INTERNATIONAL TELECOMMUNICATION UNION

CCITT Q.85

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN

STAGE 2 DESCRIPTION FOR COMMUNITY OF INTEREST SUPPLEMENTARY SERVICES

SECTION 1 – CLOSED USER GROUP (CUG)
SECTION 3 – MULTI-LEVEL PRECEDENCE AND PREEMPTION (MLPP) (rev.1)

Modifications and addenda to: Recommendation Q.85

Geneva, 1992

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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Recommendation Q.85, §§ 1 and 3 was prepared by Study Group XI and was approved under the Resolution No. 2 procedure on the 4th of February 1992.

CCITT NOTE

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

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Recommendation Q.85

STAGE 2 DESCRIPTION FOR COMMUNITY OF INTEREST SUPPLEMENTARY SERVICES

1 Closed User Group (CUG)

1.1 *Scope*

This Recommendation defines the stage 2 of the integrated services digital network (ISDN) as provided by telecommunications operators for the Closed User Group (CUG) supplementary service. Stage 2 identifies the functional capabilities and the information flows needed to support the service description. The Stage 2 description also identifies user operations not directly associated with a call (see Recommendation I.130 [1]).

This Recommendation is specified according to the methodology specified in Recommendation Q.65 [2].

This Recommendation does not formally describe the relationship between this supplementary service and the basic call, but where possible, this information is included for guidance.

In addition, this Recommendation does not specify the requirements where the service is provided to the user via a private ISDN. This Recommendation does not specify the requirements for the allocation of defined functional entities within a private ISDN, it does however, define which functional entities may be allocated to a private ISDN.

This Recommendation does not specify the additional requirements where the service is provided to the user via a telecommunications network that is not an ISDN.

The CUG supplementary service enables users to form groups to and from which access is restricted. A specific user may be a member of one or more closed user groups. Members of a specific Closed User Group can communicate among themselves but not, in general, with users outside the group.

The CUG supplementary service is applicable to all telecommunication services.

This Recommendation is applicable to the stage 3 Recommendations for the ISDN CUG supplementary service. The term “stage 3” is also defined in Recommendation I.130 [1].

1.2 *References*

This Recommendation incorporates by dated or undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this Recommendation only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] CCITT Rec. I.130 — *Methods for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN*, 1988.

[2] CCITT Rec. Q.65 — *Stage 2 of the method for the characterization of services supported by an ISDN*, 1988.

[3] CCITT Rec. I.112 — *Vocabulary of terms for ISDNs*, 1988.

[4] CCITT Rec. Q.71[1)] — *ISDN 64 kbit/s circuit mode switched bearer services*, 1988.

[5] CCITT Rec. I.255.1 — *Closed User Group*.

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1) Recommendation Q.71 will be submitted for approval at the CCITT Plenary Assembly in March, 1993.

[6] CCITT Rec. I.210 — *Principles of telecommunication services supported by an ISDN and the means used to describe them*, 1988.

[7] CCITT Rec. Q.950 — *Supplementary services protocols — Structure and general principles*.

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

[9] CCITT Rec. Q.763.— *Specifications of Signalling System No. 7 — Formats and codes*.

1.3 *Definitions*

For the purposes of this Recommendation, the following definitions apply:

Integrated services digital network (ISDN)

See Recommendation I.112 [3], § 2.3, definition 308.

Service, telecommunications service

See Recommendation I.112 [3], § 2.2, definition 201.

Supplementary service

See Recommendation I.210 [6], § 2.4.

Closed User Group

Grouping of users with common availability requirements.

preferential CUG

A preferential Closed User Group is the nominated default group to be used when no Closed User Group or explicit outgoing access request is received by the network.

incoming access

An arrangement which allows a member of a Closed User Group to receive calls from outside the Closed User Group.

outgoing access

An arrangement which allows a member of a Closed User Group to place calls outside the Closed User Group.

incoming calls barred within a Closed User Group

An access restriction that prevents a Closed User Group member from receiving calls from other members of that group.

outgoing calls barred within a Closed User Group

An access restriction that prevents a Closed User Group member from placing calls to other members of that group.

Closed User Group call

A call is a call which is restricted to a pre-defined group of users.

CUG domain

An area of common CUG interlock codes.

The domain internal CUG interlock codes need not be released via the boundary of the domain.

A Closed User Group application may span over several domains. Both domains shall treat the other domain's Closed User Group as a single member of its own Closed User Group.

1.4 *Symbols and abbreviations*

CC Call Control

CCA Call control agent

CUG Closed User Group

DB Data base

FE Functional entity

FEA Functional entity actions

IA Incoming access

ICB Incoming calls barred

IIC Incoming international centre

ISDN Integrated services digital network

LE Local exchange

OA Outgoing access

OCB Outgoing calls barred

OIC Outgoing international centre

PCUG Preferential CUG

PN Private network

TE Terminal equipment

1.5 *Description*

The general description of the CUG supplementary service is specified in Recommendation I.255.1 [5].

1.6 *Derivation of the functional model*

1.6.1 *Functional model description*

The functional model for the CUG supplementary service shall be as shown in Figures 1-1/Q.85 and 1-2/Q.85.

The functional model for the application of the CUG supplementary service within a single CUG domain shall be as shown in Figure 1-1/Q.85.

The expanded functional model used for interworking between CUG domains shall be as shown in Figure 1-2/Q.85.

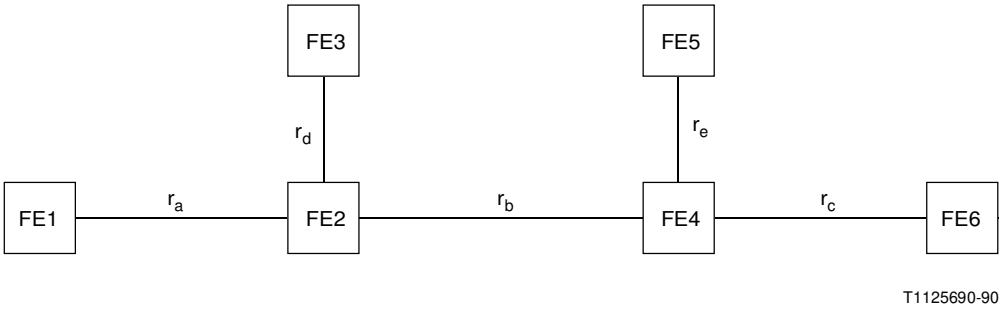


FIGURE 1-1/Q.85

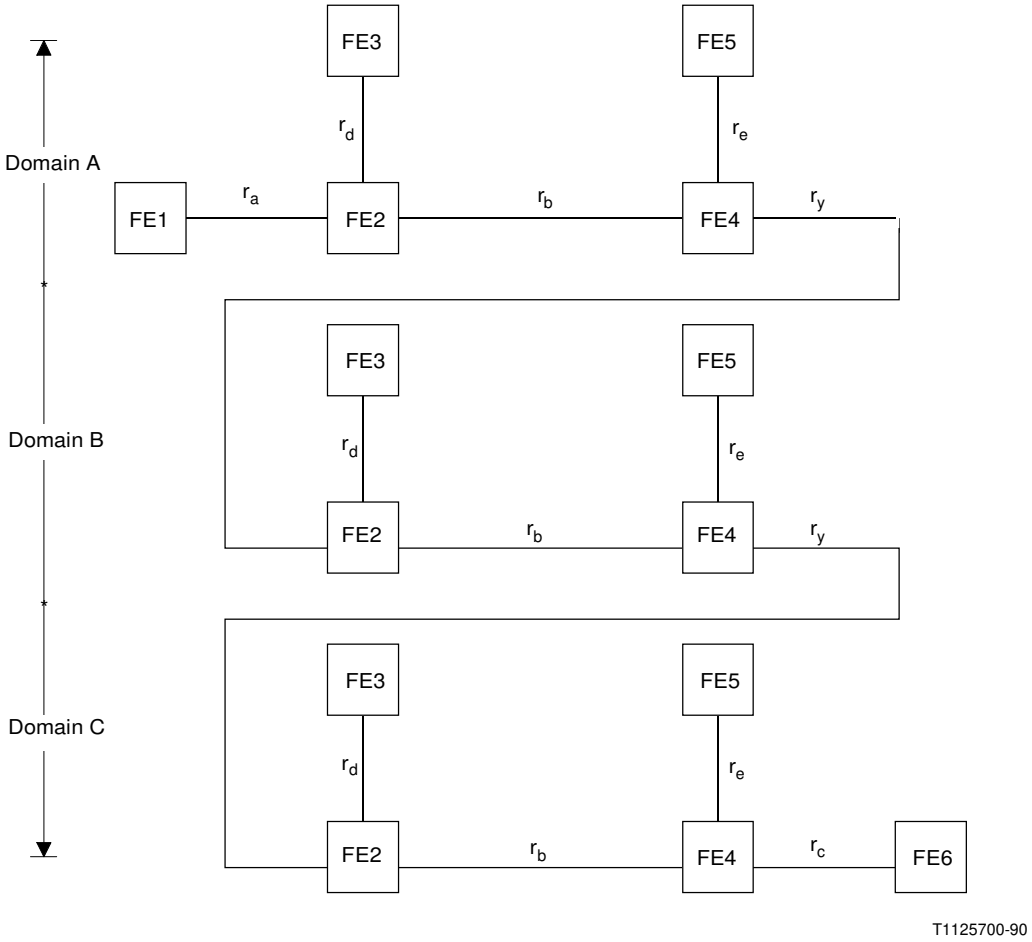


FIGURE 1-2/Q.85

Expanded functional model

1.6.2 *Description of the functional entities*

The functional entities for the CUG supplementary service shall be as shown below:

FE1 Originating CUG agent

FE2 Outgoing CUG determination

FE3 Outgoing CUG control

FE4 Incoming CUG determination

FE5 Incoming CUG control

FE6 Destination CUG agent

1.6.3 *Relationship with a basic service*

The relationship of the functional model for the CUG supplementary service with a basic call may be as shown in Figure 1-3/Q.85.

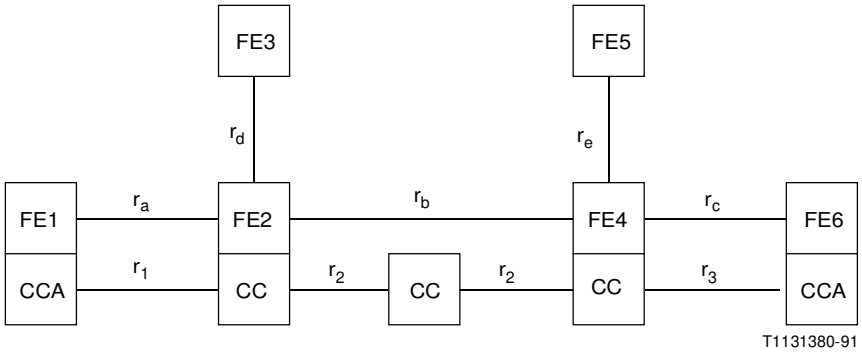


FIGURE 1-3/Q.85

Relationship of the model to a basic call

1.7 *Information flows*

1.7.1 *Information flow diagrams*

The information flows for the CUG supplementary services shall be as shown in Figures 1-4/Q.85 to 1-8/Q.85. Figures 1-5/Q.85 and 1-8/Q.85 show a portion of the flows appropriate to a call across multiple domains.

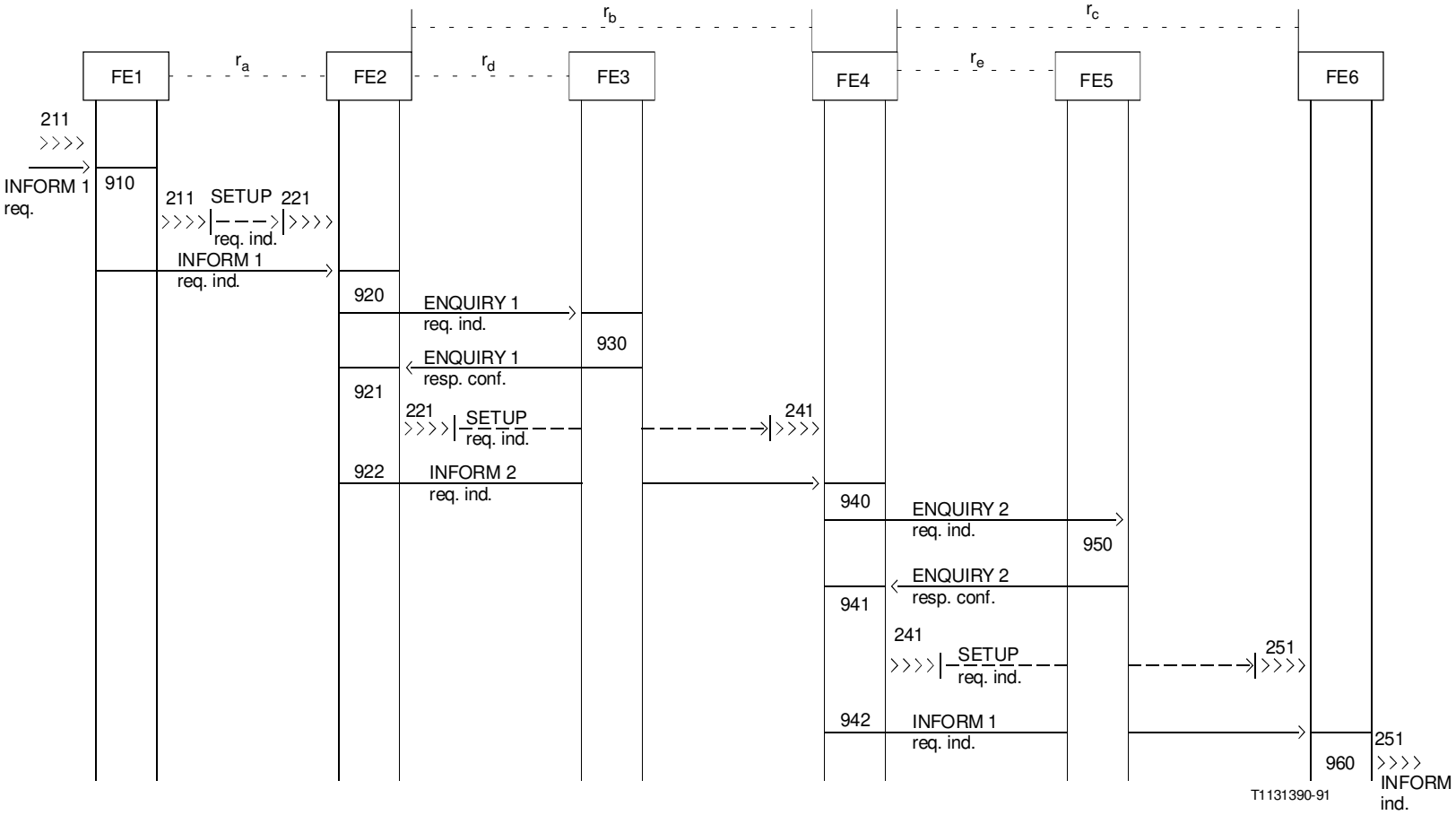
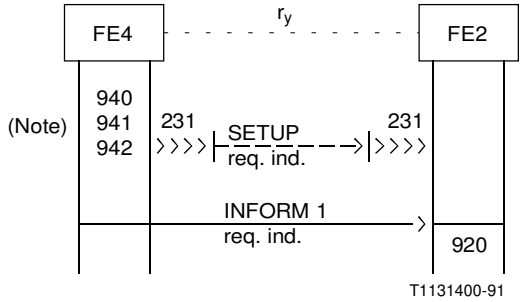


FIGURE 1-4/Q.85

Successful CUG calls own domain

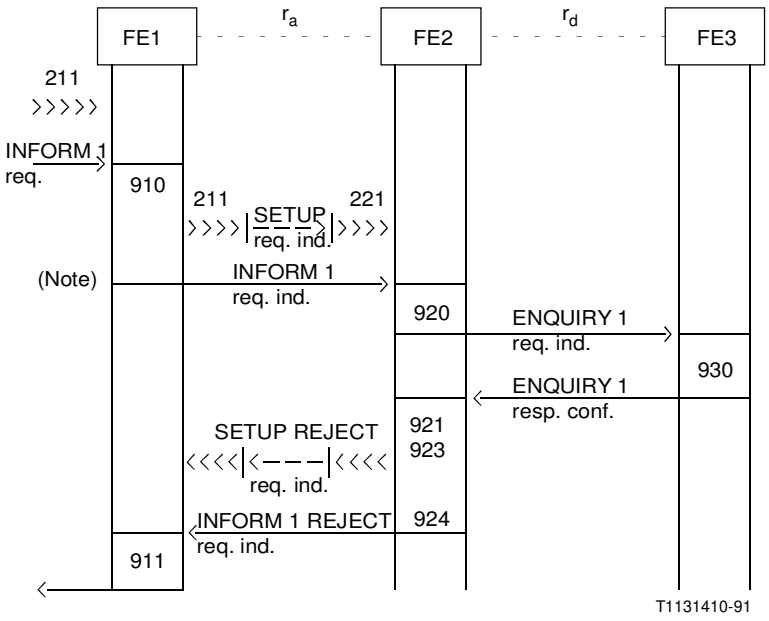


Note – Call to this point is covered in Figure 1-4/Q.85.

FIGURE 1-5/Q.85

Chaining of CUG domains

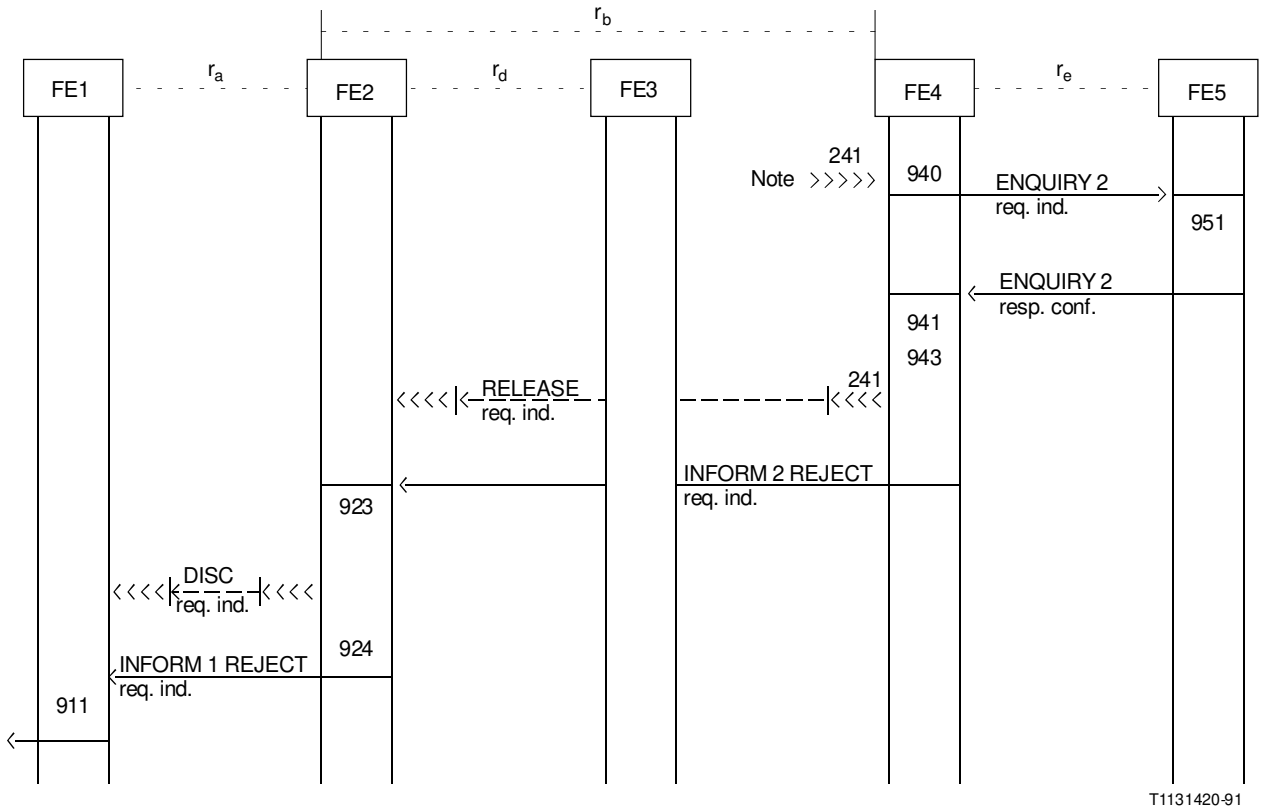
(Successful CUG calls between different CUG domains showing information flows across relationship r according to the functional model in Figure 1-2/Q.85.)



Note – Depending on the progress of the basic call INFORM 1 REJECT will be sent simultaneously with the appropriate basic call clearing information flow.

FIGURE 1-6/Q.85

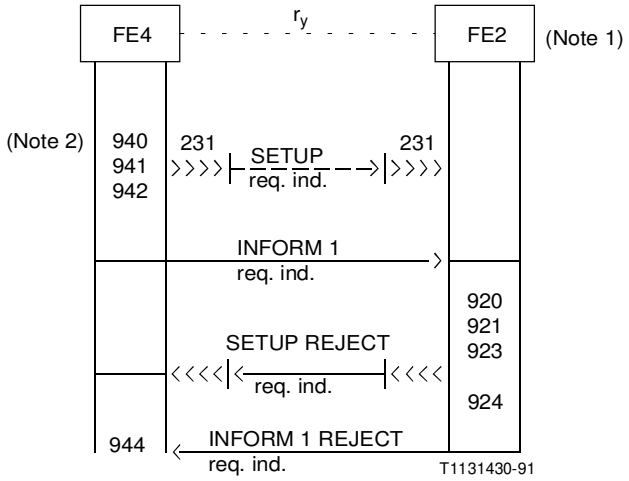
Unsuccessful CUG calls – Case 1 own CUG domains



Note – Call to this point is covered in Figure 1-4/Q.85.

FIGURE 1-7/Q.85

Unsuccessful CUG calls – Case 2 own CUG domain



Note 1 – Call to this point is covered in Figure 1-4/Q.85.
Note 2 – Depending on the progress of the basic call INFORM 1 REJECT will be sent simultaneously with the appropriate basic call clearing information flow.

FIGURE 1-8/Q.85

Chaining of CUG domains

(Unsuccessful CUG calls between different CUG domains showing information flows across relationship r_y according to the functional model in Figure 1-2/Q.85.)

1.7.2 *Definition of individual information flows*

1.7.2.1 *Relationship r_a*

1.7.2.1.1 *Contents of INFORM 1*

The contents of INFORM 1 shall be as in Table 1-1/Q.85. INFORM 1 is an optional information flow.

TABLE 1-1/Q.85

INFORM 1 contents

Name	req. ind.	Allowed value
CUG index	optional	
OA indication	optional	ON OFF

1.7.2.1.2 *Contents of INFORM 1 REJECT*

The contents of INFORM 1 REJECT shall be as in Table 1-2/Q.85.

TABLE 1-2/Q.85

INFORM 1 REJECT contents

Name	req. ind.	Allowed value
CUG specific reason	Mandatory	(Note)

Note – For allowed values, see Recommendation Q.950 [7].

1.7.2.2 *Relationship r_b*

1.7.2.2.1 *Contents of INFORM 2*

The contents of INFORM 2 shall be as in Table 1-3/Q.85. INFORM 2 at r_b is an optional information flow.

TABLE 1-3/Q.85

INFORM 2 contents

Name	req. ind.	Allowed value
CUG interlock code OA indication	Mandatory (Note 1) Optional	(Note 2) ON OFF

Note 1 – Where the INFORM 2 information flow crosses an international gateway, the CUG interlock code shall be an international CUG interlock code.

Note 2 – As specified in § 3.13 of Recommendation Q.763 [9].

1.7.2.2.2 *Contents of INFORM 2 REJECT*

The contents of INFORM 2 REJECT shall be as in Table 1-4/Q.85.

TABLE 1-4/Q.85

INFORM 2 REJECT contents

Name	req. ind.	Allowed value
CUG specific reason	Mandatory	(Note)

Note – For allowed values, see Recommendation Q.950 [7].

1.7.2.3 *Relationship r_c*

INFORM 1, see § 1.7.2.1.1.

INFORM 1 REJ, see § 1.7.2.1.2.

1.7.2.4 *Relationship r_d*

1.7.2.4.1 *Contents of ENQUIRY 1*

The contents of ENQUIRY 1 shall be as in Tables 1-5/Q.85 and 1-6/Q.85.

TABLE 1-5/Q.85

ENQUIRY 1 contents

Name	req. ind.	Allowed value
Calling party number (Note 1)	Mandatory	(Note 2)
Basic service	Mandatory	(Note 2)
CUG index	Optional	
OA indication	Optional	ON OFF

Note 1 – FE2 may send the ENQUIRY to FE3 as soon as sufficient addressing information to identify the access can be included.

Note 2 – The values are derived from the original call set-up request. For allowed values see Recommendation Q.931 [8].

The result shall be one of the following values:

TABLE 1-6/Q.85

Name	resp. conf.	Allowed value
Non-CUG	Optional	
CUG interlock code	Optional	(Note 3)
Reject reason	Optional	(Note 2)
CUG interlock code and OA indication	Optional	(Notes 3 and 4)

Note 1 – The information elements above shall be mutually exclusive.

Note 2 – For allowed values see Recommendation Q.950 [7].

Note 3 – As specified in § 3.13 of Recommendation Q.763 [9].

Note 4 – National option.

1.7.2.5 *Relationship r_e*

1.7.2.5.1 *Contents of ENQUIRY 2*

The contents of ENQUIRY 2 shall be as in Tables 1-7/Q.85 and 1-8/Q.85.

TABLE 1-7/Q.85

ENQUIRY 2 contents

Name	req. ind	Allowed value
Called party number (Note 2)	Mandatory	(Note 3)
Basic service	Mandatory	(Note 3)
CUG interlock code (Note 1)	Optional	(Note 4)
Non-CUG	Optional	
OA indication (Note 1)	Optional	(Note 4)

Note 1 — A combination CUG interlock code with OA indication shall be supported.

Note 2 — FE4 may send the ENQUIRY to FE5 as soon as sufficient addressing information to identify the access can be included

Note 3 — The values are derived from the received call set-up request. For allowed values see Recommendation Q.931 [8].

Note 4 — As specified in § 3.13 of Recommendation Q.763 [9].

The result shall be one of the following values:

TABLE 1-8/Q.85

Name	resp. conf.	Allowed value
Non-CUG	Optional	
CUG index	Optional	
OA indication	Optional	
Reject reason	Optional	(Note 2)

Note 1 – resp. conf. conveying the combination CUG index with OA indication may be supported as a national option.

Note 2 – For allowed values, see Recommendation Q.950 [7].

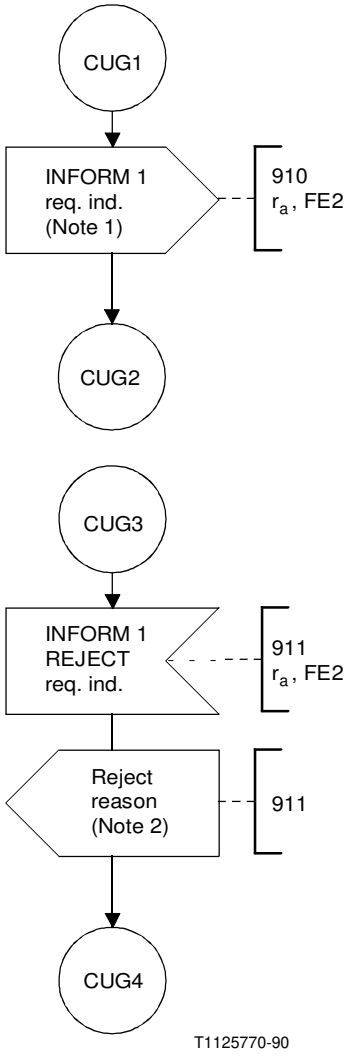
1.7.2.6 *Relationship r_y*

This relationship appears to be an r_c relationship to FE4 and an r_a relationship to FE2.

INFORM 1, see § 1.7.2.1.1.

INFORM 1 REJECT, see § 1.7.2.1.2.

At this relationship the CUG index is mandatory.



Note 1 – This INFORM 1 req. ind. shall be sent simultaneously with the basic call SETUP req. ind.

Note 2 – The INFORM 1 REJECT will be processed together with the basic call clearing information flows.

Note 3 – CUG1 and CUG2 break the base call between connector S1/1 and S1/2 of Recommendation Q.71 [4].

Note 4 – CUG3 and CUG4 break the basic call transition during the CCA state "Call sent" or "Wait for further digits" or "Wait for SETUP resp. conf." prior to the accept of SETUP resp. conf. after the receipt of SETUP REJECT req. ind., DISCONNECT req. ind. (FE411), RELEASE req. ind. (see Figure A-1/Q.71 of Recommendation Q.71 [4]).

FIGURE 1-9/Q.85

CUG, FE1

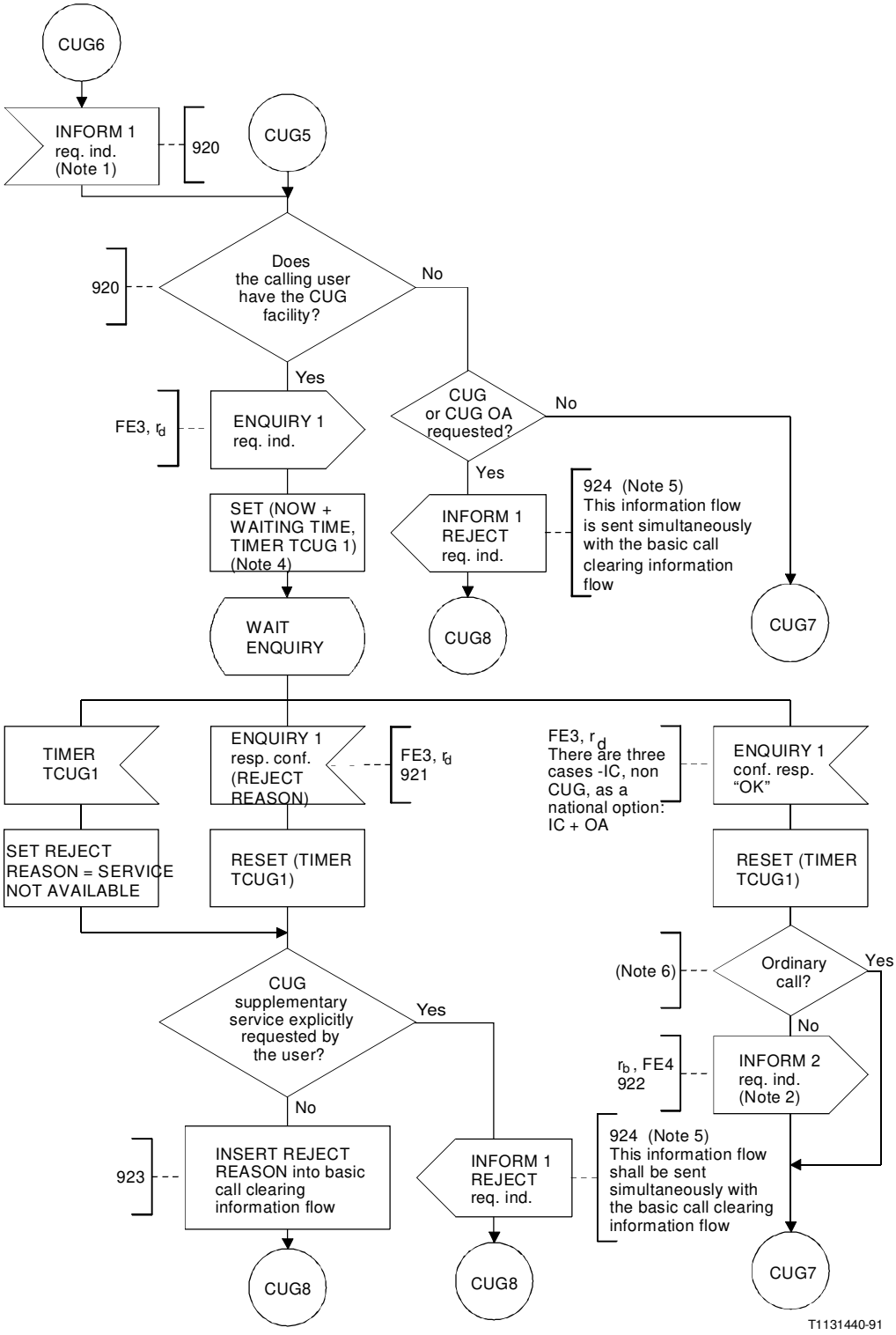


FIGURE 1-10/Q.85 (sheet 1 of 2)

CUG, FE2

Notes relative to Figure 1-10/Q.85 (sheet 1 of 2):

Note 1 – r_a , FE1 from a user end equipment – r_y from another CUG domain.

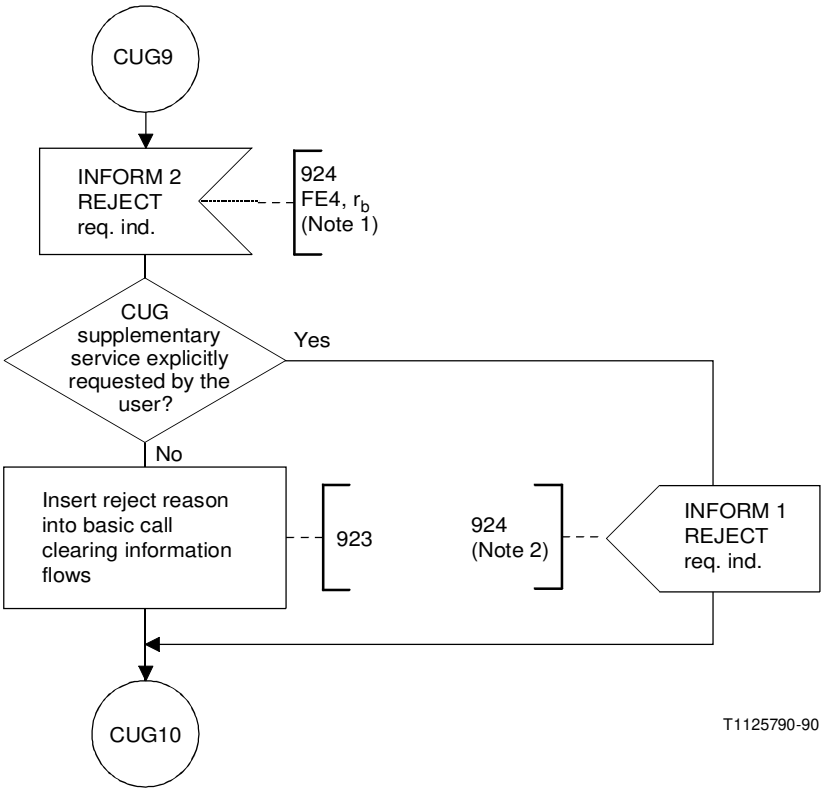
Note 2 – This INFORM 2 req. ind. shall be sent simultaneously with the basic call SETUP req. ind.

Note 3 – On a call received from an end user equipment CUG5, CUG6, CUG7 and CUG8 break the basic call between connector S2/1 and S2/2 of Recommendation Q.71 [4].
On a call received from another CUG domain of a private ISDN, CUG5, CUG6, CUG7 and CUG8 break the basic call during CC state "IDLE" during FEA 261 [see Figure 2-18/Q.71 [4] (sheet 1 of 7)] by following the YES branch of the decision "successful" and prior to sending "SETUP ind.". The analysis of MSN or DDI shall be performed prior to the invocation of CUG.
CUG7 is the exit to proceed with the call and CUG8 is the exit where the call shall be cleared, this is the same exit as the NO-branch of the preceding decision "successful" of Recommendation Q.71 [4].

Note 4 – Timer TCUG1 shall be implemented in the case of the remote data base. TCUG1 shall be automatically reset by basic call at any event resulting in clearing the call relation.

Note 5 – r_a, FE1 towards an end user equipment; r_y , FE4 towards another CUG domain.

Note 6 – The primary decision whether the call is to be set-up as a normal call or not, can be made either by FE3 or by FE2.



Note 1 – Information processed simultaneously with the basic call clearing information flows.

Note 2 – FE1, r_a towards a user end equipment FE4, r_y towards another CUG domain. This information flow shall be sent simultaneously with the basic call clearing information flow.

Note 3 – CUG9 and CUG10 are hooks at the receipt of basic call clearing information flows at outgoing calls prior to the receipt of SETUP resp. conf., they break the basic call between connectors S2/35 and S2/36, S2/37 and S2/38 of Recommendation Q.71 [4]. CUG9 and CUG10 additionally are hooks in CC FE2 call state r_1 -r_2 CALL SENT following the receipt of RELEASE req. ind. (see Recommendation Q.71 [4], Figure A-2/Q.71). On a call received from an other CUG domain of a private ISDN, CUG9 and CUG10 break accordingly (see Figures 2-18 CC FE6, sheet 2 of 7, sheet 3 of 7, sheet 7 of 7 of Recommendation Q.71 [4]).

FIGURE 1-10/Q.85 (sheet 2 of 2)

CUG, FE2

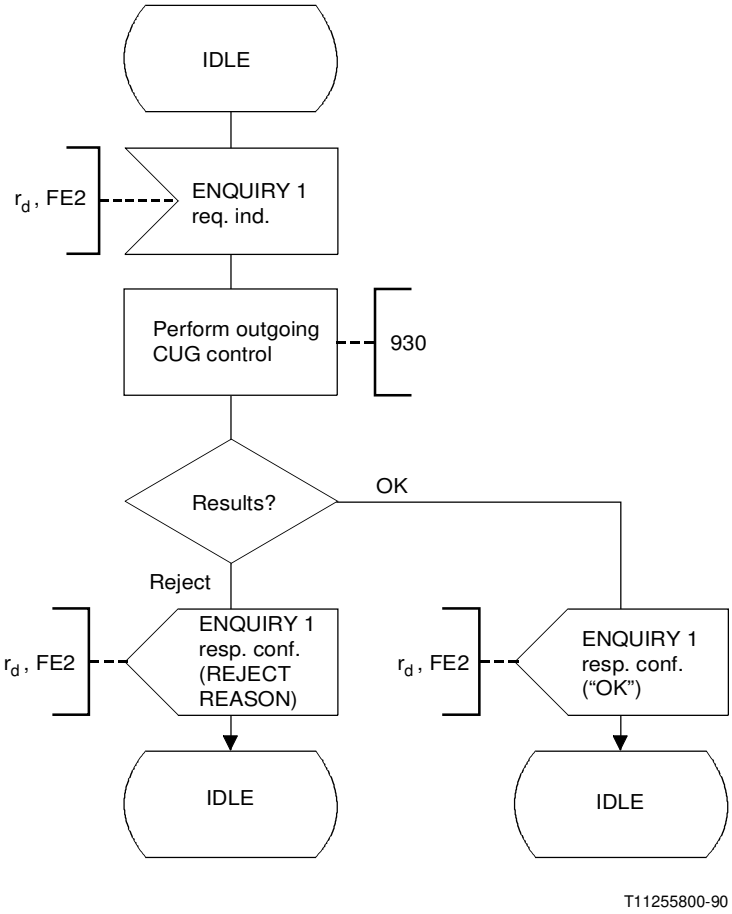


FIGURE 1-11/Q.85

CUG, FE3

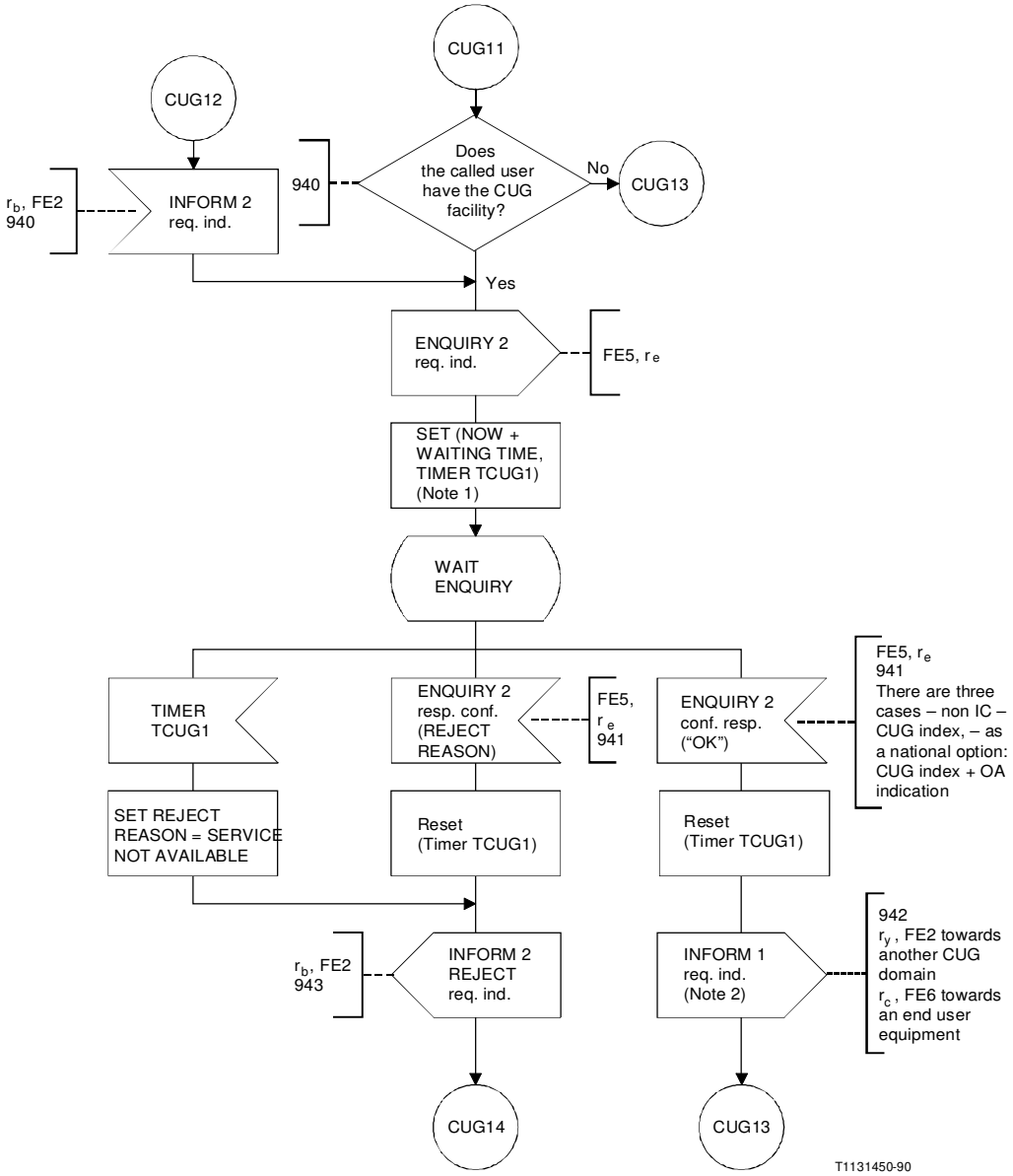


FIGURE 1-12/Q.85 (sheet 1 of 2)

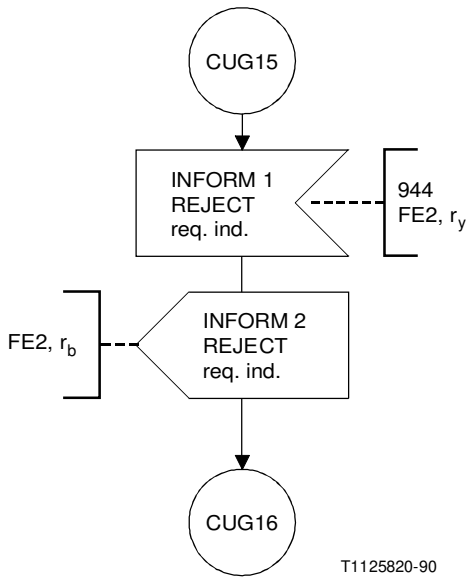
CUG, FE4

Notes relative to Figure 1-12/Q.85 (sheet 1 of 2):

Note 1 – Timer TCUG1 shall be implemented in the case of the remote data base. TCUG1 shall be automatically reset by basic call at any event resulting in clearing the call relation.

Note 2 – This INFORM 1 req. ind. shall be sent simultaneously with the basic call SETUP req. ind.

Note 3 – CUG11, CUG12, CUG13 and CUG14 break the basic call on a call towards a user end equipment between connector S4/31 and S4/32 of Recommendation Q.71 [4]. On a call towards another CUG domain of a private ISDN, CUG11, CUG12, CUG13 and CUG14 break the basic call during CC state "IDLE" during FEA271 (see Figure 2-19/Q.71 [4]). "Terminating screening, process attempt" prior to sending SETUP req. ind. (FEA271).
The analysis of MSN and DDI shall be performed prior to invocation of CUG. The CUG specific checks shall be performed prior to the determination of network determined user busy.
CUG13 is the exit to proceed with the call CUG14 is the exit where the call shall be cleared: this is the same exit as the NO-branch of the preceeding decision "successful" of Recommendation Q.71 [4].



Note – This information flow is processed simultaneously with the basic call clearing information flow. On a call towards another CUG domain of a private ISDN CUG15 and CUG16 break the basic call transition during any call state after sending of SETUP req. ind. and prior to receipt of REPORT (ALERTING) or SETUP resp. conf. (if no alerting occurs). See Figure 2-19/Q.71 of Recommendation Q.71 [4].

FIGURE 1-12/Q.85 (sheet 2 of 2)

CUG, FE4

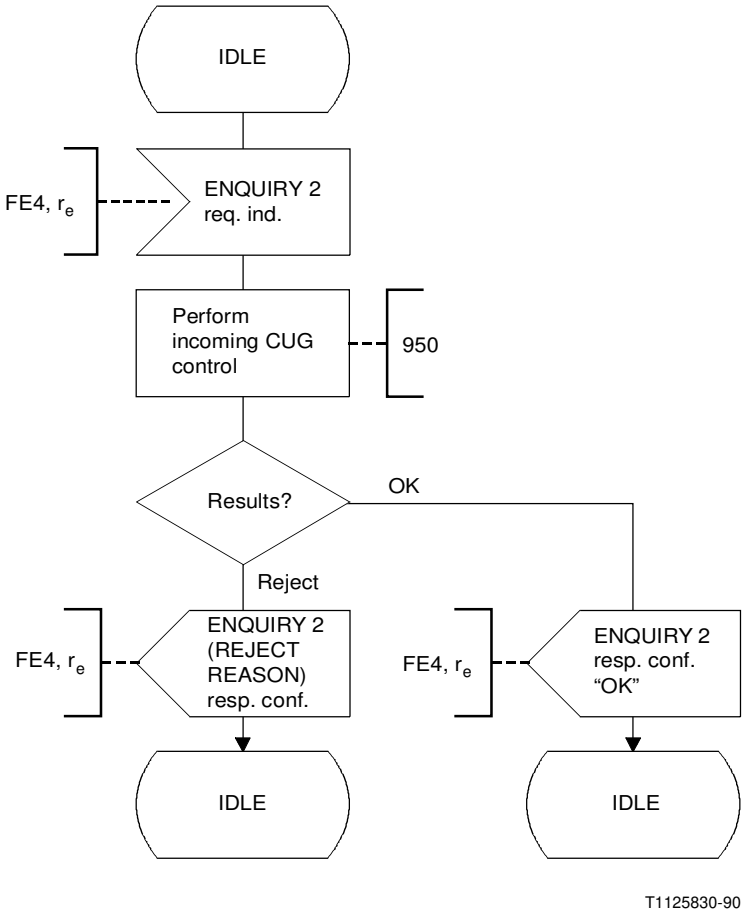


FIGURE 1-13/Q.85

CUG, FE5

1.9 *Functional entity actions (FEAs)*

1.9.1 *FEAs of FE1*

910: The functional entity shall receive CUG request from the user and transfer the request simultaneously with the call setup request.

911: The functional entity shall recognize CUG specific reject reasons and indicate the reason to its user.

1.9.2 *FEAs of FE2*

920: The functional entity shall:

— identify a CUG call;

— check the CUG subscription of the calling user;

— access the outgoing CUG control entity (FE3).

921: The functional entity shall receive the results of the CUG specific checks from the outgoing CUG control entity (FE3).

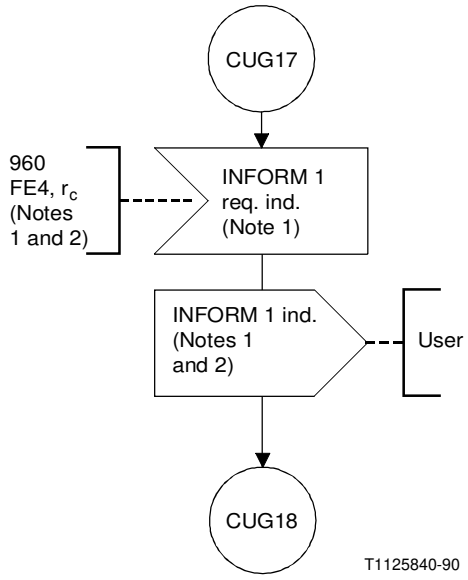
922: The functional entity shall:

— store the CUG characteristics as received from FE3;

— transfer the CUG request simultaneously with the basic call setup request as received from FE3.

923: The functional entity shall insert the reject reason into basic call clearing information flow element "cause".

924: The functional entity shall transfer simultaneously with basic call control clearing information flow INFORM 1 REJECT with CUG specific reasons.



Note 1 – This is received/sent simultaneously with the basic call SETUP req. ind.

Note 2 – CUG17 and CUG18 break the basic call between connector S5/1 and S5/2 (see Recommendation Q.71 [4]).

FIGURE 1-14/Q.85

CUG, FE6

1.9.3 *FEAs of FE3*

930: The functional entity shall:

— perform validation checks of CUG information of a calling user according to Table 1-9/Q.85;

— convert the CUG index to an interlock code.

TABLE 1-9/Q.85

CUG interpretation table (outgoing side)

Calling user class				SETUP presentation: CUG with index, OA = OFF	SETUP presentation: CUG with index, OA = ON	SETUP presentation: CUG without index, OA = OFF	SETUP presentation: CUG without index, OA = ON	SETUP presentation: Non-CUG information	
CUG	CUG + OA (E)	CUG + OA (I)	PCUG						
Yes				Specified CUG a)	Specified CUG a)	Rejected	Rejected	Rejectled	
	Yes			Specified CUG a)	Specified CUG b)	Rejected	Ordinary call	Ordinary call	
		Yes		Specified CUG b)	Specified CUG b)	Ordinary call	Ordinary call	Ordinary call	
Yes			Yes	Specified CUG a)	Specified CUG a)	PCUG a)	Rejected	PCUG a)	FE3
	Yes		Yes	Specified CUG a)	Specified CUG b)	PCUG a)	Ordinary call	PCUG a)	
		Yes	Yes	Specified CUG b)	Specified CUG b)	c) a)	Ordinary call c) a)	c) a)	
Calling user is NOT CUG				REJECT				Ordinary call	FE2

a) In case of OCB (CUG), a call is rejected.

The combination of PCUG and OCB with the PCUG is barred in the option data.

b) In case of OCB (CUG), a call is interpreted as an ordinary call.

c) Both “preferential CUG” and “implicit” outgoing access options imply that no subscriber procedures are needed to invoke either of the options when placing a call. When a user subscribes to both options, the network does not know which option the user is invoking, if no additional subscriber procedures are used when placing the call.

Three ways of operating are recommended:

1) the user has to indicate if a call is intended to be an outgoing access call. If no information (CUG request or outgoing call request) is given, the preferential CUG is assumed;

2) the combination is not allowed, i.e. a user cannot have both options allocated at the same time;

3) the caller may make a call and the network will route the call with the preferential CUG and an outgoing access request. The call will therefore be connected if the called number is a member of the preferential CUG or is a member of a different CUG and has incoming access, or is a non-CUG user.

   In the case of the first way of operating, CUG interpretation is “PCUG”. In the case of OCB, Note a) is applicable.

   In the case of the second way of operating, the combination of the options is not allowed.

   In the case of the third way of operating, CUG interpretation is “PCUG with OA”. In the case of OCB, Note a) is applicable.

   The choice from the above cases is a national option.

OA(E) Outgoing access explicit

If the “allowed per call (explicit OA)” outgoing access option is assigned then the CUG user can determine the OA status by means of the OA request on a call by call basis, but if the “allowed per call” outgoing access option is not assigned then the OA request shall be ignored by the network and the OA status shall be determined according to the OA subscription option.

OA(I) Outgoing access implicit

OA Outgoing access allowed

OCB Outgoing access barred within the CUG

PCUG Preferential CUG

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.

1.9.4 *FEAs of FE4*

940: The functional entity shall:

— identify a call for a user with CUG service;

— access the incoming CUG control entity (FE5).

941: The functional entity shall receive the results of the CUG specific checks from the incoming CUG control entity.

942: The functional entity shall:

— store the CUG characteristics as received from FE5;

— transfer the CUG request as received from FE5 simultaneously with the basic call setup request.

943: The functional entity shall transfer simultaneously with basic call clearing information flow INFORM 2 REJECT with CUG specific reasons.

944: The functional entity shall, in the case of a call towards a PN FE2, provide the capability to receive a CUG-specific rejection of the call from the PN. In this case the requirement is to receive and transfer simultaneously with basic call control information flow CUG specific INFORM 1 REJECT with CUG specific reason.

1.9.5 *FEAs of FE5*

950: The functional entity shall, according to Table 1-10/Q.85:

— converse the interlock code to CUG index;

— perform validation checks of CUG information of a called user (including the compatibility with the called user class — CUG IA — in case of ordinary incoming call).

1.9.6 *FEAs of FE6*

960: The functional entity shall receive CUG indication simultaneously with the call SETUP req. ind. and indicating this to the user.

TABLE 1-10/Q.85

CUG checking in incoming side

<table>
<tr><td rowspan="3">Called user's class

SEPUP Presentation</td><td colspan="4">Called user is CUG</td><td rowspan="3">Called user is 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>REJ</td><td>M (1)</td><td>REJ</td><td rowspan="2">REJ</td></tr>
<tr><td colspan="2">NM REJ</td><td colspan="2">NM REJ</td></tr>
<tr><td rowspan="2">CUG and OA (Note 8)</td><td>M (1)</td><td>REJ</td><td>M (2)</td><td>3</td><td rowspan="2">(3)</td></tr>
<tr><td colspan="2">NM REJ</td><td colspan="2">NM (3)</td></tr>
<tr><td>Ordinary</td><td colspan="2">REJ</td><td colspan="2">(3)</td><td>(3) a)</td></tr>
</table>

a) Covered by SDLs

IA Incoming access

OA Outgoing access

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 user 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), this is a national option;

(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.:

M
(3)

means that when matched with CUG, no CUG selection facility field is set in the SETUP to the called user.

Note 8 — This may be supported as a national option.

TABLE 1-11/Q.85

Scenarios	FE1	FE2	FE3	FE4	FE5	FE6
Scenario 1	TE	LE1	LE1	LE2	LE2	TE
Scenario 2	TE	LE1	DB1	LE2	DB1	TE
Scenario 3	TE	LE1	DB1	LE2	DB2	TE
Scenario 4	TE	<— — — — PN — — — — —> & LE1 LE1 LE2 LE2				TE
Scenario 5	TE	LE1 LE1 LE2 LE2 & <— — — — PN — — — — —>				TE
Scenario 6	TE	<— — — — PN — — — — —> & LE1 LE1 LE2 LE2 & <— — — — PN — — — — —>				TE
Scenario 7	TE	LE1 LE1/DB1 OIC OIC & OIC OIC LE2 LE2/DB2				TE
Scenario 8	TE	LE1 LE1/DB1 OIC OIC & OIC OIC IIC IIC & IIC IIC LE2 LE2/DB2				TE

DB Data base.

IIC Incoming international centre.

LE Local exchange.

OIC Outgoing international centre.

TE Terminal equipment.

Note — The symbol "&" represents the chaining of CUG domains of the public and private ISDN or two public ISNDs

The network scenarios 1, 4, 5 and 6 represent the decentralized approach of the CUG service implementation.

The network scenario 2 describes the fully centralized approach with a unique data base.

The network scenario 3 describes a centralized approach with two data bases (DB1 and DB2).

Network scenarios 7 and 8 — The translation between national and international CUG interlock codes is the responsibility of the country not accepting international CUG codes in its network.

3 Multi-Level Precedence and Preemption (MLPP) (revised 1992)

3.1 *Scope*

This Recommendation defines the stage 2 for the Multi-Level Precedence and Preemption (MLPP) supplementary service of the integrated service digital network (ISDN) as provided by public telecommunications operators. Stage 2 identifies the functional capabilities and the information flows needed to support the service description. The stage 2 description also identifies user operations not directly associated with a call (see Recommendation I.130 [1]).

This Recommendation is defined according to the methodology specified in Recommendation Q.65 [2].

This Recommendation does not formally describe the relationship between this supplementary service and the basic call but, where possible, this information is included for guidance.

In addition, this Recommendation does not specify the requirements where the service is provided to the user via a private ISDN. This Recommendation does not specify the allocation of defined functional entities within a private ISDN; however, it does define which functional entities may be allocated to a private ISDN.

This Recommendation does not specify the additional requirements where the service is provided to the user via a telecommunication network that is not an ISDN.

This Recommendation is applicable to the stage 3 Recommendations for the ISDN MLPP supplementary service. The term "stage 3" is defined in Recommendation I.130 [1].

3.2 *References*

These following references are applicable:

[1] CCITT Rec. I.130 *Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN,* 1988

[2] CCITT Rec. Q.65 *Stage 2 of the method for the characterization of services supported by an ISDN,* 1988.

[3] CCITT Rec. Q.71[1)] *ISDN 64 kbit/s circuit mode switched bearer services,* 1993.

[4] CCITT Rec. I.210 *Principles of telecommunication services supported by an ISDN and the means to describe them*, 1988.

[5] CCITT Rec. I.255.3 *Multi-Level Precedence and Preemption service (MLPP),* 1990.

3.3 *Definitions*

For the purpose of this Recommendation, the following definitions apply:

MLPP call

A call that has a precedence level established and is either being setup or is setup. Only MLPP subscribers can generate MLPP calls, which are identified by a precedence level. Calls from non-MLPP subscribers will not carry a precedence level and shall not be preempted.

preemptable circuit

A circuit that is active with or reserved for an MLPP call:

1) within the same domain as the preempting call; and
2) with a lower precedence than the preempting call. A busy or reserved circuit for which a precedence level has not been specified is not a preemptable circuit.

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1) Recommendation Q.71 will be submitted for approval at the CCITT Plenary Assembly in March, 1993.

precedence call

A call with precedence level higher than the lowest level of precedence.

users A and B

Parties of the MLPP call A-B for scenarios involving preemption in the network. User A is also a party of the MLPP call A-D for scenarios depicting preemption in the user access area.

user C

Calling party of the preempting higher precedence call.

user D

Called party of the preempting higher precedence call from user C. User D is also a party of the MLPP call A-D for preemption in the user access area scenarios.

LFB req. ind.

An optional information flow used to find out whether network resources are available to support the higher precedence call. Available resources include ideal circuits and circuits used for lower precedence calls. This information flow will provide call path reservation.

LFB resp. conf.

The response information flow used to indicate the status of the called party and network resources. Possible responses are: available and unavailable. Available means that network and called party resources are available to support the higher precedence call. The called party is available if it is either:

1) not busy;

2) busy with a call of lower precedence with preemptable access resources;

3) busy with a call of equal or higher precedence with call; completion or call offering services (i.e. Call Waiting or Call Forwarding Busy) or an alternate party, or

4) busy with access resources non-preemptable with call completion services or an alternate party.

Unavailable means that:

1) network resources are not available to support the higher precedence call;

2) the called party is busy with a call of equal or higher precedence and no call completion or call offering services or an alternate party are available, or

3) the called party is busy with non-preemptable resources and no call completion services or an alternate party are available.

response timer T_K

This is started when the service provider notifies the called user of a precedence call (for example, this would be the preemption notification if preemption occurs at the user interface). This timer establishes the time that the called party of the precedence call has to accept the precedence call from the calling party of the precedence call. The length of this timer is in the range of 4 to 30 seconds.

timer T_L

A timer that is started when a functional entity sends an LFB information flow. This timer establishes the amount of time the network has to complete and LFB search for network and access resources before preemption is initiated (if the functional entity initiated the search) or an LFB resp. conf. “available” is returned from the previous FE. The expected value of this timer is in the range of 5 to 20 seconds.

preempted

Notification sent to the parties of the preempted calls.

preempt notification

Notification of preemption at the user interface sent to the preempted user (e.g. user D) to release the existing call and to reserve the interface for the preempting call.

3.4 *Symbols and abbreviations*

CC	Call control
CCA	Call control agent
FE	Functional entity
FEA	Functional entity action
ISDN	Integrated services digital network
LE	Local exchange
LFB	Look-ahead-for-busy
MLPP	Multi-level precedence and preemption
PNX	Private network exchange
TE	Terminal equipment
TR	Transit exchange (same as Intermediate exchange)

3.5 *Description*

The description for this service can be found in Recommendation I.255.3 [5].

The MLPP service provides a prioritized call handling service. The service has two parts: precedence and preemption. Precedence involves assigning a priority level to a call. Preemption involves the seizing of busy resources, which are in use by call(s) of lower precedence, by a higher precedence call in the absence of idle resources.

Precedence provides preferred handling of MLPP services requests. It involves assigning and validating priority levels to calls and prioritized treatment of MLPP service requests (e.g. with respect to interactions with other supplementary services such as Call Waiting).

Preemption may take one of two forms. First, the called party may be busy with a lower precedence call that must be preempted in favour of completing the higher precedence call from the calling party. Second, the network resources may be busy with calls, some of which are of lower precedence than the call requested by the calling party. One or more or these lower precedence calls must be preempted to complete the higher precedence call.

The MLPP service, as described in this document, only applies within a domain of the MLPP service. An MLPP domain consists of the network and access resources that are in use by a set of MLPP subscribers at any given time. These resources are marked by a precedence level and a domain identification during establishment of an MLPP call. Connections and resources that are in use by MLPP subscribers may only be preempted by calls from MLPP users belonging to the same domain that carry a higher precedence levels.

MLPP users may receive calls from non-MLPP users. These non-MLPP calls will not carry a precedence level and, as a result, cannot be preempted. Calls from MLPP subscribers to non-MLPP users may not be preempted after receipt of the REPORT req. ind. from the destination. The destination will determine the status of the called party (MLPP or non-MLPP) and should insert an indication in the REPORT req. ind. Upon receipt of the REPORT req. ind. the originating and intermediate MLPP functional entities should reclassify the call as non-MLPP if the called party is a non-MLPP user.

As a service provider option, before preemption of a lower precedence call, a network may provide a search and reservation of network resources. This procedure utilizes a look-ahead-for-busy (LFB) function to ensure that network and called user resources are available to complete the call prior to preemption.

3.6 *Derivation of the functional model*

3.6.1 *Functional model description*

The functional model for the MLPP supplementary service is shown in Figure 3-1/Q.85. For clarity, both user A (FE2) and user C (FE1) have a relationship with the same FE.

Note that all the users shown in this description are MLPP users that may generate MLPP calls and may be preempted.

The functionalities in the model are described in the following sections with emphasis on functions required for the MLPP service. Relationships r_a to r_f, etc., between the functional entities characterize the information flows required to process calls (establish, manipulate, and release) and MLPP service requests.

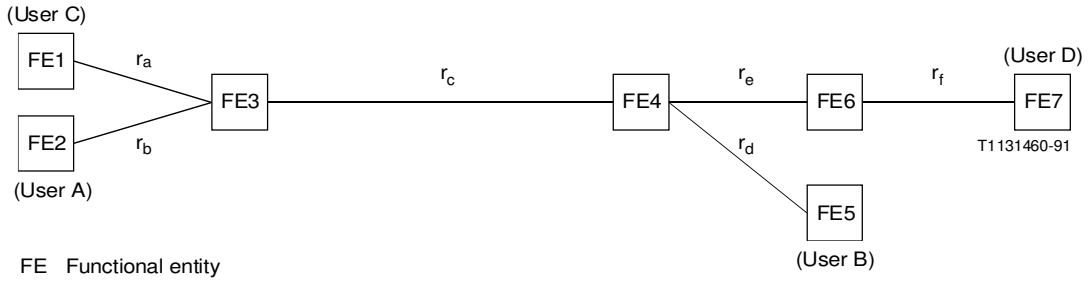


FIGURE 3-1/Q.85

Functional model for the MLPP service

The expanded functional model in Figure 3-1a/Q.85 is a concatenation of the functional model shown in Figure 3-1/Q.85. This model is used to show that multiple lower precedence calls may be preempted to complete the higher precedence call (C-D). In this case, the two lower precedence calls are the calls A1-B1 and A2-B2.

3.6.2 *Description of the functional entities*

The functional entities required by the MLPP supplementary service in addition to those of the basic call, are described in the following sections.

3.6.2.1 *FE1*

FE1 serves user C by initiating service requests, relaying MLPP indicators, and maintaining the call state information.

3.6.2.2 *FE2*

FE2 serves user A, who is on an MLPP call with user B or with user D. FE2 relays MLPP indicators and maintains the call state information.

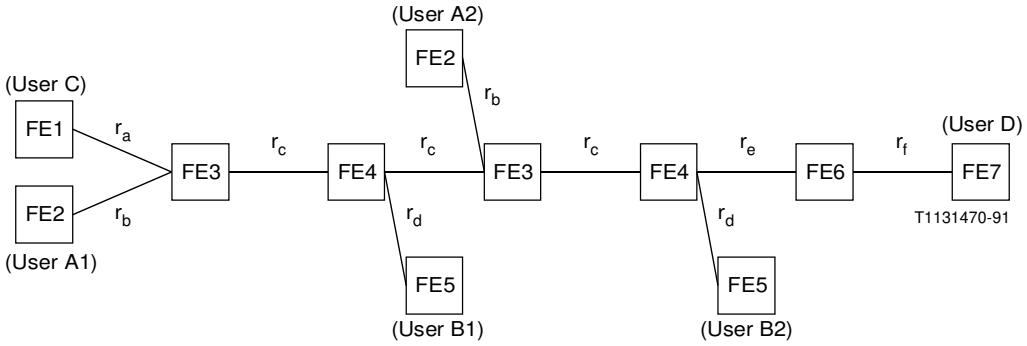


FIGURE 3-1a/Q.85

Expanded functional model

3.6.2.3 *FE3*

FE3 provides validation of the user C requested precedence level and prioritized treatment of MLPP service requests based on the precedence levels. FE3 also initiates preemption of network resources, when path congestion is encountered, in order to connect a higher precedence call. When LFB is utilized as a network provider option, FE3 initiates the LFB search, prior to preemption, and provides the appropriate response to the result of this search.

3.6.2.4 *FE4*

FE4 may preempt network resources, when it receives a SETUP request from FE3, in order to connect the higher precedence call. When LFB is utilized as a network provider option, FE4 can perform search and reservation functions as requested by FE3. In addition, if no LFB search was conducted by FE3 for this call, FE4 may initiate an LFB search (if preemption is required).

3.6.2.5 *FE5*

FE5 serves user B, who may be on an MLPP call with user A. FE5 relays MLPP indicators and maintains the call state information.

3.6.2.6 *FE6*

FE6 supports preemption of the access resources to FE7, when required. When LFB is supported, FE6 supports reservation of network resources when requested by FE4 and relays user status information to FE4 during LFB search and reservation procedures.

3.6.2.7 *FE7*

FE7 serves user D, who receives an MLPP call from user C. FE7 relays MLPP indicators, supports preemption of access resources to FE6, and maintains the call state information.

3.6.3 *Relationship with a basic service*

The relationship with a basic service is shown in Figure 3-2/Q.85.

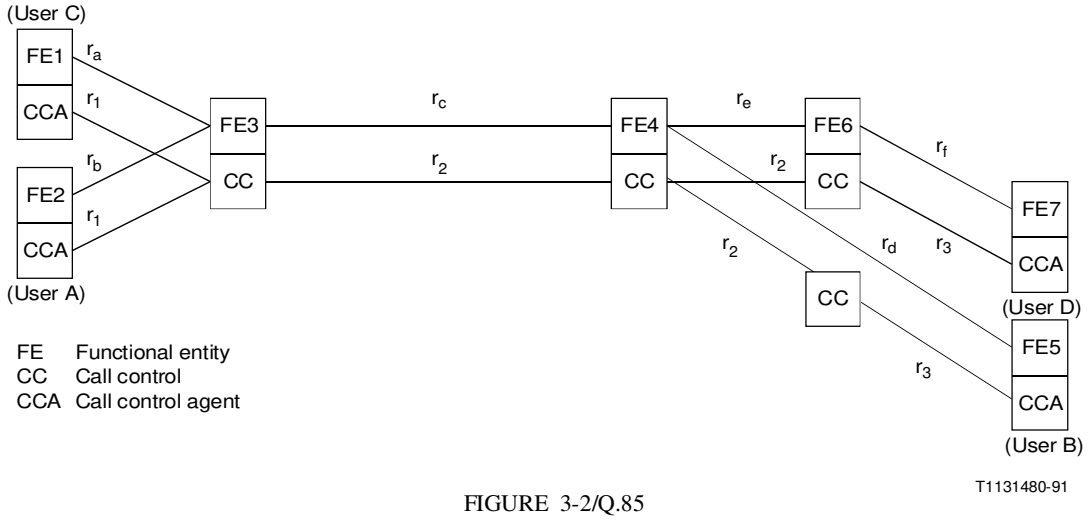


FIGURE 3-2/Q.85

Relationship with a basic service

3.7 *Information flows*

3.7.1 *Information flow diagrams*

This section contains the information flow diagrams of successful sequences for the MLPP service. Note that the basic call procedures are shown only when necessary for the description of the MLPP service (e.g. "SETUP resp. conf." is not shown in the information flow diagrams). The complete basic call SETUP and RELEASE procedures can be found in Recommendation Q.71 [3].

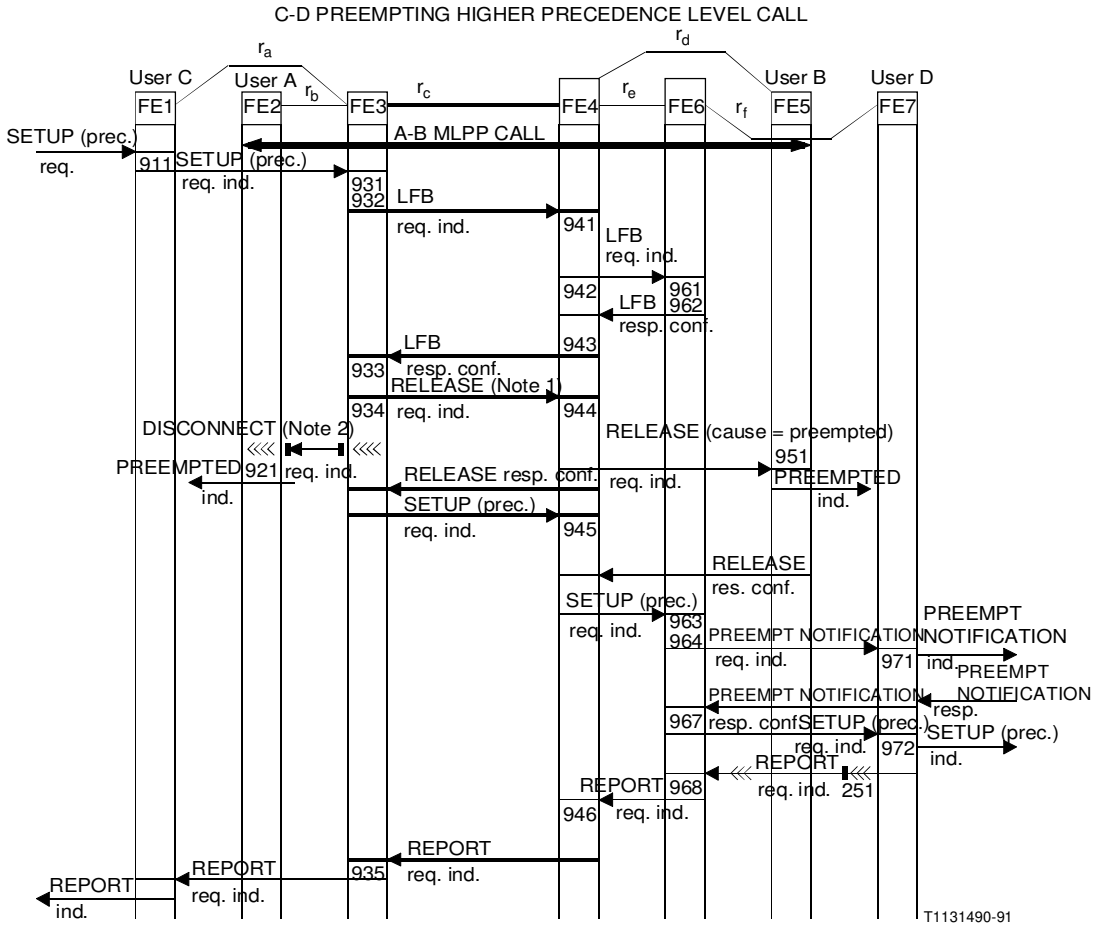
Figure 3-3/Q.85 shows the information flow for successful preemption in the network utilizing the search and reservation (LFB) option. The called party (user D) of the preempting call may or may not be busy with a call of lower precedence than that of the preempting call (from user C to user D).

Note that if the LFB search and reservation information flow encounters a network that does not support LFB procedures, the LFB gateway exchange will send back an LFB "available" response (since the LFB was capable of reaching the interworking point, it was able to reserve available circuits to that point) to the preemption initiating exchange (FE3). Upon receiving the response, the preemption initiating exchange will invoke preemption and begin call setup.

The resources that are marked as "path reserved" during the course of the LFB procedures are subject to preemption by higher precedence calls. If reserved resources are preempted, the call must initiate a normal search for ideal or preemptable resources when the SETUP (prec) req. ind. reaches the FE where the reserved resources were preempted.

Figure 3-4/Q.85 shows the information flow for successful preemption in the network without the search and reservation (LFB) option. Again, the called party (user D) of the preempting call may or may not be busy with a call of lower precedence than that of the preempting call (from user C to user D).

Figure 3-5/Q.85 shows the information flow for successful preemption in the access area. The called party (user D) of the preempting call is busy with a call of lower precedence (with user A) than that of the preempting call.

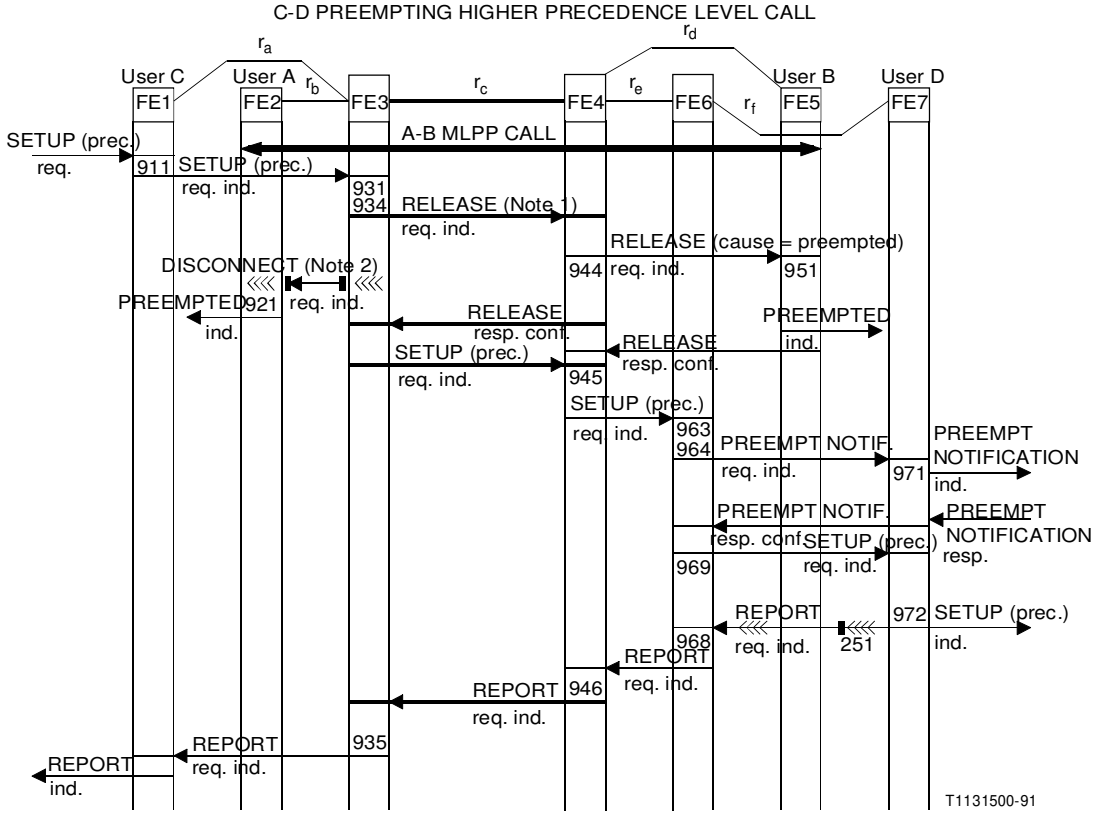


Note 1 – Cause = Preempted, circuit reserved for re-use.

Note 2 – Cause = Preempted, circuit released not for re-use because it was used for the call A-B and not used for the preempting call (call C-D).

FIGURE 3-3/Q.85

Information flow for preemption in the network with the LFB option



Note 1 – Cause = Preempted, circuit reserved for re-use.

Note 2 – Cause = Preempted, circuit released not for re-used because it was used for the call A-B and not used for the preempting call (call C-D).

FIGURE 3-4/Q.85

Information flow for preemption in the network without the LFB option

If the called user (user D) is not busy and does not respond to the precedence call setup indication within timer T_K and an alternate party is subscribed to by the called party, the service provider will initiate alternate party diversion. In addition, if the called party (user D) is busy on a call of equal or higher precedence or is busy with non-preemptable access resources, an alternate party is subscribed to by the called party, and no call completion or call offering services (i.e. Call Waiting or Call Forwarding Busy) are available, the service provider will initiate alternate party diversion.

3.7.2 *Definition of individual information flows*

3.7.2.1 *Relationship r_a*

In addition to the basic call requirements, the contents of the SETUP (prec) information flow shall contain the information as shown in Table 3-1/Q.85.

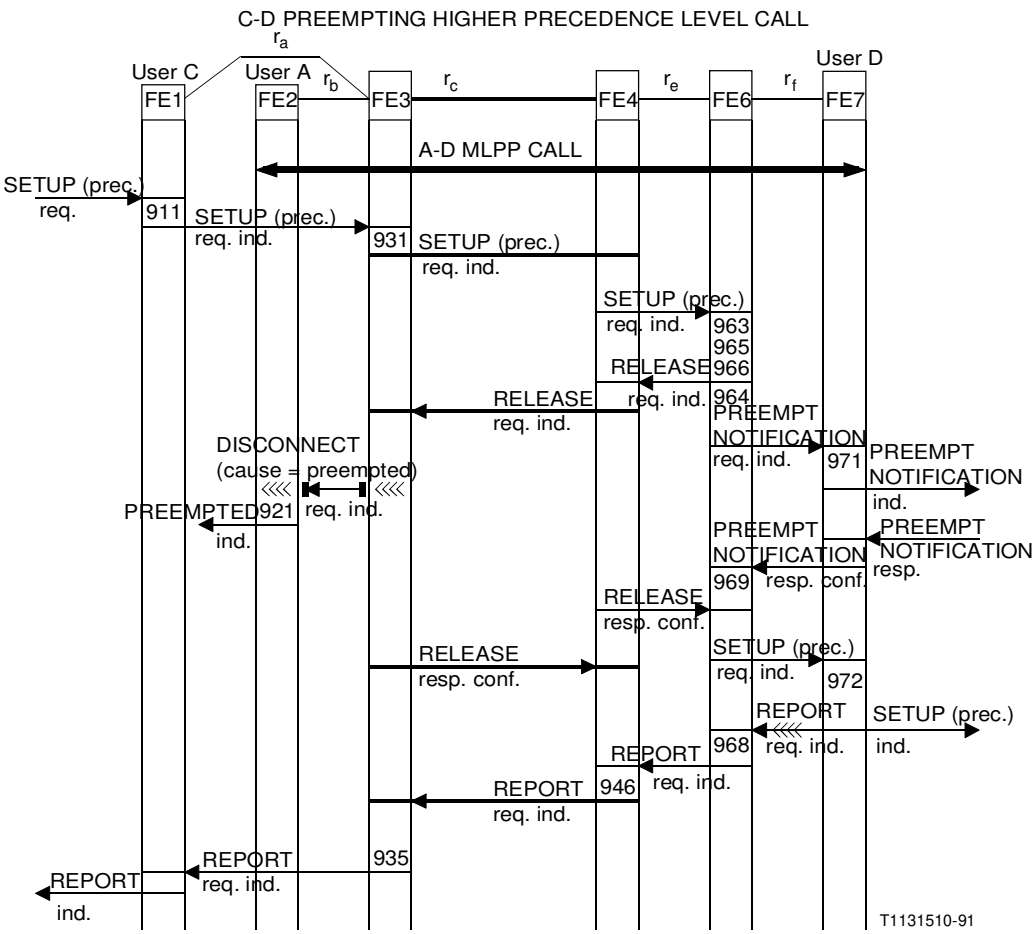


FIGURE 3-5/Q.85

Information flow for preemption in the user access area

TABLE 3-1/Q.85

Relationship r_a SETUP (prec)

Parameter	Allowed value	req. ind.
Precedence level	4 (routine) 3 (priority) 2 (immediate) 1 (flash) 0 (flash override)	Optional (Note)

Note – If the user does not specify a precedence level, the network will assign precedence level 4 (routine) for this call.

Relationship r_a shall also support the REPORT information flow which is defined in Table 3-5/Q.85.

3.7.2.2 *Relationship r_b*

In addition to the basic call requirements, the contents of the DISCONNECT information flow shall contain the information as shown in Table 3-2/Q.85.

TABLE 3-2/Q.85

DISCONNECT contents

Parameter	Allowed value	req. ind.
Cause	Preempted Precedence call blocked	Mandatory

3.7.2.3 *Relationship r_c*

Relationship r_c shall support the LFB, SETUP (prec), REPORT, and RELEASE information flows. The LFB, SETUP (prec), REPORT and RELEASE information flows are defined in Tables 3-3/Q.85 to 3-6/Q.85.

3.7.2.3.1 *Contents of LFB*

In addition to the basic call setup information flow requirements, the contents of the LFB information shall contain the information as defined in Table 3-3/Q.85.

TABLE 3-3/Q.85

LFB contents

Parameter	Allowed value	req. ind.	resp. conf.
Precedence level	4 (routine) 3 (priority) 2 (immediate) 1 (flash) 0 (flash override)	Mandatory	
MLPP domain		Mandatory	
Network/Called party status	Available Unavailable		Mandatory

3.7.2.3.2 *Contents of SETUP (prec) req. ind.*

In addition to the basic call requirements, the contents of the SETUP (prec) information flow shall contain the information as defined in Table 3-4/Q.85.

3.7.2.3.3 *Contents of REPORT*

In addition to the basic call requirements, the contents of the REPORT information flow shall contain the information contained in Table 3-5/Q.85.

TABLE 3-4/Q.85

SETUP (prec) contents

Parameter	Allowed value	req. ind.
Precedence level	4 (routine) 3 (priority) 2 (immediate) 1 (flash) 0 (flash override)	Mandatory
MLPP domain		Mandatory
LFB indicator	LFB Allowed LFB Not Allowed Path reserved	Mandatory

TABLE 3-5/Q.85

REPORT contents

Parameter	Allowed value	req. ind.
MLPP indicator	MLPP user Non-MLPP user	Mandatory (Note)

Note – The MLPP indicator is not required for r_f.

3.7.2.3.4 *Contents of RELEASE*

TABLE 3-6/Q.85

RELEASE contents

Parameter	Allowed value	req. ind.
Cause	Preempted Precedence call blocked	Mandatory

3.7.2.4 *Relationship r_d*

Relationship r_d shall support the RELEASE information flow as defined in Table 3-6/Q.85.

3.7.2.5 *Relationship r_e*

Relationship r_e shall support the LFB, SETUP (prec), REPORT, and RELEASE information flows as defined in Tables 3-3/Q.85, 3-4/Q.85, 3-5/Q.85, and 3-6/Q.85 respectively.

3.7.2.6 *Relationship r_f*

Relationship r_f shall support the SETUP (prec), REPORT, and PREEMPT NOTIFICATION information flows. The SETUP (prec) information flow is defined in Table 3-4/Q.85. The PREEMPT NOTIFICATION is as defined in § 3.3. Note that there is no parameter included in this PREEMPT NOTIFICATION. The REPORT information flow is defined in Table 3-5/Q.85.

3.8 *SDL diagrams for functional entities*

The following contains the SDLs for the functional entities as defined in Figures 3-1/Q.85 and 3-2/Q.85. These SDLs reflect preemption in the network and at the user-network interface for networks with and without the LFB option.

3.8.1 *SDLs for FE1*

Figure 3-6/Q.85 contains the SDL for MLPP call setup procedures for FE1.

3.8.2 *SDLs for FE2*

Figure 3-7/Q.85 contains the SDL for MLPP call preempted notification procedures for FE2.

3.8.3 *SDLs for FE3*

Figure 3-8/Q.85 contains the SDL for MLPP call setup, preemption, and LFB procedures, for FE3. It should be noted that the LFB procedures are only initiated once per call, since multiple LFB procedures could greatly delay call setup. In addition, the release (preemption) procedures for the call A-B are only shown for this FE, since normal call release procedures are used to release the call once preemption is initiated by FE3. The only exception to this is preemption indications from the FEs that directly serve the users (i.e. FE1, FE2, FE5, and FE7).

3.8.4 *SDLs for FE4*

The SDL for MLPP call setup, preemption, LFB initiation, and LFB continuation procedures for FE4 is given in Figure 3-9/Q.85. It should be noted that the LFB initiation procedures will only apply if no LFB operation has been performed at FE3.

3.8.5 *SDLs for FE5*

Figure 3-11/Q.85 contains the SDL for MLPP call preempted notification procedures for FE5.

3.8.6 *SDLs for FE6*

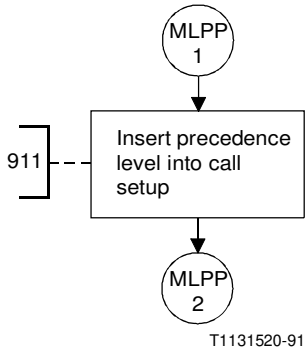
The SDL diagram for MLPP call setup, preemption, and LFB procedures at FE6 are shown in Figure 3-10/Q.85.

3.8.7 *SDLs for FE7*

Figure 3-12/Q.85 contains the SDL for MLPP call preemption and precedence call setup procedures for FE7.

3.9 *Functional entity actions (FEAs)*

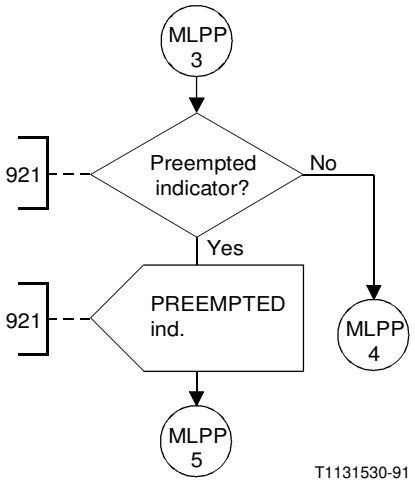
Functional entities are assumed to have the basic capabilities required to properly perform their assigned functions in the ISDN (e.g. synchronism, signalling capabilities, etc.). In addition, the actions that occur at the functional entities during call processing stages for providing the MLPP service described in this Recommendation, have been given reference numbers and brief descriptions. The reference numbers are shown on the information flow diagrams (Figures 3-2/Q.85 to 3-4/Q.85).



Note – MLPP 1 and MLPP 2 break the basic call between connectors S1/1 and S1/2 (see Recommendation Q.71 [3]).

FIGURE 3-6/Q.85

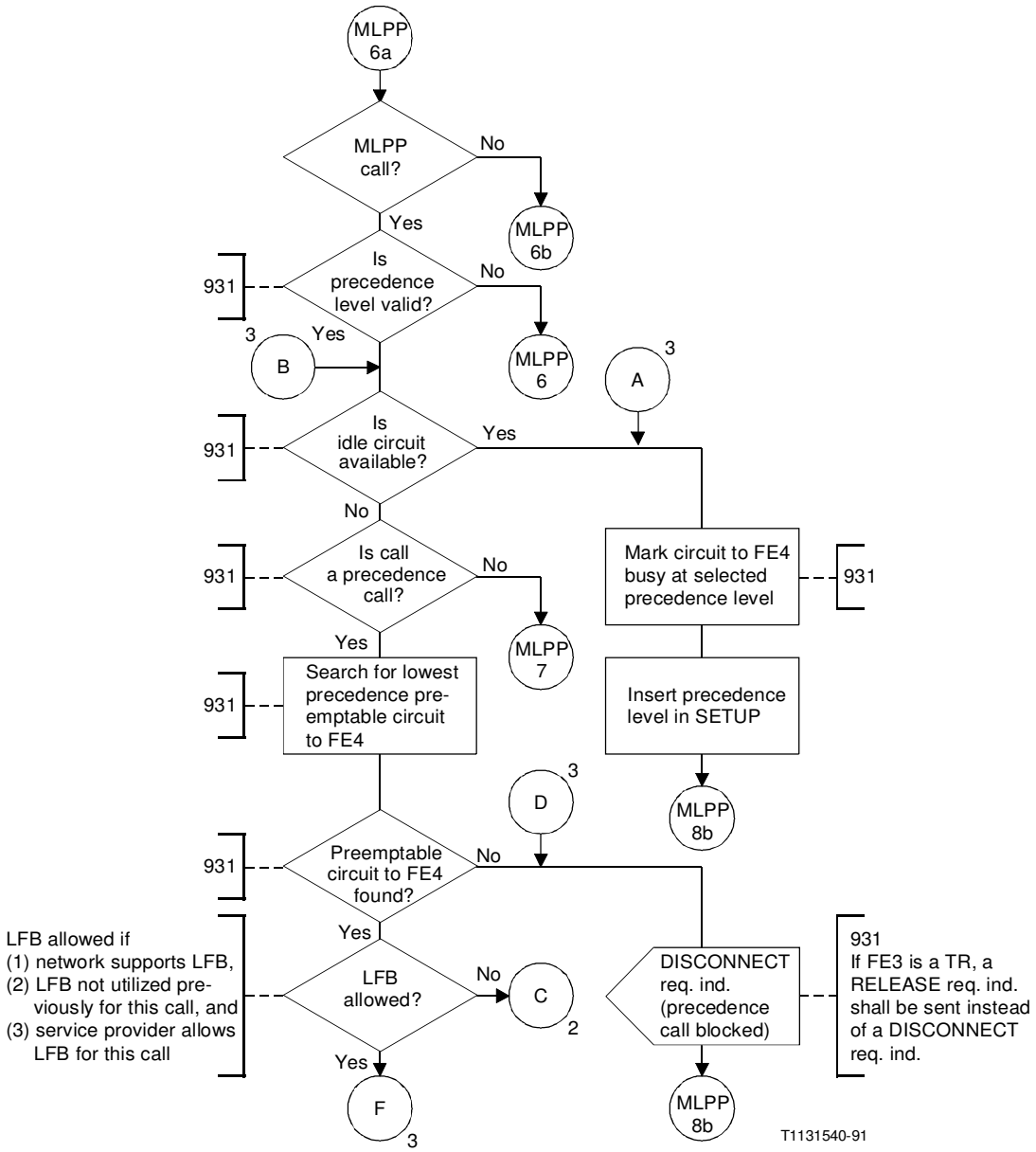
FE1 – Incoming MLPP call from user



Note – MLPP 3, MLPP 4 and MLPP 5 break the basic call between connectors S1/15, S1/16 and S1/MLPP 5 or S5/14, S5/15 and S5/16 (see Recommendation Q.71 [3]).

FIGURE 3-7/Q.85

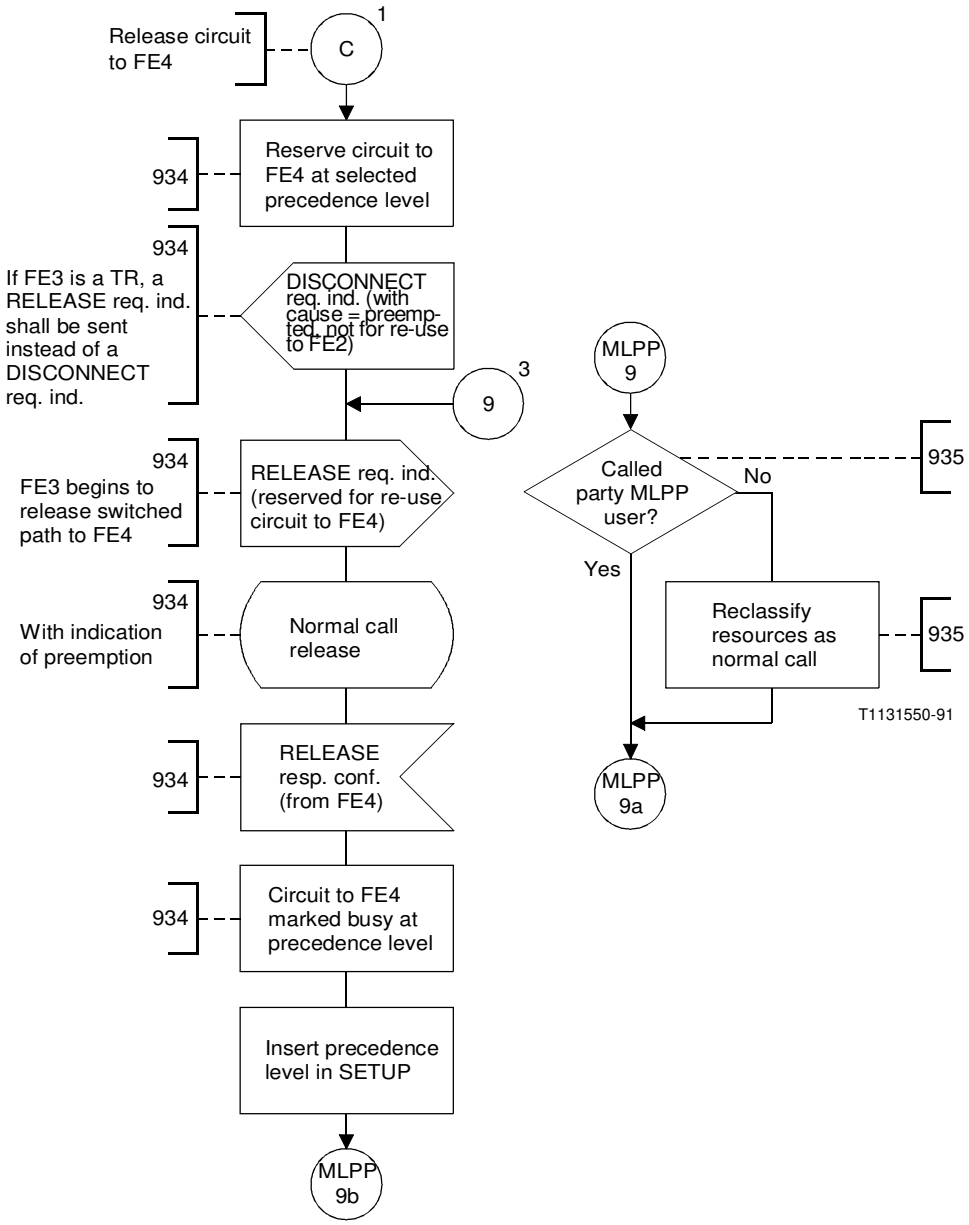
FE2 – Preempted notification to user



Note – MLPP 6 and MLPP 7 enter the basic call at connector S2/6 (see Recommendation Q.71 [3]).
MLPP 6a and MLPP 6b break the basic call between connectors S2/17 and S2/18 (see Recommendation Q.71 [3]).
MLPP 8b enters the basic call at connector S2/10 (see Recommendation Q.71 [3]).

FIGURE 3-8/Q.85 (sheet 1 of 3)

FE3 – Incoming MLPP call from FE1



Note – MLPP 9 and MLPP 9a break the basic call between connectors S2/19 and S2/20 (see Recommendation Q.71 [3]).
MLPP 9b enters the basic call at connector S2/10 (see Recommendation Q.71 [3]).

FIGURE 3-8/Q.85 (sheet 2 of 3)

FE3 – Release and preemption of call A-B

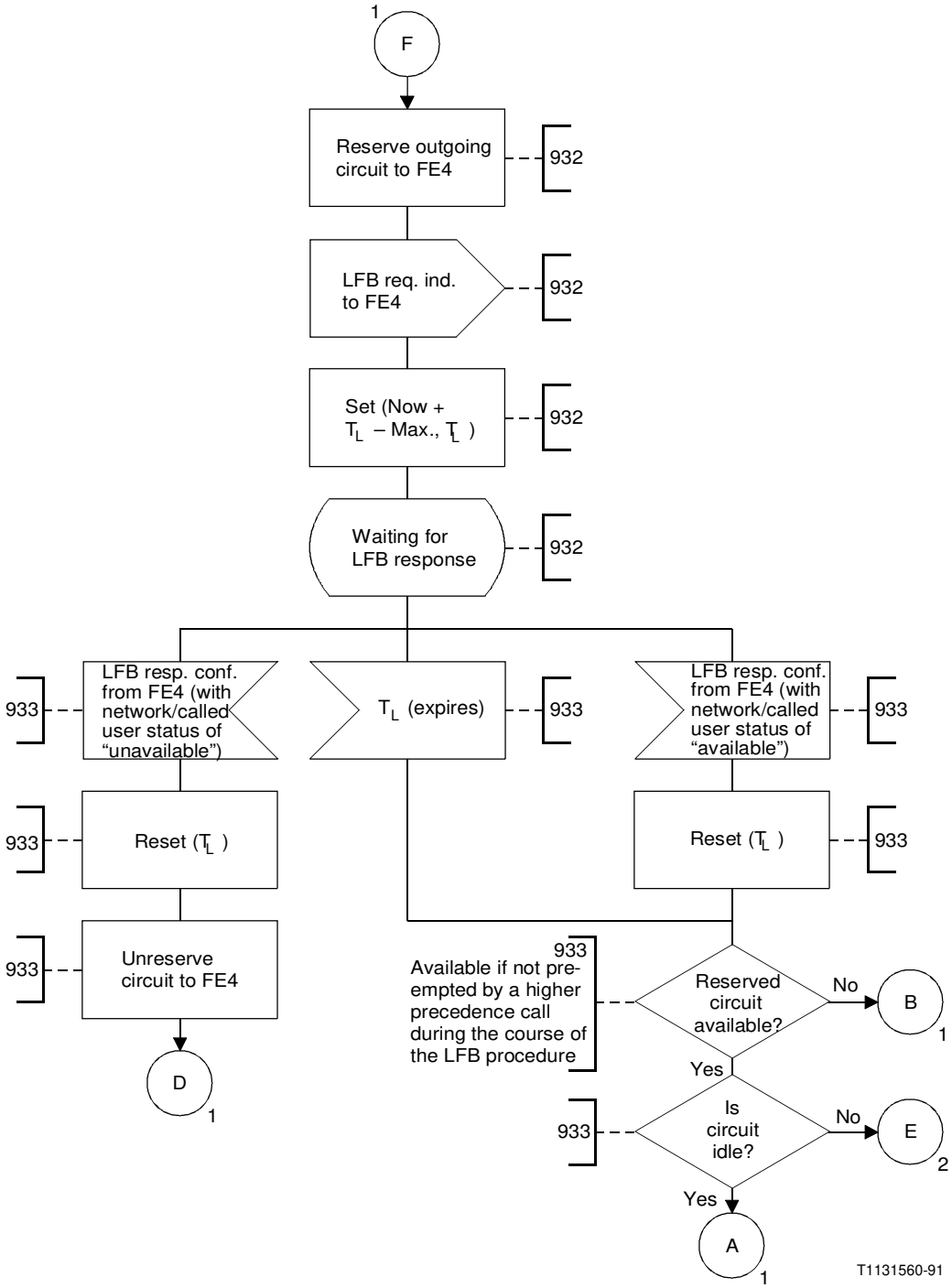
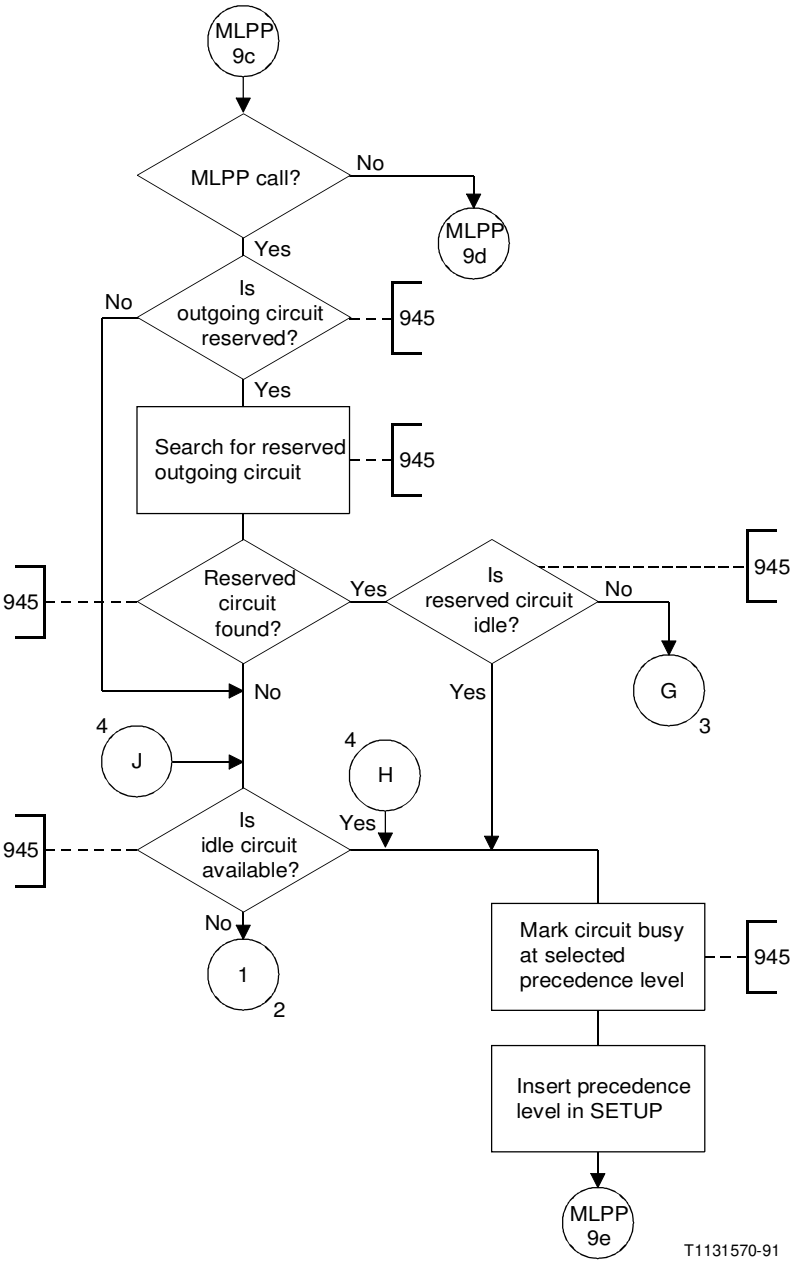


FIGURE 3-8/Q.85 (sheet 3 of 3)

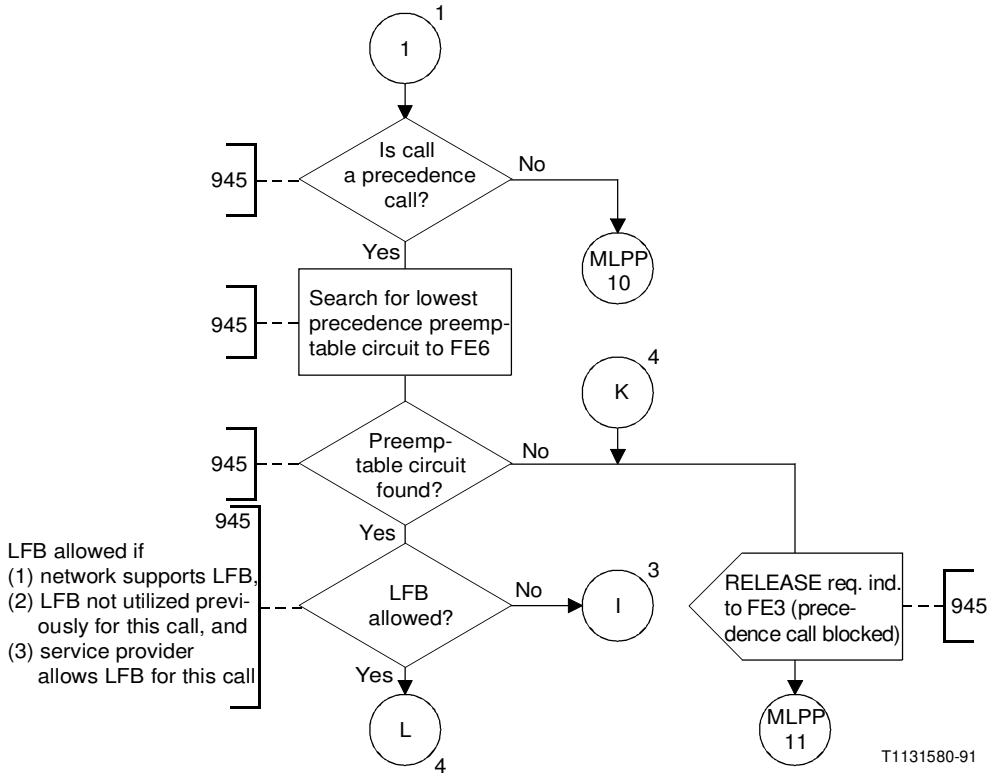
FE3 – LFB procedure



Note – MLPP 9c and MLPP 9d break the basic call between connectors S3/3 and S3/4 (see Recommendation Q.71 [3]).
MLPP 9e enters the basic call at connector S3/6 (see Recommendation Q.71 [3]).

FIGURE 3-9/Q.85 (sheet 1 of 6)

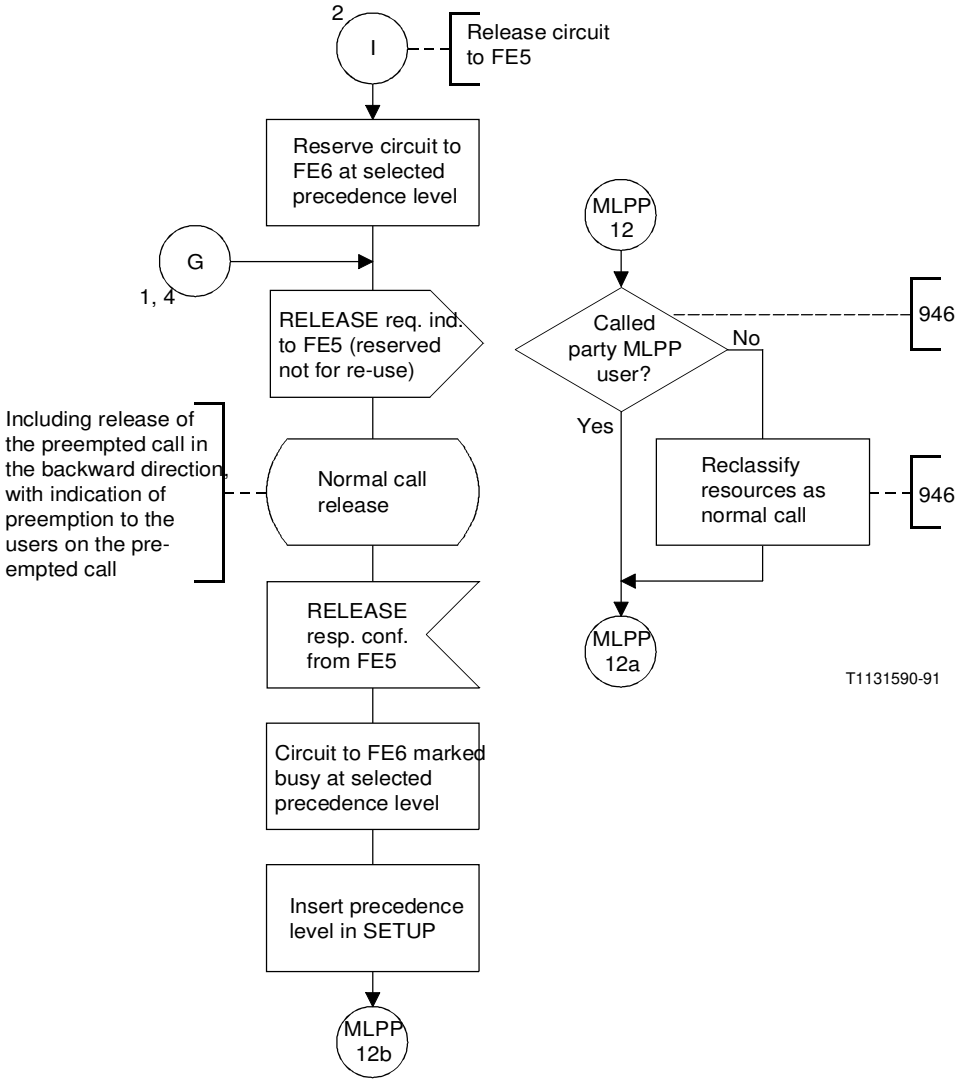
FE4 – Incoming MLPP call from FE3



Note – MLPP 10 and MLPP 11 enter the basic call at connector S4/2 (see Recommendation Q.71 [3]).

FIGURE 3-9/Q.85 (sheet 2 of 6)

FE4 – Incoming MLPP call from FE3



Note – MLPP 12 and MLPP 12a break the basic call between connectors S4/5 and S4/6 (see Recommendation Q.71 [3]).
MLPP 12b enters the basic call at connector S3/6 (see Recommendation Q.71 [3]).

FIGURE 3-9/Q.85 (sheet 3 of 6)

FE4 – Release and preemption of an existing call

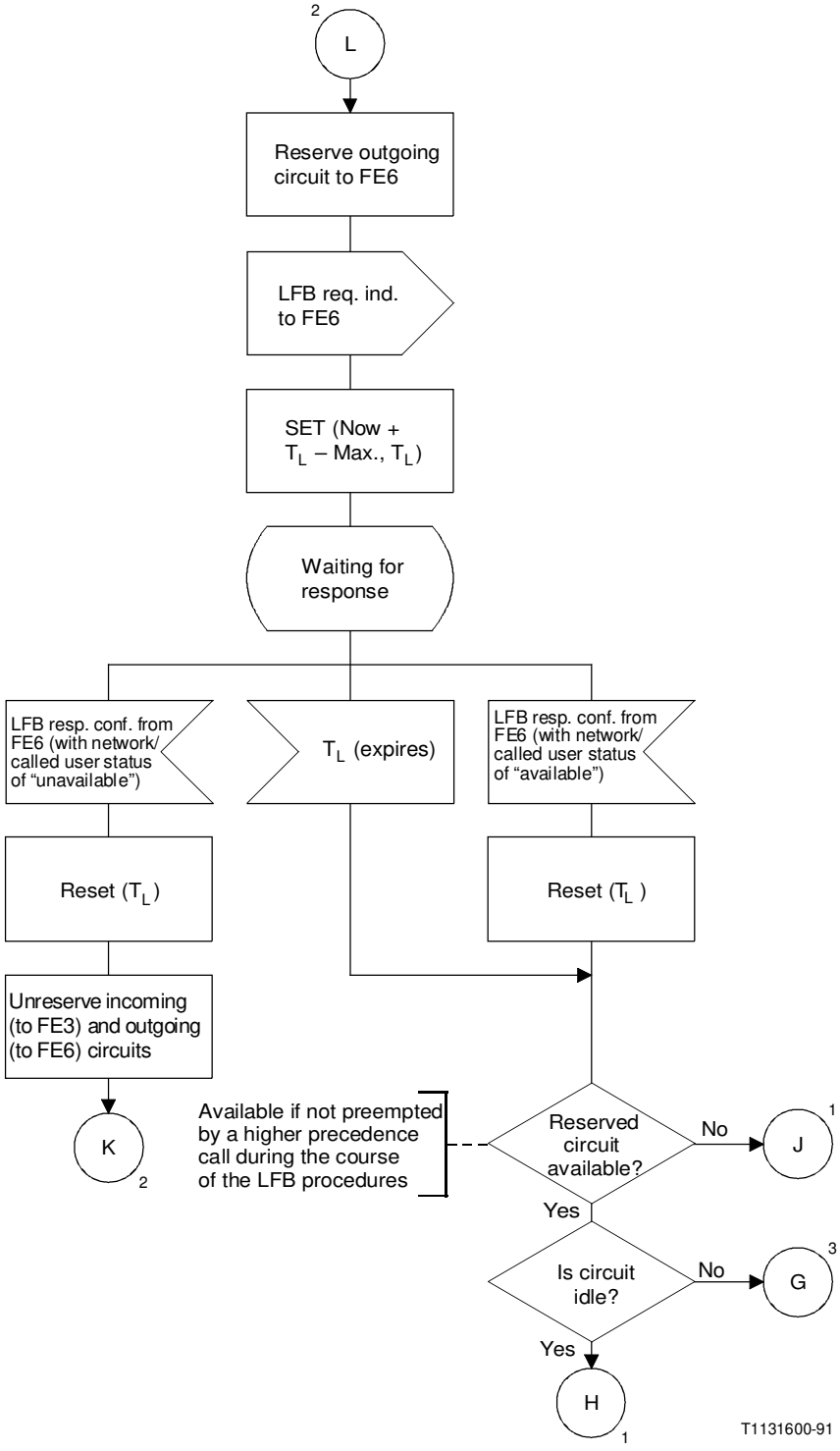


FIGURE 3-9/Q.85 (sheet 4 of 6)

FE4 – LFB initiation procedures

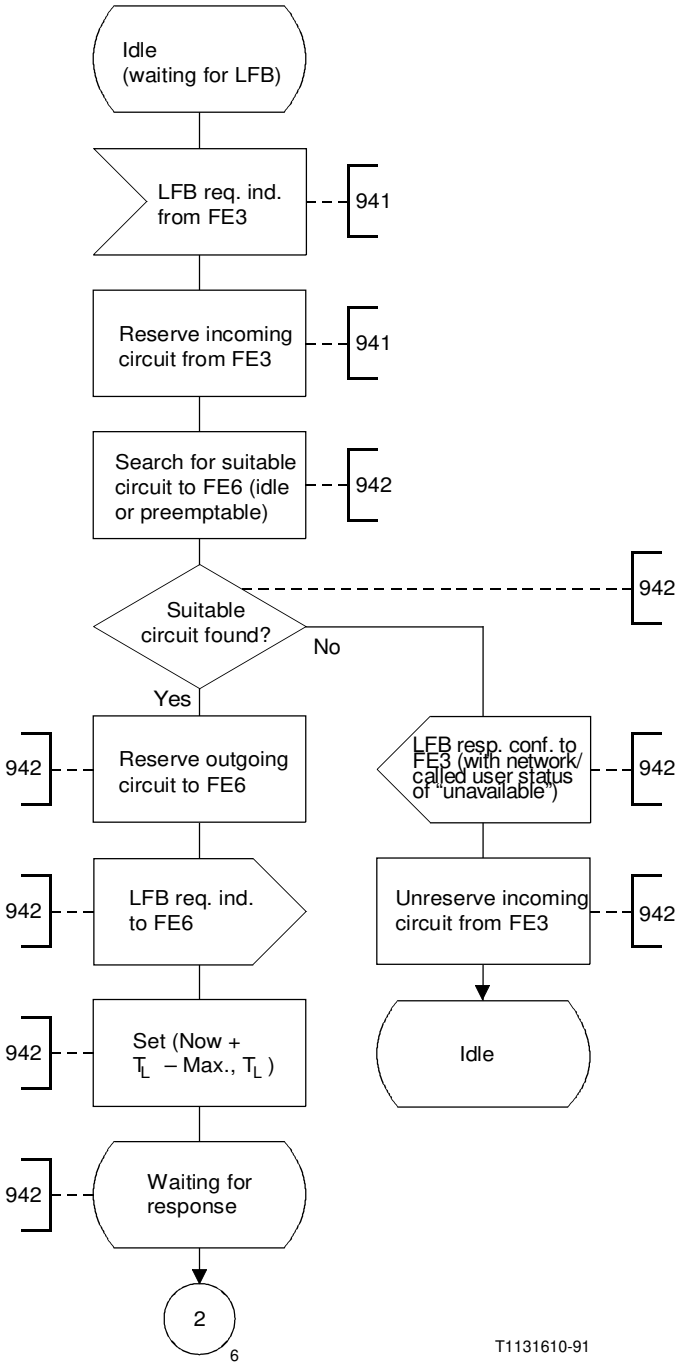
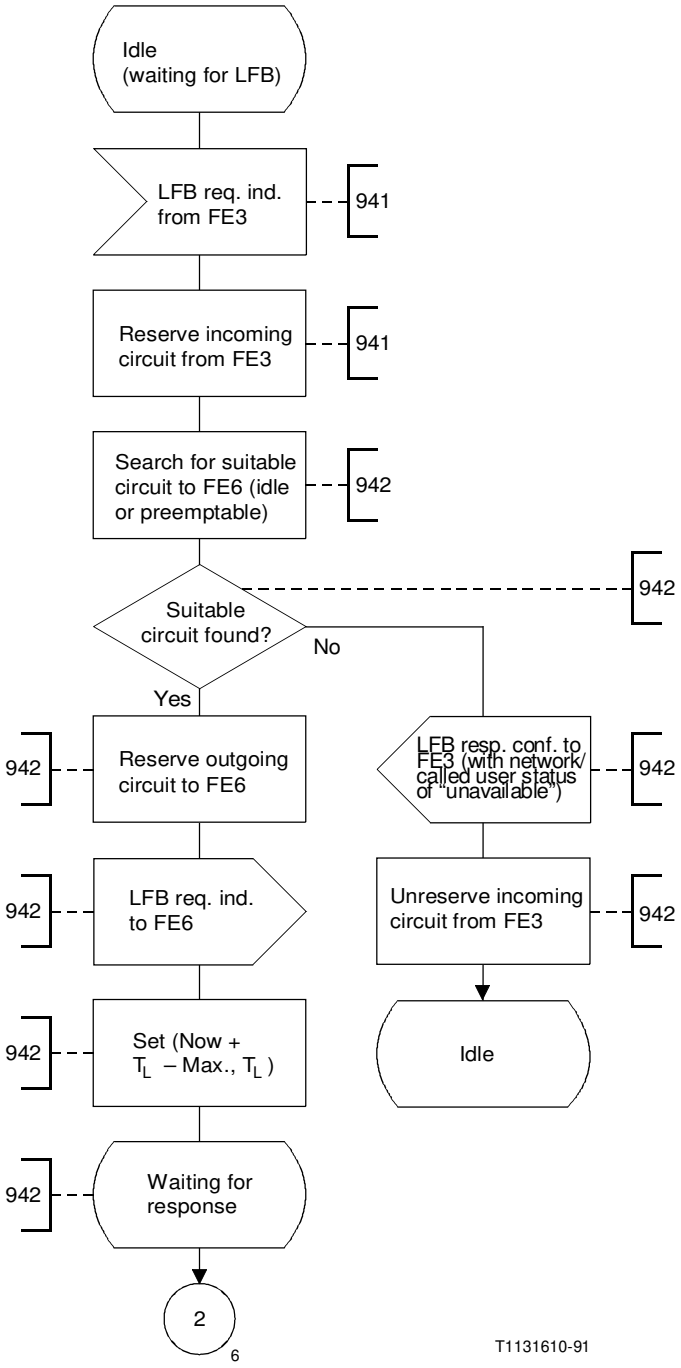
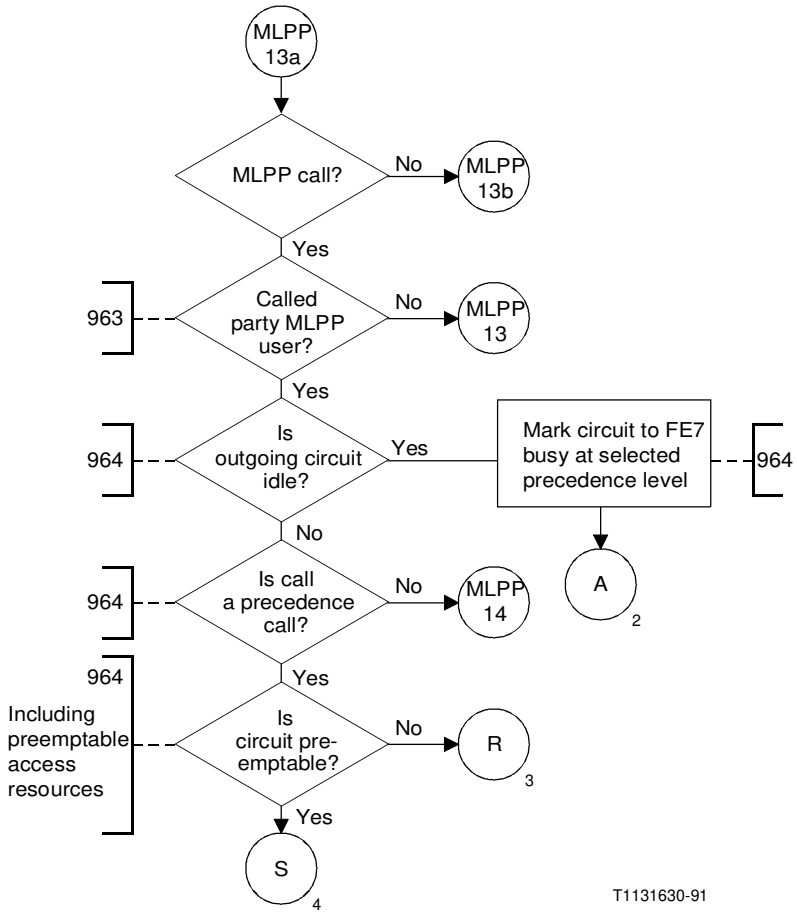


FIGURE 3-9/Q.85 (sheet 5 of 6)

FE4 – LFB continuation procedures



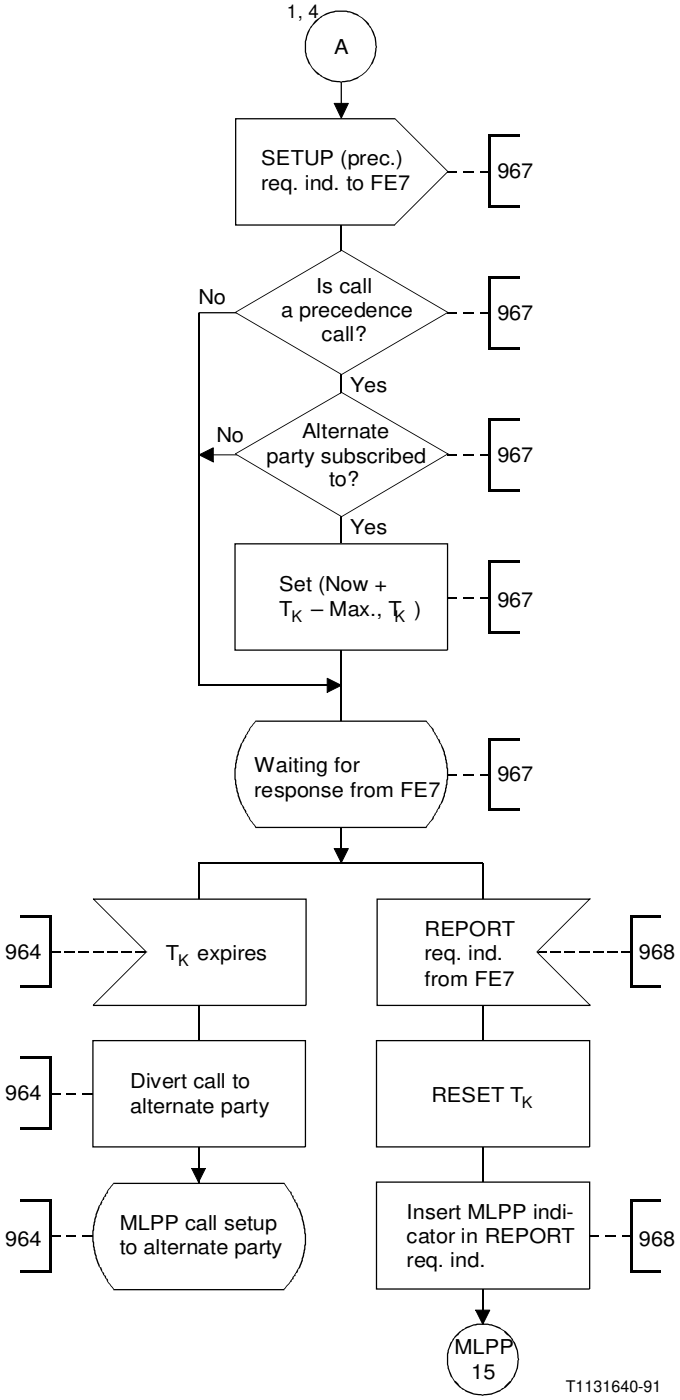
FE4 – LFB continuation procedures



Note – MLPP 13 enters the basic call at connector S4/30 (see Recommendation Q.71 [3]).
MLPP 14 enters the basic call at connector S4/2 (see Recommendation Q.71 [3]).
MLPP 13a and MLPP 13b break the basic call between connectors S4/31 and S4/32 (see Recommendation Q.71 [3]).

FIGURE 3-10/Q.85 (sheet 1 of 5)

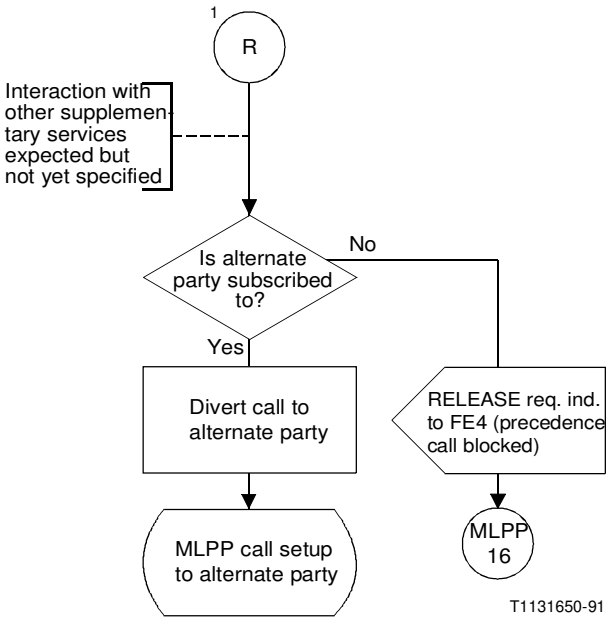
FE6 – Incoming MLPP call from FE4



Note – MLPP 15 enters the basic call at connector S4/6 (see Recommendation Q.71 [3]).

FIGURE 3-10/Q.85 (sheet 2 of 5)

FE6 – Incoming MLPP call from FE4



Note – MLPP 16 enters the basic call at connector S4/34 (see Recommendation Q.71 [3]).

FIGURE 3-10/Q.85 (sheet 3 of 5)

FE6 – Incoming MLPP call from FE4

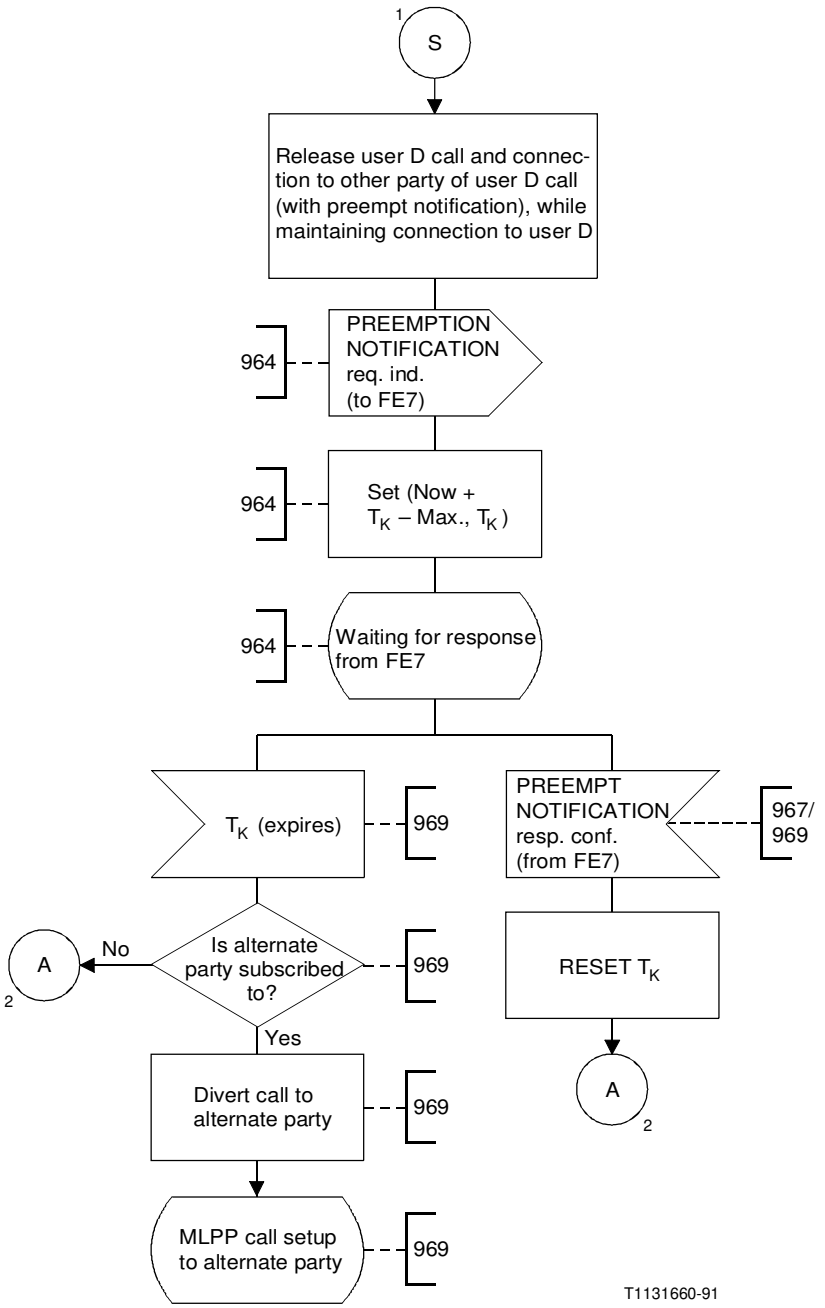


FIGURE 3-10/Q.85 (sheet 4 of 5)

FE6 – Release and preemption of an existing call

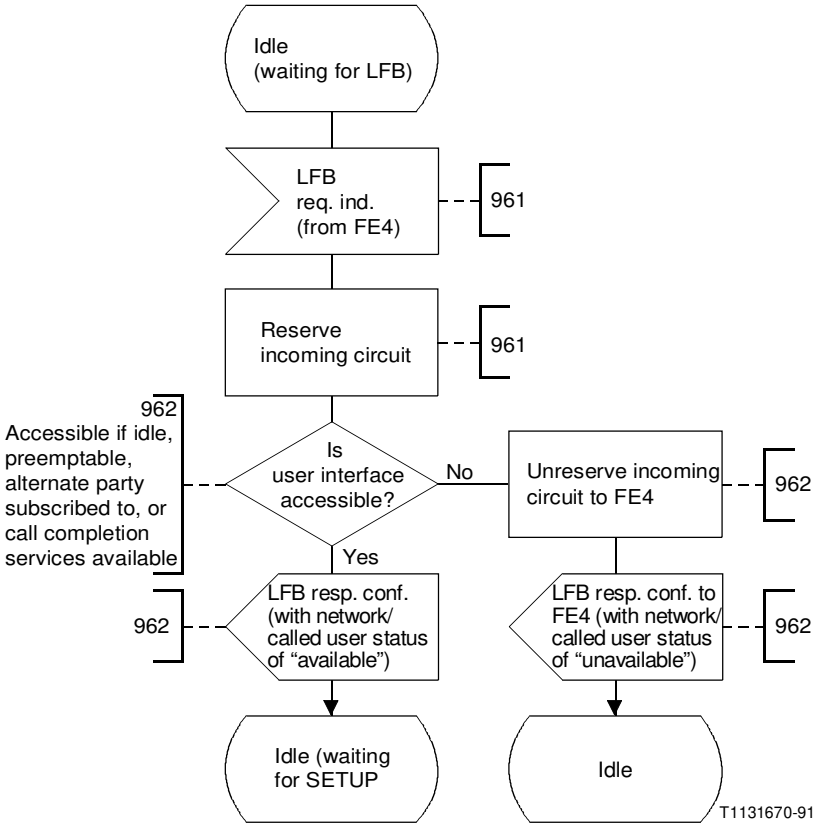
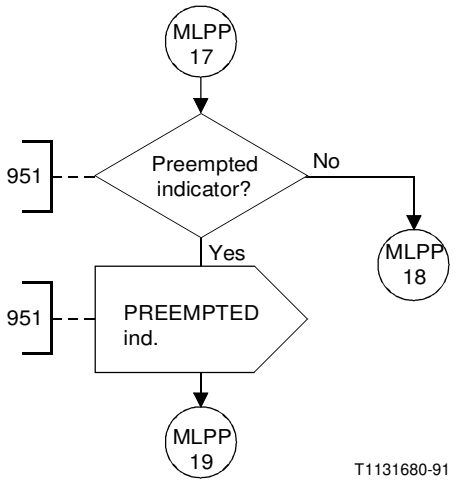


FIGURE 3-10/Q.85 (sheet 5 of 5)

FE6 – LFB procedures



Note – MLPP 17, MLPP 18 and MLPP 19 break the basic call between connectors S1/15, S1/16 and S1/MLPP 19 or S5/14, S5/15 and S5/16 (see Recommendation Q.71 [3]).

FIGURE 3-11/Q.85

FE5 – Preempted notification to user

3.9.1 *FEAs of FE1*

911**:** Insert the precedence level in the call set-up information.

3.9.2 *FEAs of FE2*

921: Check for the cause preempted in the DISCONNECT req. ind. and if it is present, send a PREEMPTED ind. to the user.

3.9.3 *FEAs of FE3*

931**:** Receive a higher precedence call request from user [via SETUP (prec) req. ind.].

Check and validate subscription option.

Validate the precedence level of the call (assign the lowest precedence level if the user does not specify the precedence level for the call).

Record successful invocation by precedence level.

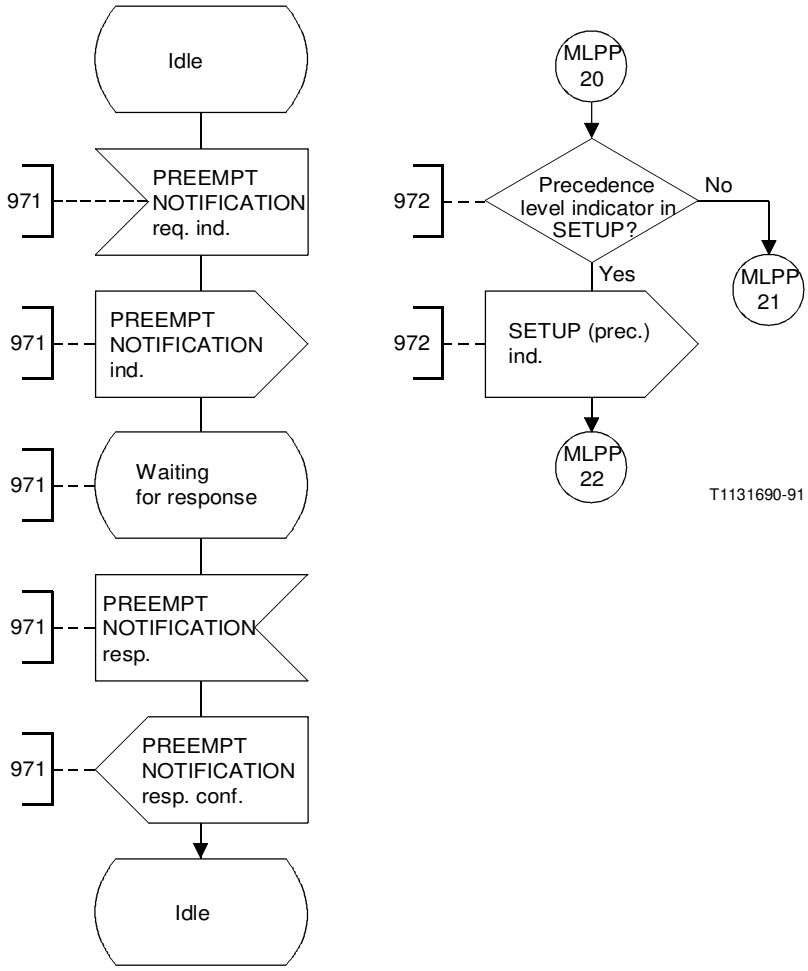
Queue the call request if all outgoing network resources to the called user are busy — that is, if congestion is encountered (if idle resources are available, mark the circuits with appropriate precedence level and MLPP domain information, and continue normal call set-up).

If no idle resources are available, search for the lowest precedence preemptable circuits within the same MLPP domain, provided that the call is a precedence call (a call with precedence level higher than the lowest level of precedence). If no preemptable circuits are available, release the call with a cause of "precedence call blocked" to the user C.

932: A preemptable circuit is available. Identify and mark the circuit as "path reserved" along with the precedence level and MLPP domain of the higher precedence call. (This happens to be the circuit of MLPP call A-B between FE3 and FE4.)

Send LFB req. ind. to the next FE on the route (FE4).

Start timer T_L (if the LFB resp. conf. is not received before timer T_L expires, preemption is initiated as given in FEA 934).



Note – MLPP 20, MLPP 21 and MLPP 22 break the basic call between connectors S5/1, S5/2 and S5/18 (see Recommendation Q.71 [3]).

FIGURE 3-12/Q.85

FE7 – Incoming MLPP call to user

933**:** Receive LFB resp. conf.

Determine the status of the called user and network resources (circuits). If the network/called party status is "unavailable", a RELEASE req. ind. is sent to user C with a "precedence call blocked" indication, and the call A-B is not preempted.

If the network/called party status is "available", and if the reserved circuit is not preempted by another higher precedence call during the course of the LFB procedure, then proceed as shown in FEA 934.

934**:** A DISCONNECT req. ind. is sent to the preceding FE (FE2) and a RELEASE req. ind. is sent to the next FE to preempt the lower precedence call A-B.

A SETUP (prec) req. ind. is initiated and sent to the next FE (in this case it is FE4). The SETUP (prec) req. ind. includes the LFB indicator, MLPP domain, and the precedence level required to setup the higher precedence call C-D.

935: Receive REPORT req. ind.

Examine the MLPP indicator. If the called party is not an MLPP user, reclassify the call as a normal call.

Relay the REPORT req. ind. to the preceding FE.

Continue normal call setup.

3.9.4 *FEAs of FE4*

941**:** Receive LFB req. ind.

Mark the preemptable incoming circuit as "path reserved" along with the precedence level and MLPP domain of the higher precedence call.

942**:** Search for the lowest precedence preemptable outgoing circuits within the same MLPP domain. (If no preemptable circuits are available, unreserve the incoming circuit and send LFB resp. conf. to the preceding FE with the network/called user status of "unavailable".)

A preemptable circuit is available. Mark the preemptable outgoing circuit as "path reserved" along with the precedence level and MLPP domain of the higher precedence call.

Send LFB req. ind. to the next FE on the route.

Start timer T_L (if the LFB resp. conf. is not received before timer T_L expires, the outgoing circuit is unreserved and an LFB resp. conf. "available" indication is returned to the preceding FE).

943: Receive LFB resp.conf.

Determine the status of the called user and network resources (circuits). If the network/called party status is "unavailable", unreserve the incoming and outgoing circuits.

Relay LFB resp. conf. to the preceding FE.

944: Receive RELEASE req. ind. from the preceding FE.

Release the network resources of the lower precedence call A-B.

Send RELEASE resp. conf. to the preceding FE.

945**:** Receive SETUP (prec) req. ind. from the preceding FE.

Search for the reserved outgoing circuit. If the reserved outgoing circuit was preempted by another higher precedence call, initiate a normal search for an idle or preemptable circuit to reserve without using the LFB option (the procedure is similar to the procedure as described in FEA 931).

If the reserved outgoing circuit is found and is idle, mark circuit as "busy" at selected precedence level and MLPP domain. If the reserved circuit is found and is busy with lower precedence, preempt the reserved outgoing circuit before marking circuit as "busy" at selected precedence level and MLPP domain.

Send SETUP (prec) req. ind. to the next FE. The SETUP (prec) req. ind. includes MLPP domain, LFB indicator, calling party number, and the precedence level required to setup the higher precedence call C-D.

946**:** Receive REPORT req. ind.

Examine the MLPP indicator. If the called party is not an MLPP user, reclassify the call a normal call.

Relay the REPORT to req. ind. to the preceding FE.

3.9.5 *FEAs of FE5*

951: Check for the cause preempted in the RELEASE req. ind. and if it is present send a PREEMPTED ind. to the user.

3.9.6 *FEAs of FE6*

961**:** Receive LFB req. ind.

Mark the preemptable incoming circuit as "path reserved" along with the precedence level and MLPP domain of the higher precedence call.

962**:** Determine the status of the called party. If the called party is available (the circuit is idle, preemptable, or the called party is subscribed to call completion service or has an alternate party) then send LFB resp. conf. to the preceding FE with network/called user status of "available". Otherwise, an LFB resp. conf. is sent to the preceding FE with network/called user status of "unavailable".

963**:** Receive SETUP (prec) req. ind. from the preceding FE.

Identify MLPP subscription status (MLPP or non-MLPP user) of called party. If the called party is a non-MLPP user, continue setup using basic call setup procedures and, once a SETUP resp. conf. is received from FE7, proceed as shown in FEA 968. If the called party is an MLPP subscriber, continue MLPP call setup as shown in FEA 964.

964**:** Search for an idle outgoing circuit. (If there is an idle outgoing circuit, mark the outgoing circuit as "busy" at selected precedence level and MLPP domain, and send SETUP (prec) req. ind. to the user D).

If no idle resources are available, search for the lowest precedence preemptable circuits within the same MLPP domain, provided that the call is a precedence call (a call with precedence level higher than the lowest level of precedence).

If the called user is busy with a lower precedence call, an "intended preemption" indicator is sent to the called user D via PREEMPT NOTIFICATION req. ind.

Start timer T_K (If no acceptance of intended preemption is received before the expiry of timer T_K, call diversion is initiated to the alternate party).

965: Determine the status of the called user D (busy with lower precedence level call in this case).

966**:** Initiate preemption of current call between user A and user D by sending RELEASE req. ind. to FE4.

967: Receive called user acceptance of intended preemption (via PREEMPT NOTIFICATION resp. conf.)

Mark circuit as "busy" at selected precedence level and MLPP domain.

Initiate call setup by sending SETUP (prec) req. ind. to user D.

968: Insert MLPP indicator in REPORT req. ind. to indicate the status of the called party (MLPP or non-MLPP user).

Relay REPORT req. ind. to FE4.

969: Receive called user acceptance of intended preemption (via PREEMPT NOTIFICATION resp. conf.). (If no acceptance of intended preemption is received before the expiry of timer T_K, initiate alternate party diversion).

Reserve user access channel for preempting call.

3.9.7 *FEAs of FE7*

971**:** Receive PREEMPT NOTIFICATION req. ind. from the preceding FE.

Send a PREEMPT NOTIFICATION ind. to the user and wait for a response.

Receive PREEMPT NOTIFICATION resp. from the user.

Send a PREEMPT NOTIFICATION resp. conf. to the preceding FE.

972**:** Receive SETUP (prec) req. ind. for the preceding FE.

Check for the precedence level in SETUP req. ind. and if it is present, send SETUP (prec) ind. to user. If it is not present, it will be treated as a non-compatible call in accordance with basic call procedures.

3.10 *Allocation of functional entities to physical locations*

The functional model relates to preemption of call(s) in the network to connect a higher precedence call. The following matrix contains additional, non-exhaustive scenarios.

Functional entities

Functional entities / Scenarios	FE1	FE2	FE3	FE4	FE6	FE5	FE7
Scenario 1	TE	TE	LE	LE	LE	TE	TE
Scenario 2	TE	TE	PNX	LE	PNX	TE	TE
Scenario 3	TE	TE	PNX	TR	LE	TE	TE
Scenario 4	TE	TE	LE	TR	PNX	TE	TE
Scenario 5	TE	TE	TR	LE	LE	TE	TE
Scenario 6	TE	TE	TR	LE	PNX	TE	TE
Scenario 7	TE	TE	TR	TR	LE	TE	TE
Scenario 8	TE	TE	TR	TR	PNX	TE	TE

LE Local exchange
TE Terminal equipment
TR Transit exchange
PNX Private network exchange