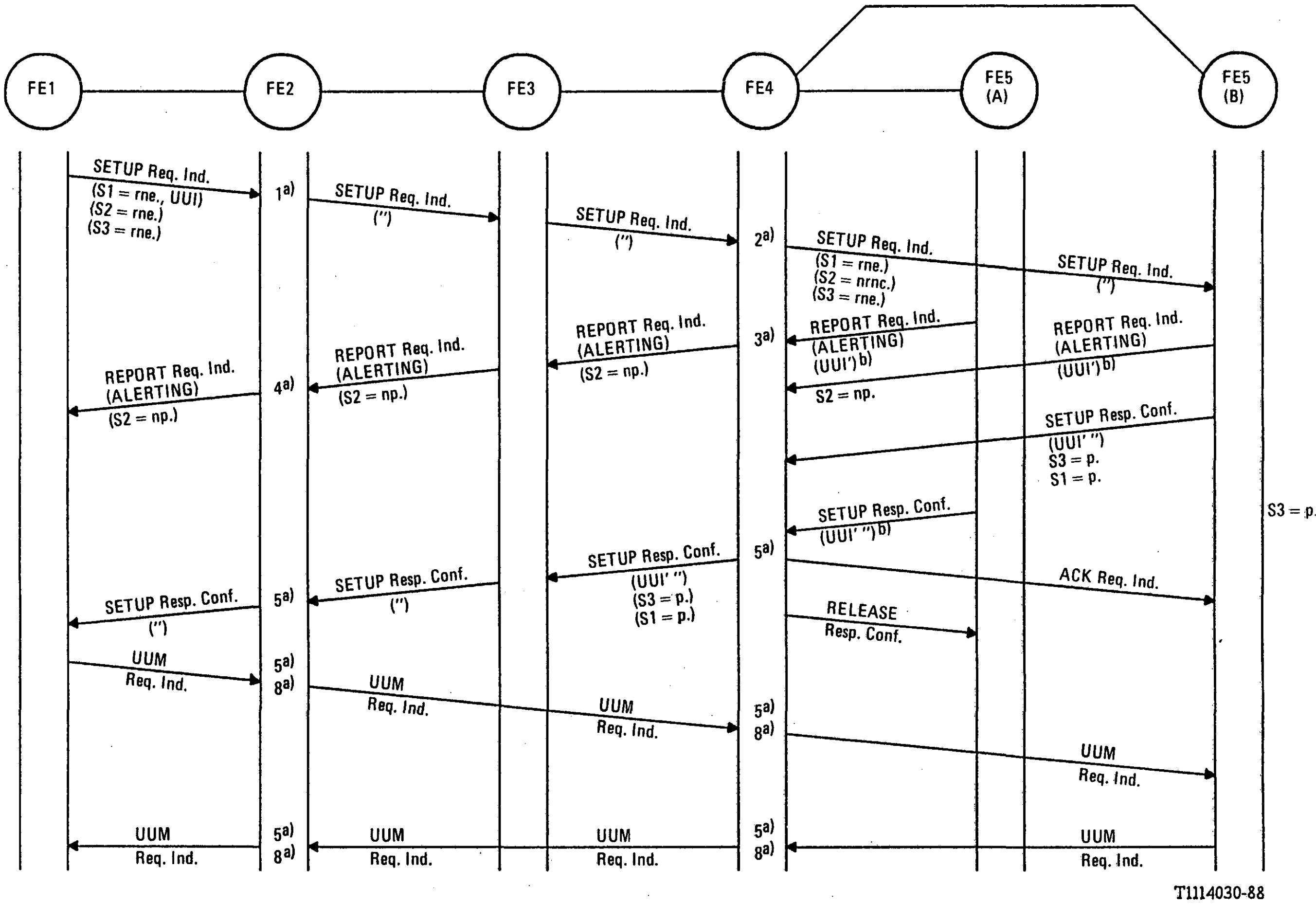
UUS service 3
Requested during active phase (by calling party)
(Not-essential)



a) 1-7 are functional action entities described in § 6.

FIGURE 1-9/Q.87

UUS service 3
Requested during active phase (by called party)
(Not-essential)



[a] 1-7 are functional action entities described in § 6.

[b] In case of point-to-point configuration, UUI (', '', '''), in the ALERTING [FE5 (A) or FE5 (B)] and CONNECT from the non-selected FE5 [FE5 (A)] are discarded at FE4.

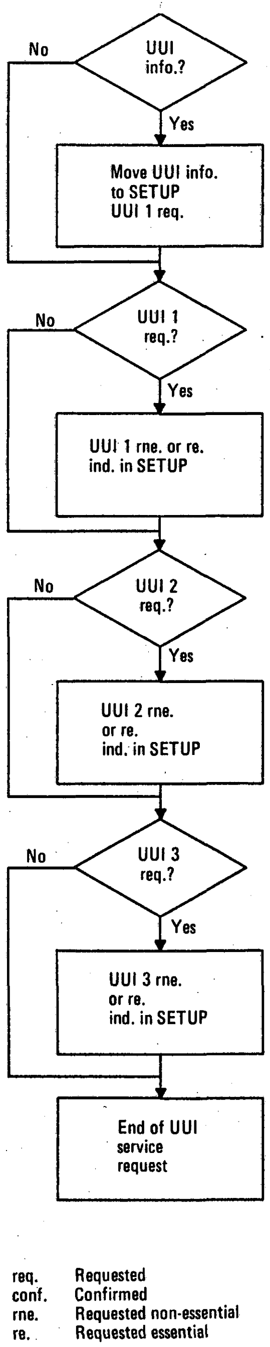
FIGURE 1-10/Q.87

All the UUS services, 1, 2, 3 are requested

Called user to point-to-multipoint

1.5 *SLD diagrams for functional entities*

1.5.1 *SLDs for FE1 and FE5*



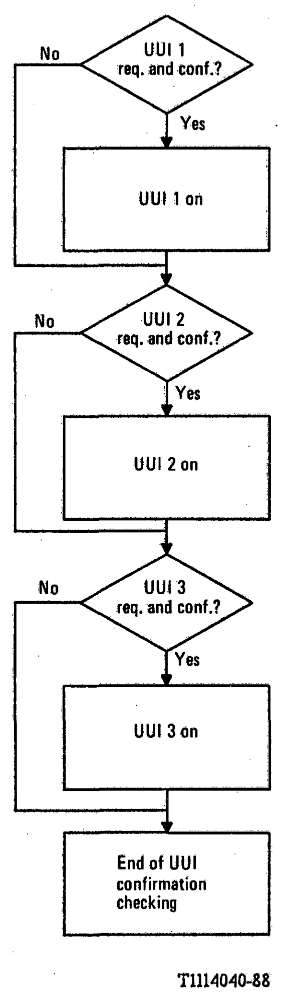


FIGURE 1-11/Q.87

CCA additions to basic call for UUS
Process service request

FIGURE 1-12/Q.87

Report ind. or report (Alerting) ind.
Processing of parameters

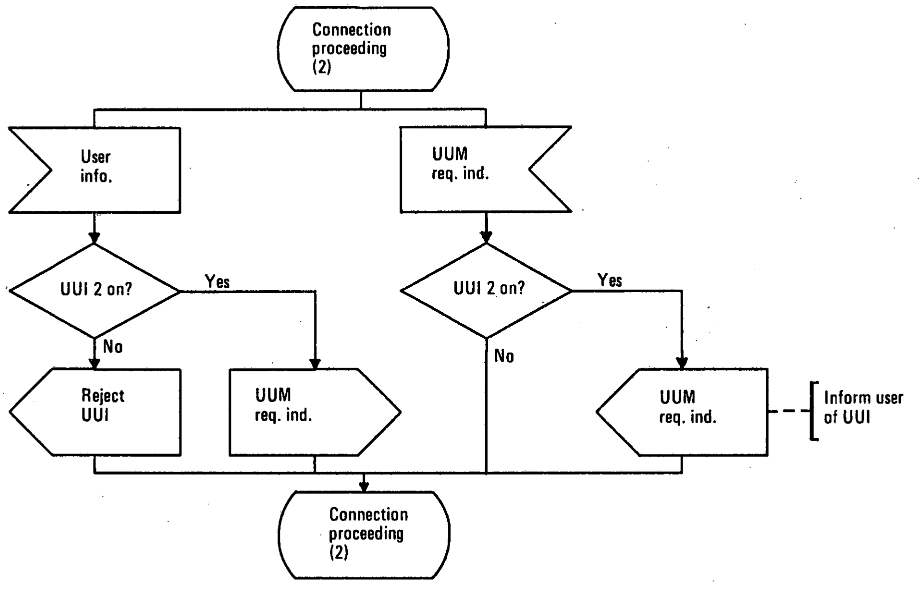
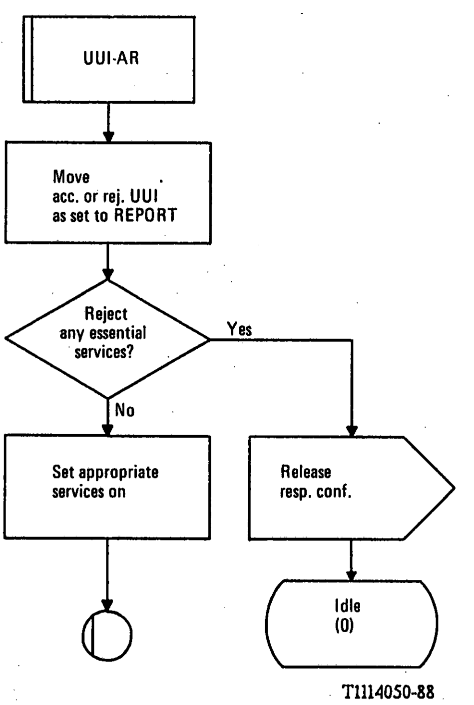


FIGURE 1-13/Q.87

CCA r_1-User UUM connection proceeding processing



acc. Acceptance
rej. Rejection

FIGURE 1-14/Q.87

CCA r_1-User acceptance or rejection of UUI request
Process attempt
Macrodefinition UUI AR

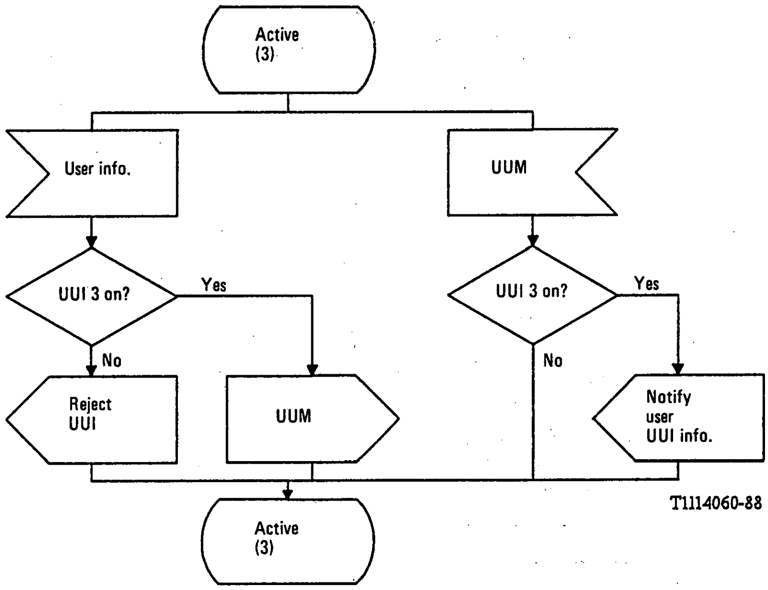


FIGURE 1-15/Q.87

CCA r_1-User UUM active processing

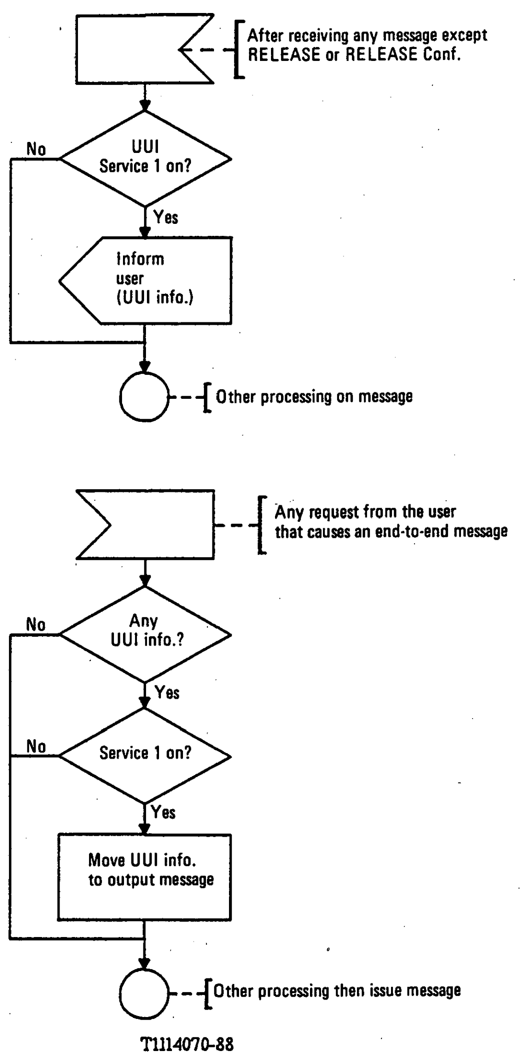


FIGURE 1-16/Q.87

CCA r_1-User UUS 1 processing

For call control message handling

1.5.2 *Stage 2 SDLs for FE2 "CC functional entity (r_I-r_I)"*

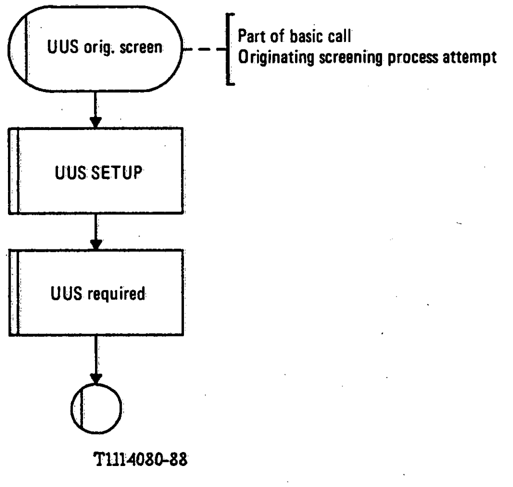


FIGURE 1-17/Q.87

Macrodefinition UUS originating screen

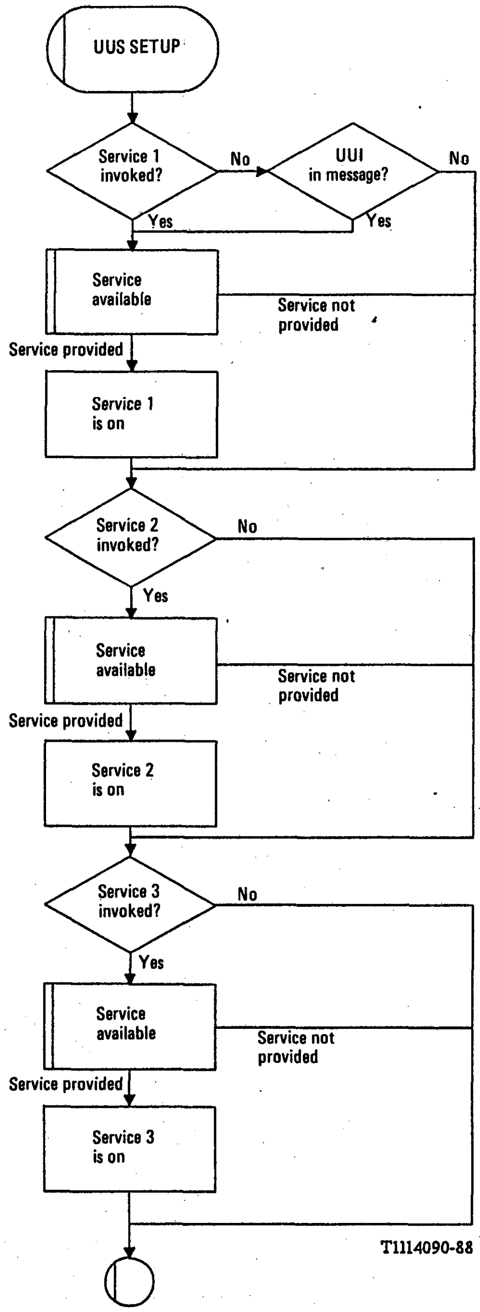


FIGURE 1-18/Q.87

Macrodefinition UUS SETUP, r_1 - r_1

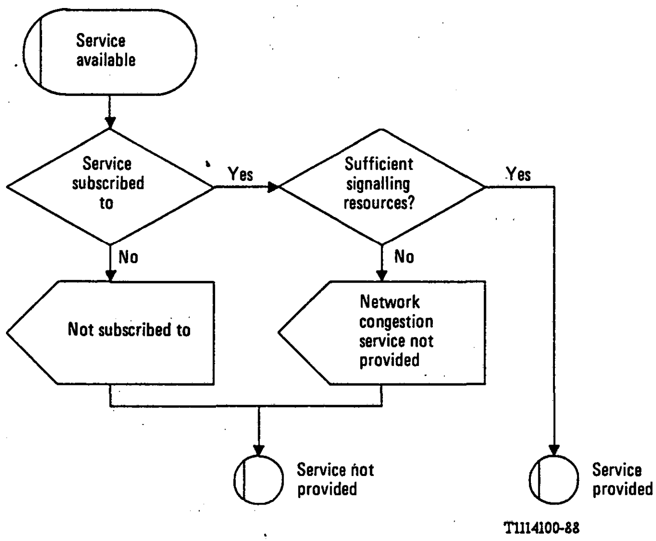


FIGURE 1-19/Q.87

Macrodefinition service available

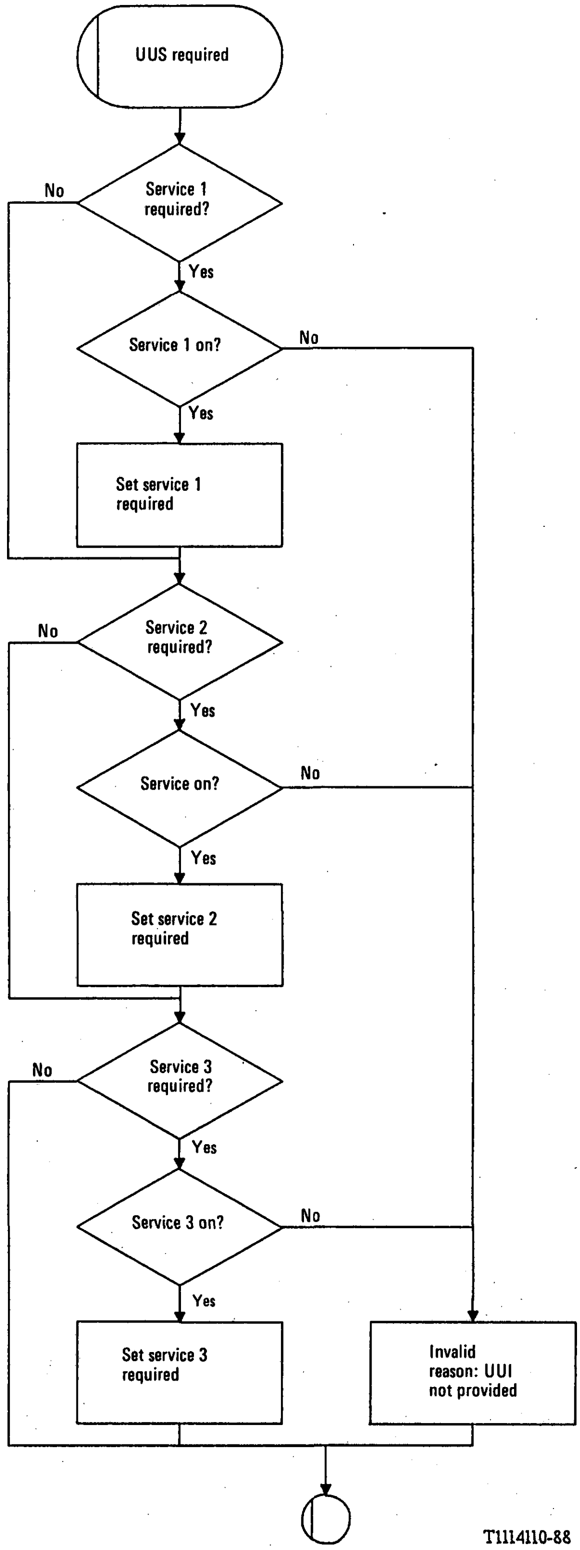


FIGURE 1-20/Q.87

Macrodefinition UUS required

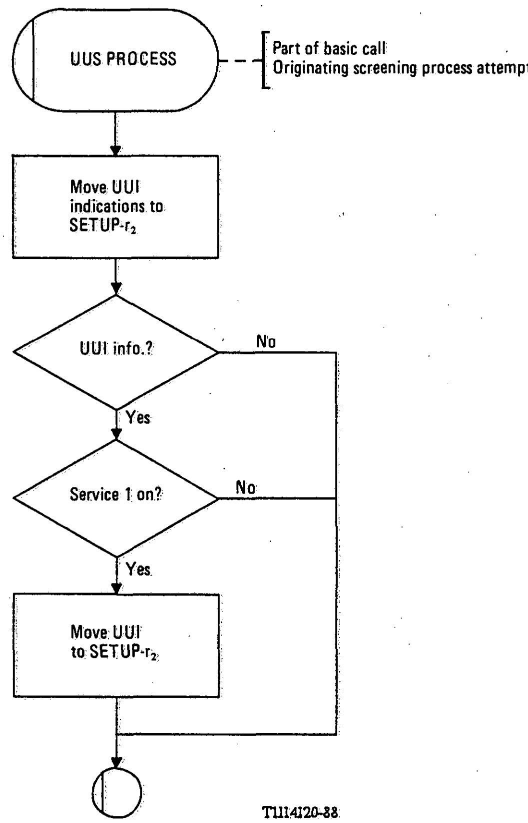


FIGURE 1-21/Q.87

Macrodefinition UUS process

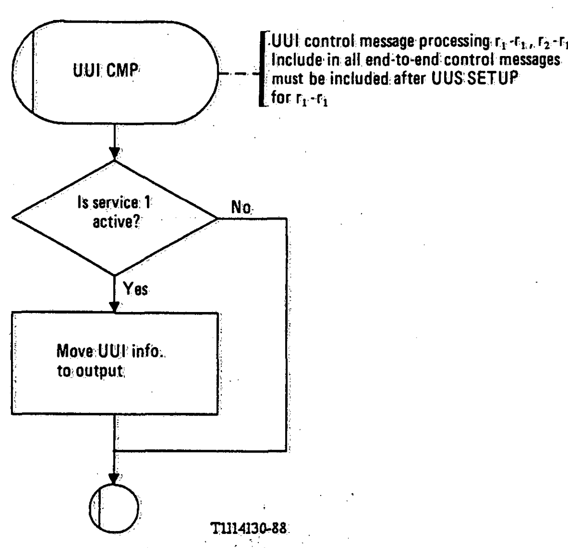


FIGURE 1-22/Q.87 (Sheet 1 of 2)

Macrodefinition UUI CMP

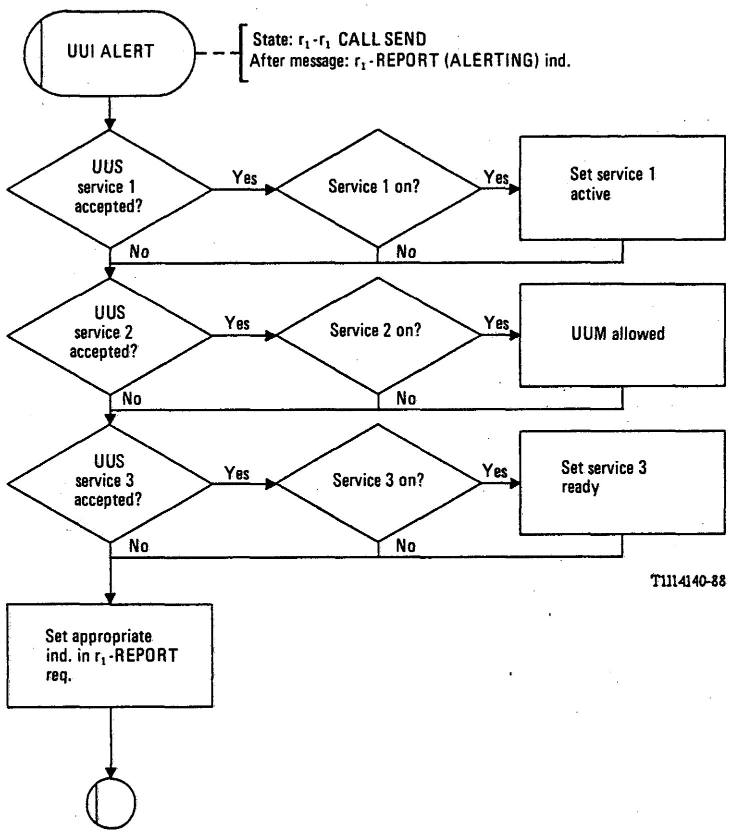


FIGURE 1-22/Q.87 (Sheet 2 of 2)

Macrodefinition UUI Alert

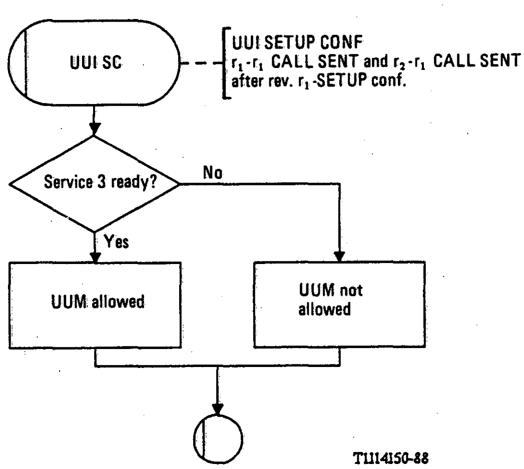
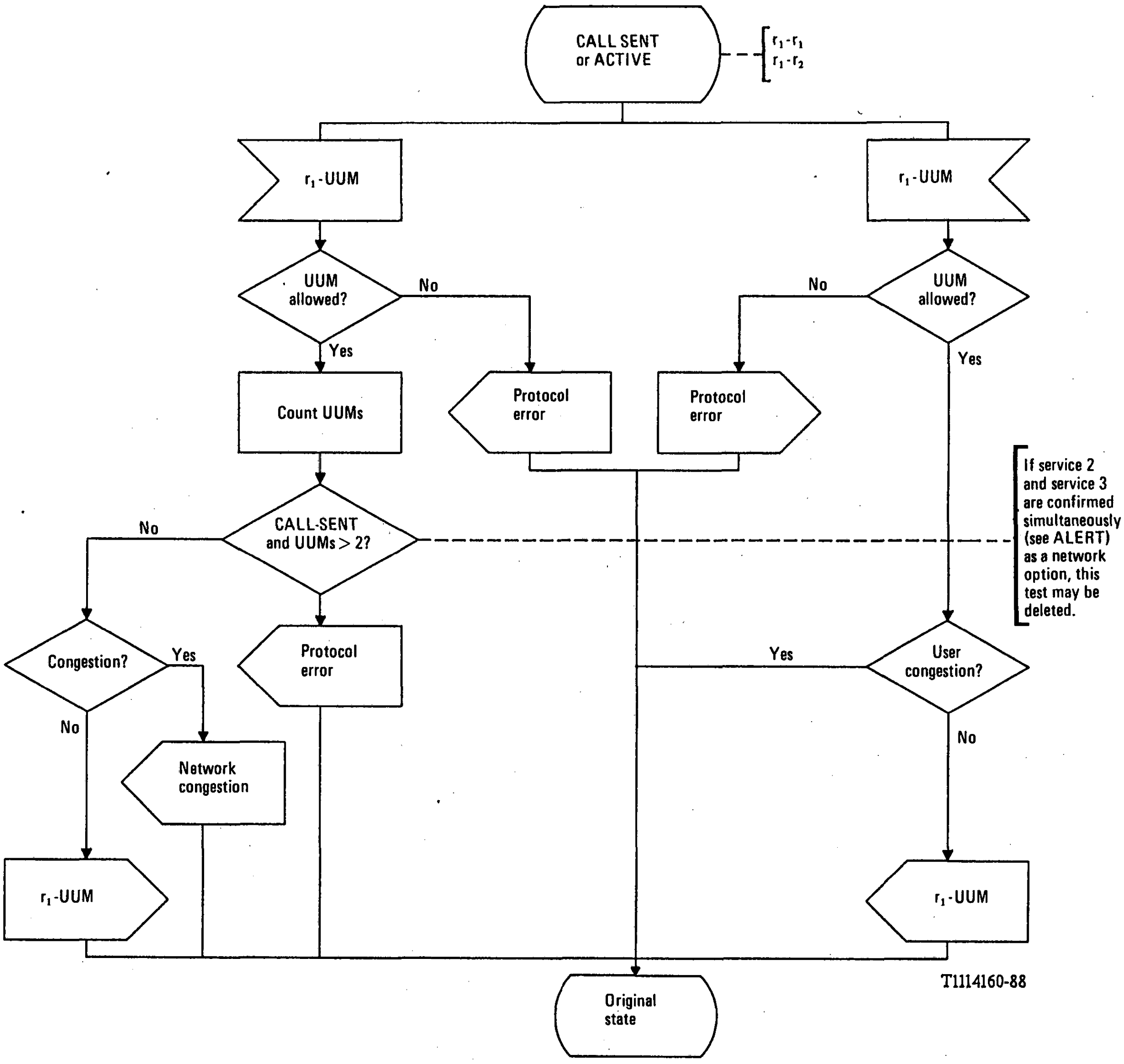


FIGURE 1-23/Q.87

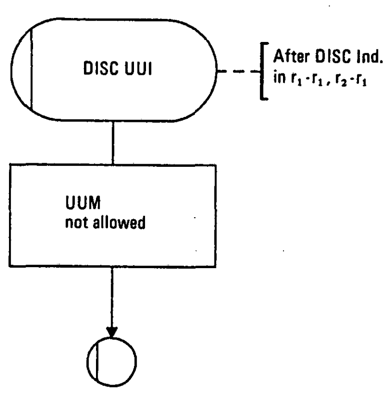
Macrodefinition UUI SC



Note – A limit may be introduced for service 3 SDL UUM handling also found in FE4.

FIGURE 1-24/Q.87

UUM handling



SDL disc UUI also used in FE4.

FIGURE 1-25/Q.87

Macrodefinition DISC UUI

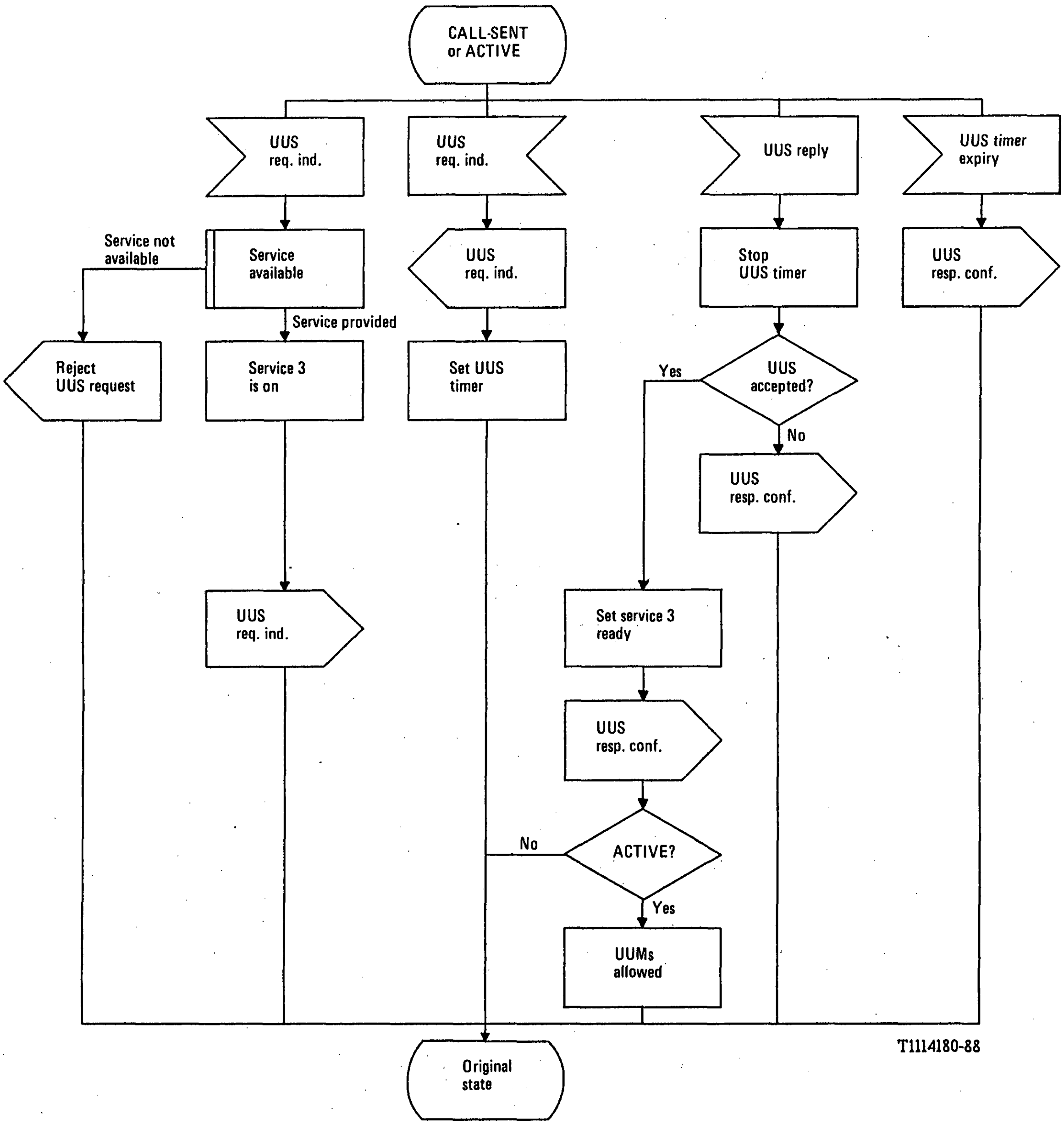
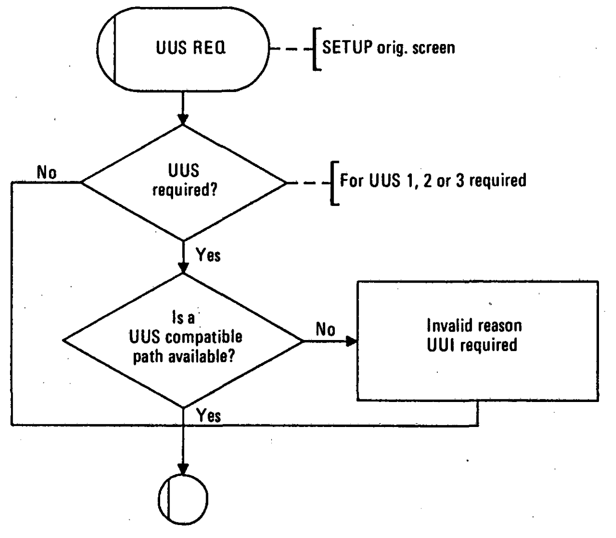


FIGURE 1-26/Q.87

Late invocation r_1 - r_1

1.5.3 *SLDs for functional entity FE3*



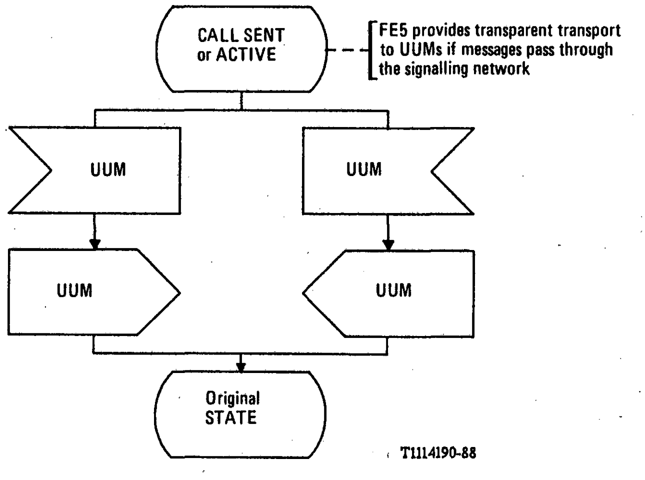
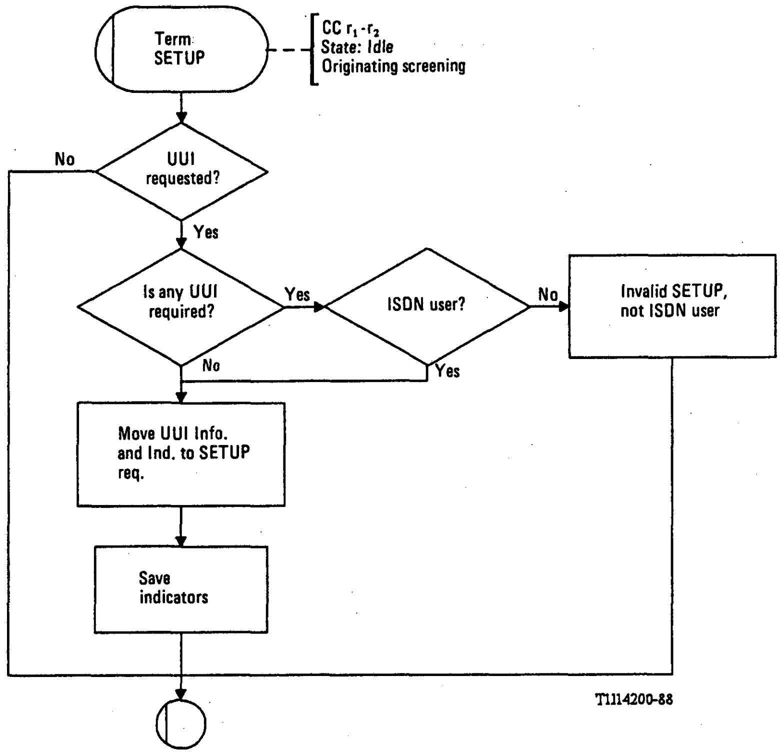


FIGURE 1-27/Q.87

SDL additions to basic call for FE3 "CC r_2-r_2"
Macrodefinition UUS REQ

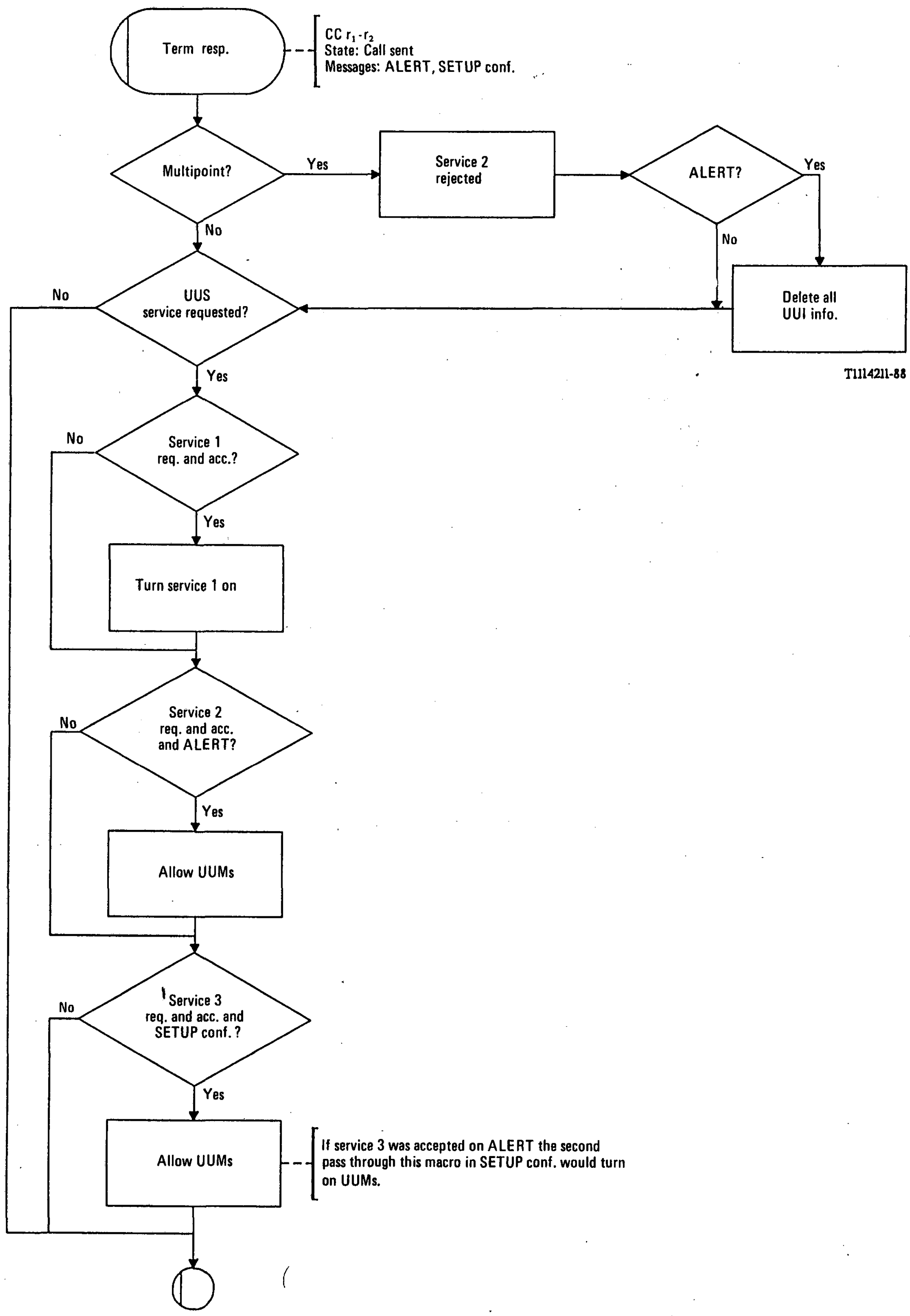
1.5.4 *SDL for functional entity FE4*



Info. Information
req. Request

FIGURE 1-28/Q.87

Macrodefinition TERM SETUP FE4



Note – Required = Required and essential.

FIGURE 1-29/Q.87

Macrodefinition TERM RESP FE4

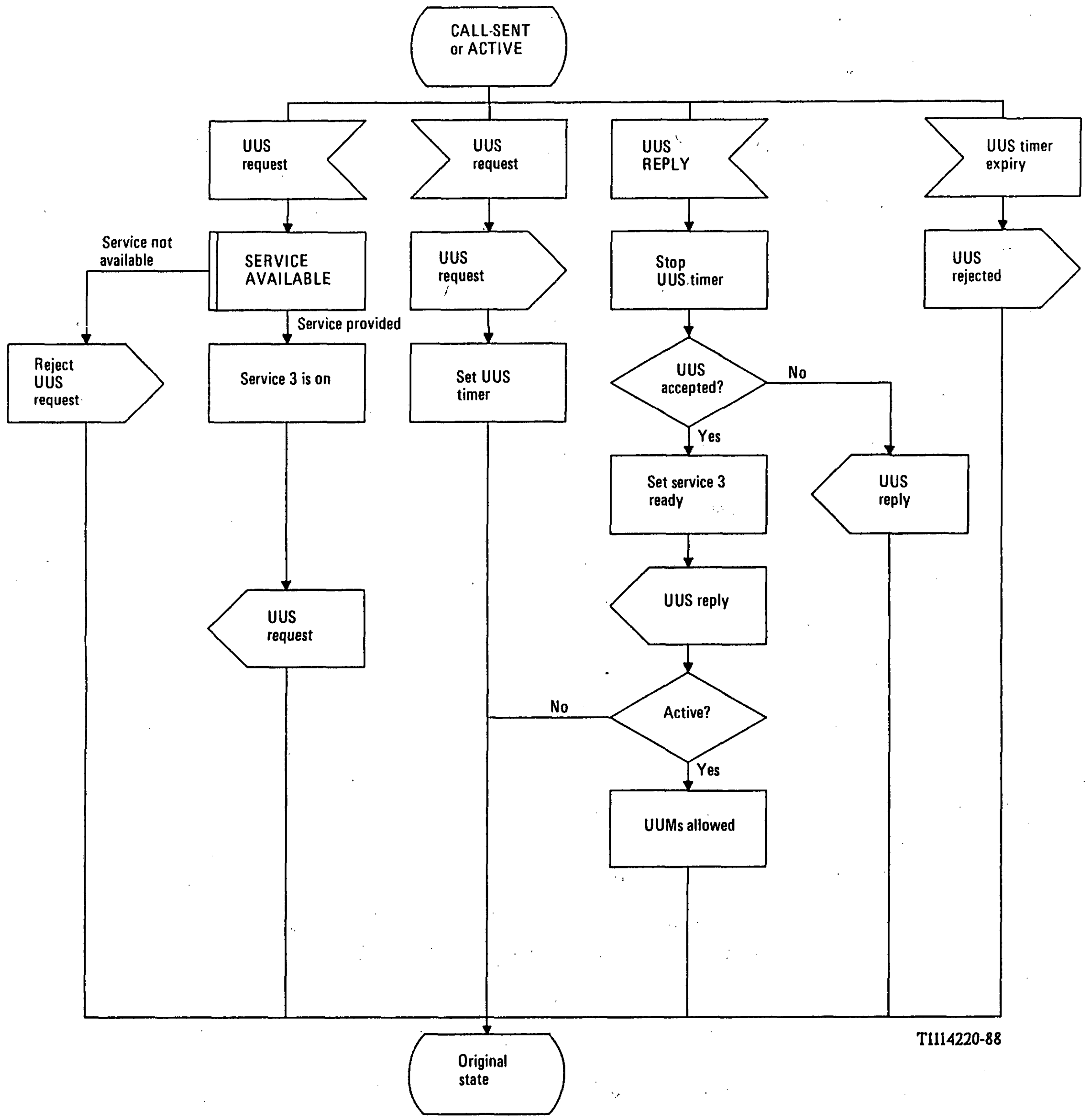


FIGURE 1-30/Q.87

Late invocation r_2-r_1

1.6 *Functional entity actions*

1.6.1 *Check UUS service request*

- Check for implicit Service 1 request
- Check for explicit service requests
- Determine any services are essential
- Are services subscribed to?
- Are there sufficient signalling resources?

1.6.2 *Check for UUI to END user*

- UUI requested?
- Any UUI required?
- Is the user an ISDN user?

1.6.3 *Check called user response*

- Is user multipoint?
- Can user accept UUI Service 2?
- Are all required services accepted?

1.6.4 *Check which services are available to calling user*

- Which services were requested?
- Which services were confirmed by called user?
- Inform calling user of accepted services

1.6.5 *Is UUI or UUM transfer allowed?*

- Is there UUI or UUM?
- Is the appropriate service active?
- If UUM is the network congested?

1.6.6 *Check limit of Service 2 UUMs*

- Count UUMs
- Reject UUMs over 2 coming from attached user

1.6.7 *Can a UUI compatible path be found?*

- Is UUS required?
- If there is no compatible path act appropriately

1.7 *Allocation of functional entities to physical location*

The mapping between functional entities of the functional model for the user signalling bearer service and their possible physical locations is given in the matrix shown in Table 1-1/Q.87.

TABLE 1-1/Q.87

Possible physical location of functional entities

	FE1	FE2	FE3	FE4	FE5
TE (User terminal equipment)	X				
NT2 (Network termination 2)	X	X			
LE (Local exchange)	X	X	X		
TR (Transit exchange)			X		
LE (Local exchange)			X	X	X
NT2 (Network termination 2)				X	X
TE (User terminal equipment)					X

Note – A cross in the matrix indicates a possible allocation of the functional entity on top of the column to the physical location on each line. Different call scenarios can be generated from this matrix.

2 User signalling bearer services

Under study.

PART IV

Recommendations Q.101 to Q.118 *bis*

CLAUSES APPLICABLE TO CCITT STANDARD SYSTEMS

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SECTION 1

GENERAL CLAUSES

Recommendation Q.101

1.1 FACILITIES PROVIDED IN INTERNATIONAL SEMI-AUTOMATIC WORKING

1.1.1 The operating methods used in the semi-automatic international service are described in the *Instructions for the International Telephone Service.* These operating methods assume the existence of equipment (operator's positions and automatic switching equipment) involving the following categories of operators:

a) *outgoing* operators;

b) *incoming* operators;

c) *delay* operators;

d) *assistance* operators;

e) *information* or *special service* operators.

1.1.2 The *outgoing operator* controls the setting up of calls at the outgoing exchange. (From the operating point of view she is, in general, the controlling operator and is sometimes so referred to in the *Instructions.*)

She must be able to set up calls to any one of the following points in the called country:

a) subscribers;

b) incoming operators at the incoming international exchange;

c) delay operators, especially a particular delay operator at the incoming international exchange;

d) incoming operators at a local manual exchange in the called country;

e) information or special service operators.

The outgoing operator should be able to recall incoming and delay operators on calls set up via these operators, by sending a forward-transfer signal as defined in the relevant system specifications.

1.1.3 The *incoming operator*[1] at the incoming international exchange is obtained by using a special code 11 signal or a special number. The code 11 signal is a particular combination provided by the signal code. This operator performs the functions of an incoming operator in ordinary manual service for those calls which cannot be routed automatically at the incoming international exchange.

[1] Called alternatively in French "opèratrice translatrice", see *Instructions for the International Telephone Service* (art. 125).

1.1.4 The *delay operator* is obtained by using a special code 12 signal, or a special number. The code 12 signal is a particular combination provided by the signal code. The delay operator may be:

- any of the operators of this category;
- or a particular operator, or one of those operating a particular group of positions; her position or her group of positions is then indicated by a number which follows the code 12 signal or is indicated by the special number.

With respect to the direction in which a required call is set up, the delay operator may be at the outgoing international exchange and may be called by an operator at the incoming international exchange. From the technical point of view and as far as signalling is concerned, however, the delay operator at the outgoing international exchange called back by an operator at an incoming international exchange must be regarded as being at the incoming end of the international circuit over which she has been called back.

1.1.5 *Notes on incoming and delay operators*

a) Incoming and delay operators must be able to speak the *service language* used for the route concerned, and hence may have to belong to a particular language group. A *language (or information) digit*, from 1 to 8, sent on all semi-automatic calls, is used to obtain operators of a particular language group [see Recommendation Q.104][2].

b) It may be the same operator who acts as an incoming and as a delay operator, and even as an assistance operator. She enters a circuit in any of these capacities in response to the appropriate signal.

c) While an incoming or delay operator is being called, the national ringing tone of the incoming country must be sent back over the international circuit.

1.1.6 The *assistance operator* at the incoming international exchange enters a semi-automatic circuit on a call already set up, when requested by the outgoing operator, because of language difficulties or, for instance, when she is required to interpret a national tone. Access to an assistance operator at an international transit exchange is not possible.

The assistance operator is called by a forward-transfer signal, sent by the outgoing operator when, for example, she operates a key on the outgoing position. An assistance operator in a required language group is obtained in conjunction with the forward-transfer signal by the language digit (or information) sent previously during the setting up of the call. Hence the incoming relay set must store the language digit (or information).

The outgoing operator receives no indication to show that the assistance operator is being called, or to show when she answers or withdraws from the circuit, but if necessary the outgoing operator can send the forward-transfer signal several times on the same call.

The assistance operator must be able:

a) to break into the call as a third party (this she would do, for example, when the language spoken in the country of arrival is other than the service language used in that relation, and the operator intervenes as an interpreter);

b) to enter a circuit on one side only after having isolated the other. She does this, in particular, when she translates a verbal announcement or interprets an audible tone returned from the incoming end.

In no circumstances will the assistance operator be able to block the international circuit.

Note – It should be noted that the term "assistance operator" has a very definite meaning in CCITT documents. It stands for an operator who breaks in, as required, as a third party in a circuit already set up. Hence this operator must not be confused with any other operator in the incoming country who may help to *set up* the call in conjunction with the international outgoing operator. Assistance operators may not be available on intraregional circuits.

1.1.7 The *information or special service operator* of the country of destination is obtained by using a special number. This operator is responsible for giving details concerning subscriber number and miscellaneous inquiries.

[2] The language digit may not be used on some intraregional circuits.

Recommendation Q.102

1.2 FACILITIES PROVIDED IN INTERNATIONAL AUTOMATIC WORKING

In international automatic working, the calling subscriber can obtain only such subscriber numbers as are made up of the numerical digits appearing on his dial or push-button set. Hence, he cannot obtain operators reached by code 11 or code 12 signal, or an assistance operator reached by a forward-transfer signal. In principle, he should not obtain access to incoming, delay or information operators[1] reached by special numbers.

He can have direct dialling access to manual exchanges in the incoming country only subject to certain conditions (these conditions are defined in Recommendation Q.28, § 2, and in Recommendation Q.120, § 1.8, and are applicable to all CCITT standard systems).

It is pointless to send a language digit (or information) over an international circuit since the calling subscriber does not have to obtain operators speaking a particular language at the incoming international exchange. On automatic calls, a discriminating digit (or discriminating information) replaces the language digit (or information) sent on semi-automatic calls. This:

- enables the equipment in the outgoing international exchange to make a distinction between semi-automatic and automatic calls as is required when drawing up international accounts, as described in § 2 of Recommendation E.260;
- enables, therefore, incoming equipment to serve both automatic and semi-automatic service;
- in Systems No. 4, 6, 7 and R2 informs the equipment in the international incoming exchange that it has not to rely on an end-of-pulsing signal (see Recommendation Q.106);
- enables the equipment in the incoming international exchange to prevent automatic calls from having access to certain destinations (special services, for example).

Recommendation Q.103

1.3 NUMBERING USED

1.3.1 *International prefix*

The international prefix (see definition 1 in Recommendation Q.10) which gives subscribers access to the international automatic network is used only in automatic working and is not used in semi-automatic working.

The international prefix is not included in the numerical signals sent out from the international outgoing exchange.

1.3.2 *Country code*[2]

Information about country codes will be found under § 8.2 in Recommendation Q.11. In the international outgoing exchange, the country code is used:

a) in automatic working for the purpose of giving access to outgoing circuits;

b) in semi-automatic working it is required to give outgoing operators in the outgoing international exchange access to the circuit by means of selectors.

The country code is sent on the international circuit or signalling channel:

- in the case of transit calls;
- in terminal and transit calls to a demand assignment system.

---

[1] For information operators, see Recommendation E.115.

[2] The country code may not be used on some intraregional calls.

1.4 LANGUAGE DIGIT OR DISCRIMINATING DIGIT

1.4.1 *Language digit (or language information)*

1.4.1.1 The language digit defined under § 1.1.5 above indicates the *service language* to be used between operators in the international service, that is to say, the language to be spoken in the incoming international exchange by the incoming, delay and assistance operators when they come on the circuit. The language digit (or information) must be sent on *all* semi-automatic calls.

1.4.1.2 The digit (or indicator) to be used to select the appropriate language is as follows:

1 = French

2 = English

3 = German

4 = Russian

5 = Spanish

6, 7, 8 } available to Administrations for selecting a particular language provided by mutual agreement (in System No. 5, however, digit 7 is used on calls requiring access to test equipment)

9 = reserve (see § 1.4.2.2 below)

1.4.1.3 The language digit (or information) is either:

- sent by the operator to the outgoing equipment; in this case the operator must send it immediately before the national (significant) number [1] of the called subscriber; or
- sent automatically by the outgoing equipment.

1.4.2 *Discriminating digit (or discriminating information)*

1.4.2.1 In all automatic calls, the position in the sequence of numerical signals occupied by the discriminating digit (or information) is that occupied by the language digit (or information) in semi-automatic calls (see Recommendations Q.102 and Q.107).

1.4.2.2 The digit 9 (or its equivalent) in the list of language digits (or calling party's categories) has been kept in reserve for use as extra discriminating information if required. Such use should be for a call with special characteristics, but the digit 9 (or the equivalent information) must not be used merely to take the place of the digit 0 (or its equivalent) in an automatic call [2].

1.4.2.3 Combination 13 in the signal code of System No. 4 and System R2 and its equivalent in Systems No. 6 and No. 7, as well as combination 7 in the signal code of System No. 5 serve as a discriminating digit (or information) on calls to automatic testing equipment.

---

[1] See definition in Recommendation Q.10.

[2] For example, it might be thought useful to have an additional discriminating digit (or information) when a distinction has to be made between:

a) automatic calls, and

b) semi-automatic calls set up in the outgoing country directly by ordinary operators, in national exchanges and not by international operators in the international exchange, and arriving by the same group of national circuits as calls mentioned in a).

Such a distinction might be necessary because:

- in international accounts, calls mentioned in b) are dealt with as semi-automatic calls and are not to be metered by the international equipment.
- for signalling, calls mentioned in b) are not accompanied by an end-of-pulsing signal.

On Signalling System No. 5 the discriminating digit 9 may be used to indicate a data call by bilateral agreement.

1.4.2.4 In Signalling Systems No. 6 and 7, the equivalent of the combinations 11 and 12 may be used as a discriminating digit (or calling party's indicator) on calls originated by a subscriber with priority (combination 11) or on data calls (combination 12).

1.4.2.5 On all automatic calls the discriminating digit must be sent over the international circuit or signalling channel by the country of origin of the call, and this country has to arrange for the automatic insertion of the discriminating digit (or information).

Recommendation Q.105

1.5 NATIONAL (SIGNIFICANT) NUMBER

1.5.1 In automatic working, the subscriber sends the called subscriber's national (significant) number[1)] by means of a dial, push-button set, or automatic dialling device.

1.5.2 In semi-automatic working, the operator sends the national (significant) number[1)] of the called subscriber by means of a keyset for example.

1.5.3 The outgoing equipment must be designed to cater for a sufficient number of digits in the national (significant) number[1)] as specified in Recommendation Q.11, §§ 2.2 and 3.

Recommendation Q.106

1.6 THE SENDING-FINISHED SIGNAL

In semi-automatic working, when the international outgoing operator has finished keying or dialling, she operates a special button on her keyboard or a key so that, after the number, a local signal which is called a *sending-finished* signal is sent to the outgoing equipment to show that there are no more digits to follow. In automatic working, subscribers cannot show when they have finished dialling the number, and so this signal does not apply.

Note – In semi-automatic working, local sending of the sending-finished signal will cause an *end-of-pulsing* signal to be sent on the international circuit[2)] or signalling channel. This has the same function and shows the incoming equipment that there are no more digits to be received. In some cases also in automatic working, when the outgoing equipment decides that there are no more digits to follow, an end-of-pulsing signal is sent on the international circuit or signalling channel, for example in the ST condition of System No. 5 (see Recommendation Q.152).

1) See definition in Recommendation Q.10.

2) In System R2 the sending of end-of-pulsing signal (code 15) may not occur if a *number-received* indication has already been received.

STANDARD SENDING SEQUENCE OF FORWARD ADDRESS INFORMATION

(Geneva, 1980; modified at Melbourne, 1988)

A distinction is made in this Recommendation between the information to be sent by the telephone user for different types of calls and the corresponding information to be sent by the international signalling equipment.

With regard to the latter, the sequence of forward address information signals is dealt with in detail. The detailed exchange of other signalling information is covered by the procedures described in the specifications of the CCITT signalling systems concerned.

1 Information to be sent by the telephone user

The normal sequence of address information required for the set-up of an international call and to be sent by the user, i.e. the calling subscriber or operator, is as shown in Table 1/Q.107. This sequence does not depend on the CCITT signalling system used in the international network. Here five different types of call, from *a)* to *e)* are covered.

TABLE 1/Q.107

Standard sequence of the address information to be sent by the telephone user

Type	Call to:	Address information sent by the user
a)	A subscriber (automatic)	1. International prefix [a)] 2. Country code [b)] 3. National (significant) number [c)]
b)	A subscriber (semi-automatic)	1. Country code [b), d)] 2. National (significant) number [c)] 3. Sending-finished
c)	Any incoming or delay operator's position (semi-automatic)	1. Country code [b), d)] 2. Extra digit designating the incoming international exchange [e)] 3. Code 11 or code 12 [f)] 4. Sending-finished
d)	An particular delay operator, or one of those operating a particular group of delay operator's positions (semi-automatic)	1. Country code [b), d)] 2. Extra digit designating the incoming international exchange [e)] 3. Code 12 [f)] 4. Number of a particular position or a group of positions 5. Sending-finished
e)	An information operator or a special service operator	1. Special numbers

[a)] The recommended international prefix is 00, see Recommendation Q.11 *bis*, § 4.1.

[b)] The country code consists of one these digit combinations: I_1, I_1 I_2, I_1 I_2 I_3.

[c)] The national (significant) number consists of the subscriber number and the trunk code: N_1, N_2, N_3, ... It does not contain the national (trunk) prefix (the preferred national prefix is 0 – see Recommendation Q.11 *bis* § 4.5.2). The subscriber using the international automatic telephone network should be informed in an appropriate manner that the national prefix after the country code must not be sent.

[d)] If, in the case of semi-automatic calls, the language digit L = 1, 2, 3, ... is not sent automatically by the outgoing signalling equipment, it has to be sent by the operator to the outgoing equipment. In this case, the operator must send the L digit immediately following the country code.

[e)] The extra digit (N_1) designating the incoming international exchange is used in cases where more than one incoming international exchange can be reached in the country of destination. (It is recognized that the existing design of some equipment does not permit the insertion of the extra digit.)

[f)] See Recommendation Q.101.

2 Sequence of forward address information to be sent by the outgoing international signalling equipment

The information to be sent in the forward direction by the outgoing international signalling equipment in order to set up telephone connections differs from the information to be sent by the telephone user. The content and the sequence of forward address information is furthermore dependent on the signalling systems used in the international network. In the following, a distinction is made between common channel and channel associated signalling systems.

2.1 *Common channel signalling systems*

In the case of common channel Signalling Systems No. 6 and No. 7, the first signal to be sent to an (international) signalling data link relating to the set up of a telephone connection is the initial address message. According to the definitions in Recommendations Q.254 [1], Q.722 [2] and Q.762 [7], the initial address message normally contains, among others, the following forward address information:

a) nature-of-address indicator indicating that the
   - international number,
   - national (significant) number, or
   - subscriber number is included;

b) nature-of-circuit indicator indicating that
   - a satellite circuit is included
   - no satellite circuit is included;

c) echo-suppressor indicator indicating that
   - an outgoing half-echo suppressor is included
   - no outgoing half-echo suppressor is included;

d) calling-party's-category indicator including, among others,
   - a language digit, L
   - the discriminating digit D;

e) address signals
   - country code
   - national (significant) numbers
   - code 11
   - code 12
   - end-of-pulsing (ST) signal or code 15.

As the initial address message of Signalling Systems No. 6 and No. 7 carries at least the information mentioned above, it is not necessary to describe here in detail the sequence of the forward address information to be sent by the outgoing international signalling equipment; reference is made to Recommendations Q.258 [3], Q.723 [6] and Q.763 [8], instead.

Nevertheless, the following additional comments are made:

a) In cases where the international call is routed
   - from an originating international exchange (CT) to an international transit CT, or
   - from one international transit CT to another international transit CT

   (i.e. for international transit calls) the appropriate nature-of-address indicator (international number – Signalling System No. 7) or country code indicator (country code included – Signalling System No. 6) will be used together with the country code.

b) If a terminal international link is selected; i.e. in cases where the call is routed
   - from an originating CT direct to a destination CT, or
   - from a transit CT to a destination CT

   the nature-of-address indicator [national (significant) number: Signalling System No. 7] or the country code indicator (country code not included: Signalling System No. 6) will be used. In this case, no country code has to be sent.

In both cases a) and b) described above, further routing information will be included in the initial address message. For further details, see Recommendations Q.258 [3], Q.723 [6] and Q.763 [8].

2.2 *Channel associated signalling systems*

For channel associated signalling systems, it is important to determine the first interregister signal and the sequence of forward address information. This matter is dealt with in the following, taking into account various types of calls and Signalling Systems No. 4, No. 5, R1 and R2.

With the exception of the seizing signals in Signalling System No. 4, no line signals are dealt with.

2.2.1 *The first signals to be sent on international links*

Table 2/Q.107 shows the first type of signal to be sent on four different types of international links in the case where channel associated signalling systems are used.

TABLE 2/Q.107

First signal to be sent on international links

Type	International link		First signal sent on the international link
	from	to	
a)	Orginating country	Destination country	Terminal-call indicator or discriminating or language digit
b)	Originating country	Transit country	Transit-call indicator
c)	Transit country	Transit country	Transit-call indicator
d)	Transit country	Destination country	Terminal-call indicator or discriminating or language digit

The terminal-call indicator is a type of signal indicating that an international terminal link *a)* or *d)* is involved and that no country code has to be sent to the incoming CT. In the case of Signalling System No. 4, the terminal-call indicator is represented by the terminal seizing signal – a forward line signal. For the other channel associated signalling systems, interregister signals are used. The discriminating digit D and the language digit L (both are also called the characteristic digit Z) must be in accordance with Recommendation Q.104.

The transit-call indicator is a type of signal indicating that an international transit link *b)* or *c)* is involved and that the country code will be included in the signalling sequence. In the case of Signalling System No. 4, the transit-call indicator is represented by the transit seizing signal – a forward line signal. For the other channel associated signalling systems, interregister signals are used.

2.2.2 *Sequence of forward address information for automatic and semi-automatic calls to a subscriber*

The forward address information to be sent by the outgoing international signalling equipment differs from the information sent by the telephone user as described in § 1.

Details covering the different channel associated CCITT signalling systems are shown in Table 3/Q.107.

2.2.3 *Sequence of forward address information for calls to any incoming or delay operator's position*

Table 4/Q.107 shows in detail the standard sequence of forward address information for calls to any incoming or delay operator's position to be sent by the outgoing international signalling equipment. A distinction is made between international transit and terminal calls as well as between different channel associated CCITT signalling systems.

TABLE 3/Q.107

Sequence of forward address information for automatic and semi-automatic calls to a subscriber to be sent by the outgoing international signalling equipment

Sending sequence ↓	Channel associated CCITT signalling system	No. 4	No. 5	R2	R1 [a]
International transit call	Transit-call indicator	Transit seizing [b]	KP 2	I-12 or I-14 or I-11 [c]	–
	Echo-suppressor indicator	– [d]	–		–
	Nature-of-circuit indicator	–	–	I-13 or I-14 [e]	–
	Country code	I_1, I_1 I_2, I_1 I_2 I_3 [f]			–
	Calling-party's-category indicator	D = 0 or L = 1, 2, 3, ...			–
	National (significant) number	N_1 N_2 N_3 ...			–
	Sending-finished	Code 15	ST	Code 15	–
International terminal call	Terminal-call indicator	Terminal seizing [b]	KP 1		KP [h]
	Calling-party's-category indicator	D = 0 or L = 1, 2, 3 ... [g]			–
	Echo-suppressor indicator	– [d]	–	1-14 [e]	–
	Nature-of-circuit indicator	–	–	1-13 or 1-14 [e]	–
	National (significant) number	N_1 N_2 N_3 ...			
	Sending-finished	Code 15	ST	Code 15	–

a) Signalling system R1 is not used for international transit calls.

b) For Signalling System No.4, the transit and the terminal-call indicators are represented by line signals. For the other signalling systems, no line signals are shown.

c) The use of signal I-11 in international working is subject to bilateral agreements.

d) Code 14 can be used for echo-suppressor control to bilateral or multilateral agreements.

e) These signals are sent on request.

f) See Recommendation Q.101.

g) For Signalling System R2, the L digit is also used as terminal-call indicator.

h) The KP signal is only used to prepare the incoming signalling equipment for the reception of the subsequent interregister signals; see also footnote a) above.

TABLE 4/Q.107

Sequence of forward address information for calls to any incoming or delay operators' position

Sending sequence ↓

<table>
<tr><th colspan="2">Channel associated CCITT signalling system</th><th>No. 4</th><th>No. 5</th><th>R2</th><th>R1 [a]</th></tr>
<tr><td rowspan="8">International transit call</td><td>Transit-call indicator</td><td>Transit seizing [b]</td><td>KP 2</td><td rowspan="2">I-12 or I-14 or I-11 [c]</td><td>–</td></tr>
<tr><td>Echo-suppressor indicator</td><td>– [d]</td><td>–</td><td>–</td></tr>
<tr><td>Nature-of-circuit indicator</td><td>–</td><td>–</td><td>I-13 or I-14 [e]</td><td>–</td></tr>
<tr><td>Country code</td><td colspan="3">I_1, I_1 I_2, I_1 I_2 I_3</td><td>–</td></tr>
<tr><td>Language digit</td><td colspan="3">L = 1, 2, 3, . . .</td><td>–</td></tr>
<tr><td>Extra digit designating the incoming exchange</td><td colspan="3">N_1</td><td>–</td></tr>
<tr><td>Access to operator's position</td><td colspan="3">Code 11 or code 12 [f]</td><td>–</td></tr>
<tr><td>Sending-finished</td><td>Code 15</td><td>ST</td><td>Code 15</td><td>–</td></tr>
<tr><td rowspan="7">International terminal call</td><td>Terminal-call indicator</td><td>Terminal seizing [b]</td><td>KP 1</td><td></td><td>KP [h]</td></tr>
<tr><td>Language digit</td><td colspan="3">L = 1, 2, 3, . . . [g]</td><td>–</td></tr>
<tr><td>Echo-suppressor indicator</td><td>– [d]</td><td>–</td><td>1-14 [e]</td><td>–</td></tr>
<tr><td>Nature-of-circuit indicator</td><td>–</td><td>–</td><td>1-13 or 1-14 [e]</td><td>–</td></tr>
<tr><td>Extra digit designating the incoming exchange</td><td colspan="3">N_1</td><td>–</td></tr>
<tr><td>Access to operator's position</td><td colspan="3">Code 11 or code 12 [f]</td><td>e.g. 121 or 1150</td></tr>
<tr><td>Sending-finished</td><td>Code 15</td><td>ST</td><td>Code 15</td><td>ST</td></tr>
</table>

[a] Signalling System R1 is not used for international transit calls.

[b] For Signalling System No.4, the transit and the terminal-call indicators are represented by line signals. For the other signalling systems, no line signals are shown.

[c] The use of signal I-11 in international working is subject to bilateral agreements.

[d] Code 14 can be used for echo-suppressor control subject to bilateral or multilateral agreements.

[e] These signals are sent on request.

[f] See Recommendation Q.101.

[g] For Signalling System R2, The L digit is also used as terminal-call indicator.

[h] The KP signal is only used to prepare the incoming signalling equipment for the reception of the subsequent interregister signals; see also Note a).

2.2.4 *Sequence of forward address information for calls to a particular delay operator*

The standard sequence of forward address information for calls to a particular delay operator or one of those operating a particular group of delay operator's position is shown in detail in Table 5/Q.107. Again a distinction is made between international transit and terminal calls as well as between different channel associated CCITT signalling systems.

The footnotes relating to Table 4/Q.107 are also valid for Table 5/Q.107.

3 Standard sending sequence of forward address information in the case of calls to testing and measuring devices

International calls to testing and measuring devices are terminal calls. Therefore, the outgoing signalling equipment will not send the country code. In Signalling System No. 4, the terminal-call indicator is a line signal.

Table 6/Q.107 contains the standard sending sequence and forward address information in the case of calls to testing and measuring devices to be sent by the outgoing signalling equipment for Signalling Systems No. 4, No. 5, No. 6, No. 7, R1 and R2.

Recommendation O.11 [4] contains the detailed specifications for CCITT manual maintenance access lines. Recommendation O.22 [5] contains the detailed specifications for the CCITT ATME No. 2. Further information with regard to calls to testing and measuring devices can be found in the detailed specifications of the relevant CCITT signalling systems.

In the case of the common channel Signalling Systems No. 6 and No.7, all information will be carried by means of an initial address message in which the message indicators will be set to their appropriate values as specified in Recommendations Q.258 [3], Q.723 [6] and Q.763 [8].

In Table 7/Q.107 the access codes required to reach the testing and measuring devices in the exchange of destination are given for CCITT Signalling Systems No. 4, No. 5, No. 6, No. 7 and R2.

TABLE 5/Q.107

Sequence of forward address for calls to a particular delay operator's position

Sending sequence ↓

	Channel associated CCITT signalling system	No. 4	No. 5	R2	R1 a)
International transit call	Transit-call indicator	Transit seizing b)	KP 2	I-12 or I-14 or I-11 c)	–
	Echo-suppressor indicator	– d)	–		–
	Nature-of-circuit indicator	–	–	I-13 or I-14 e)	–
	Country code	I_1, I_1 I_2, I_1 I_2 I_3			–
	Language digit	L = 1, 2, 3, ...			–
	Extra digit designating the incoming CT	N_1			–
	Access to operator's position	Code 12			–
	Number of a particular position	x_1 (x_2 x_3 ...)			–
	Sending-finished	Code 15	ST	Code 15	–
International terminal call	Terminal-call indicator	Terminal seizing b)	KP 1		KP g)
	Language digit	L = 1, 2, 3, ... f)			–
	Echo-suppressor indicator	– d)	–	1-14 e)	–
	Nature-of-circuit indicator	–	–	1-13 or 1-14 e)	–
	Extra digit designating the incoming CT	N_1			–
	Access to operator's position	Code 12			e.g. 1150
	Number of a particular position	x_1 (x_2 x_3 ...)			e.g. 11x_1 x_2
	Sending-finished	Code 15	ST	Code 15	ST

a) Signalling System R1 is not used for international transit calls.

b) For Signlling System No.4, the transit and the terminal-call indicators are represented by line signals. For the other signalling systems, no line signals are shown.

c) The use of signal I-11 in international working is subject to bilateral agreements.

d) Code 14 can be used for echo-suppressor control subject to bilateral or multilateral agreements.

e) These signals are sent on request.

f) For Signalling System R2, the L digit is also used as terminal-call indicator.

g) The KP signal is only used to prepare the incoming signalling equipment for the reception of the subsequent interregister signals; see also Note a).

TABLE 6/Q.107

Sending sequence of forward address information in the case of calls to testing and measuring devices

Sending sequence ↓

CCITT signalling system	No. 4	No. 5	No. 6	No. 7	R2	R1
Terminal-call indicator	Terminal seizing	KP 1	Together with other message indicators		D = code 13 [a]	KP
Calling party's category indicator	D = code 13	D = 7	Test call	Test call		–
Test-call indicator	Code 12	Code 12	–	–	Code 13	–
Access code for a particular testing or measuring device	Digit 0 plus 2 digits x, y	Digit 0 plus 2 digits x, y	16 combinations	2 digits x, y	2 digits x, y	Digits to be agreed upon (minimum three)
Sending-finished	Code 15	ST	ST	ST	Code 15	ST

[a] For signalling System R2, the D digit is also used as terminal-call indicator.

TABLE 7/Q.107

Access codes for a particular testing or measuring device

CCITT signalling system	Access codes				
	No. 4	No. 5	R2	No. 6	No. 7
Multiple address capability for transmission access test line	21-29	21-29	21-29	6 7 8	21-29
ATME 2 Type a ATME 2 Type b ATME 2 Type c	61 62 63	61 62 63	61 62 –	1 2 –	61 62 63
Quiet termination Echo suppressor test Loop around Echo canceller test Loop back test line	64 65 66 67 68	64 65 66 67 68	64 65 66 67 68	3 4 5 9 10	64 65 66 67 68
Simplified test	–	–	90		
Good/no good transmission				–	–
Test	00	–	00		
Continuity check	–	–	–	0	00

References

[1] CCITT Recommendation *Telephone signals*, Vol. VI, Fascicle VI.3, Rec. Q.254.

[2] CCITT Recommendation *General function of telephone messages and signals*, Vol. VI, Fascicle VI.8, Rec. Q.722.

[3] CCITT Recommendation *Telephone signals*, Vol. VI, Fascicle VI.3, Rec. Q.258.

[4] CCITT Recommendation *Specifications for manual maintenance access lines*, Vol. IV, Fascicle IV.4, Rec. O.11.

[5] CCITT Recommendation *CCITT automatic transmission measuring and signalling testing equipment (ATME No. 2)*, Vol. IV, Fascicle IV.4, Rec. O.22.

[6] CCITT Recommendations, *Formats and codes*, Vol. VI, Fascicle VI.8, Rec. Q.723.

[7] CCITT Recommendations, *General function of messages and signals*, Vol VI, Fascicle VI.8, Rec. Q.762.

[8] CCITT Recommendations, *Formats and codes*, Vol. VI, Fascicle VI.8, Rec. Q.763.

Recommendation Q.107 *bis*

ANALYSIS OF FORWARD ADDRESS INFORMATION FOR ROUTING

(Geneva, 1980; modified at Melbourne, 1980)

1 General

This Recommendation covers the analysis of forward address information for the routing of circuits using Signalling Systems No. 4, No. 5, No. 6, No. 7 and R2.

For Signalling System R1, Recommendation Q.324 [1] indicates that in the application of Signalling System R1 to intra-regional networks, the routing plan of that network shall apply. The routing plan is such that analysis is limited to a maximum of six digits.

Signalling Systems No. 4, No. 5, No. 6, No. 7 and R2 as specified are suitable for international application (see also Recommendation Q.7) and Recommendations Q.12 and Q.13 on routing are applicable. Similarly, for international traffic the combinations of digits to be sent must be in accordance with Recommendations Q.10, Q.11 *bis* and Q.101 to Q.107.

Based on the forward address information received (see Recommendation Q.107), routing is performed at the outgoing international exchange and at the following (transit) exchanges. For this purpose, an analysis of some of the information received is required. Recommendation Q.107 specifies the standard sequences of forward address information for each of the signalling systems mentioned above.

2 Digit analysis at the outgoing international exchange

The ISDN numbering plan is based on an extension of the existing numbering plans applicable to national and international public telephone networks. In fact, ISDN services may be provided under the existing numbering plan for the international telephone service (the E.163 subset of E.164). However, some Administrations may choose to allow for full E.164 numbers (maximun 15 digits). Therefore, the associated change which motivates an increase in the maximum number of digits which must be analysed in the outgoing international exchange to determine routing should be fully supported.

More specifically, according to E.164, this maximum should be equal to 6 digits, the language digit (L) or the discriminating digit (D) not being included. Some examples of the information required to determine routing at an international exchange are given in the following:

$$I_1\ Z\ N_1\ N_2\ N_3N_4N_5$$

$$\text{or } I_1\ I_2\ Z\ N_1\ N_2N_3N_4$$

$$\text{or } I_1\ I_2\ I_3\ Z\ N_1\ N_2N_3$$

where

I_1, I_2, I_3 = digits of the country code

Z = characteristic digit, i.e. discriminating digit (D) or language digit (L), and

$N_1, \dots N_n$ = digits of the national (significant) number.

In cases where the country code is shared by different countries, up to 7 digits may have to be analysed for routing and accounting purposes. In the implementation of new international exchanges, this should be taken into account.

In general, the whole amount of forward address information relating to international calls is stored at the outgoing international exchange.

Some examples of the information required to determine the routing at an international exchange are given in the following:

$$I_1\ Z\ N_1\ N_2\ N_3\ ^{1)}$$

$$\text{or } I_1\ I_2\ Z\ N_1\ N_2\ ^{1)}$$

$$\text{or } I_1\ I_2\ I_3\ Z\ N_1\ N_2\ ^{1)}$$

where

I_1, I_2, I_3 = digits of the country code

Z = characteristic digit, i.e. discriminating digit (D) or language digit (L), and

$N_1, \dots N_n$ = digits of the national (significant) number.

The maximum number of digits which has to be analysed in the outgoing international exchange to determine the routing is 5, the language digit (L) or the discriminating digit (D) not being included. In cases where the country code is shared by different countries, up to 7 digits may have to be analysed for routing and accounting purposes. In the implementation of new international exchanges, this should be taken into account.

In semi-automatic working, in the case where the language digit is not sent by the operator, and in automatic working, it is necessary to determine (in the outgoing international exchange) the position where the language or discriminating digit must be inserted automatically (for channel associated signalling systems immediately after the country code). This position is determined by an analysis of the first or the first two digits of the country code. A three-digit country code can also be detected by an analysis of the first two digits.

In the case of countries with more than one incoming international exchange where semi-automatic calls to code 11 or code 12 operators require a digit analysis beyond the country code for routing in the outgoing international exchange, N_1 may be used as the extra digit designating the incoming international exchange. For direct relations between the outgoing exchange and the incoming exchanges, sending of the digit N_1 to the incoming international exchanges is not required[2].

3 Digit analysis at the international transit exchange

Signalling equipment for transit exchanges must be designed for the transfer of all information necessary for setting up calls including access to operators' positions.

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1) In the cases of common channel Signalling Systems No. 6 and No. 7, the information content of the D or L digit will be conveyed by the calling-party's-category indicator.

2) It is recognized that the existing design of some equipment may not permit the reception of the extra digit N_1. In this situation, agreement will be required between the relevant countries concerned that the extra digit N_1 would not be sent to a particular incoming international exchange.

In an international transit exchange, analysis of some of the digits is required to determine the routing to the desired international incoming exchange or to another international transit exchange. The maximum number of digits which has to be analysed at the international transit exchange to determine the routing is 5, the language (L) or the discriminating digit (D) not being included (see also § 2). In cases where the country code is shared by different countries, up to 7 digits may have to be analysed for routing and accounting purposes. In the implementation of new international exchanges, this should be taken into account.

The transit exchange decides how many of the received digits it needs for this analysis.

In an international transit exchange, an analysis, effective on the first or the first two digits of the country code, determines the number of digits in the country code. For channel associated signalling systems, the position of the language or the discriminating digit is therefore determined which, in the sequence of forward address information, follows immediately the country code.

Since in the case of common channel Signalling Systems No. 6 and No. 7 the initial address message contains all digits required for routing the call, selection of the outgoing circuit can start as soon as this message has been received. In addition to the digit information, other routing information is contained in the initial address message, e.g. country code or nature-of-address indicator, nature-of-circuit indicator, calling-party's-category indicator, and echo-suppressor indicator, some or all of which must be analysed as described in the detailed specifications.

Normally, it will not be necessary for a transit exchange using Signalling System No. 6 or No. 7 to analyse digits in more than the initial address message. Subsequent address messages can be forwarded to the next international exchange without analysis as soon as the outgoing circuit is determined.

In the case of Signalling System No. 6, however, a subsequent address message (SAM) must always be analysed for sequence reasonableness before being forwarded to the next international exchange.

In the case of incoming Signalling System No. 4, the transit exchange must ensure that it does not request signal code 15 in order to avoid premature release of the outgoing register, e.g. by evaluating the signal code 11 or code 12.

4 Examples of the digit analysis in an international transit exchange

Possible cases for digit analysis by an international transit exchange are shown in the following examples (the letters given to the international exchanges correspond to Figure 1/Q.107 *bis* and the letters given to the digits correspond to the examples given in § 2 above). It should be noted that in some cases analysis of fewer digits than those indicated in the following examples may be sufficient.

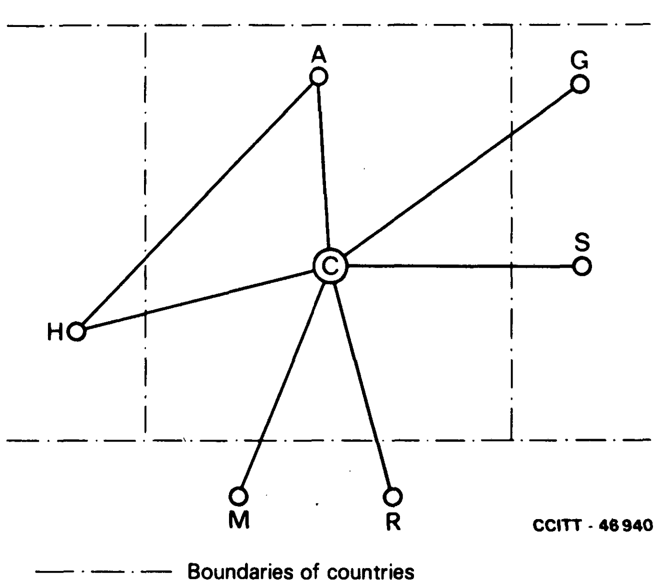

FIGURE 1/Q.107 *bis*

Examples of the digit analysis in an international transit exchange C

4.1 *Example 1*

In example 1, transit traffic via C in one country is routed to one of the two exchanges M or R in another country according to the first digit(s) of the national (significant) number.

a) Automatic and semi-automatic calls with normal national numbers

Example: $I_1\ I_2\ Z\ N_1\ N_2$ [3)]

b) Semi-automatic calls to code 11 or code 12 operators in the case where only one incoming international exchange (M or R) is equipped to receive calls to operators' positions

Examples: $I_1\ I_2\ L\ C_{11}$ or $I_1\ I_2\ L\ C_{12}$ [3)]

In the case of countries with more than one incoming international exchange where code 11 or code 12 traffic requires for routing in the transit exchange a digit analysis beyond the country code, N_1 may be used as the extra digit designating the incoming international exchange [4)].

Examples: $\underbrace{I_1\ I_2\ L\ N_1}_{\text{analysed}}\ C_{11}$ or $\underbrace{I_1\ I_2\ L\ N_1}_{\text{analysed}}\ C_{12}$ [3)]

4.2 *Example 2*

In example 2, transit traffic via C in one country is routed to G or S in another country. Automatic traffic with the presence of discriminating digit (D) is routed to G or S according to the first digit of the national significant number, while all semi-automatic traffic with the presence of language digit (L) is routed to S for assistance operator use regardless of digits following L.

Examples: $\underbrace{I_1\ I_2\ D}_{\text{analysed}}$ or $\underbrace{I_1\ I_2\ L}_{\text{analysed}}$ [3)].

5 Example of digit analysis for incoming terminal traffic

Terminal traffic incoming to an international exchange C in a country and which is to be routed to code 11 or code 12 operators in another international exchange A in the same country according to the extra digit N_1 [4)].

Examples: $\underbrace{L\ N_1}_{\text{analysed}}\ C_{11}\ C_{15}$ or $\underbrace{L\ N_1}_{\text{analysed}}\ C_{12}\ X\ X\ C_{15}$ [5)]

6 Cross-border traffic between adjacent countries

If for cross-border traffic between adjacent countries access to operators' positions is not provided, it may be decided by bilateral agreement to exclude the transfer of the language or the discriminating digit. In this case, the first digit sent will be the first of the national (significant) number. In addition, one or more of the first digits of the national (significant) number may be omitted, depending on the routing requirements at the incoming exchange.

For cross-border traffic between adjacent countries, the number of digits that must be analysed will be determined by bilateral agreement. This may involve more digits than for normal international traffic.

Reference

[1] CCITT Recommendation *Analysis of address information for routing*, Vol. VI, Fascicle VI.4, Rec. Q.324.

3) In the cases of common channel Signalling Systems No. 6 and No. 7, the information content of the D or L digit will be conveyed by the calling-party's-category indicator.

4) It is recognized that the existing design of some equipment may not permit the reception of the extra digit N_1. In this situation, agreement will be required between the relevant countries concerned that the extra digit N_1 would not be sent to a particular incoming international exchange.

5) In the cases of common channel Signalling Systems No. 6 and No. 7, the information content of the D or L digit will be conveyed by the calling-party's-category indicator. Code 15 may be considered as equivalent to ST in all CCITT signalling systems.

1.8 ONE-WAY OR BOTH-WAY OPERATION OF INTERNATIONAL CIRCUITS

1.8.1 *One-way operation*

In order to have as simple as possible equipment in international exchanges and to avoid double seizures, System No. 4 has been designed in 1949-1954 for one-way operation of international circuits in semi-automatic and automatic working.

1.8.2 *Both-way operation*

1.8.2.1 These advantages of one-way operation naturally hold good in the case of long international (intercontinental) circuits. However, for these circuits the following considerations have been determining factors in providing both-way circuit operation:

a) When a group of circuits is composed of a small number of circuits, the increase in efficiency due to both-way operation is obviously very important. Moreover, long international (intercontinental) circuits are very costly. Finally, the increase in the cost of terminal equipment which results from both-way operation is small compared with the considerable economic advantage derived from this mode of operation.

b) The two ends of a long international (intercontinental) group of circuits may belong to two time zones which are very far apart and, depending on the difference in time, this is likely to result in important and variable differences between the traffic in the two directions.

1.8.2.2 All circuits in System No. 5 and the speech circuits in Systems No. 6 and 7 should be equipped to work in both-way operation. Nevertheless, the both-way method of operation would be applied only if it offered a considerable economic advantage. Hence in the case of large groups (for example, more than 40 circuits in each direction), the possibility of maintaining one-way operation might be considered, because of the extra reliability of this type of operation. If, in circumstances necessitating the use of large groups, there are great differences between the busy hours at each end, it would be advisable, if it were desired to maintain one-way operation, to arrange that the circuits be used successively in one or the other direction according to the time of day. This availability of the circuits for routing traffic from country A to country B or vice versa would be arranged by a convenient method.

In certain cases another solution is worthy of consideration. This consists of setting up three groups of circuits, two operated one-way and the third both-way, it being understood that the latter would be used as an overflow route for calls which could not be routed on the first two groups.

1.8.2.3 Attention is drawn to the conditions which should be introduced to avoid double seizing and false blocking on both-way international circuits. In addition, attention is drawn to the fact that in semi-automatic working, as in automatic working, access to the circuits at both ends should be automatic.

In semi-automatic operation, in the event of double seizing, automatic selection of a new circuit should be preferred to the operator's setting up the call again, so that the operator does not become aware of the double seizing. In automatic operation, automatic selection of a new circuit should naturally be the rule.

The necessary arrangements have been made in the specifications of the systems concerning simultaneous seizing in both-way operation.

1.8.2.4 The digital circuits in System R2 and the circuits in System R1 may be equipped to work in both-way operation.

1.9 TRANSMISSION OF THE ANSWER SIGNAL IN INTERNATIONAL EXCHANGES

For the reasons given in Recommendation Q.27, it is necessary to reduce to a minimum the delays resulting from:

- the conversion of the national answer signal into the international answer signal and vice versa; and
- the transmission of the international answer signal over the international part of the connection,

these delays being additional to any delays due to conversions and repetitions of the answer signal within the national systems of the incoming and outgoing countries.

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SECTION 2

TRANSMISSION CLAUSES FOR SIGNALLING

A. Signalling on PCM links

Recommendation Q.110

2.0 GENERAL ASPECTS OF THE UTILIZATION OF STANDARDIZED CCITT SIGNALLING SYSTEMS ON PCM LINKS

2.0.1 *Signalling Systems No. 4 and No. 5*

Signalling Systems No. 4 and No. 5 are in-band signalling systems. It is not planned to specify modified versions of these systems for application to PCM transmission systems.

Should it be required to use one of these signalling systems on circuits routed partly or wholly via PCM transmission systems it is recommended that the standard in-band signalling arrangements for both line and interregister signals be used. The circuits should be connected on a 4-wire basis to appropriate analogue inputs and outputs of the PCM transmission system.

When used at analogue exchanges the circuits should be connected on a 4-wire basis to appropriate analogue inputs and outputs of a PCM transmission system conforming to Recommendations G.732 [1] or G.733 [2].

At digital exchanges, circuits should be connected to PCM interfaces conforming to Recommendation Q.503.

2.0.2 *Signalling System No. 6*

For the transmission of signalling information over digital systems a digital version of Signalling System No. 6 has been developed and is specified in Recommendations Q.251 and Q.295.

Alternatively, the analogue version of System No. 6, as also specified in Recommendations Q.251 to Q.295 may be used without modifications by replacing the analogue voice-frequency channel of the signalling data link by PCM voice-frequency channels. In this case, the connection of the modem to the PCM transmission channel should be made on a 4-wire basis to the analogue input and the analogue output.

2.0.3 *Signalling System No. 7*

Signalling System No. 7 has been developed for the use in integrated digital networks. It is optimized for 64 kbit/s PCM transmission channels.

In addition, it can be used on analogue transmission channels with lower bit rates.

2.0.4 *Signalling System R1*

Signalling System R1, as specified in Part I of Fascicle VI.4, may be used without modification on PCM voice-frequency channels by direct connection of the circuits to appropriate analogue inputs and outputs of the PCM transmission system.

An alternative method of transmitting the line signals via a PCM system as specified in Recommendation G.733 has been developed as the digital version of System R1. Details are given in Recommendations Q.314 to Q.316. The multifrequency interregister signals are applied in-band via the analogue input of the speech circuit.

At digital exchanges, circuits should be connected to PCM interfaces conforming to Recommendation Q.503.

2.0.5 *Signalling System R2*

The analogue version of System R2 line signalling cannot be transmitted via an analogue input of a PCM system since these line signals are sent out-band using a 3825 Hz signalling channel. The digital version of System R2 line signalling specified in Recommendations Q.421-Q.424 has been developed for use with PCM systems specified in Recommendation G.732 [1]. The multi-frequency inter-register signals are applied in-band via the input of the speech circuit. At digital exchanges, circuits should be connected to PCM interfaces conforming to Recommendation Q.503.

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Fascicle III.3, Rec. G.732.

[2] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Fascicle III.3, Rec. G.733.

B. Clauses common to signal receivers (and senders) for Signalling Systems No. 4, No. 5, R1 and R2 [1)]

Recommendation Q.112

2.1 SIGNAL LEVELS AND SIGNAL RECEIVER SENSITIVITY

2.1.1 *Standardized transmitted power*

The values of the standardized transmitted power for the different line and interregister signals are defined in the relevant parts of the specifications for the CCITT Systems No. 4, No. 5, R1 and R2.

Note – The level of leak current which might be transmitted to line, for example when static modulators are used for signal transmission, should be considerably below signal level, as specified.

2.1.2 *Variations of the absolute power level of received signals*

The standardized absolute power level of the signalling current to be transmitted is fixed at the maximum value compatible with circuit transmission requirements and the extreme values of absolute power level, between which received signalling currents may lie, depend on three factors:

1) the overall loss and the variation with time of this loss of the international circuit (link-by-link signalling) or of the chain of international circuits (end-to-end signalling) at 800 Hz;
2) the variation with frequency of the overall loss of these circuits, in relation to the nominal value at 800 Hz;
3) the tolerance on the transmitted absolute power level in relation to the nominal value.

1) For Signalling Systems No. 6 and No. 7, see Fascicles VI.3 and VI.7 respectively.

The operate level range of the signal receivers about a nominal value should take account of these three factors. In System No. 4, the operate range (± 9 dB) is appropriate for end-to-end signalling. The maximum number of circuits in the end-to-end signalling situation is normally three but more may be possible depending upon the actual conditions. In System No. 5 the operate range, (± 7 dB) for line signals and for register signals is appropriate for each circuit in link-by-link signalling. For the other CCITT systems see the relevant parts of their specifications.

2.1.3 *Maximum sensitivity of the signal receiver*

It is desirable to limit the maximum sensitivity of the signal receiver, particularly on account of crosstalk between the GO and RETURN paths of a 4-wire circuit, leak currents, etc.

Recommendation Q.113

2.2 CONNECTION OF SIGNAL RECEIVERS IN THE CIRCUIT

2.2.1 The line signal receivers are permanently connected to the 4-wire side of the circuit. The register signal receivers in System No. 5 are connected to the 4-wire side of the circuit when the register is associated with the circuit for the setting up of the call; the same is valid (in the international exchanges) for the register signal receivers in Systems R1 and R2.

2.2.2 An in-band line signal receiver should be protected against disturbing currents (voice currents or possibly noise), coming from the the near end of the circuit, by a buffer amplifier or other arrangement. The arrangement used should introduce an appropriate supplementary attenuation in such a manner that, at the point where the line signal receiver is connected, these disturbing currents are of such a level that they cannot:

- operate the line signal receiver;
- interfere with the reception of signals by operating the guard circuit of the line signal receiver.

The additional attenuation introduced should in consequence take account of:

a) the relative level n at the point where the signal receiver is connected (this relative level is obtained by assuming a zero relative level at the distant origin of the circuit);

b) the minimum permissibe signal level at the input to the signal receiver, for example:

   $-18 + n$ dBm in the case of System No. 4 (see Recommendation Q.123 § 3.2.1),

   $-16 + n$ dBm in the case of System No. 5 (see Recommendation Q.144 § 2.4.1);

c) the maximum permissible level for disturbing currents (voice currents and switching noise) coming from the near end of the circuit. The maximum level of voice current might be assumed to be, for example, +10 dBm0 in the direction *opposite* to that of the signals. The nature of the switching noises depends on the national systems used;

d) any attenuation (terminating set and possibly pads) between the point where the signal receiver is connected and the point where the near-end disturbing currents are considered;

e) a safety margin to give an appreciable reduction of the level of disturbing currents coming from the near end [as defined in c)] compared to the minimum level of the signal as defined in b).

2.2.3 When a register-signal receiver is connected to the circuit, the exchange side of the circuit is disconnected and hence the receiver is not subject to near-end disturbances.

2.2.4 The Recommendations of Volume III concerning international circuits must still be met after the connection of a signal sender and a signal receiver and of the switching equipment. In consequence, it is necessary to fix the limits of input and output impedance, insertion loss, attenuation distortion, non-linear distortion, balance, and crosstalk of line signal senders and receivers; an example of specification clauses concerning these conditions is given in Recommendation Q.114.

2.3 TYPICAL TRANSMISSION REQUIREMENTS FOR SIGNAL SENDERS AND RECEIVERS

2.3.1 In-band line signal receivers (including the buffer amplifier or equivalent device), in §§ 2.3.2 to 2.3.7 below, apply only in the case where the signal receiver is a 4-terminal device ("quadripole") and where the nominal circuit impedance is 600 ohms.

2.3.2 *Input and output impedance*

The nominal value of the input and output impedances of the signal receiver is 600 ohms.

Z_E and Z_S, which are respectively the measured values of the input and output impedance of the signal receiver, should meet the following condition throughout the 300 to 3400 Hz frequency band:

$$\left| \frac{Z_E - 600}{Z_E + 600} \right| \leqslant 0.35 \text{ and } \left| \frac{Z_S - 600}{Z_S + 600} \right| \leqslant 0.35.$$

In making these measurements the free terminals should be looped by a resistance of 600 ohms and the voltage applied must not overload the equipment.

2.3.3 *Attenuation*

At 800 Hz, the insertion loss of the signal receiver, measured with a generator and a receiver of internal resistance of 600 ohms, must be between the limits:

$$A \pm 0.5 \text{ decibel}\cdot$$

The value A is to be determined from the level diagram of the circuit according to the point of the circuit at which the signal receiver should be connected.

The measurement is made with a 1 mW generator having an internal impedance equal to a pure resistance of 600 ohms and having an e.m.f. of 2×0.775 volt (so-called "standard generator"). The e.m.f. of the generator will be adjusted to take into account the relative level of the point of the circuit at which the signal receiver is connected.

If n is the relative level at the signal receiver input, the e.m.f. of the generator will therefore be:

$$1.55 \cdot 10^{\frac{n}{20}} \text{ volts, if } n \text{ is expressed in decibels.}$$

2.3.4 *Attenuation distortion*

The variation in insertion loss of the signal receiver in the 300-3400 Hz frequency band, measured under the conditions of § 2.3.3 above, should not exceed the limits shown in Figure 1/Q.114.

As in certain cases Systems No. 5, and R1 may be applied to circuits in transmission systems with a channel spacing of less than 4 kHz, the 300 Hz lower limit shown above may be replaced by 200 Hz for System No. 5.

2.3.5 *Nonlinear distortion*

The curve representing the variation (as a function of power) of the output level of the signal receiver, with reference to the nominal value of the output level, should be within the limits shown in Figure 2/Q.114 over the relevant frequency range.

2.3.6 *Balance*

The input and output of the signal receiver should have a high degree of balance to earth, the admittance of each terminal to earth being very low.

The same clause should apply to the signal sender.

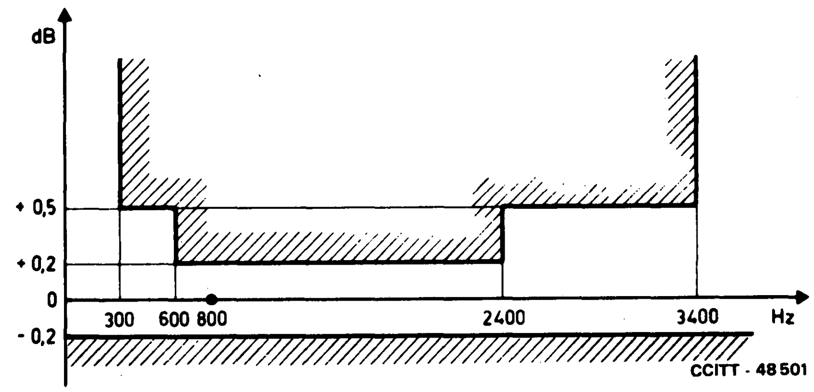

FIGURE 1/Q.114

Attenuation distortion of the signal receiver

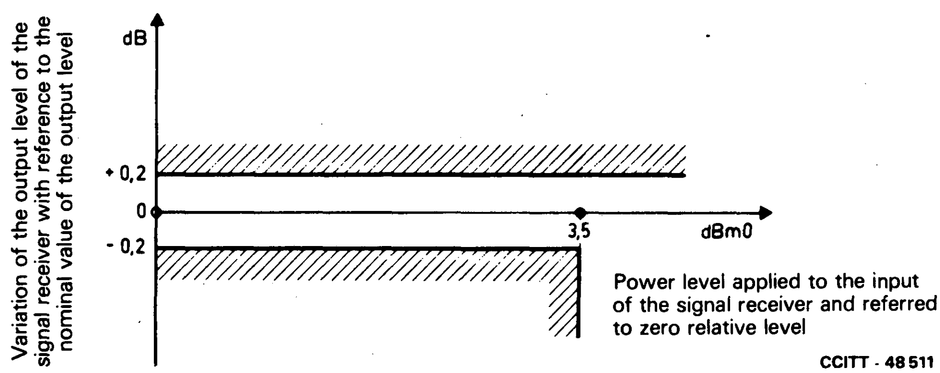

FIGURE 2/Q.114

Limits for nonlinear distortion due to the insertion of the signal receiver

2.3.7 *Crosstalk between adjacent signal receivers*

The crosstalk ratio between two adjacent signal receivers should not be less than 74 dB in the relevant frequency band.

2.3.8 During the register signalling period no speech transmission takes place. It is not essential therefore for the register signalling equipment of systems having separate equipment for that purpose to take account of §§ 2.3.2 to 2.3.7 above but it is desirable to adopt appropriate clauses for efficient signalling performance.

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SECTION 3

CONTROL OF ECHO SUPPRESSORS

Recommendation Q.115

CONTROL OF ECHO SUPPRESSORS AND ECHO CANCELLERS BY INTERNATIONAL SWITCHING CENTRES

3.1 *General*

In order to achieve transmission objectives on long automatic and semi-automatic telephone connections, it is necessary to take into account the effects of echo. A general discussion of echo considerations is given in Recommendation Q.42 which is an extract of Recommendation G.131. The characteristics of terminal half-echo control devices are given in Recommendations G.161 [1] and G.164 [2]. The characteristics of echo cancellers are given in Recommendation G.165 [3].

In order to achieve optimum echo control for each call, it is necessary to control both types of echo control devices.

This can be carried out at switching centres only if sufficient information is available to coordinate an overall control action.

Logical means to obtain pertinent information and the switching considerations governing its practicable use are detailed below. Control based on the transfer of signals between switching centres is given particular attention. Self-contained control action such as tone disablement of echo suppressors and echo cancellers for data transmission is not within the scope of this Section.

In the cases to be discussed, control methods will be applied at international exchanges (CTs), but it is recognized that in some countries covering large geographic areas it may be appropriate to extend the control methods into national networks.

The actions described in §§ 3.5 to 3.8 about the analysis of information and the decision to be taken in an outgoing transit or incoming international exchange are summarized in the SDL flowchart of the Annex A.

Annex A does not cover the handling of echo control devices in the case of different bearer services and CCITT Signalling System No. 7.

3.2 *Terminology*

a) Subsequent discussion of control measures will refer to the standard terminal half-echo suppressor specified in Recommendation G.164 [2] and the echo cancellers specified in Recommendation G.165 [3]. The terms echo suppressor and echo canceller will be used to denote these devices. The term echo control device will comprise both, echo suppressors and echo cancellers.

b) Two means of introducing echo control devices are considered as acceptable, these are, the use of permanently associated echo control devices and the use of echo control devices inserted from a common pool of echo control devices.

c) With respect to control of permanently associated echo control devices control actions are said to enable or disable.

d) With respect to echo control devices provided from pools, control actions are concerned with inserting or not inserting.

e) The signals assigned in Systems R2, No. 6 and No. 7 (and reserved in System No. 4) for echo control equipment control are in most cases a means to guide subsequent exchanges in taking necessary action with respect to possible introduction of an incoming echo control device. Thus the descriptive phrases associated with the various signalling systems, as given below, convey comparable meaning in the control plan.

Systems No. 4 and R2: incoming half-echo suppressor (half-echo canceller) required;

Systems No. 6 and No. 7: outgoing half-echo suppressor (half-echo canceller) included in the connection.

f) A secondary signalling function related to echo control provides for the possibility that echo control device may not be available at an originating CT. In this case responsibility for both outgoing and incoming echo control device may be delegated by signal.

g) A long circuit is considered as one which, if used by itself, would require echo control.

h) A short circuit is considered as one which, if used by itself, would not require echo control.

3.3 *Compatibility of echo control devices and signalling equipment*

3.3.1 Arrangements should be incorporated in the switching equipment to prevent echo suppressor and echo canceller action from disturbing simultaneous forward and backward signalling via the speech paths.

For this case typical arrangements are:

i) locating the echo control device on the switching side of the signalling equipment;

ii) inhibiting the action of echo control device located on the line side of the signalling equipment by means of an appropriate condition extended from the signalling equipment to the echo control device while signalling is in progress.

Note 1 – The standard half-echo suppressor (Recommendations G.161 [1] and G.164 [2]) if located on the line side of line signalling equipment may adversely affect signalling. This difficulty is possible because with the new standard half-echo suppressor normal operation will at times cause 6 dB additional loss to appear in the path to a line signalling receiver. Operating margins are correspondingly reduced. For example, with signalling receivers for System No. 5 as specified in Recommendation Q.112, signalling reliability could be impaired. Accordingly, adequate operating margins should be assured or the echo suppressor should not be located on the line side of line signalling receivers. With regard to inter-register signalling which requires simultaneous transmission in both directions, similar considerations call for disabling the echo suppressors while inter-register signalling is in progress in order to prevent the 6 dB loss.

Note 2 – Echo cancellers will not introduce any fixed loss during in-band signalling. But they can cause a problem during the continuity check used in CCITT Signalling Systems No. 6 (Recommendation Q.271) and No. 7 (Recommendation Q.724), or with compelled signals having the same frequency(ies) on both directions of transmission in Signalling System No. 5 (Recommendation Q.112) where the received signal is processed through the existing echo path model and produces an interfering signal in the return path.

Note 3 – Some echo control devices are capable of internally providing either signalling bypass or an appropriate internal function which permits transparent operation to in-band signalling or other in-band tones.

3.3.2 Arrangements should be incorporated in the Systems No. 6 and No. 7 equipment to prevent echo suppressor action from disturbing the procedure for making the continuity check of the speech path. Echo suppressor and echo cancellers must be permanently disabled, if a circuit is used for common channel signalling.

3.4 *Operation without signals*

In Signalling Systems No. 5 and R1, signals are not available for echo control information. In System No. 4 a signal may be applied only if multilateral or bilateral agreements authorize its use. Accordingly, the recommended control plan relies on means other than signals in cases where it has not been found practicable to provide signals. In the case of System No. 5, the normal field of application to long circuits typically indicates the presence of echo control device. In the case of System R1, regional control procedures not requiring signals are applicable.

3.5 *Analysis of information at an outgoing international exchange*

The outgoing international exchange, hereafter designated "A", must make a decision with respect to its echo control requirements at the time an outgoing circuit is selected. Unless echo control devices are not available, one or more of the following items of information should influence this decision:

i) country code of destination and possibly some additional address digits;

ii) information about the actual routing of the call;

iii) nature of outgoing international circuit at A (e.g. satellite circuit);

iv) nature of incoming national circuit at A;

v) signals received over the incoming national circuit at A;

vi) requested bearer service (see Recommendation I.231 [4]).

With respect to iii) and iv), the characteristic of primary interest is propagation time. Two general categories, long and short, are the basis of control action. See §§ 3.2 g) and h) above, for definition of terminology.

3.6 *Decision to be taken at the outgoing international exchange*

If the factors i) to vi) in § 3.5 above indicate that there is no need to provide echo control devices on a particular connection, the outgoing exchange should act accordingly and advise subsequent exchanges by signal or other appropriate means, of its decision.

If the information available indicates that the connection to be established will require echo control and if it is known that an outgoing echo control device is not already provided in the national network, then the outgoing exchange should provide for the outgoing echo control device. The outgoing exchange should also, if signals are available, indicate by signal to subsequent exchanges as appropriate what action it has taken.

In the event that an outgoing exchange is unable to provide an outgoing echo control device when a need is known, it may call for cooperative action. (Signal I-11 in System R2 is specifically assigned to make possible a cooperative transfer of responsibility for echo control device control from an originating CT to a transit CT. The signal outgoing half-echo suppressor not included could be used with Systems No. 6 and No. 7, but such an application would in effect assume that a modern exchange found sufficient reason to displace an outgoing echo control device from its preferred location.)

3.7 *Decision to be taken at an international transit exchange*

The decision at an international transit exchange depends on an assessment of switching and signalling information available after the transit CT has selected an outgoing circuit. Information similar to that listed in 3.5 i) to vi) above is of interest.

a) When the first transit CT knows that an outgoing echo control device has not yet been provided closer to the call source by a signal of CCITT Systems No. 6, 7 and R2, or by bilateral agreements for specific exceptions, the transit CT should consider the outgoing circuit selected, the ultimate call destination and such other information as indicated above. If a connection requiring echo control may result, an outgoing echo control device should be enabled or inserted at the first transit CT.

b) When the transit CT concerned knows that an outgoing echo control device is located closer to the call source, the question to be decided is the location of the incoming echo control device. The incoming echo device is located at the transit CT only when a location nearer to the called party is not practicable. Specifically, an exception may result when the transit CT selects a short terminal circuit equipped with CCITT Signalling Systems No. 4, 5, or R1. In this case, an incoming echo control device should be enabled or inserted at the transit CT.

c) It follows from the above that in every case where an international transit centre interconnects two circuits and knows that echo control device will be provided at a preceding location and also at a more distant location, the transit centre should disable or not insert its own echo control device. (Full echo control device is not covered in the control plan and should not be affected by the procedures described in this Section.)

d) It is, of course, commonly the case that an outgoing echo control device has not been introduced at the outgoing exchange because none is required. When the transit exchange has reason to know of such a situation, it should not introduce an echo control device and should advise the subsequent exchange when possible that an incoming echo control device is not required (or equivalently, that an outgoing echo control device has not been introduced).

e) In the case of a routing where both an incoming and outgoing echo control device has already been inserted at earlier points, the transit exchange should advise the subsequent exchange, where possible, that an incoming half echo control device is not required.

3.8 *Decision to be taken at the incoming international exchange*

Short circuits equipped with CCITT Systems No. 5, R1 and No. 4 (unless bilateral agreements are reached), provide no signals at the incoming CT for selective use of echo control devices. As a result, in the absence of separate circuit groups on the same route or other alternatives, the economic choice is to omit echo devices. In the case of a call that has passed through a transit exchange en route to the incoming exchange, the requirement for an incoming echo control device should then be met at the preceding CT as covered in § 3.7 b) above.

With CCITT Systems No. 6, 7, R2 and 4 (assuming multilateral or bilateral agreement) selective use of echo control devices on short terminal links is a basic option. Therefore, the terminal CT acts in accordance with the control signal received. When an outgoing echo control device has been included at a preceding CT, the incoming CT should enable or insert an incoming echo control device.

When no echo control device has yet appeared elsewhere in the connection, none should be enabled or inserted at the incoming CT.

3.9 *Other considerations*

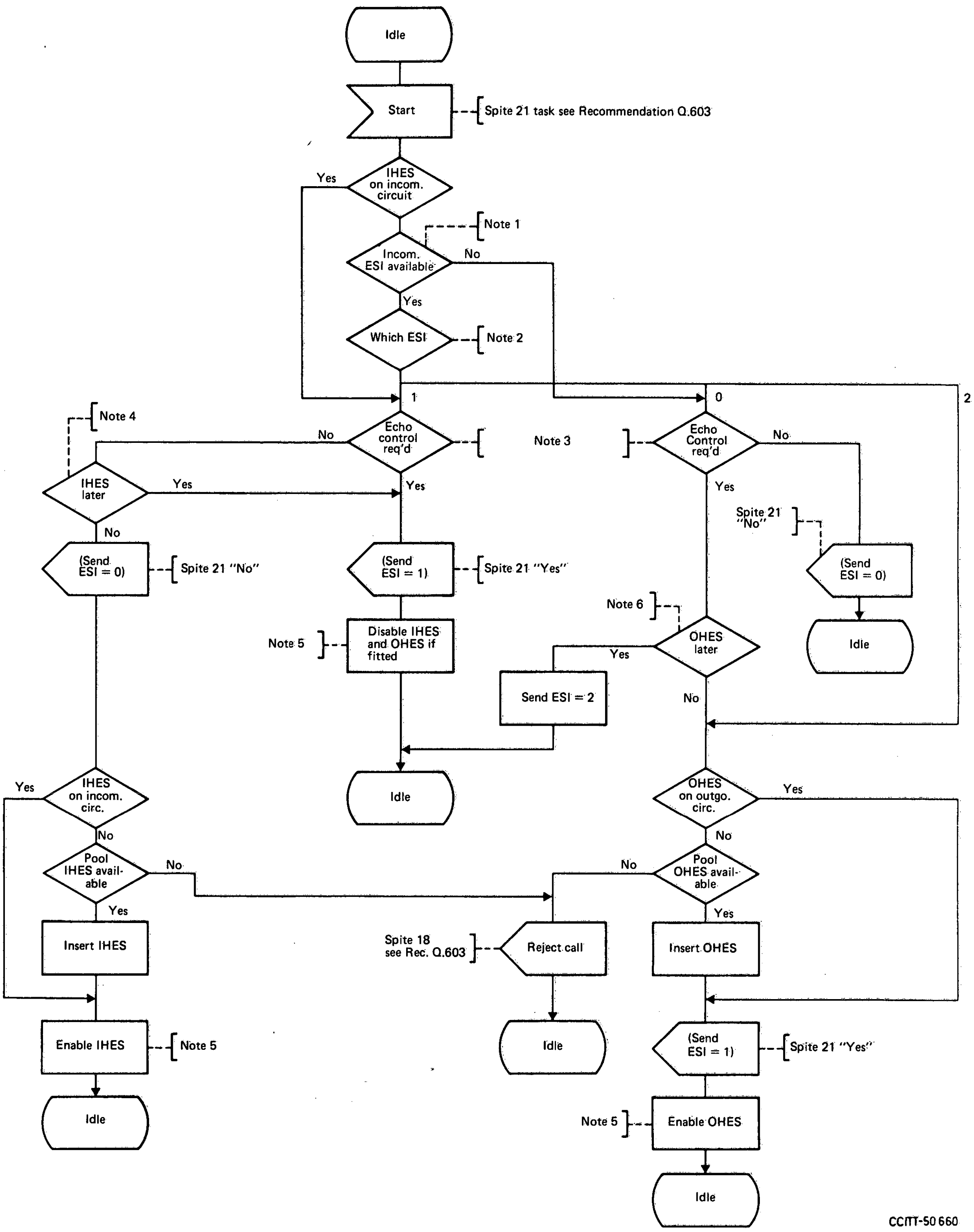
It is recognized that when echo control devices are inserted from pools, there is a small probability that no echo control device will be available when needed. In this case an (equipment) congestion signal should be given to the calling subscriber.

Nothing in this Recommendation should be construed as discouraging control measures which may supplement the plan described and lead to improved results in specific situations. For example, regional procedures which introduce loss to control echo may be arranged to satisfy both regional and international needs on a selective basis. In addition for multiple ISC in one country the procedure of Annex B may be applied. It is recognized that possibilities for echo control have not been exhausted. If switching and signalling equipment have a changed role in the application of future procedures, this Recommendation will be subject to revision.

ANNEX A

(to Recommendation Q.115)

Call processing logic – Echo suppressor control



(See the Notes at the next page.)

Call processing logic – Echo suppressor control diagram notes

Note 1 – "Yes" where incoming signalling system provides echo suppressor indicators (ESI). For terminal R2 calls ESI is only available on request using A14. Signal A14 should only be returned where an IHES can be inserted.

Note 2 – ESI = 0, OHES not includes, IHES not required.
ESI = 1, OHES included, IHES required.
ISE = 2, OHES not included, OHED required.

Note 3 – Analysis of digits indicates a long connection which requires or already has echo suppressors; or route analysis indicates that permanent echo suppressors are fitted.

Note 4 – IHES should be connected as close to called subscriber as possible. This decision relates to the capability of the next or a later exchange to connect echo suppressors from a pool.

Note 5 – During the "register activated" phase all echo suppressors should be disabled. Enable or disable actions refer to the period after register deactivation, except for System R2 where it refers to the period after the reception of the answer signal.

Note 6 – This exchange cannot connect OHES, but by bilateral agreement is to be connected at next exchange. The indicator ESI = 2 is only used in Signalling System R2 and can only be used between the outgoing R2 international exchange and the first transit exchange.

ESI	Echo suppressor indicator.
IHES	Incoming half echo suppressor.
OHES	Outgoing half echo suppressor.
SPITE 21	Incoming half echo suppressor to be included at distant end? See Recommendation Q.603.

ANNEX B

(to Recommendation Q.115)

Echo suppressor control on inter-ISC circuits within a single country

In the case where an international transit call is connected through multiple ISCs in a single country in tandem, the following problem may arise with the control of echo suppressors.

Referring to Figure B-1/Q.115, which shows such a connection with two possible outgoing international circuits, one echo suppressed (Exchange B), and one unsuppressed (Exchange C). Exchange E does not have echo suppressors in a pool. Exchange D does not know whether or not the outgoing circuit from Exchange E is provided with echo suppressors. It is not therefore able to control the half echo suppressor HESd, since there may be an incoming half echo suppressor later in the connection.

In order to overcome this problem, a backward signal can be used from Exchange E, which informs Exchange D of the provision of echo suppressors on the outgoing international circuit.

Two methods are currently proposed by Administrations to provide these backward indications, these are detailed below:

i) A backward signal to Exchange D indicating the presence or absence of echo suppressors on the outgoing international circuit is generated by Exchange E as soon as the outgoing circuit has been selected. If a call failure situation subsequently arises and a repeat attempt is made then a new outgoing international circuit is chosen, and a further signal is passed back to Exchange D indicating the presence or absence of echo suppressors on this new circuit. HESd is then enabled, or disabled according to the last backward echo suppressor indicator received from Exchange E.

ii) In this case HESd is initially disabled, and remains so unless a signal is received from Exchange E indicating the absence of echo suppressor on the outgoing circuit. Exchange E only transmits such a signal if the outgoing international circuit has no echo suppressor provided, and will delay transmission of the signal until the address complete signal (or equivalent) is ready to be sent.

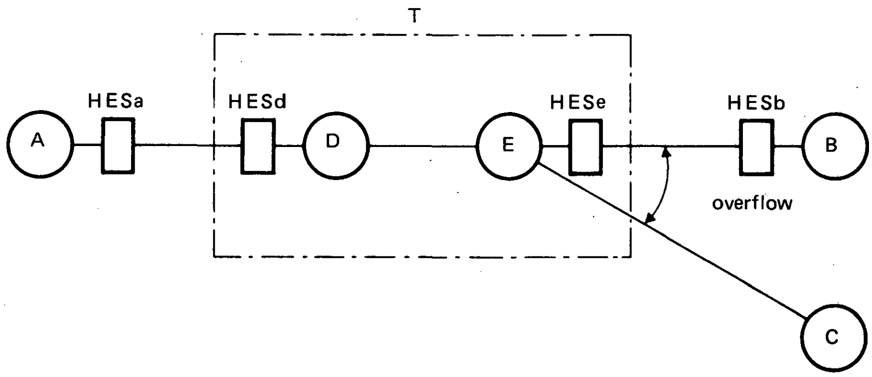


FIGURE B-1/Q.115

Echo control on multiple ISCs in a country

References

[1] CCITT Recommendation *Echo suppressors suitable for circuits having either short or long propagation times,* Volume III of Orange Book, Recommendtion G.161.

[2] CCITT Recommendation *Echo suppressors,* Volume III, Recommendation G.164.

[3] CCITT Recommendation *Echo cancellers,* Volume III, Recommendation G.165.

[4] CCITT Recommendation *Circuit-mode bearer services categories,* Volume III, Recommendation I.231.

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SECTION 4

ABNORMAL CONDITIONS

Recommendation Q.116

4.1 INDICATION GIVEN TO THE OUTGOING OPERATOR OR CALLING SUBSCRIBER IN CASE OF AN ABNORMAL CONDITION

In general, when an abnormal condition occurs in the setting up of a call, the outgoing operator in semi-automatic operation and the calling subscriber in automatic operation should receive an indication to show that it is necessary to make a new attempt to set up the call or to take other appropriate action.

The tables in the specifications of the signalling systems give details of the signals that are received at the outgoing exchange when abnormal conditions occur in setting up a call. Each Administration will decide how these signals are to be translated into appropriate indications for outgoing operators or calling subscribers.

Recommendation Q.117

4.2 ALARMS FOR TECHNICAL STAFF AND ARRANGEMENTS IN CASE OF FAULTS

4.2.1 In general, when an abnormal condition is recognized as being possibly due to a fault, an alarm must be given to indicate this condition and, if possible, any other necessary operation must be carried out to avoid circuits being put out of service unnecessarily and to facilitate fault tracing.

4.2.2 There will be the usual alarm and fault indication arrangements for such items as blown fuses, disconnected heat coils, faulty signalling equipment, failures of power supplies, failures of common control equipment, etc., as provided under the specifications of each Administration.

4.2.3 The occupation of each item of equipment such as line circuit equipment, link circuit, operators' calling equipment, selectors, registers, etc., can be indicated by the lighting of a lamp near to the equipment concerned, or by other suitable means, as may be available, e.g. in exchanges with stored-programme control.

4.2.4 It can be arranged for the progress of a call to be followed, in particular the sending or reception of digits or successive numerical signals. In this respect, each Administration will decide the arrangements it desires to install, taking account of the practice which it normally follows in this matter.

4.3 SPECIAL RELEASE ARRANGEMENTS

4.3.1 *Answer signal not received by an outgoing exchange after receiving a number-received signal or number-received information (Systems No. 4 and R2) or after receiving an address complete signal (Systems No. 6 and No. 7) or after transmitting the ST signal (System No. 5)*

It is recommended that arrangements should be made either in the national network of the outgoing country or at the outgoing international exchange, for the connection to be released if an answer signal is not received within a delay period of 2 to 4 minutes as soon as it is known, or can be assumed, that the called subscriber's line has been reached.

If an Administration adopts a shorter delay period for this forced release condition, there will be a risk that the international connection will be released prematurely on calls not returning an answer signal. If the maximum delay of 4 minutes is exceeded, it will of course involve an unnecessary occupation of international circuits.

4.3.2 *Delay in clearing by the calling subscriber in automatic service* (arrangements made in the outgoing country)

In automatic working, arrangements must be made to clear the international connection and stop the charging if, between 1 and 2 minutes after receipt of the clear-back signal [1], the calling subscriber has not cleared. Clearing of the international connection should preferably be controlled from the point where the charging of the calling subscriber is carried out.

Such timed supervision may also be applied in semi-automatic service.

During the establishment of a connection to a PABX extension it is not appropriate to send a clear-back signal. However, if a PABX returns a clear back condition, the duration must be less than 10 seconds, so that it would not uninentionally clear the connection, especially on calls from networks with short time-out. [2]

4.3.3 *Clear-forward signal not received by the incoming exchange after sending a clear-back signal*[3]

The incoming circuits at the incoming international exchange should include an arrangement for releasing the national part of the connection if, after sending a clear-back signal, a clear-forward signal is not received within 2 to 3 minutes (provided that a similar arrangement is not already made in the national network of the incoming country). This arrangement avoids indefinite blocking of the national circuits of the country of destination or of the subscriber's line in the case of interruptions of the line or equipment faults.

Since the call may be a semi-automatic call not including the time-out of § 4.3.2 at the outgoing end, the expiry of the 2 to 3 minute time-out should not cause any alarm or blocking actions on the international circuit.

Recommendation Q.118 *bis*

4.4 INDICATION OF CONGESTION CONDITIONS AT TRANSIT EXCHANGES

In the case of congestion at a transit exchange, the following conditions apply:

4.4.1 The busy-flash signal or an equivalent signal shall be returned to indicate that there is equipment congestion in the exchange or that no free outgoing circuit is available. This signal shall be returned within the periods specified.

In semi-automatic and in automatic working, the receipt of this signal by the international exchange will cause the clear-forward signal to be sent so as to release the international connection and will give a suitable indication to the calling subscriber or operator, unless an automatic repeat attempt is made.

---

1) In the North American network the corresponding time-out is 10 to 32 seconds.

2) For call where the charging is applied to called party (e.g., free phone service) the time-out may be reduced. The value to be chosen is for further study.

3) These release arrangements may not be used within some regional networks.

PART V

SUPPLEMENTS TO THE SERIES Q RECOMMENDATIONS

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Supplement No. 1

REPORT ON THE ENERGY TRANSMITTED BY CONTROL SIGNALS AND TONES

(For this Supplement, see Supplement No. 1 in Volume VI-4 of the *Green Book*)

Supplement No. 2

CHARACTERISTICS OF SPEECH INTERPOLATION SYSTEMS AFFECTING SIGNALLING

1 CELTIC system

1.1 *General*

The first generation CELTIC system (concentrator exploiting the idle time of circuits) has been in operation since 1977. A second generation system, to come into operation in 1983, is now being developed (1980).

CELTIC is a fully digital system (see Figure 1).

Connection and service messages can be routed on a CELTIC signalling circuit between terminals A and B.

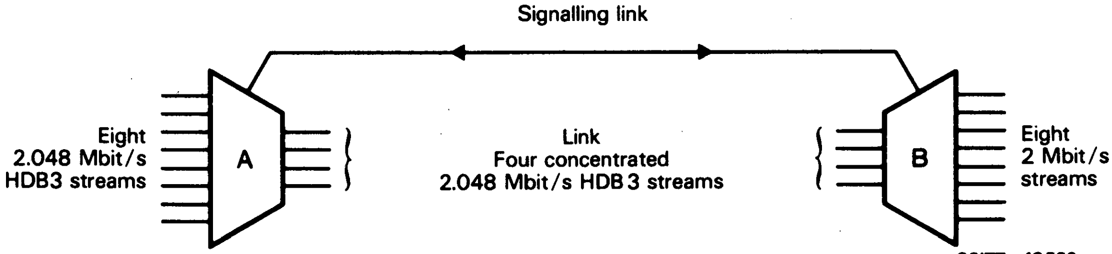

FIGURE 1

1.2 *Summary description of CELTIC*

The incoming PCM streams are synchronized and then multiplexed (possibly with a jump or doubling of the PCM frame, if the clocks of the incoming PCM streams are not synchronous).

The signal is then sent to a speeh detector unit and to a delay line (see Figure 2).

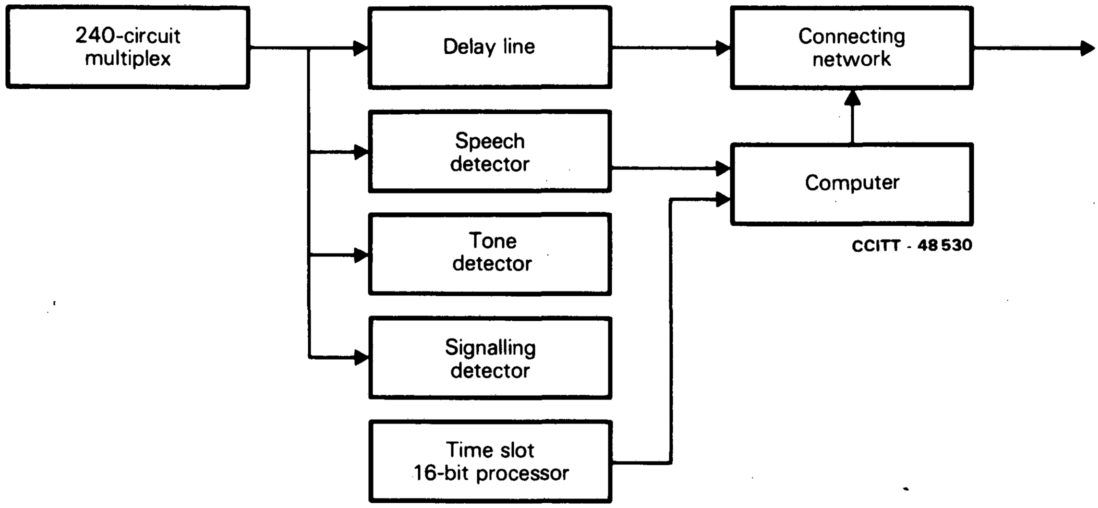

FIGURE 2

1.2.1 *Delay line*

The delay line is used to offset delay due to the decision time of the speech detector, the answering time of the computer (search for an available channel and its assignment to an active circuit) and the processing time taken by the CELTIC signalling unit to set up the connecting message. The delay line is the same for all circuits (adjustable from 0 to 32 ms). Its nominal value is *32 ms.*

This delay line may be cancelled circuit by circuit.

1.2.2 *Speech detector*

- In the CELTIC 1G system, the speech detector has two hangover times:
  Short hangover: 50 ms (speech duration less than 50 ms)
  Long hangover: 180 ms (speech duration more than 50 ms).
- In the CELTIC 2G system, there will be only one hangover of 120 ms. The speech detector will be adapted to noise in a range between −40 and −55 dBm0.

The decision time of the speech detector varies according to the nature of the signal (between approximately 2 and 12 ms). The decision criteria are constituted mainly by the amplitude of the signal, but also by the presence of sibilants in the speech.

The speech detector takes into account the speech level in the receiving channel: a positive decision is given only if the level of the sample of transmitted speech is higher than the level in the receiving channel.

In the CELTIC 2G system, the speech detector is backed up by a *signalling detector*: when a signalling frequency is recognized, this detector suppresses the return channel protection and where necessary the delay line and disables the echo suppressors which may be integrated in CELTIC. This signalling detector reacts quickly and is adapted to the signalling pulses in the band (signal shape criterion).

The speech detector is associated with a *2100 Hz* tone detector (data transmission).

Tone detection suppresses *return channel protection,* effects *circuit-channel locking* and suppresses *the delay line of the circuit concerned.*

1.2.3 *Processing of TS-16 bits*

CELTIC contains a device for taking out the significant bits of the TS 16 (a, b, c) in the transmitting direction and reinserting them in the receiving direction.

This device has two functions:

- transmitting direction: it detects changes in the state of the significant bits of the TS 16 and informs the computer.
- receiving direction: it can modify one or more bits of the TS 16 according to information provided by the computer (command to block junctor or to disable echo suppressor).

1.2.4 *Echo suppressor*

An echo suppressor multiplexed on 240 circuits is provided with CELTIC, if desired (an inexpensive addition).

In this case, the echo suppressor should be disabled on a telephone signalling phased circuit (one of the purposes of the above mentioned signalling detector).

Note – The 32 ms delay introduced by CELTIC in any case necessitates the use of echo suppressors on all circuits.

1.3 *Links between CELTIC and the transit centre*

There are four types of link:

- speech links,
- signalling links,
- links for circuit blocking command,
- links for echo protection disabling command, where necessary.

The number and nature of the links depend on the operational conditions of CELTIC:

- nature of transit centre,
- signalling system (CCITT Nos. 4, 5 and 6, R1 or R2),
- position of CELTIC in relation to the transit centre,
- position of echo suppressors in relation to signalling sets.

Circuit blocking is requested circuit by circuit or for 30 circuits common to the same PCM, in case of alarm, in case of gradual stopping of the CELTIC or in case of dynamic load control.

1.4 *Operation of CELTIC with different types of signalling*

1.4.1 *Signalling System No. 4*

The 32 ms delay introduced by CELTIC necessitates the use of echo suppressors, which must be disabled if they are below the signalling sets in the signalling sequence (echo suppressors integrated in CELTIC). Pulse bridging would lead to a prohibitive hangover time.

Adoption of a *fixed hangover time of 120 ms* for the speech detector will lead to a lower concentration rate, by preventing the CELTIC from operating in "freeze-out", in order to limit the number of unsuccessful calls.

1.4.2 *Signalling System No. 5*

A hangover of 120 ms is suitable for this type of signalling. The signalling detector disables echo protection where necessary.

1.4.3 *Signalling System No. 6*

The echo suppressors are disabled during the continuity test. No particular problems.

1.4.4 *Signalling System R2*

In the digital version, line signalling is transmitted by 2 bits of the TS 16:

The CELTIC 2G system examines these bits and transmits through the CELTIC signalling channel to the other end *any change in the state of these bits*, circuit by circuit.

The echo suppressors and the action of the delay line are disabled during the register signalling sequence (action of signalling detector).

1.4.5 *Conclusion*

The presence of delay lines implies systematic provision of echo suppressors. A single hangover time of about 120 ms in the speech detector will suffice, with a limitation for System No. 4, which requires a lower freeze-out rate.

2 DSI characteristics

The INTELSAT 120 Mbit/s time division multiple access (TDMA) system incorporates the use of digital speech interpolation (DSI). The TDMA/DSI system will be used with Intelsat V and post-Intelsat V satellites operating in 80-MHz hemisphere and zone beam transponders and will provide high quality service in accordance with CCIR Recommendation 522 [1].

The DSI system increases the capacity of the TDMA system by interleaving speech bursts from different terrestrial channels on the same satellite channel. Inputs to the DSI module are digitally encoded in accordance with Recommendation G.711 [2] using encoding referred to as "A-law" with alternate digit inversion.

The system is transparent to in-band Signalling System No. 5 and the speech detector hangover time is such as to avoid disconnection of the link between successive signalling packets.

Competitive clipping (of speech bursts) lasting more than 50 ms occurs on less than 2% of the voice spurts. This is made possible in part by appropriating (or stealing) the least significant bit (8th bit) of satellite channels to create overload channels when all normal satellite channels are in use.

A complete description of the INTELSAT TDMA/DSI system may be found in the INTELSAT document BG-42-65 [3].

3 TASI characteristics affecting signalling

3.1 During a normal telephone conversation each party usually speaks for only about 40% of the time (speech activity), 60% of his channel time being idle. TASI (Time Assignment Speech Interpolation) is an equipment which rapidly switches channels to talkers on a time-shared basis to make use of the otherwise idle channel time and thus permits a greater number of simultaneous calls than would otherwise be possible with the available channels in the cable.

TASI interpolates to associate an interchange circuit with a transmission channel when speech is detected on a circuit at one end and is required to be transmitted, over a channel, to the same circuit at the other end. Depending upon the need, circuit/channel association ceases, and the channel is made available to other circuits when the cessation of a burst of speech is detected.

When speech begins and a channel is available, but not yet associated, a time (the initial clip) elapses before detection of the speech (or signal) by the TASI speech detector and circuit/channel association at each end. Should the TASI system be heavily loaded, a channel may not be immediately available. In this situation a time (extended clip) in addition to the initial clip elapses before circuit/channel association.

To reduce the number of times clipping occurs, the TASI speech detector is given a hangover, maintaining circuit/channel association, to bridge the shorter gaps in speech, and thus reduce the interpolation. This feature permits the transmission of a sequence of short-pulse short-gap signals without signal clipping.

As signals must be detected by the TASI speech detector before transmission over the TASI system and as the total clip (initial clip + extended clip) reduces the duration of the received signal, TASI affects signalling.

3.2 There are three TASI systems in service. TASI-A and TASI-B make use of analogue – time division switching matrices while TASI-E uses a digital, time division matrix. Circuits can be connected directly from a digital switch to the TASI-E in digital format. A primary multiplex per Recommendation G.733 [4] must be placed between an analogue switch and the TASI-E to provide the conversion to PCM digital format. If the outgoing transmission channels are analogue, a primary multiplex per Recommendation G.733 must be placed between the TASI-E equipment and the analogue channels. TASI-E is designed to work with Signalling System No. 5 using the standard in-band line signalling, and of course with System Nos. 6 and 7 circuits. The continuous energy Signalling System R1 line signalling on each circuit is detected by the TASI-E terminal and then sent to the distant TASI-E terminal over the internal data links.

Clipping has been reduced in TASI-E by putting 50 ms fixed delay in each direction in the circuits so that processing and circuit/channel connections can be made while the inband signals are still in the delay circuits. The initial clip is thus eliminated and the extended clip reduced by about 20 ms.

3.3 The characteristics of TASI affecting signalling may be summarized as follows: TASI-A, TASI-B and TASI-E have similar characteristics except where noted:

3.3.1 TASI-A speech detector sensitivity; −40 dBm0.

TASI-B speech detector sensitivity: usually −36 dBm0 although it does change to −28 dBm0 if input level remains higher than −20 dBm0 in excess of 200 milliseconds. The TASI-E speech detector is made up of the basic speech detector, which adapts to the average speech level and background noise, and signalling-by-pass circuits which detect the presence of moderate level MF frequencies and provide extended hangover time to bridge the gaps between pulses.

3.3.2 To minimize speech activity on the RETURN channel due to reflection from the GO channel. The TASI speech detector on the RETURN channel is reduced in sensitivity in the presence of speech on the GO channel. This also applies to signalling. Thus in situations where simultaneous forward and backward signalling is required, the level of the backward signalling must be such as to take account of a reduction in the sensitivity of the speech detector at the end receiving the forward signal. TASI-A sensitivity may be reduced to as little as −25 dBm0. TASI-B sensitivity to −28 dBm0. In TASI-E the basic speech detector has echo protection but the signalling-by-pass circuits do not, thus allowing simultaneous signalling in both directions.

3.3.3 Nominal duration of speech detector hangover for a single burst:

TASI-A

a) 50 ms for input signals of 50 ms or less;

b) 240 ms for input signals greater than 50 ms;

TASI-B

c) 10 ms plus burst length for burst lengths up to 40 ms;

d) 180 ms for burst lengths greater than 40 ms.

TASI-E

e) 128 ms for input signals greater than −19 dBm0;

f) 88 ms for input signals between −19 and −25 dBm0;

g) 16 ms for input signals less than −25 dBm0.

3.3.4 Nominal duration of clip of a signal (including the 5 ms response time of the TASI-A or TASI-B speech detector):

a) initial clip: 18 ms;

b) total clip when TASI-A or TASI-B is heavily loaded and a free channel is not immediately available, expressed as a probability that a signal will be clipped for a certain time or longer: see Table 1.

TABLE 1

Total clip	Number of TASI-A or TASI-B systems in series on one circuit		
	1	2	3
125 ms	1/100	1/20	1/10
250 ms	1/700	1/140	1/60
500 ms	1/15 000	1/5000	1/1500

A total clip of 500 ms was assumed for the System No. 5 design, and the duration (850 ± 200 ms) of the forward-transfer pulse line signal concerned includes a 500-ms TASI prefix for TASI circuit/channel association.

3.3.5 For multiple pulses of short duration, a maximum duration of gaps between short-pulse signals has been determined to maintain continuous operation of the speech detector and thus continuous circuit/channel association. For TASI-A the maximum allowable duration of the gaps is twice the pulse duration over the pulse range 10 to 60 ms and over the operate level range of the speech detector.

This assumes prior energizing of the speech detector to give the 240 ms hangover [see § 3.3.3 b) above] before the short-pulse short-gap signalling is applied. Since TASI-A is more critical than either TASI-B or TASI-E in this respect, a short pulse signalling system designed to work properly over TASI-A circuits will also work properly over TASI-B or TASI-E circuits. For TASI-B prior energizing of the speech detector will give 180 ms hangover initially. The hangover for successive pulses will depend on the length of the pulse as given in §§ 3.3.3 c) and d). The hangover for TASI-E will depends on the level of the signal which energized the speech detector and will be up to 128 ms for the range of signalling frequency levels as shown in §§ 3.3.3 e) to g).

The register short-pulse short-gap multifrequency signalling adopted for the System No. 5 takes advantage of this continued speech detector operation and is transmitted without a TASI prefix, reliance being placed on the circuit/channel association due to the seizing signal.

References

[1] CCIR Recommendation *Allowable bit error rates at the output of the hyperthetical reference circuit for systems in the fixed satellite service using pulse-code modulation for telephony*, Vol. IV, Rec. 522, ITU, Geneva, 1978.

[2] CCITT Recommendation *Pulse code modulation (PCM) of voice frequencies*, Vol. III, Fascicle III.3, Rec. G.711.

[3] INTELSAT document, No. BG-42-65.

[4] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Fascicle III.3, Rec. G.733.

INFORMATION RECEIVED ON NATIONAL VOICE-FREQUENCY SIGNALLING SYSTEMS

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Spliting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Algeria	2000	± 6	± 12	15 then 35 with attenuated 18 dB	−5
Saudi Arabia	3825	± 3	± 5	–	−5
Argentina	3825	± 4	± 10	–	−5
Australia	600-750 separate	± 5	± 15	160-210	0
Austria	2280	± 6	± 15	30	−6
Bahamas	2600	± 5	± 10	35 maximum	−8 and after attenuation −20
Bangladesh	3825	± 5	–	28-55	–
Belgium	3825	± 4	± 6	30	−5, and −20, after attenuation
Benin	700-1700 separete 200	± 10	± 10	50	−6
Botswana	3825	± 3	± 10	25	−5
Brazil	3825	± 3	± 6	30 maximum	−5
Brunei	3825 1380-1500 1620-1740 1860-1980 1140-1020 900-780 660-540	± 4 ± 4	± 6 ± 10	– –	In agreement with Recommendations Q.414, Q.415, Q.452, Q.454
Burundi	3825	± 6	± 15	–	−6
Cameroun	3825	± 4	± 15	–	−5 and after attenuation −20
Canada	2600	± 5	± 10	30 maximum	−8 and after attenuation −20
Chile	3825	± 4	± 10	–	−18 or −20
China	2600	± 5	–	30-50	−8

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Spliting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Cyprus	3825	± 3	± 8	–	–6 –18
Colombia	3825	± 4	± 4	40 ± 10	–20
Comoros	3825	± 5	–	–	–20
Congo	3825	± 4	–	20	–20
Korea (Rep. of)	3825	± 10	± 10	–	–15
Costa Rica	3825	± 4	± 10	–	–20
Cuba	3825	± 6	± 15	25	–5
Denmark	3000 3825	± 6 ± 4	± 10 ± 6	30 à 50 –	–8 –20
Dominican (Rep.)	2600	–	–	–	–
Egypt	3825	± 3	± 10	20-50	–6 –18 –20
United Arab Emirates	3825 700, 900, 1100, 1300, 1500, 1700, 2400, 2600	± 3 ± 6	± 15	30-50	Regist. sign. –7 Line sign. –9
Ecuador	3825	± 4	± 6	40 ± 10	–20
Spain	2500	± 3	± 15	10	–6
United States of America	2600	± 5	± 10	30 maximum	–8 and after attenuation –20
Fiji	3825	± 3	–	–	–20
Finland	3825	± 5	± 5	30-50	–18 –20
France	2280	± 3	± 6	35	–6
Gabon	3825	± 4	± 15	15	–8 and –20 after attenuation
Ghana	3825	± 3	–	–	–5

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Spliting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Guatemala	3825	± 4	± 4	–	−20
Guinea-Bissau	3800	± 3	–	15	−6
Hungary	2100 or 2280 3825	± 6 ± 6	± 15 ± 15	25 25	−6 −6 −20
India	2400	± 2	± 10	25 filter loss at 2400 Hz → 50 dBm	−10
Indonesia	3825	± 4	± 15	30	−8 ± 1
Iran	3825	± 4	± 6	35	−5 ± 1
Iraq	3825	± 5	–	–	−18
Ireland	3825	± 4	–	–	−20
Israel	3850 550-1980	± 4 ± 4	± 6 ± 10	–	−5 −11.5 ± 1
Italy	2040-2400 separate and compound	± 6	± 15	35	−9
Jamaica	2600	± 5	± 15	35 maximum	−8 and after attenuation −20
Jordan	3825	± 3	–	10	−18 −20
Kenya	3825	± 6	–	–	−6 and after attenuation −20
Lesotho	3825	± 5	± 10	–	−5
Liberia	3825	± 5	–	–	−6
Luxembourg	3825	± 3	± 5	35-40	−5
Madagascar	2280	± 3	± 6	35	−6
Malta	3825 3825	± 10 ± 1	– –	– –	−18 −18
Morocco	2280	± 3	± 10	25-35	−6

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Spliting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Mexico	2400 2600	± 6 ± 5	± 15 ± 15	35 20	−6 −8 and after attenuation −20
Mozambique	3825	± 4	± 4	40 maximum	−5 and after attenuation −20
New Zealand	600-750 2280 3825	± 3 ± 6 ± 4	± 3 ± 6 ± 4	140 maximum 35 maximum –	−3 −10 −20
Oman	3825	± 5	–	10	−6 and after attenuation −18
Uganda	2040-2400	± 6	–	30-40	−9
Pakistan	3825	± 3	–	–	−5 −20
Panama	3825	± 4	± 10	90	−20
Paraguay	3825	± 4	–	–	−5
Peru	3825 1380-1500 1620-1740 1860 1140-1020 900-780 660	± 4 ± 4 ± 4	± 6 ± 6 ± 10	– – –	In agreement with Recommendations Q.414 [1] Q.415 [2] Q.452 [3] Q.454 [4]
Philippines	2600(*) 3825 (*) This frequency will not be used in the future	± 5 ± 3	± 10 ± 15	40 ± 10 20	−8, −20 −14 and after attenuation +9
Poland	2280 3825 500/20 2100	± 6 ± 3 ± 10 ± 3	± 8 ± 4 ± 20 ± 10	– – – –	−6 −5 −3 −6
Portugal	3825 1380-1500 1620-1740 1860-1920 1140-1020 900-780	± 5 } ± 4 } ± 10	± 15 In agreement with Recommendations Q.451 and Q.455	30-50	−18 In agreement with Recommendations Q.454 and Q.455
Syria	3825	± 3	–	50	−18

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Spliting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Dem. People's Rep. of Korea	2600 3825 2100	± 5 ± 4	± 15	35	−8
Romania	3825 or 2280	± 4	–	–	−6
United Kingdom	2280	± 7	–	20-35	−6 ± 1
Rwanda	3825	± 4	Between ± 6 and ± 10	30-50	−16 ± 1 et −7 ± 0.5
Sao Tome and Principe	2600 2400	± 30	–	20	−2,2
South Africa (Rep.)	3825 2280	± 1 ± 5	– –	– 35 maximum	−5 −6
Sweden	2400	± 6	± 11	35-40	−6
Switzerland	3000	± 6	± 2	40	−3,5
Surinam	3825 1380-1500 1620-1740 1860-1980 1140-1020 900-780 660-540	± 0.8	± 10	–	−18 after attenuation In agreement with Recommendations Q.452 to Q.454
Swaziland	3825	± 0.5	–	–	−6 and −20 −5 and −18
Tanzania	3825	± 6	–	–	−6 and after attenuation −20
Czechoslavakia	2280	± 6	± 15	150 then 130 with filter	−6
Thailand	3825	± 5	± 6	30-50	−6
Togo	3825 1380-1500 1620-1740 1860-1920 1140-1020 900-780 660-540	+ 5 + 4 + 4 + 4 + 4 + 4 + 4	± 10 ± 10	40-50 40-50	In agreement with Recommendations Q.414 Q.415 Q.452 Q.454
Tunisia	2400	± 6	± 15	40 maximum	−6

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Spliting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
USSR	1200-1600 separate and compound 2600	± 5 ± 6	± 15 ± 15	40 maximum before reply, 150 ± 50 after reply 50-75	−9 −9.5
Uruguay	3825	± 3	± 40	20	−18
Venezuela	3825	± 2	± 2	–	−6 −18
Viet Nam	3825	± 6	± 25	–	−6
Yugoslavia	2280 3825	± 6 ± 6	– –	– –	−6 −5
Zambia	3825	± 3	± 3	30-50	−20

References

[1] CCITT Recommendation *Signal sender,* Vol. VI, Fascicle VI.4, Rec. Q.414.

[2] CCITT Recommendation *Signal receiver,* Vol. VI, Fascicle VI.4, Rec. Q.415.

[3] CCITT Recommendation *Requirements relating to transmission conditions,* Vol. VI, Fascicle VI.4, Rec. Q.452.

[4] CCITT Recommendation *The sending part of the multifrequency signalling equipment,* Vol. VI, Fascicle VI.4, Rec. Q.454.

Supplement No. 4

VARIOUS TONES USED IN NATIONAL NETWORKS

(For this Supplement, see Supplement No. 2 of Fascicle II.2)

Supplement No. 5

NORTH AMERICAN PRECISE AUDIBLE TONE PLAN

(For this Supplement, see Supplement No. 3 of Fascicle II.2)

Supplement No. 6

TREATMENT OF CALLS CONSIDERED AS "TERMINATING ABNORMALLY"

(For this Supplement, see Supplement No. 4 of Fascicle II.2)

Supplement No. 7

MEASUREMENTS OF IMPULSIVE NOISE IN A 4-WIRE TELEPHONE EXCHANGE

(For this Supplement, see Supplement No. 7 in Volume VI-4 of the *Green Book*)

Supplement No. 8

SIGNALLING FOR DEMAND ASSIGNMENT SATELLITE SYSTEMS

(For this Supplement, see Supplement No. 8 in Volume VI-4 of the *Green Book*)

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