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ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Q.764 – Annex H

(02/95)

**SPECIFICATION OF
SIGNALLING SYSTEM No. 7**

**SIGNALLING SYSTEM No. 7 –
ISDN USER PART SIGNALLING
PROCEDURES**

ANNEX H: STATE TRANSITION DIAGRAMS

ITU-T Recommendation Q.764 – Annex H

(Previously “CCITT Recommendation”)

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation Q.764 – Annex H was prepared by ITU-T Study Group 11 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 7th of February 1995.

NOTE

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

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SIGNALLING SYSTEM No. 7 – ISDN USER PART SIGNALLING PROCEDURES

(Malaga-Torremolinos 1984; modified at Helsinki, 1993)

Annex H

State transition diagrams

(Geneva, 1995)

(This annex forms an integral part of this Recommendation)

NOTE – Should any conflict arise between the text and the SDL definition, the textual description is taken as definitive.

H.1 General

This annex contains the description of the signalling procedures described in this Recommendation in the form of state transition diagrams according to the CCITT Specification and Description Language (SDL). In order to facilitate functional description, the ISDN User Part (ISDN-UP) signalling procedure is divided into main functional blocks, as shown in Figure H.1. These blocks are as follows:

1) *Signalling Procedure Control (SPRC)*

SPRC provides procedures for sending ISDN-UP messages to Level 3 (SCCP or MTP) and distributing received messages to the other ISDN-UP functional blocks.

2) *Call Processing Control (CPC)*

CPC provides call control procedures for realizing basic circuit-switched service according to user's request.

3) *Circuit Supervision Control (CSC)*

CSC provides procedures for circuit supervision control for maintenance purpose and for recovery from abnormal situation.

H.2 Drafting convention

- a) External inputs and outputs are used for interactions with a remote exchange and interaction between SPRC and the other functional blocks. Internal inputs and outputs are used for interactions within each functional block, e.g. to indicate control of timeout. For these interactions, input and output symbols are used as shown in Figure H.2.
- b) Inputs and outputs symbols contain as part of their name acronyms of their source and destination functional block names with an arrow in between, e.g. Blocking BLS → CPC.
- c) A simple example of SDL diagram according to the above conventions is shown in Figure H.3.

H.3 Abbreviations, timers and primitives

H.3.1 Abbreviations

For the purposes of this Recommendation, the following abbreviations are used:

- 1) Table H.1:
Signalling Procedure Control.
- 2) Table H.2:
Call Processing Control.
- 3) Table H.3:
Circuit Supervision Control.

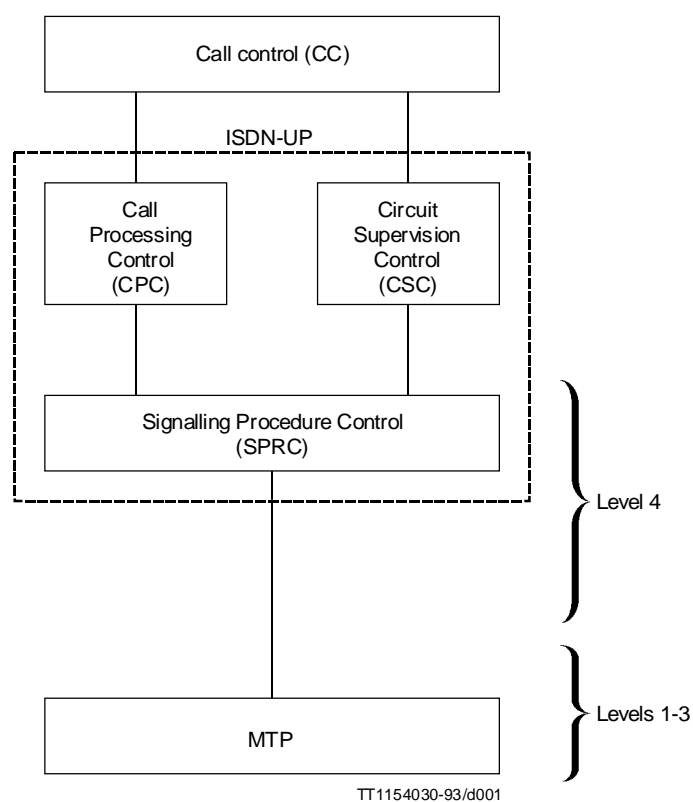
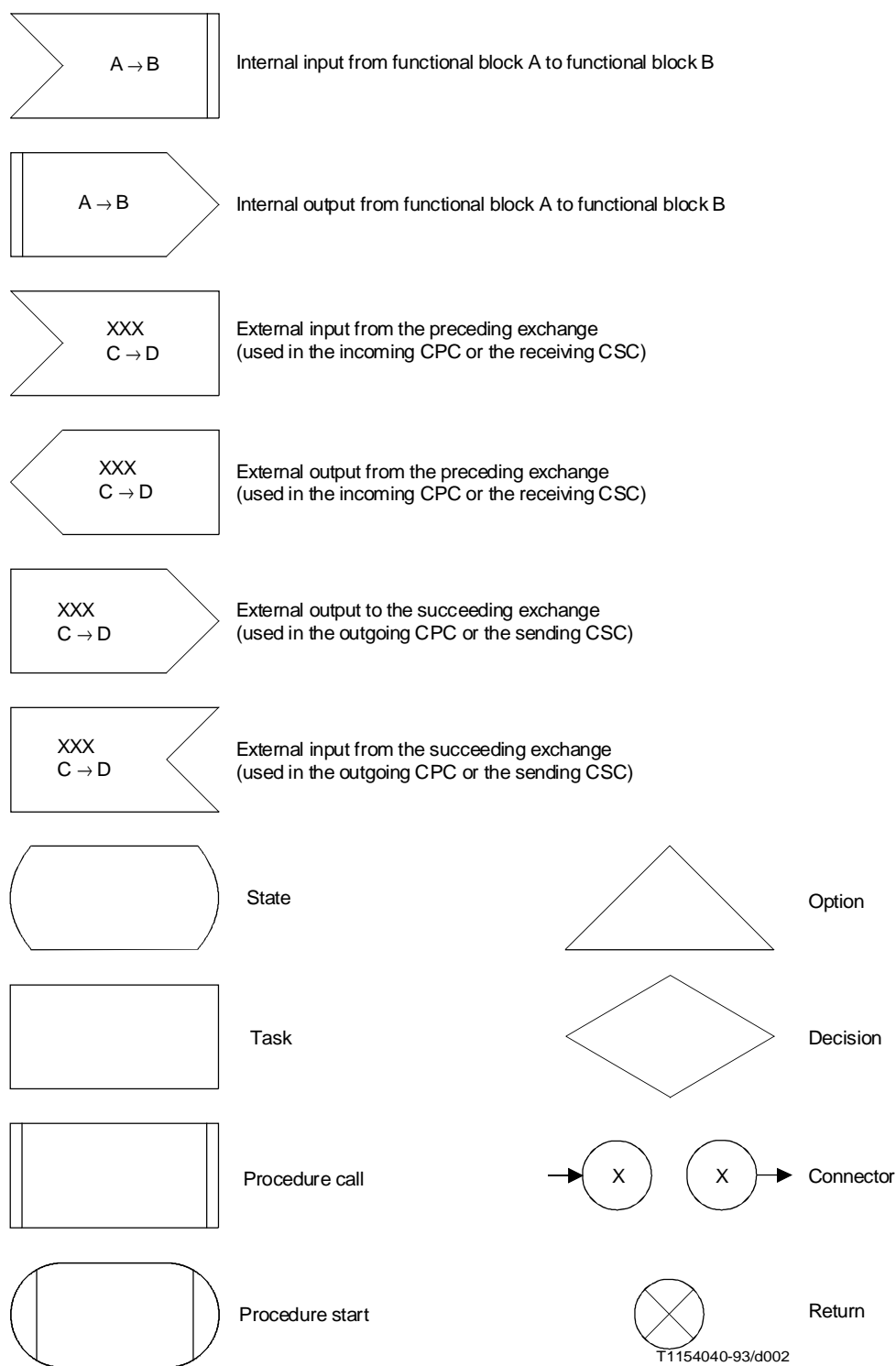
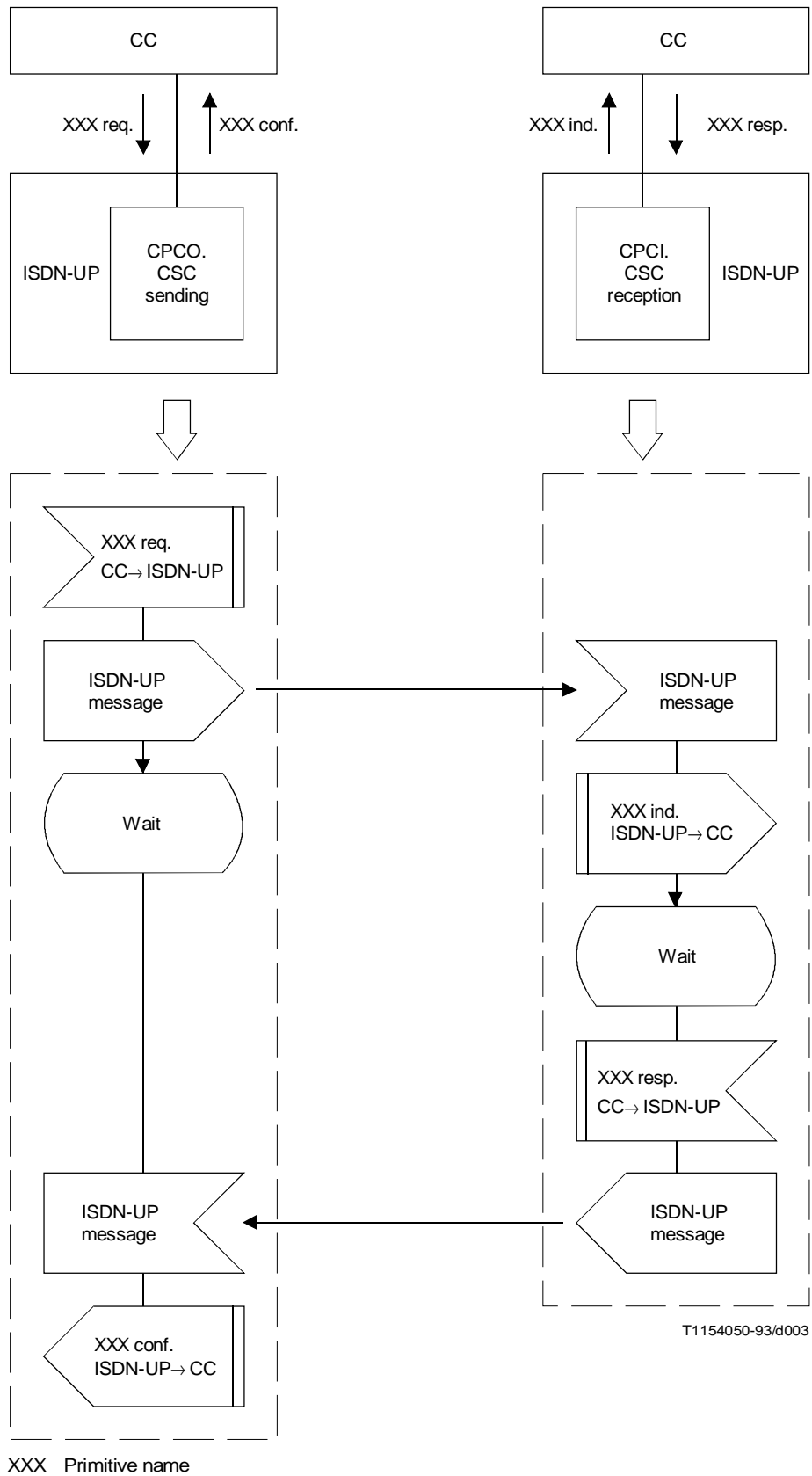


FIGURE H.1/Q.764
Overview functional block diagram for basic call ISDN-UP



NOTE – Input which is not explicitly or implicitly shown in SDL diagrams should be discarded.

FIGURE H.2/Q.764
Symbols used in the SDL diagrams



T1154050-93/d003

FIGURE H.3/Q.764
SDL convention example

TABLE H.1/Q.764

Signalling procedure control acronym

	Acronym	Description
Funcional block name	BLR	Blocking/Unblocking Message Reception
	BLS	Blocking/Unblocking Message Sending
	CCO	Continuity Check Outgoing
	CCI	Continuity Check Incoming
	CGRS	Circuit Group Reset Sending
	CGRR	Circuit Group Reset Reception
	CPC	Call Processing Control
	CRR	Circuit Reset Reception
	CRS	Circuit Reset Sending
	CSC	Circuit Supervision Control
	SPCR	Signalling Procedure Control
	MGBR	Maintenance Oriented Circuit Group Blocking/Unblocking Reception
	HGBR	Hardware Failure Oriented Circuit Group Blocking/Unblocking Reception
	MGBS	Maintenance Oriented Circuit Group Blocking/Unblocking Sending
	HGBS	Hardware Failure Oriented Circuit Group Blocking/Unblocking Sending
	CRCR	Continuity Recheck Control Reception
	CRCS	Continuity Recheck Control Sending
	MSDC	Message Sending Control
	MDSC	Message Distribution Control
Message type	BLA	Blocking Acknowledgement
	BLO	Blocking
	GRA	Group Reset Acknowledgement
	GRS	Group Reset
	UBA	Unblocking Acknowledgement
	UBL	Unblocking
	CCR	Continuity Check Request
	CGB	Circuit Group Blocking
	CGBA	Circuit Group Blocking Acknowledgement
	CGU	Circuit Group Unblocking
	CGUA	Circuit Group Unblocking Acknowledgement
	RSC	Reset Cicuit
	CFN	Confusion

TABLE H.2/Q.764

Call processing control acronym

	Acronym	Description
General	OGC	Outgoing Trunk Circuit
	ICC	Incoming Trunk Circuit
	CCH	Continuity Check Indicator
Functional block name	CC	Call Control
	SPRC	Signalling Procedure Control
	CPC	Call Processing Control
	BLR	Blocking/Unblocking Message Reception
	BLS	Blocking/Unblocking Message Sending
	CCO	Continuity Check Outgoing
	CCI	Continuity Check Incoming
	CGRR	Circuit Group Reset Reception
	CRR	Circuit Reset Reception
	CRS	Circuit Reset Sending
	CPCI	Call Processing Control Incoming
	CPCO	Call Processing Control Outgoing
	SSCI	Simple Segmentation Control Incoming
	SSCO	Simple Segmentation Control Outgoing
	MGBR	Maintenance Oriented Circuit Group Blocking/Unblocking Reception
	MGBS	Maintenance Oriented Circuit Group Blocking/Unblocking Sending
	HGBR	Hardware Failure Oriented Circuit Group Blocking/Unblocking Reception
	HGBS	Hardware Failure Oriented Circuit Group Blocking/Unblocking Sending
	CRCR	Continuity Recheck Control Reception
	CRCS	Continuity Recheck Control Sending
Message type	ACM	Address Complete
	ANM	Answer
	COT	Continuity
	CPG	Call Progress
	IAM	Initial Address
	NRM	Network Resource Management
	SGM	Segmentation
	SUS	Suspend (Network-or user-initiated)
	RES	Resume (Network-or user-initiated)
	REL	Release
	RLC	Release Complete
	FOT	Forward Transfer
	SAM	Subsequent Address
	CON	Connect

TABLE H.3/Q.764

Circuit supervision control acronym

	Acronym	Description
Functional block name	BLR	Blocking/Unblocking Message Reception
	BLS	Blocking/Unblocking Message Sending
	CRR	Circuit Reset Reception
	CRS	Circuit Reset Sending
	CGRR	Circuit Group Reset Reception
	CGRS	Circuit Group Reset Sending
	MGBR	Maintenance Oriented Circuit Group Blocking/Unblocking Reception
	HGBR	Hardware Failure Oriented Circuit Group Blocking/Unblocking Reception
	MGBS	Maintenance Oriented Circuit Group Blocking/Unblocking Sending
	HGBS	Hardware Failure Oriented Circuit Group Blocking/Unblocking Sending
	CRCR	Continuity Recheck Reception
	CRCS	Continuity Recheck Sending
	HRB	Hardware Failure Oriented Remotely Blocking
	HLB	Hardware Failure Oriented Locally Blocking
Message type	BLA	Blocking Acknowledgement
	BLO	Blocking
	COT	Continuity
	GRA	Group Reset Acknowledgement
	GRS	Group Reset
	RLC	Release Complete
	RSC	Reset Circuit
	UBA	Unblocking Acknowledgement
	UBL	Unblocking
	CGB	Circuit Group Blocking
	CGBA	Circuit Group Blocking Acknowledgement
	CCR	Continuity Check Request
	CGU	Circuit Group Unblocking
	CGUA	Circuit Group Unblocking Acknowledgement
	REL	Release

H.3.2 Timers

Timers used in the ISDN-UP SDL diagrams are shown in Table H.4.

TABLE H.4/Q.764

Timer

Timer	Symbol	Timeout value
Awaiting RLC after REL	T1	15-60 seconds
Awaiting RLC after initial REL	T5	5-15 minutes
Awaiting RES (network) or REL after SUS (Controlling exchange)	T6	Covered in Rec. Q.118
Awaiting ACM or CON after latest address message	T7	20-30 seconds
Awaiting COT after IAM	T8	10-15 seconds
Awaiting ANM after ACM (National controlling or outgoing international exchange)	T9	Covered in Rec. Q.118
Awaiting BLA after BLO	T12	15-60 seconds
Awaiting BLA after initial BLO	T13	5-15 minutes
Awaiting UBA after UBL	T14	15-60 seconds
Awaiting UBA after initial UBL	T15	5-15 minutes
Awaiting RLC after RSC (Not due to expiry of T5)	T16	15-60 seconds
Awaiting RLC after initial RSC	T17	5-15 minutes
Awaiting CGBA after CGB	T18	15-60 seconds
Awaiting CGBA after initial CGB	T19	5-15 minutes
Awaiting CGUA after CGU	T20	15-60 seconds
Awaiting CGUA after initial CGU	T21	5-15 minutes
Awaiting GRA after GRS	T22	15-60 seconds
Awaiting GRA after initial GRS	T23	5-15 minutes
Awaiting backward check tone	T24	< 2 seconds
After initial continuity check failure	T25	1-10 seconds
After subsequent continuity check failure	T26	1-3 minutes
Awaiting CCR after continuity check failure	T27	4 minutes
Awaiting SGM after a segmented message is received	T34	2-4 seconds
Awaiting COT or REL after CCR (Transit or incoming international exchange)	T36	10-15 seconds
Awaiting indication that a half echo control device is included/not included	T37	2-4 seconds
Awaiting RES (network) or REL after SUS (network) (Incoming international exchange)	T38	Covered in Rec. Q.118

H.3.3 Primitives

Primitives used over the interface between call control and ISDN-UP are shown in Table H.5.

TABLE H.5/Q.764

Primitives

Primitive		ISDN-UP message	Interface
Set-up	Request Indication	IAM ANM, CON	Interface between CC and CPC
Release	Response Confirmation	REL, RLC	
Reset	Indication Response	RSC, RLC GRS, GRA	
Forward Transfer	Request Indication	FOT	
Proc		ACM (Other)	
Alert		CPG, ACM (Subscriber fee)	
Info		SAM	
Prog ^{a)}		CPG, ACM (Interworking, Q.931 progress indicator)	
IBI ^{b)}		CPG (In-band information) ACM (In-band information)	
Suspended		SUS	
Resumed		RES	
Blocking		Request Indication	
Unblocking	Response Confirmation	UBL, UBA CGU, CGUA	
Stop ^{c)}	Request Confirmation		
Continuity Recheck		CCR	
Reset		GRS, GRA	
		RSC, RLC	
CallFailure ^{c)}	Indication		Interface between CC and CPC
Reattempt ^{c)}			
Continuity Report	Request	COT	
NRM	Indication	NRM	
UMT		UMT	
MaintenanceSystem ^{c)}	Indication		Interface between CC and CSC
StartReset ^{c)}			
<div><div><div>a)</div><div>Prog (network): Interworking. Prog (access): Q.931 progress indicator.</div></div><div><div>b)</div><div>IBI: In-band information available.</div></div><div><div>c)</div><div>Local primitive (does not have end-to-end significance).</div></div></div>			

H.4 State transition diagrams and SDL diagrams

Each ISDN-UP main functional block is further sub-divided into the functional blocks. Functional diagrams and simple state transition diagrams for each main functional block are shown below:

1) *Signalling Procedure Control (SPRC)*

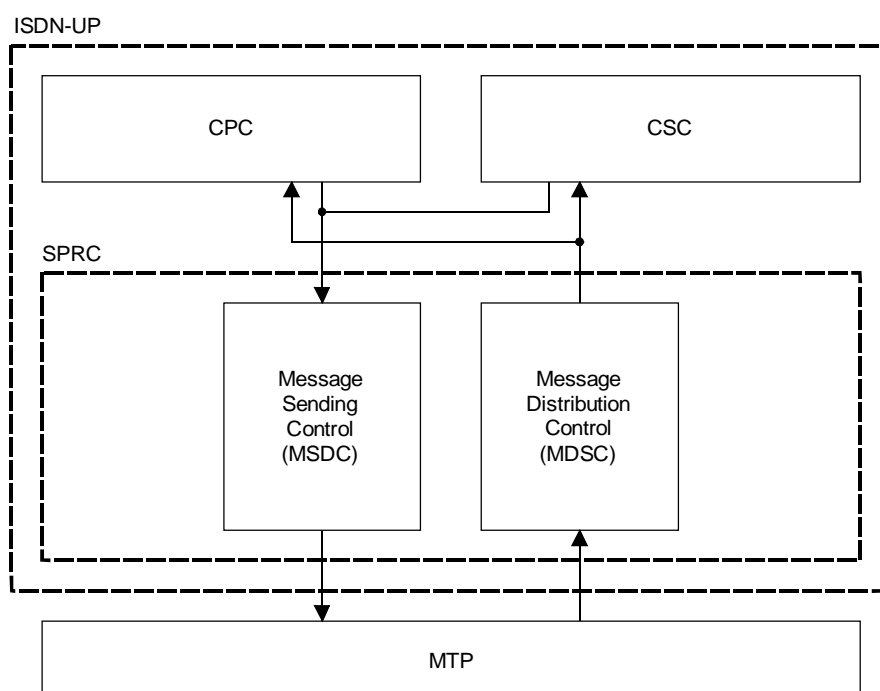
- Figure H.4:
Functional diagrams.
- Figure H.5:
State transition diagrams.

2) *Call Processing Control (CPC)*

- Figure H.6:
Functional diagrams.
- Figures H.7 to H.10:
State transition diagrams.

3) *Circuit Supervision Control (CSC)*

- Figure H.11:
Functional diagrams.
- Figures H.12 to H.18:
State transition diagrams.



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FIGURE H.4/Q.764
Functional block diagram for SPRC

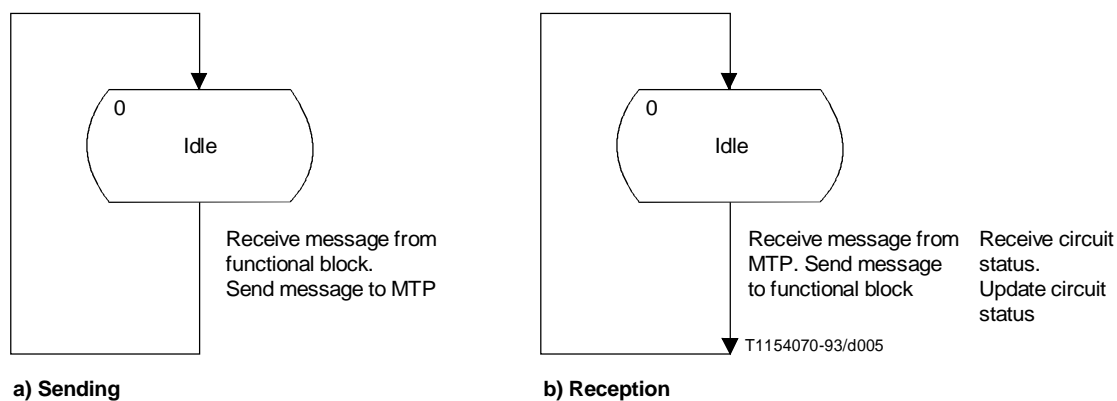


FIGURE H.5/Q.764
State transition diagrams for SPRC

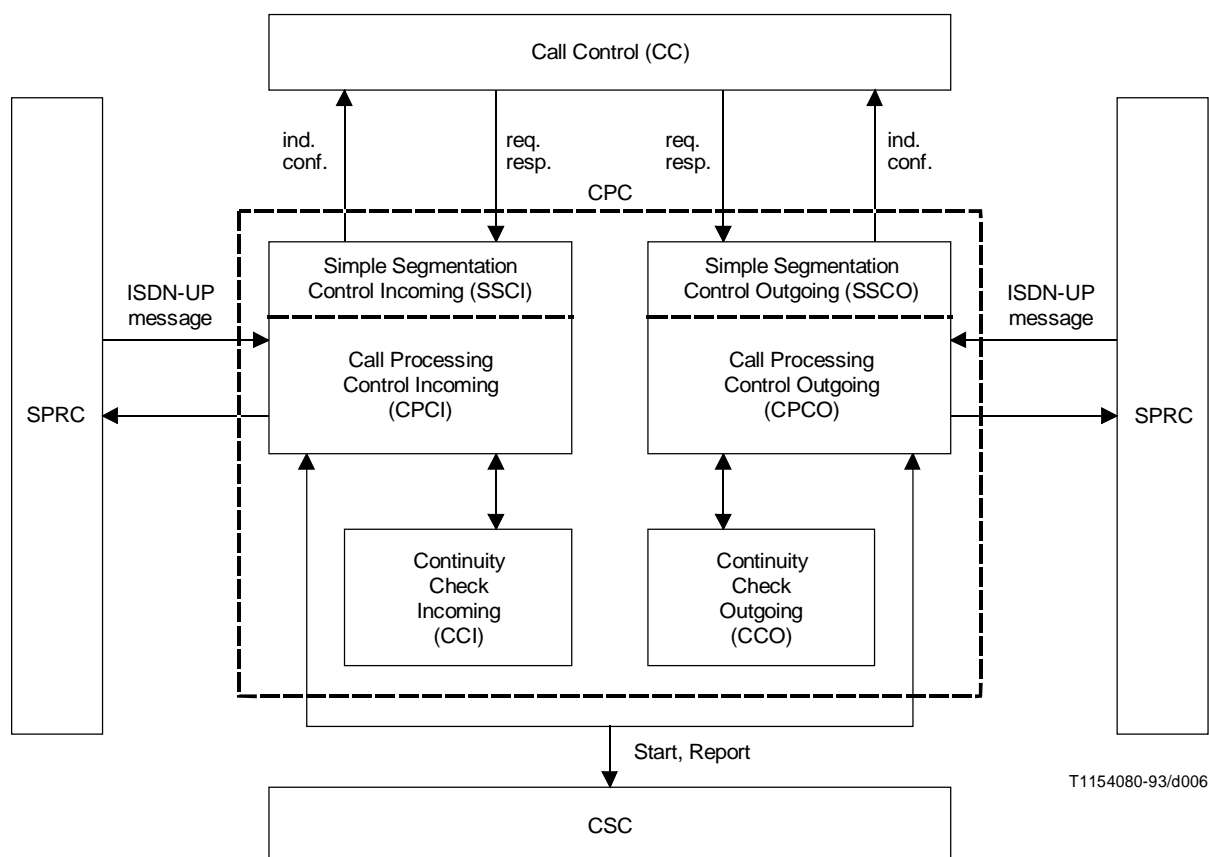
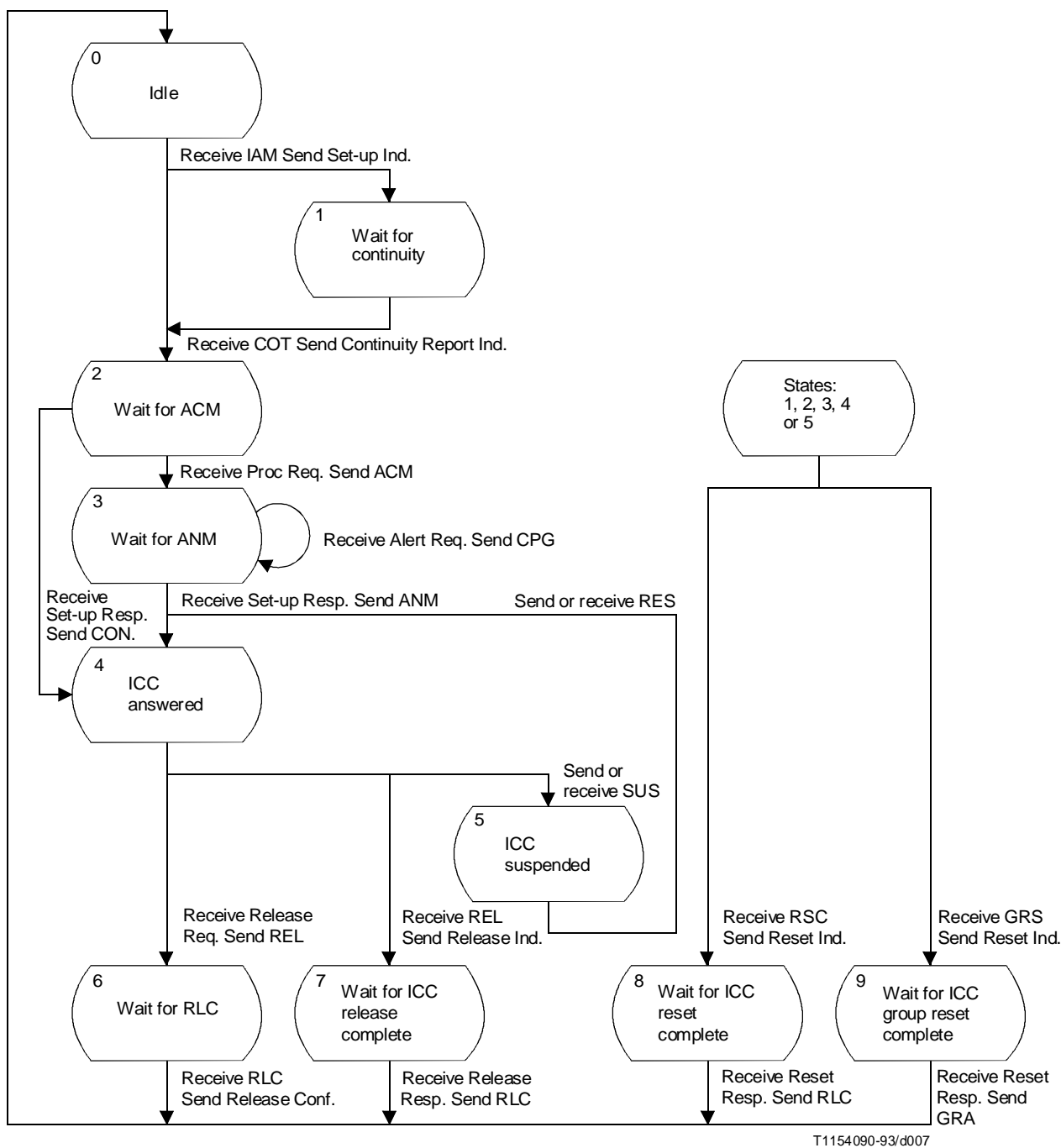


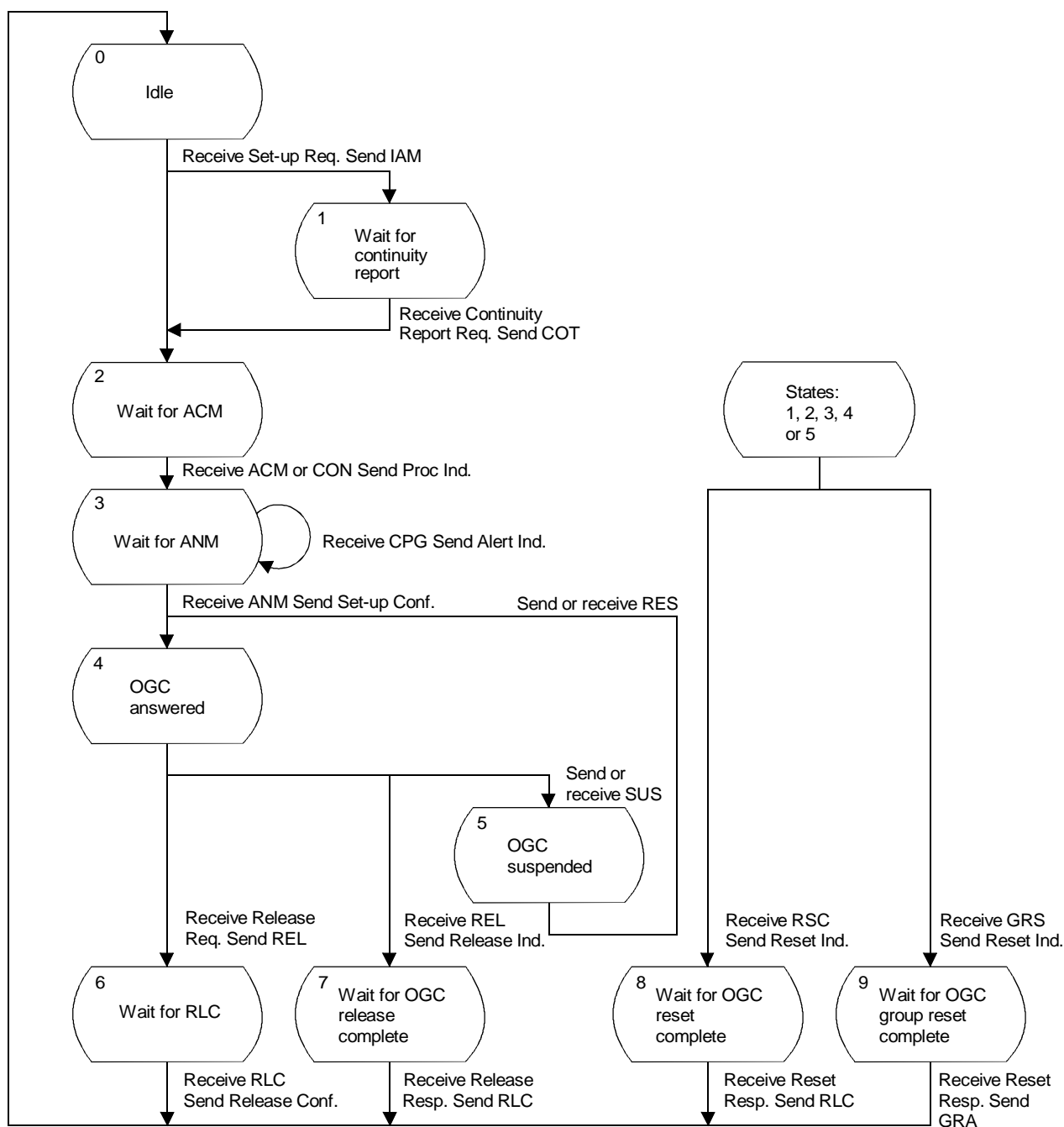
FIGURE H.6/Q.764
Functional block diagram for CPC



NOTES

- 1 An SGM or UMT, received in any state from SPRC, is sent in an SGP or UMT Indication to SSCI.
- 2 An SGP or UMT Request, received in any state from SSCI, is sent in an SGM or UMT to SPRC.

FIGURE H.7/Q.764
State transition diagram for CPC Incoming (CPCI)



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NOTES

- 1 An SGM or UMT, received in any state from SPRC, is sent in an SGP or UMT Indication to SSCO.
- 2 An SGP or a UMT Request, received in any state from SSCO, is sent in an SGM or UMT to SPRC.

FIGURE H.8/Q.764
State transition diagram for CPC Outgoing (CPCO)

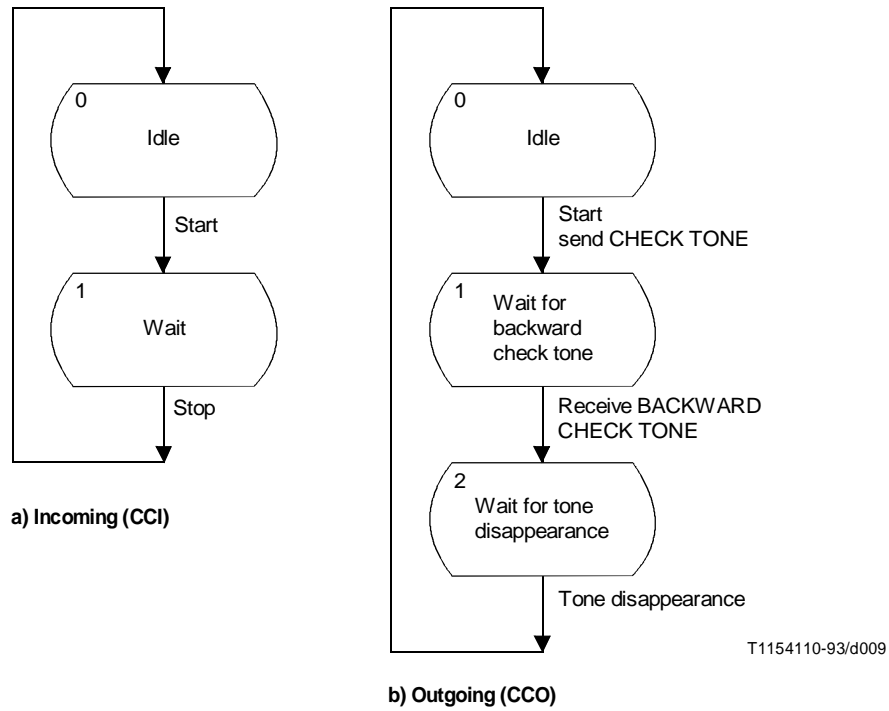


FIGURE H.9/Q.764
State transition diagrams for CPC Continuity Check

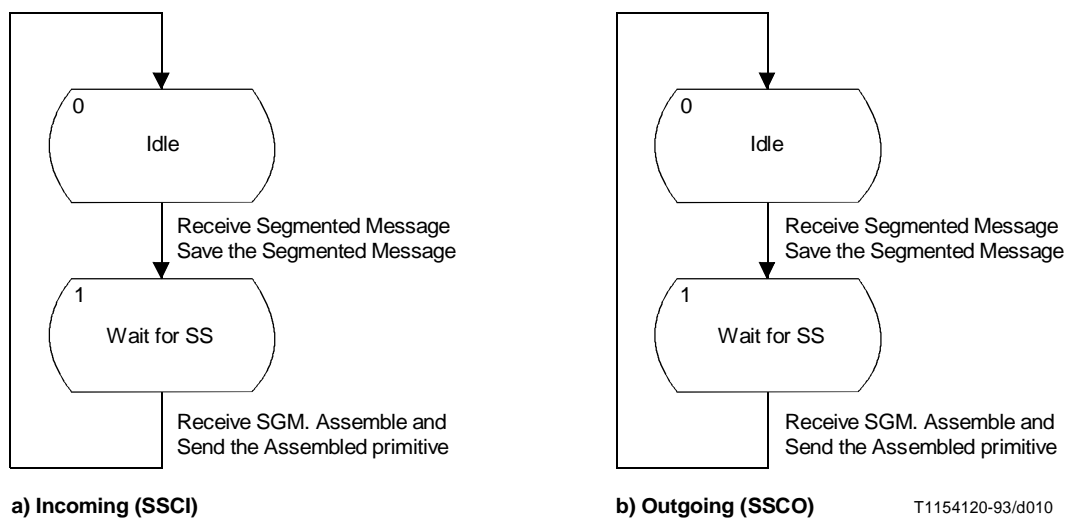
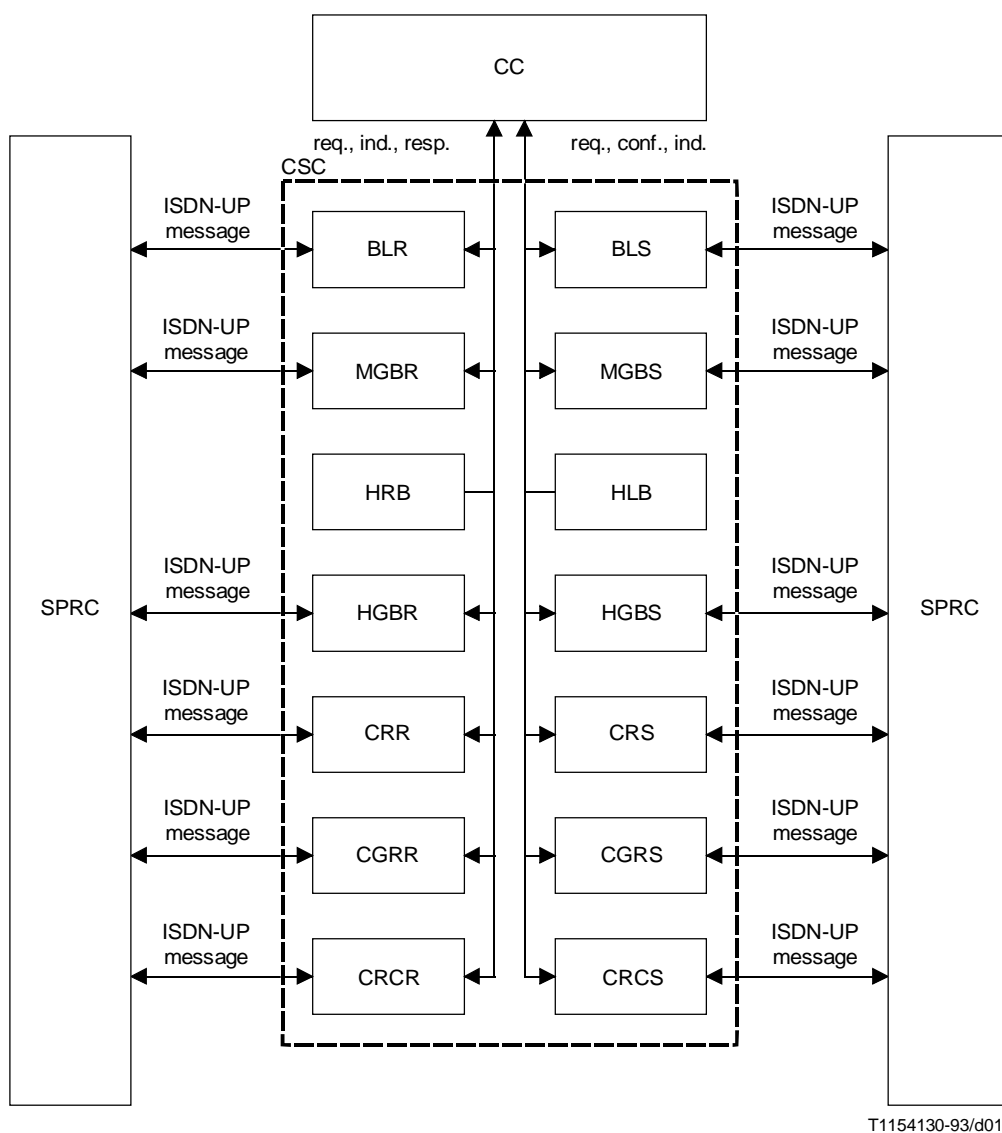


FIGURE H.10/Q.764
State transition diagrams for CPC Simple Segmentation



T1154130-93/d011

FIGURE H.11/Q.764
Functional block diagram for CSC

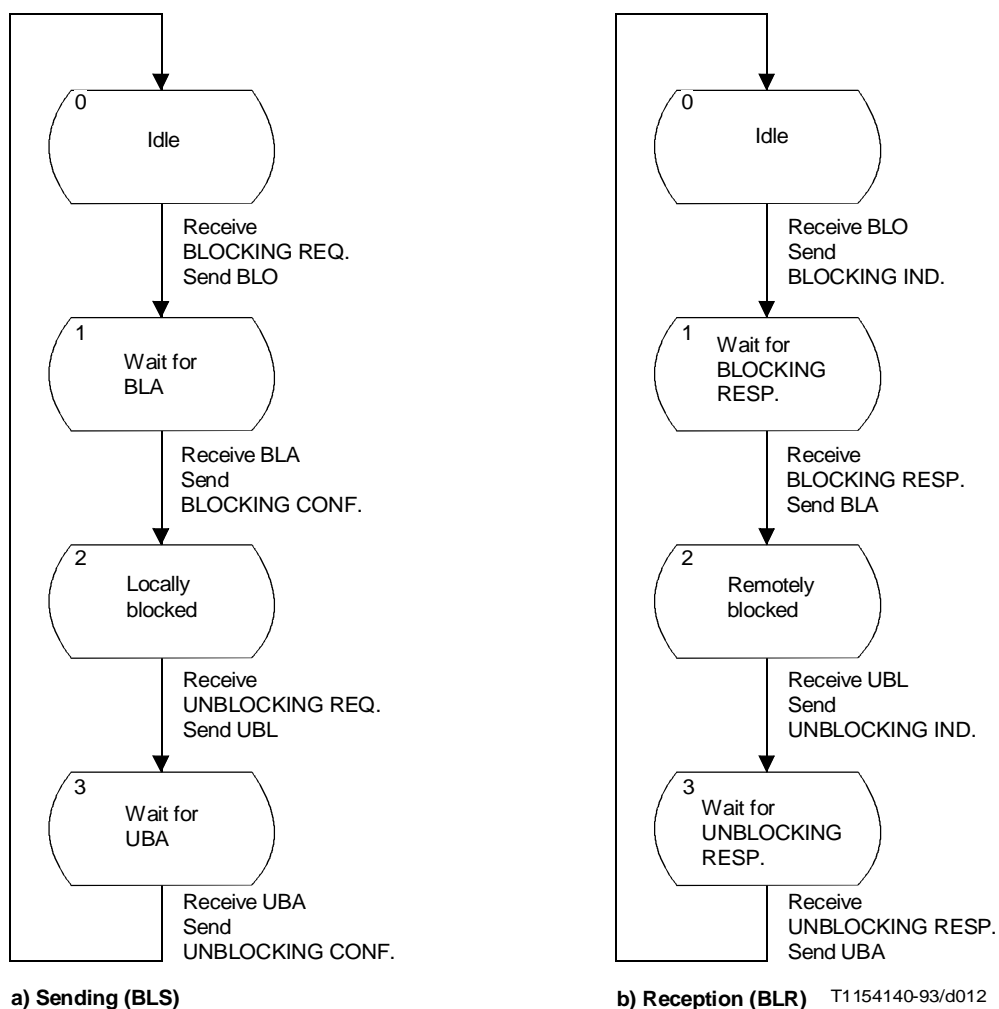


FIGURE H.12/Q.764
State transition diagrams for Blocking/Unblocking

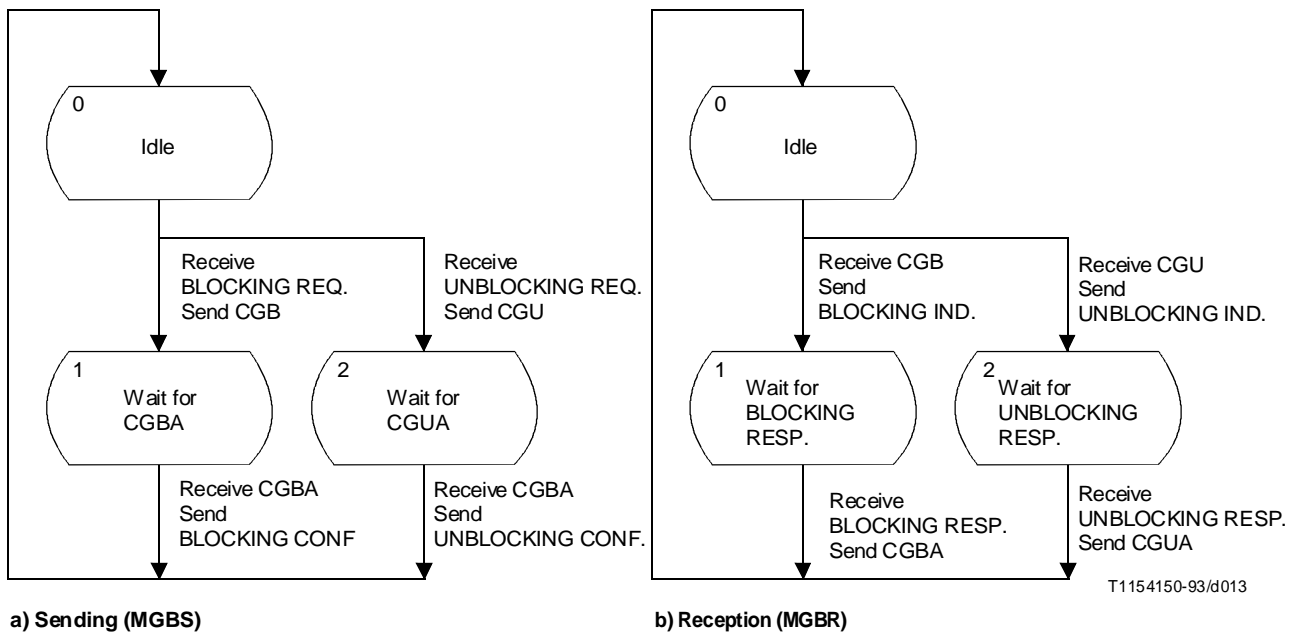


FIGURE H.13/Q.764
State transition diagrams for Maintenance Group Blocking/Unblocking

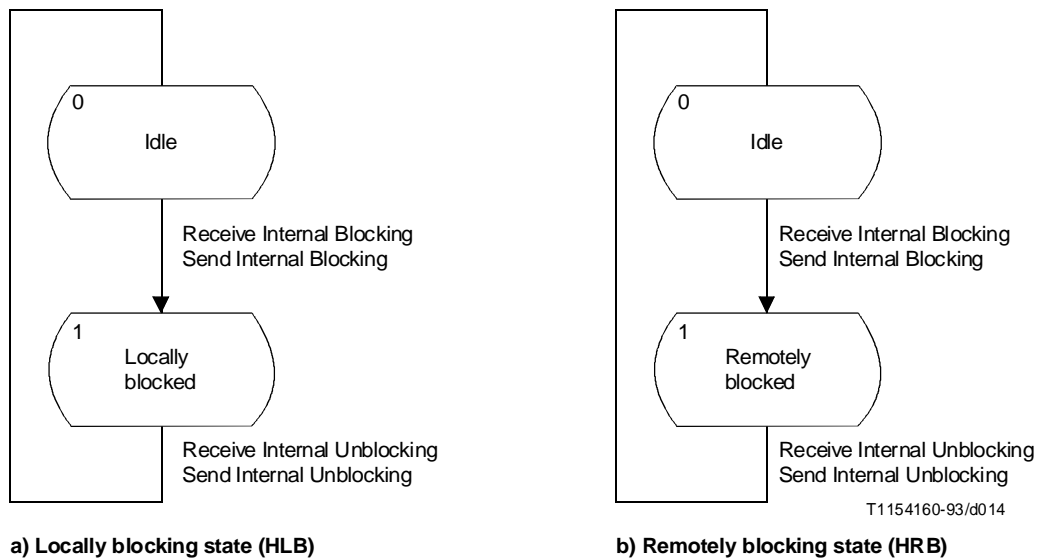


FIGURE H.14/Q.764
State transition diagrams for Hardware Failure Oriented Blocking state

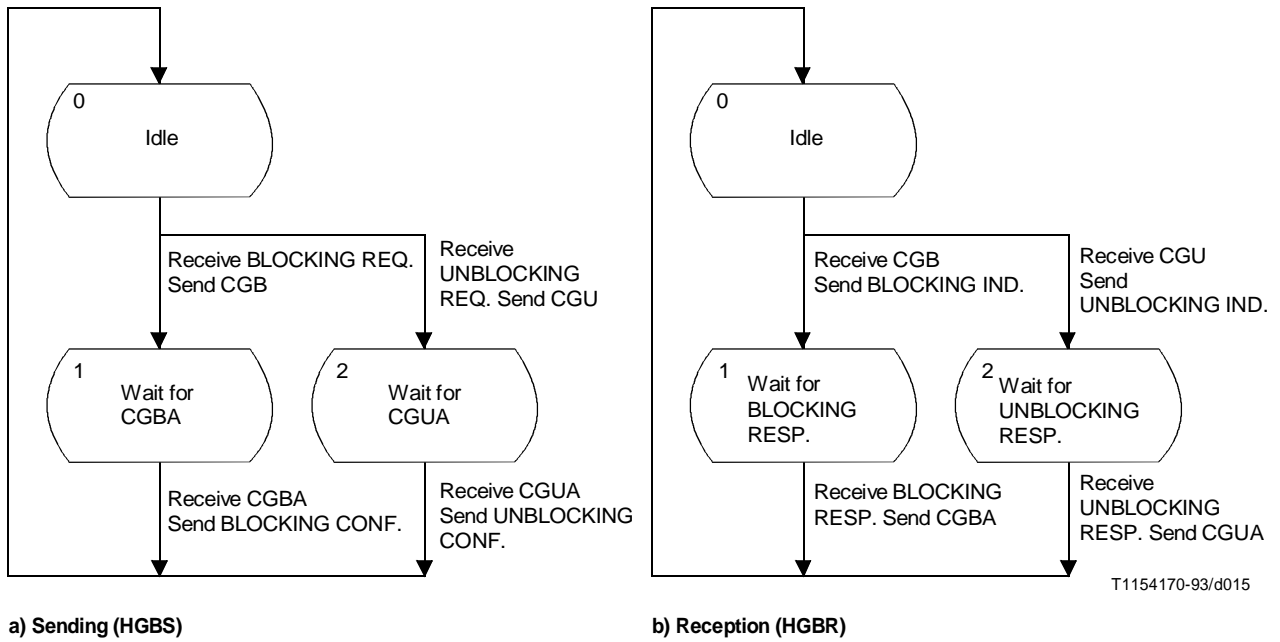


FIGURE H.15/Q.764
State transition diagrams for Group Blocking/Unblocking

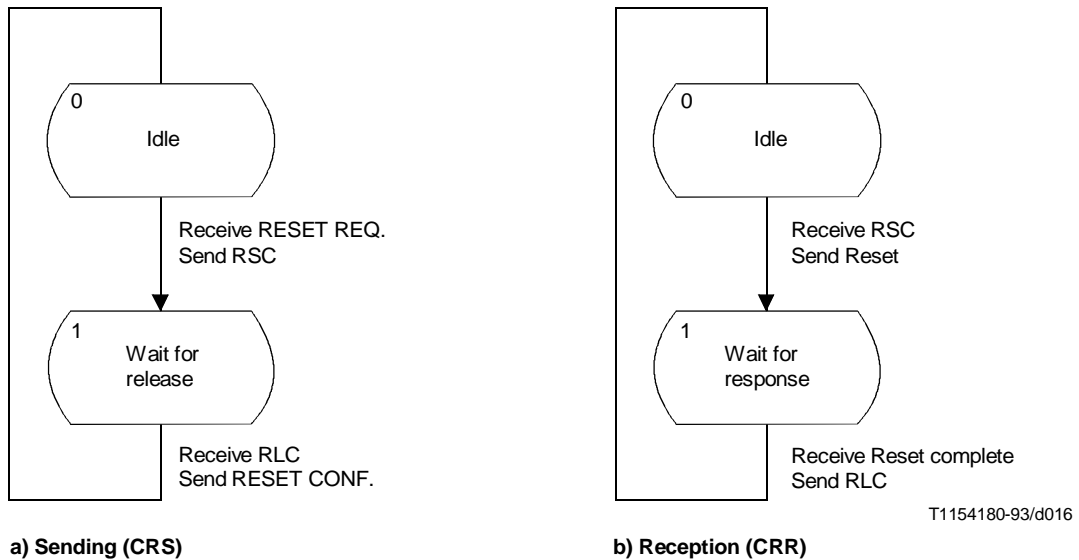


FIGURE H.16/Q.764
State transition diagrams for circuit reset

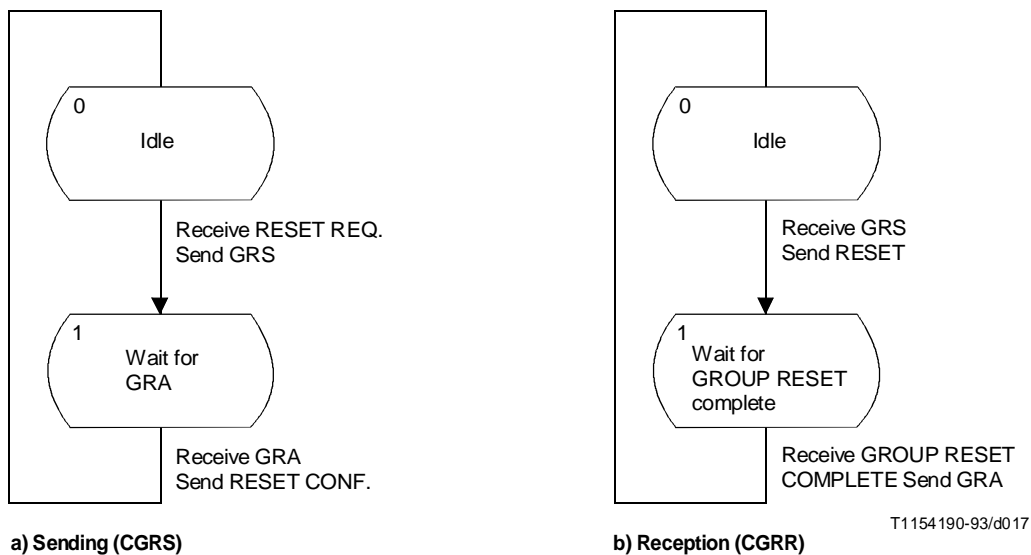


FIGURE H.17/Q.764
State transition diagrams for group reset

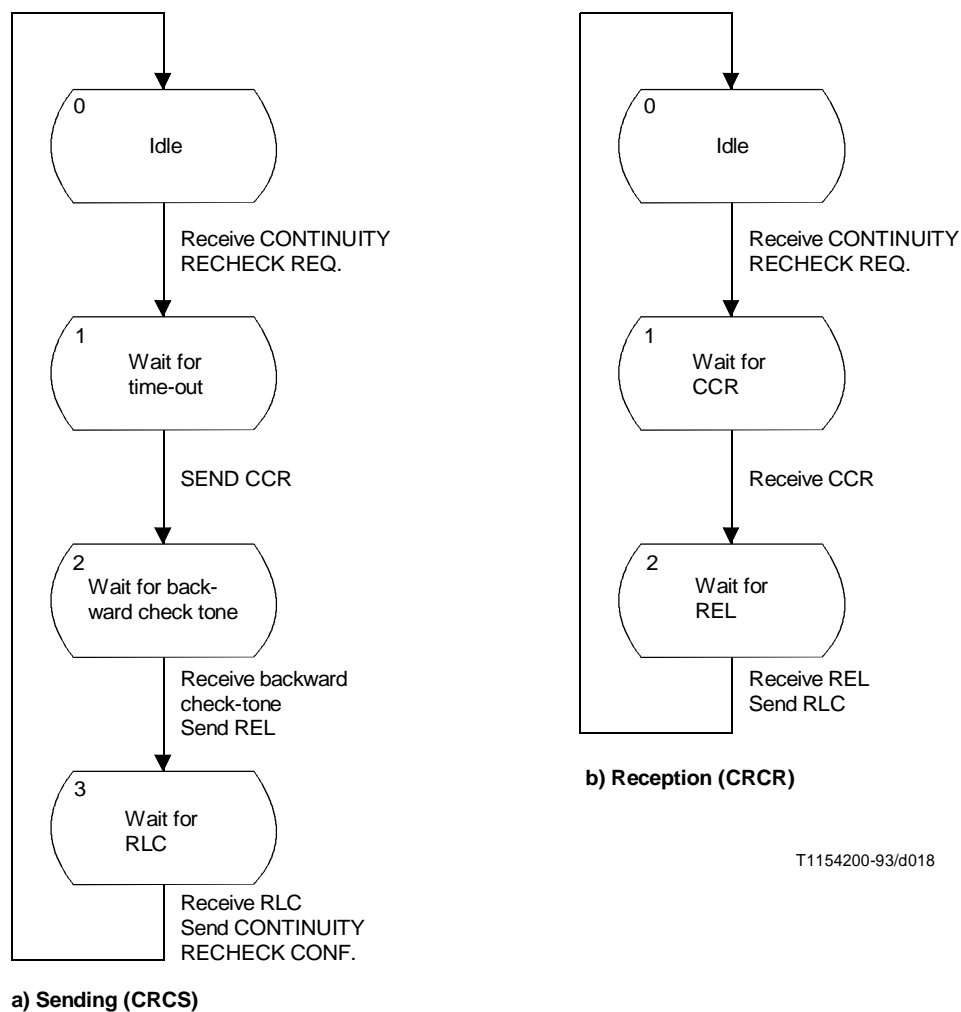


FIGURE H.18/Q.764
State transition diagrams for Continuity Recheck

The ISDN-UP SDL diagrams are described based on the three-block approach. In this approach, call control, which provides signalling-independent functions such as connect-through, circuit selection and digits analysis, is outside the ISDN-UP. The SDL diagrams provide functional modelling at message level for the basic call procedures as in this Recommendation. The SDL diagrams do not include models for the procedures for supplementary services, end-to-end signalling, and for national use. The states defined in the SDL diagrams are merely for illustration. The ISDN-UP diagrams are provided for the above main functional blocks, as shown below:

1) *Signalling Procedures Control (SPRC)*

- Figure H.19:
Message Sending Control (MSDC).
- Figure H.20:
Message Distribution Control (MDSC).

2) *Call Processing Control (CPC)*

- Figure H.21:
Call Processing Control Incoming (CPCI).
- Figure H.22:
Call Processing Control Outgoing (CPCO).
- Figure H.23:
Simple Segmentation Control Incoming (SSCI).
- Figure H.24:
Simple Segmentation Control Outgoing (SSCO).
- Figure H.25:
Continuity Check Incoming (CCI).
- Figure H.26:
Continuity Check Outgoing (CCO).

3) *Circuit Supervision Control (CSC)*

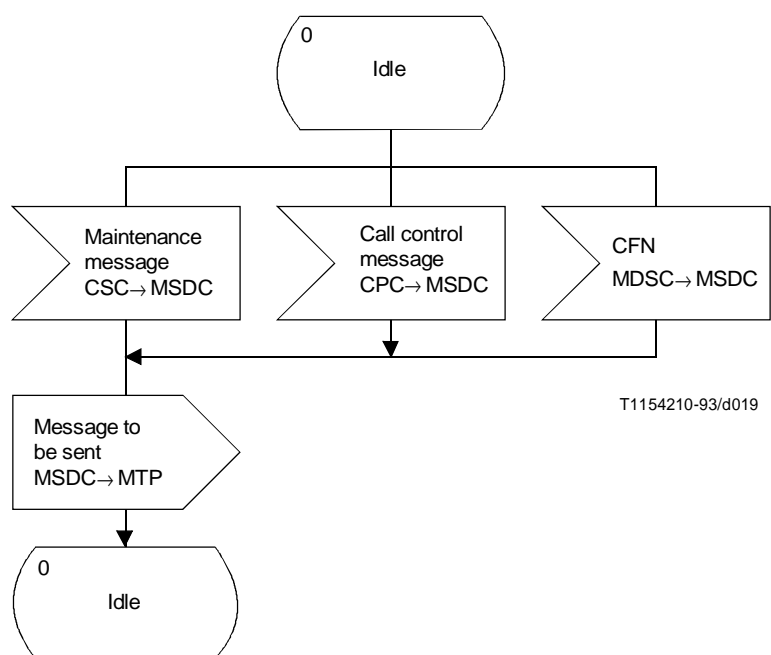
- Figure H.27:
Blocking/Unblocking Message Sending (BLS).
- Figure H.28:
Blocking/Unblocking Message Reception (BLR).
- Figure H.29:
Maintenance Oriented Circuit Group Blocking/Unblocking Sending (MGBS).
- Figure H.30:
Maintenance Oriented Circuit Group Blocking/Unblocking Reception (MGBR).
- Figure H.31:
Hardware Failure Oriented Locally Blocking (HLB).
- Figure H.32:
Hardware Failure Oriented Remotely Blocking (HRB).
- Figure H.33:
Hardware Failure Oriented Circuit Group Blocking/Unblocking Sending (HGBS).
- Figure H.34:
Hardware Failure Oriented Circuit Group Blocking/Unblocking Reception (HGBR).

- Figure H.35:
Circuit Reset Sending (CRS).
- Figure H.36:
Circuit Reset Reception (CRR).
- Figure H.37:
Circuit Group Reset Sending (CGRS).
- Figure H.38:
Circuit Group Reset Reception (CGRR).
- Figure H.39:
Continuity Recheck Sending (CRCS).
- Figure H.40:
Continuity Recheck Reception (CRCR).

The procedures referred to in the functional blocks are described in the last section of the SDL diagrams. The diagrams describing the procedures are listed as shown below:

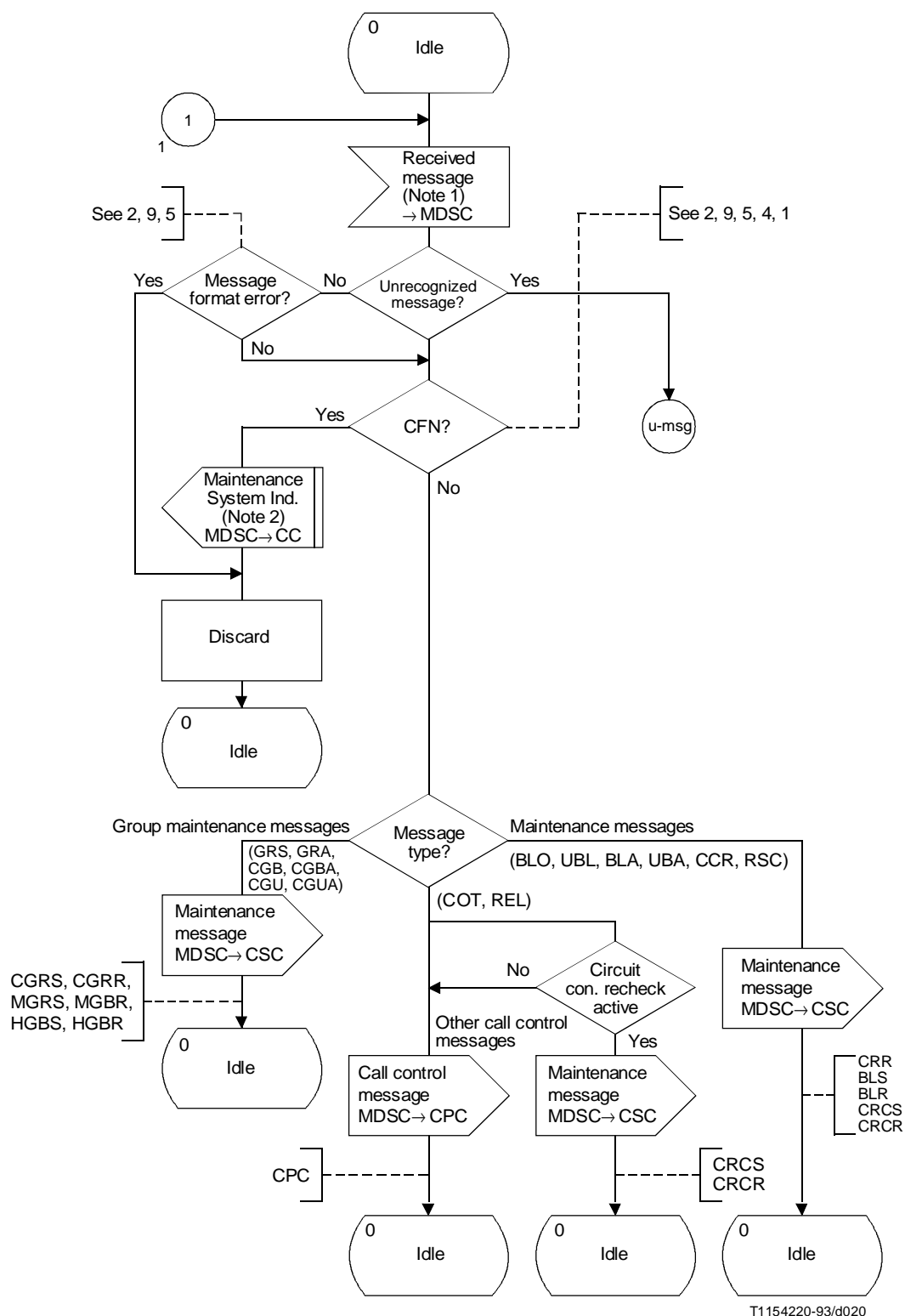
1) *Call Processing Control (CPC)*

- Figure H.41:
Segment the message.
- Figure H.42:
CPCI local exchange echo control device.
- Figure H.43:
CPCI transit exchange echo control device.
- Figure H.44:
CPCO local exchange echo control device.
- Figure H.45:
CPCO transit exchange echo control device.
- Figure H.46:
CPCO local exchange echo control device.



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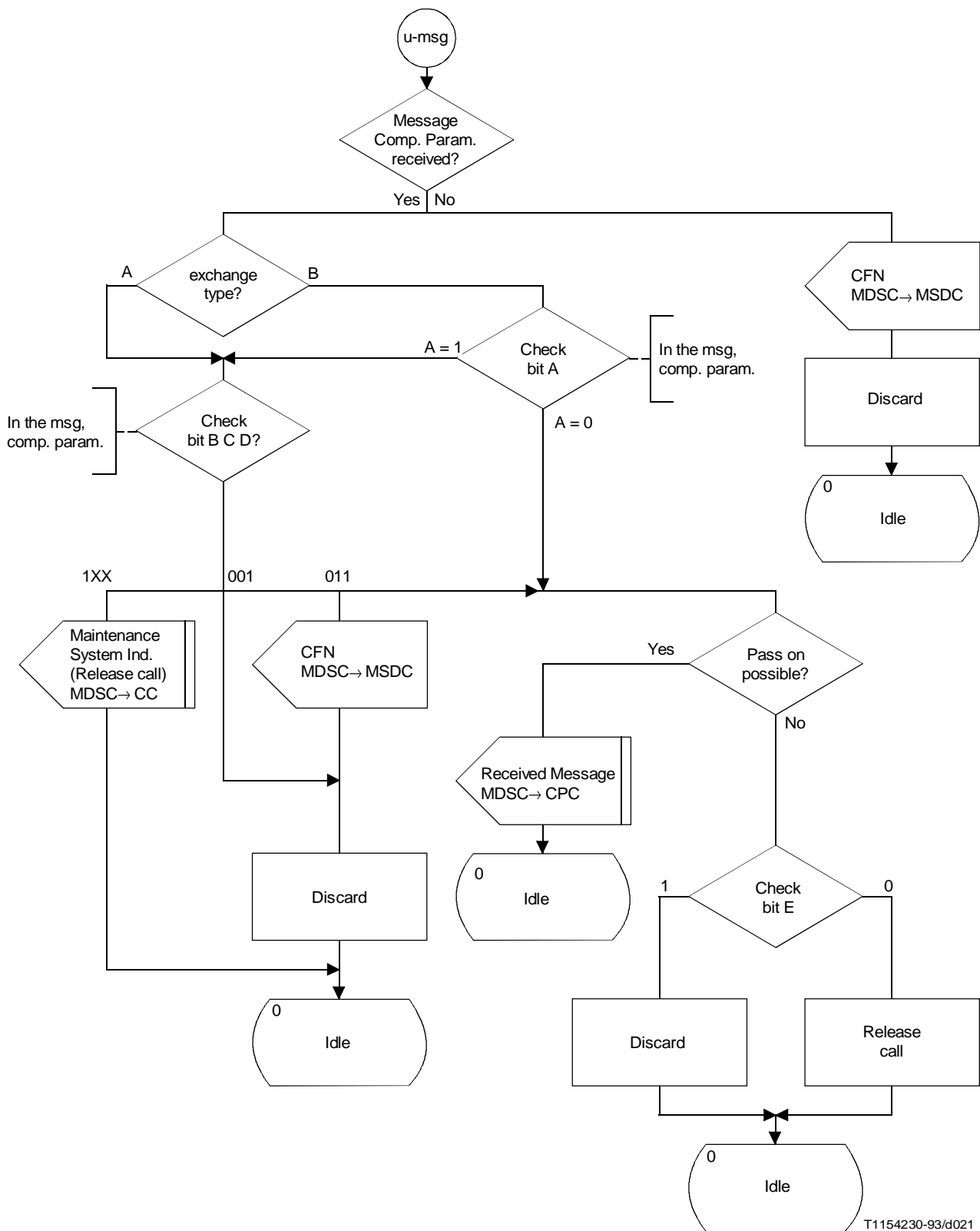
FIGURE H.19/Q.764
Message Sending Control (MSDC)



NOTES

- 1 MTP.
- 2 Procedure dependent action.

FIGURE H.20/Q.764 (sheet 1 of 2)
Message Distribution Control (MDSC)



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FIGURE H.20/Q.764 (sheet 2 of 2)
Message Distribution Control (MDSC)



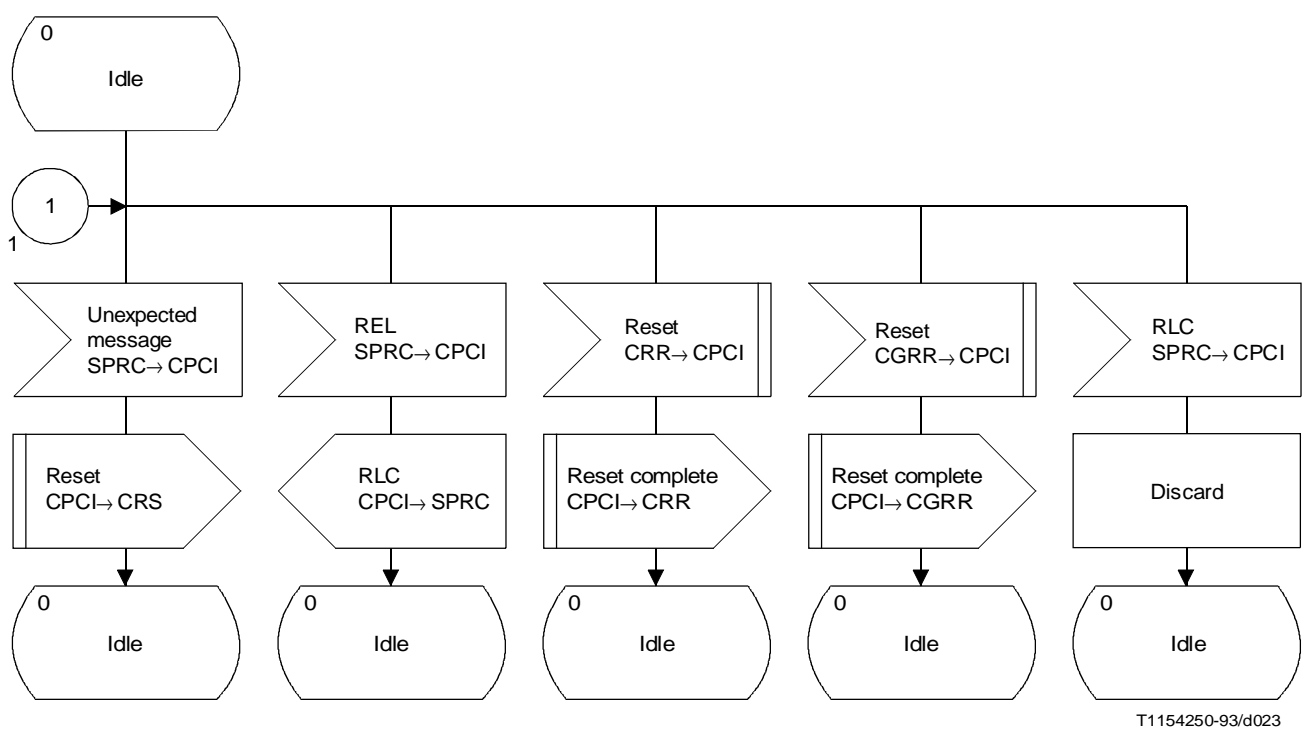


FIGURE H.21/Q.764 (sheet 2 of 20)
Call Processing Control Incoming (CPCI)

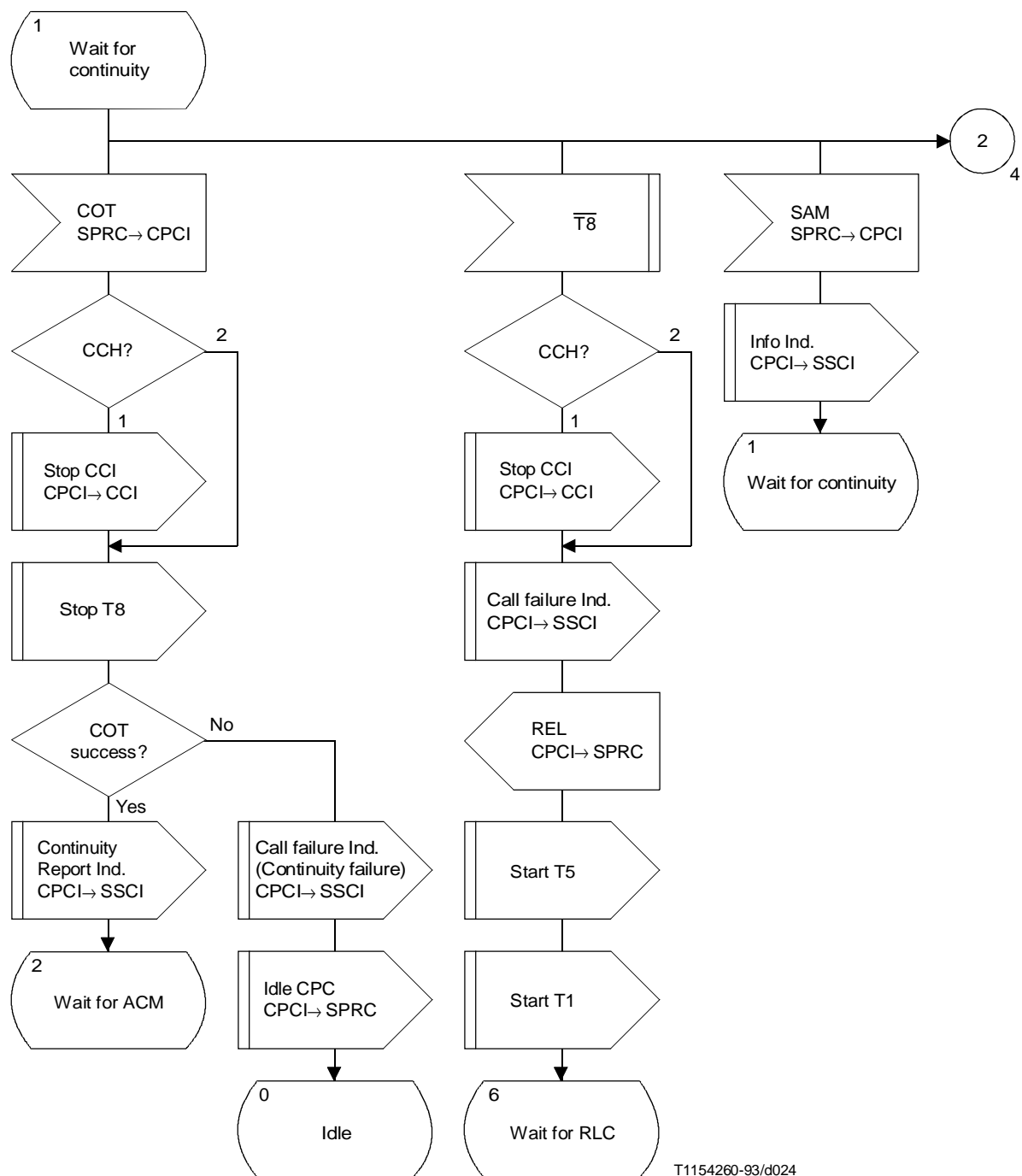
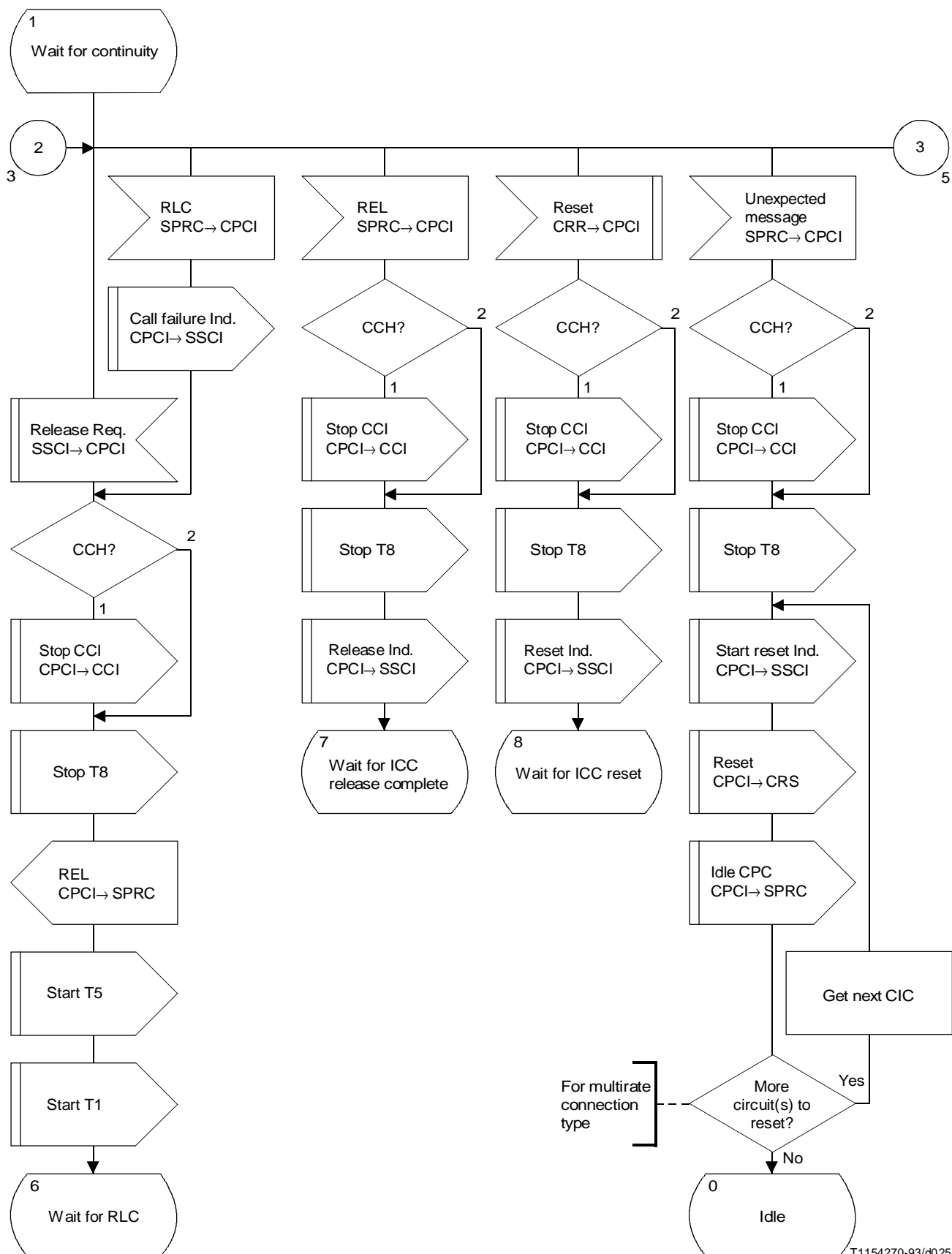
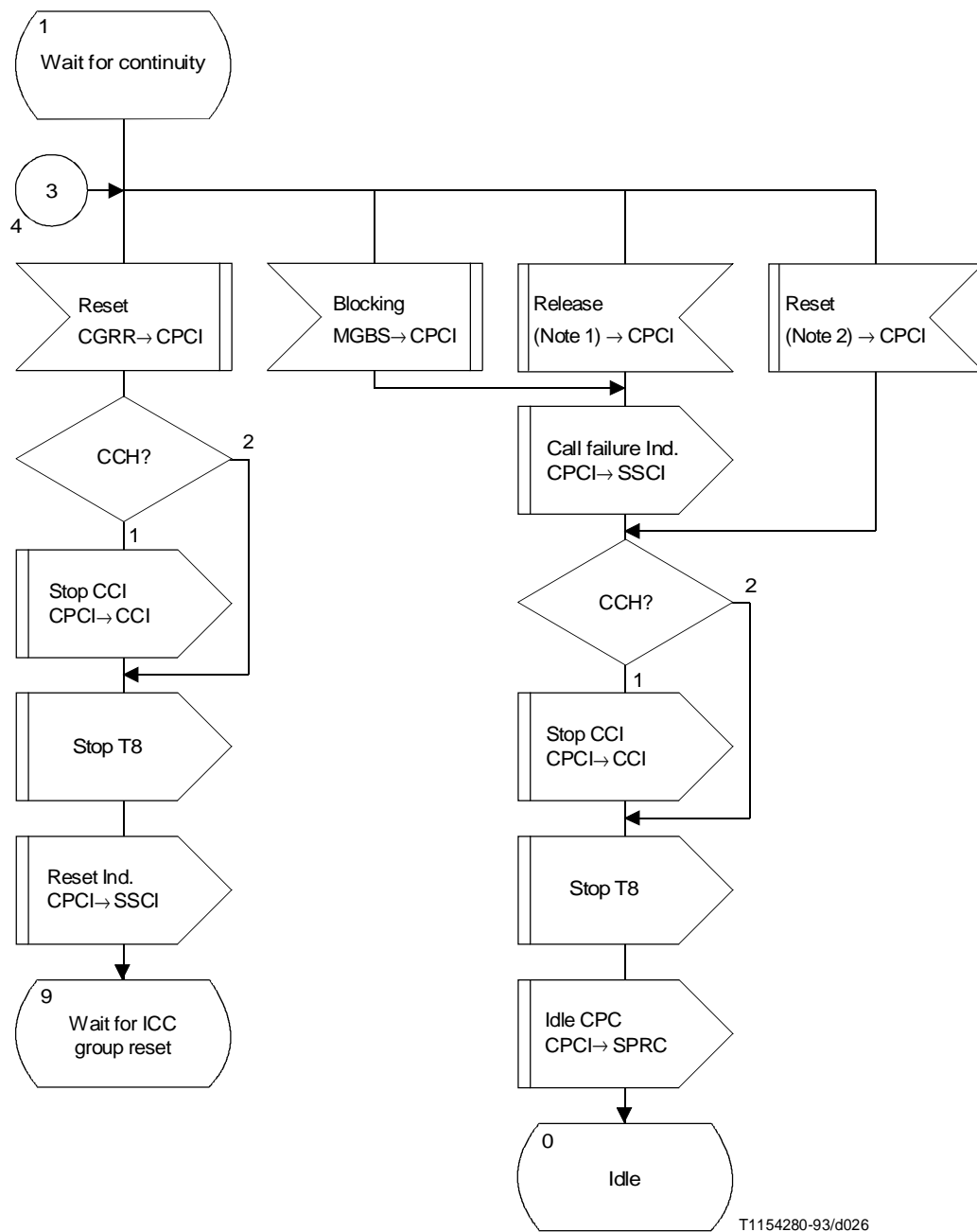


FIGURE H.21/Q.764 (sheet 3 of 20)
Call Processing Control Incoming (CPCI)



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FIGURE H.21/Q.764 (sheet 4 of 20)
Call Processing Control Incoming (CPCI)

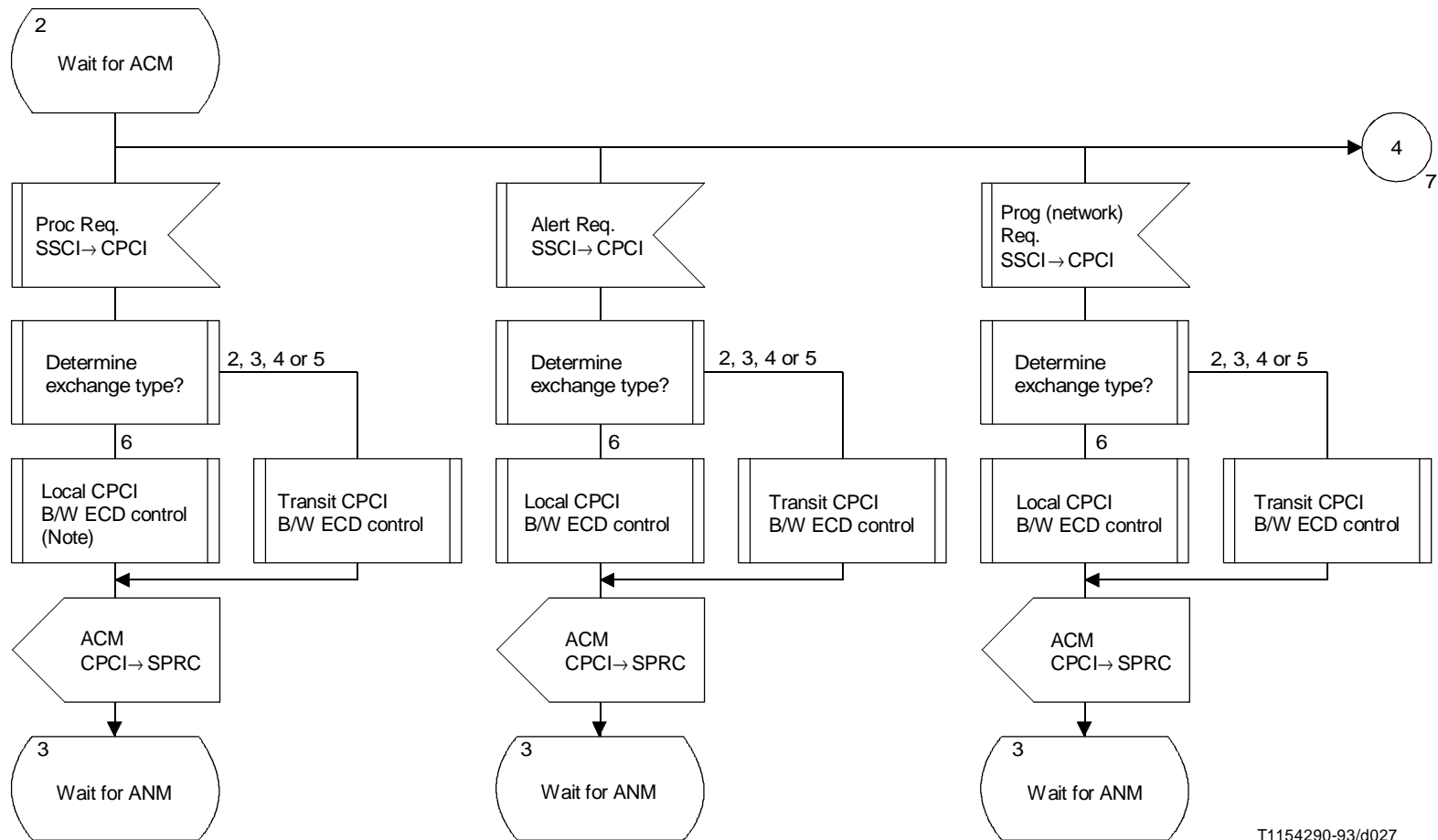


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NOTES

- 1 HGBS, HGBR.
- 2 CRS, CGRS.

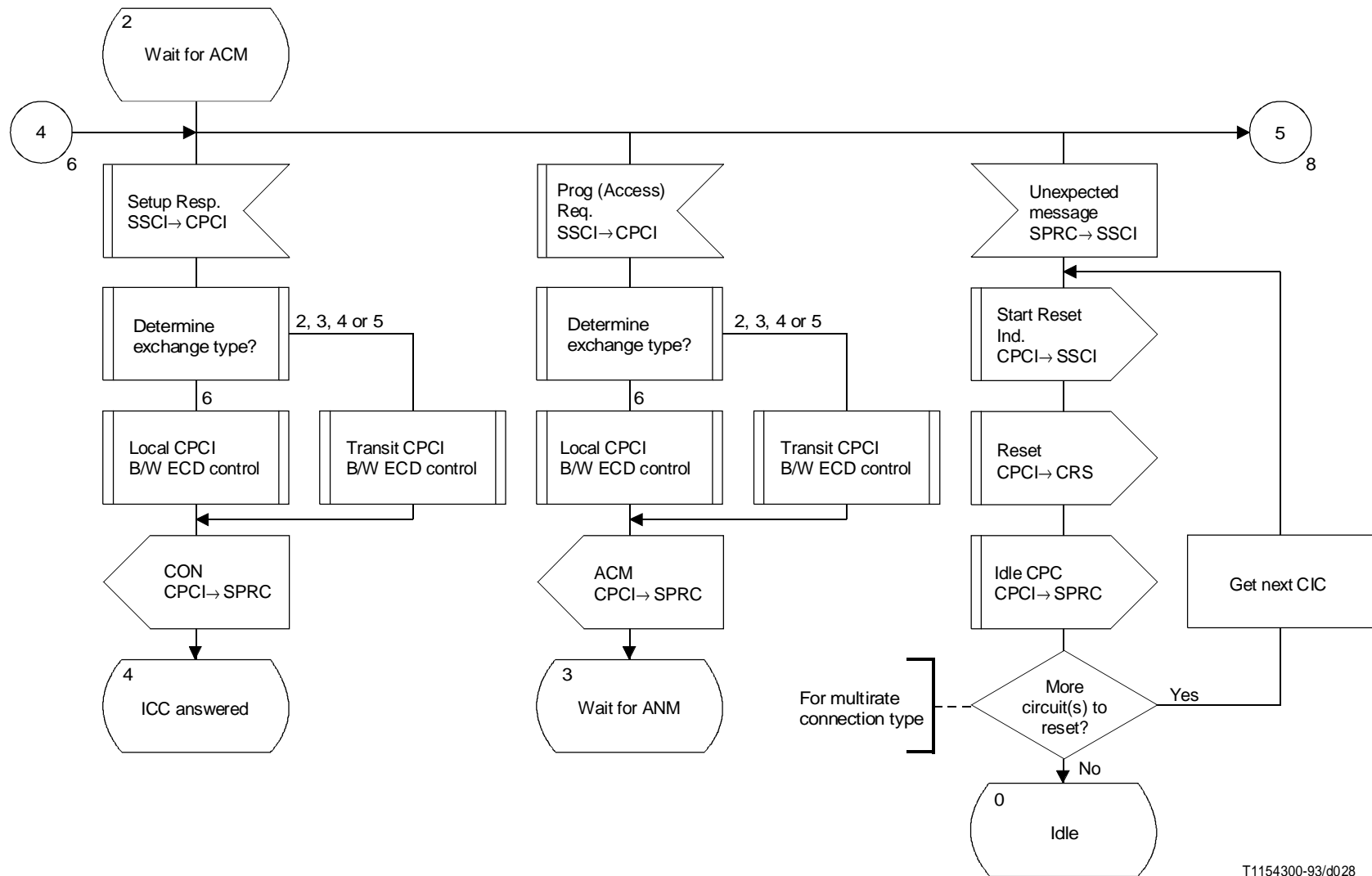
FIGURE H.21/Q.764 (sheet 5 of 20)
Call Processing Control Incoming (CPCI)



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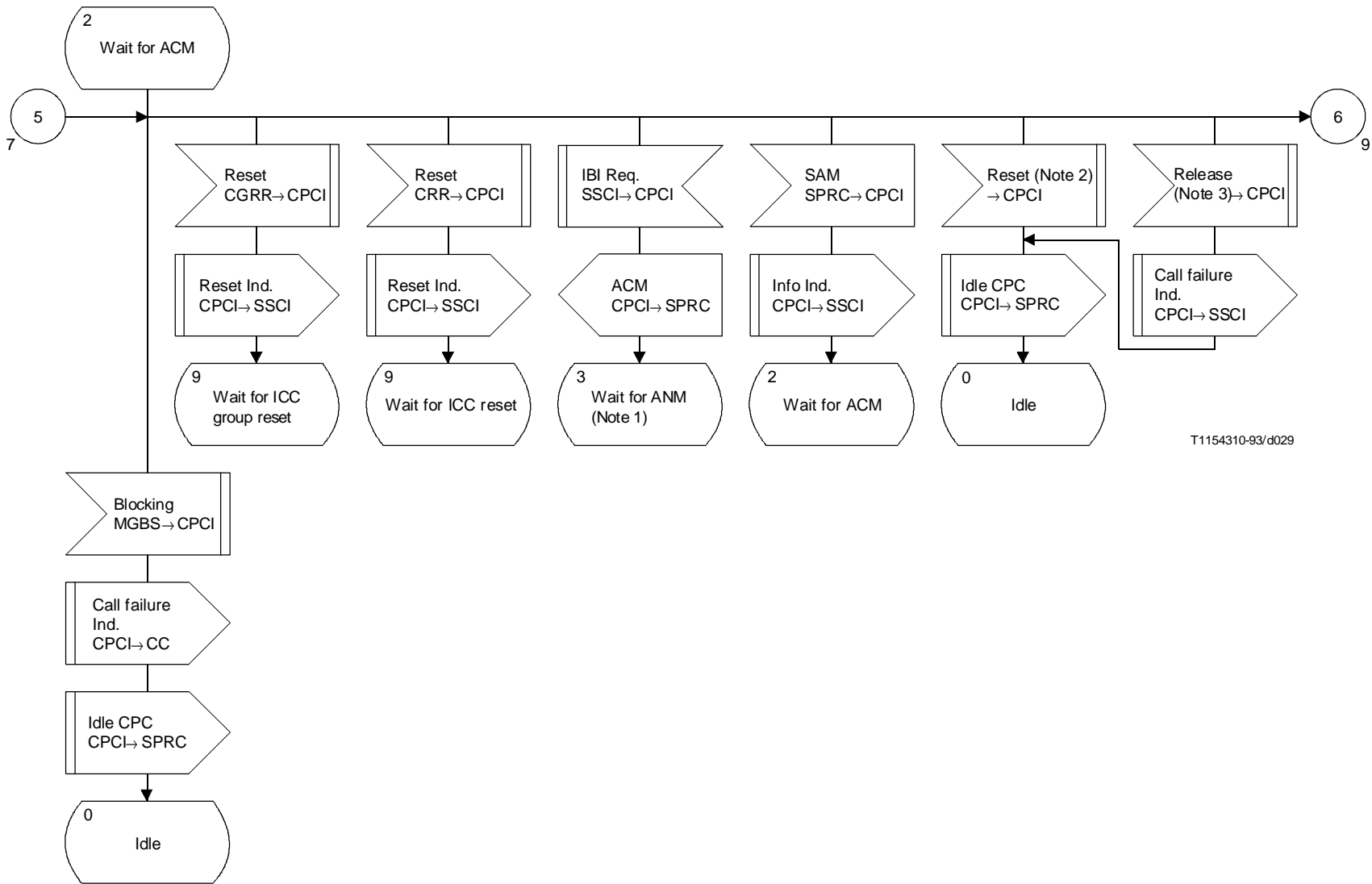
NOTE – B/W Backward.

FIGURE H.21/Q.764 (sheet 6 of 20)



T1154300-93/d028

FIGURE H.21/Q.764 (sheet 7 of 20)



NOTES

- 1 Only REL/RLC message is expected. Other messages are discarded.
- 2 CRS, CGRS.
- 3 HGBS, HGBR.

FIGURE H.21/Q.764 (sheet 8 of 20)

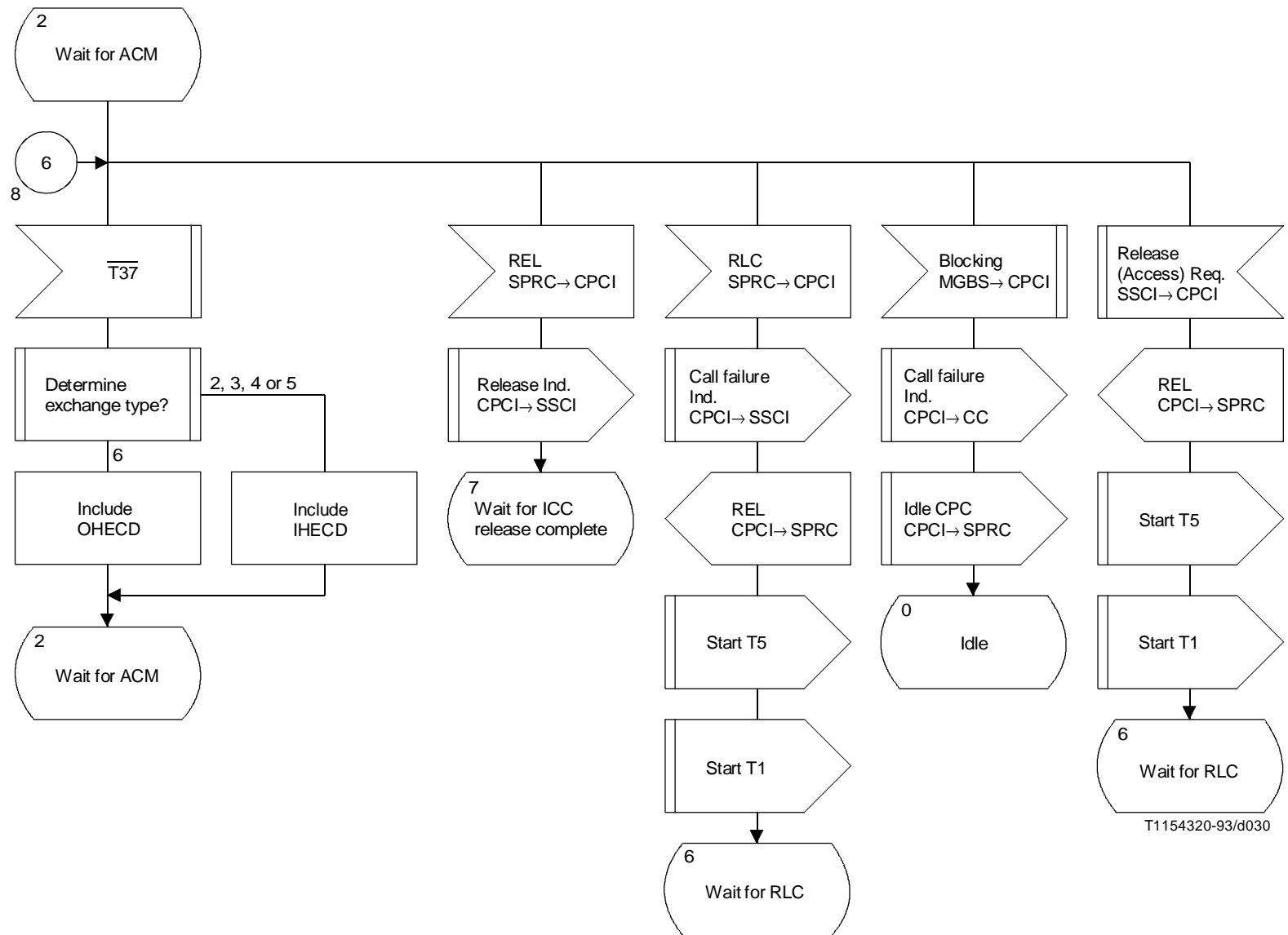
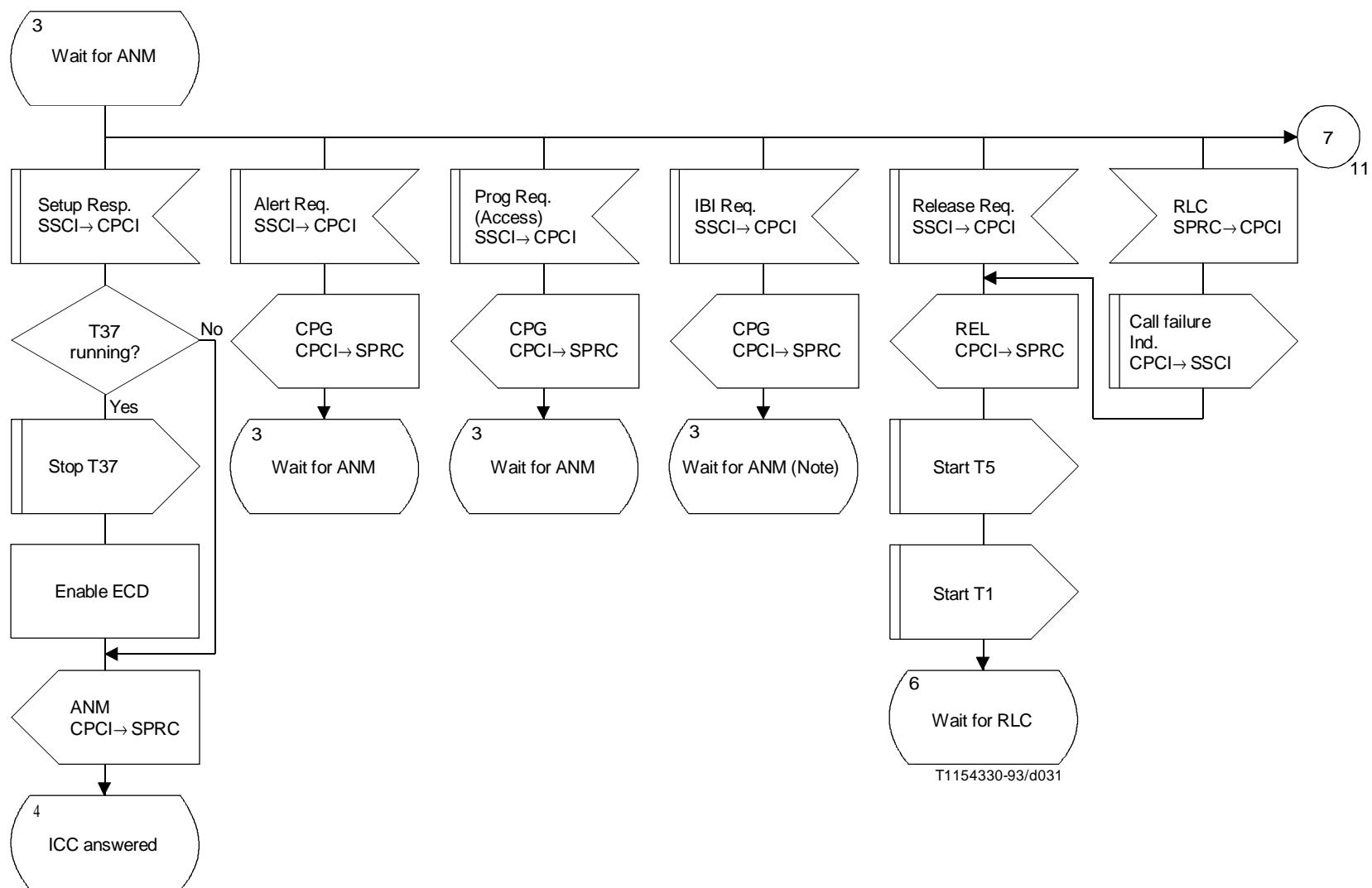
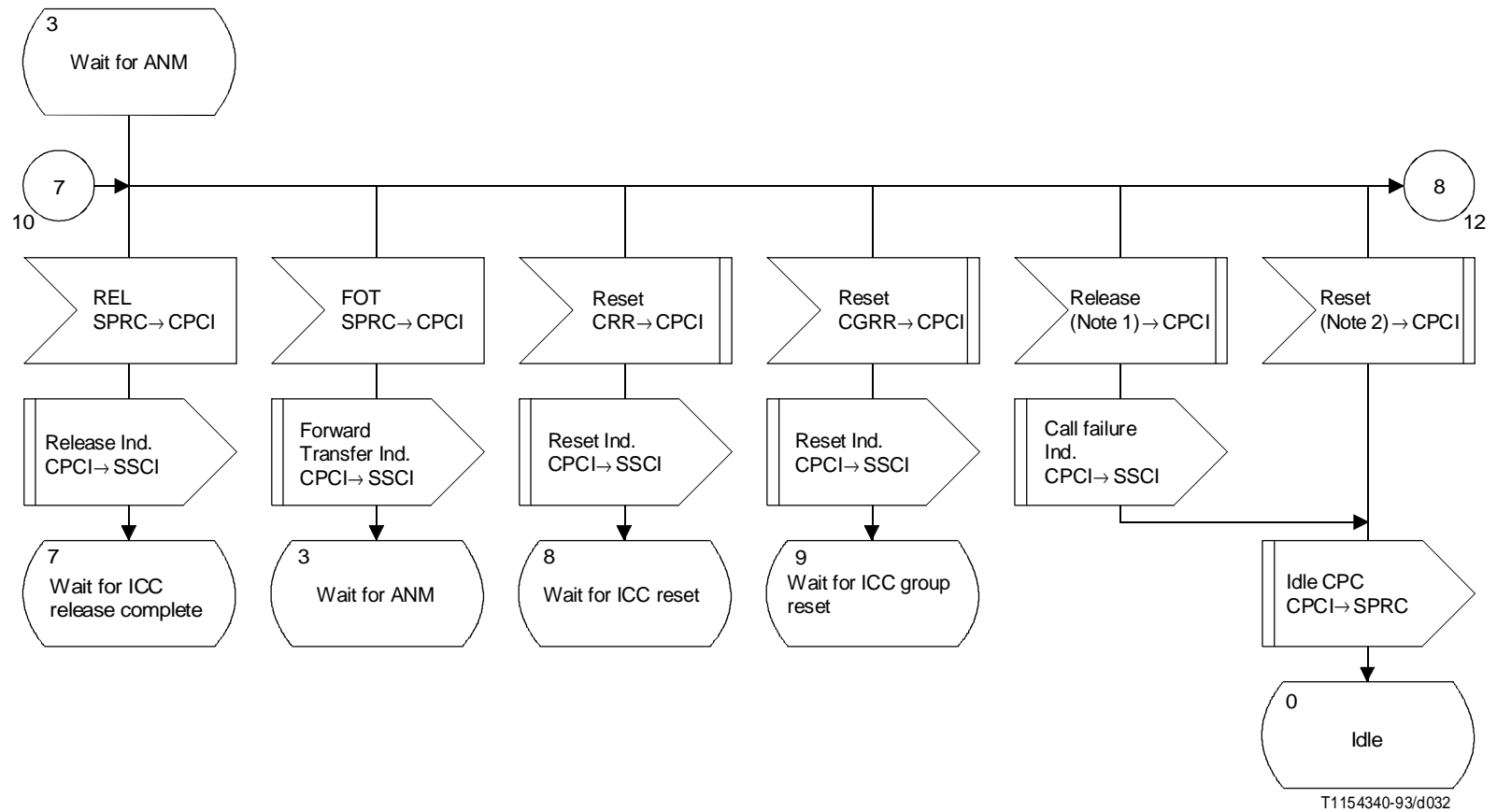


FIGURE H.21/Q.764 (sheet 9 of 20)



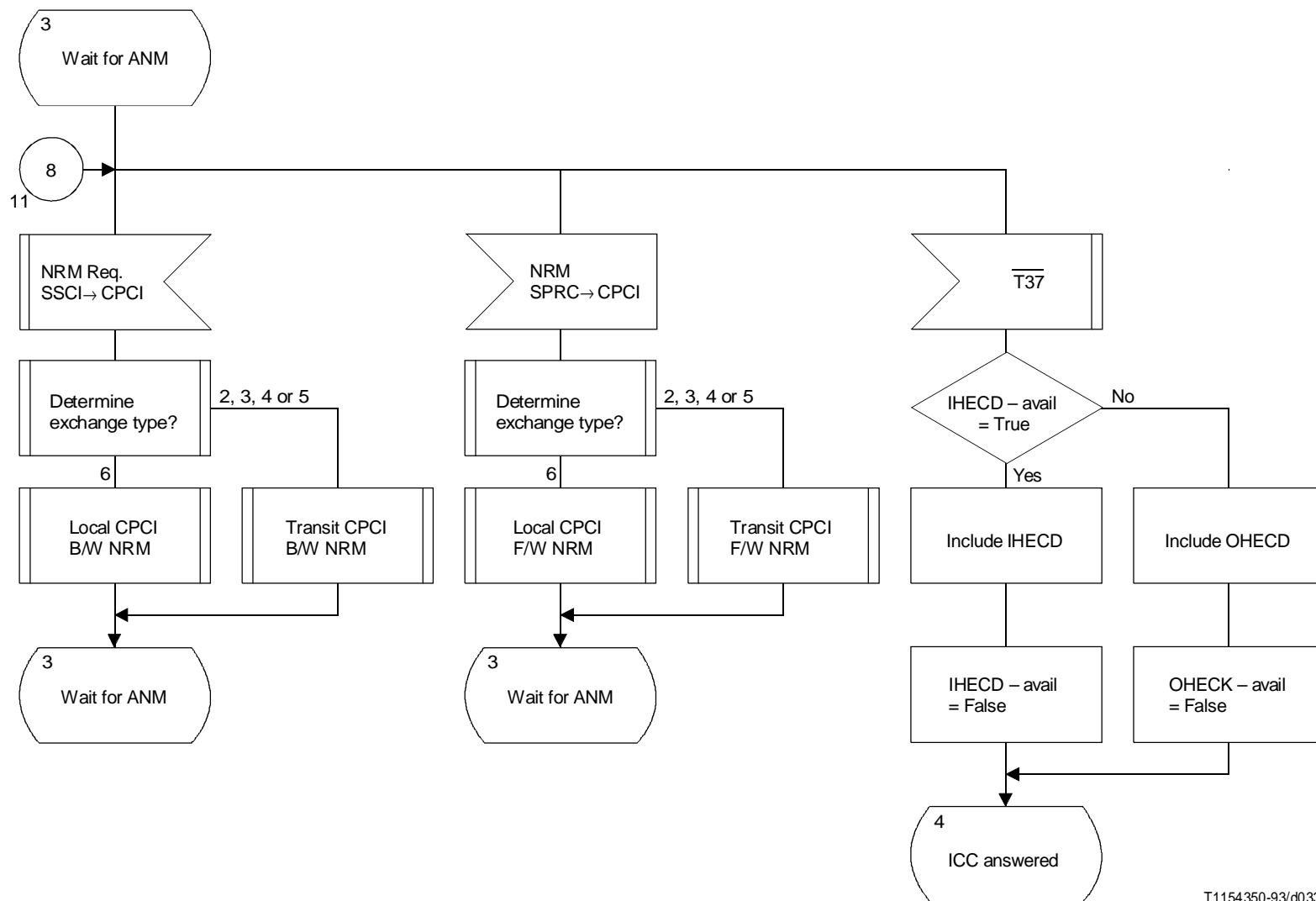
NOTE – Only REL/RLC message is expected. Other messages are discarded.

FIGURE H.21/Q.764 (sheet 10 of 20)



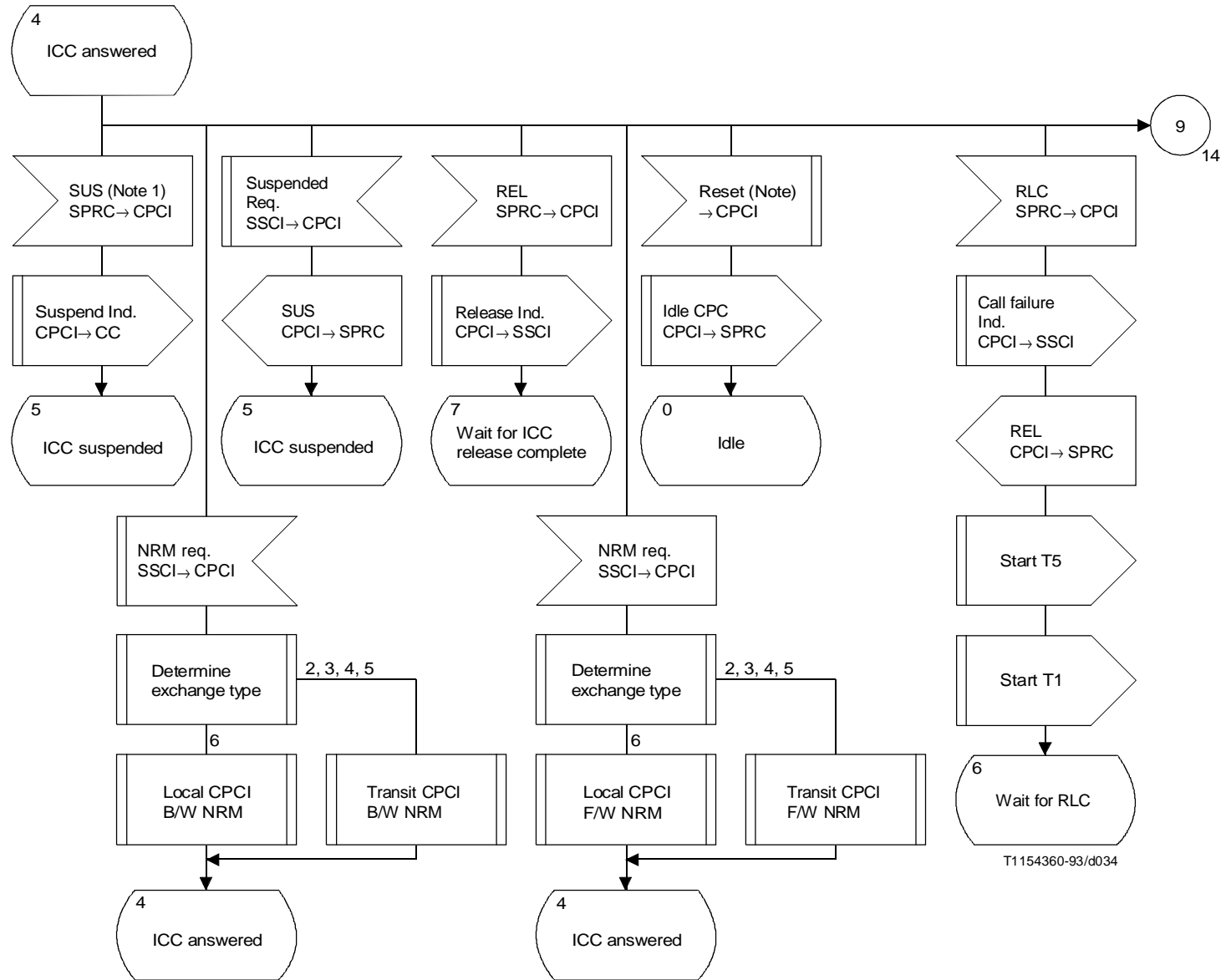
NOTES
 1 HGBS, HGBR.
 2 CRS, CGRS.

FIGURE H.21/Q.764 (sheet 11 of 20)



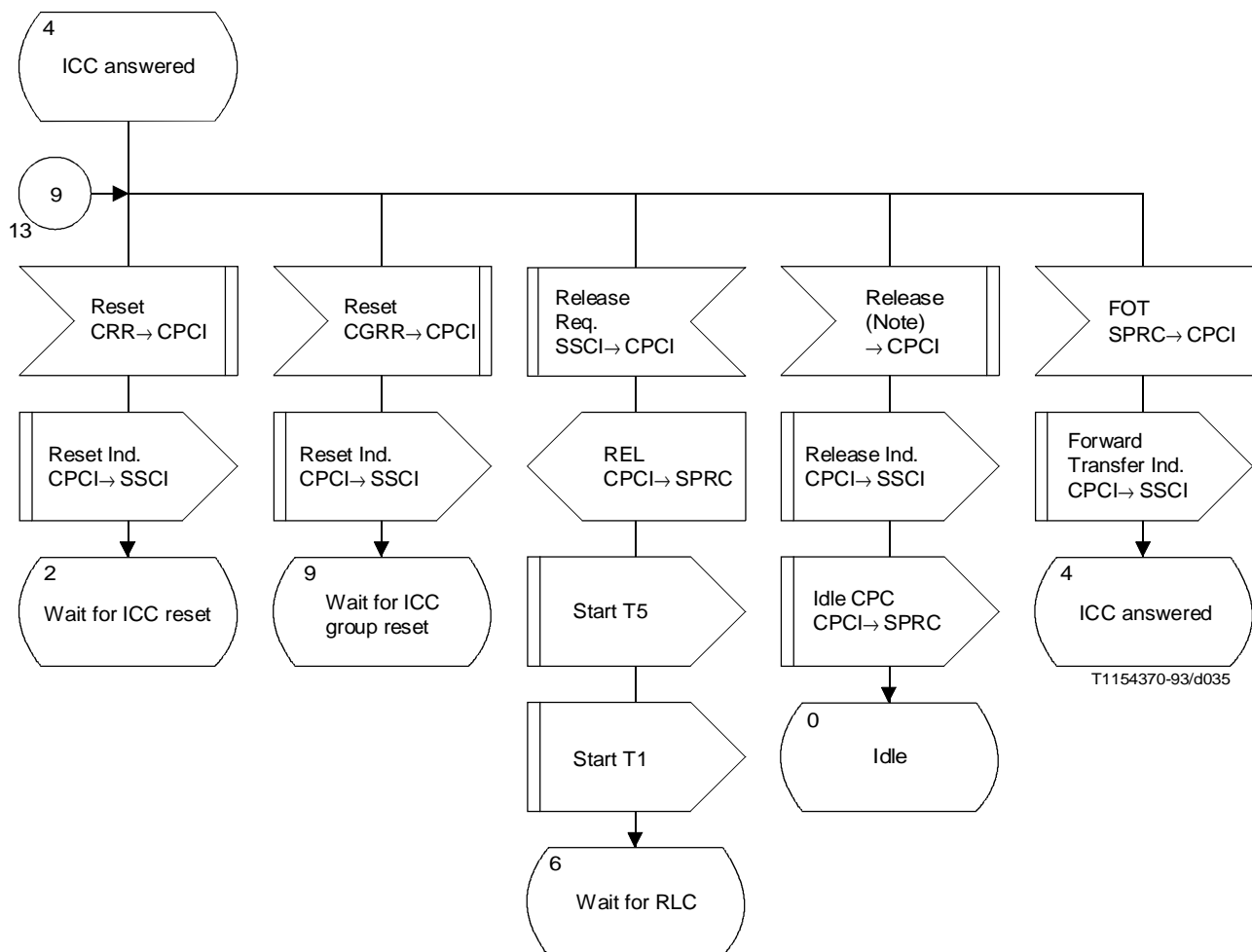
T1154350-93/d033

FIGURE H.21/Q.764 (sheet 12 of 20)



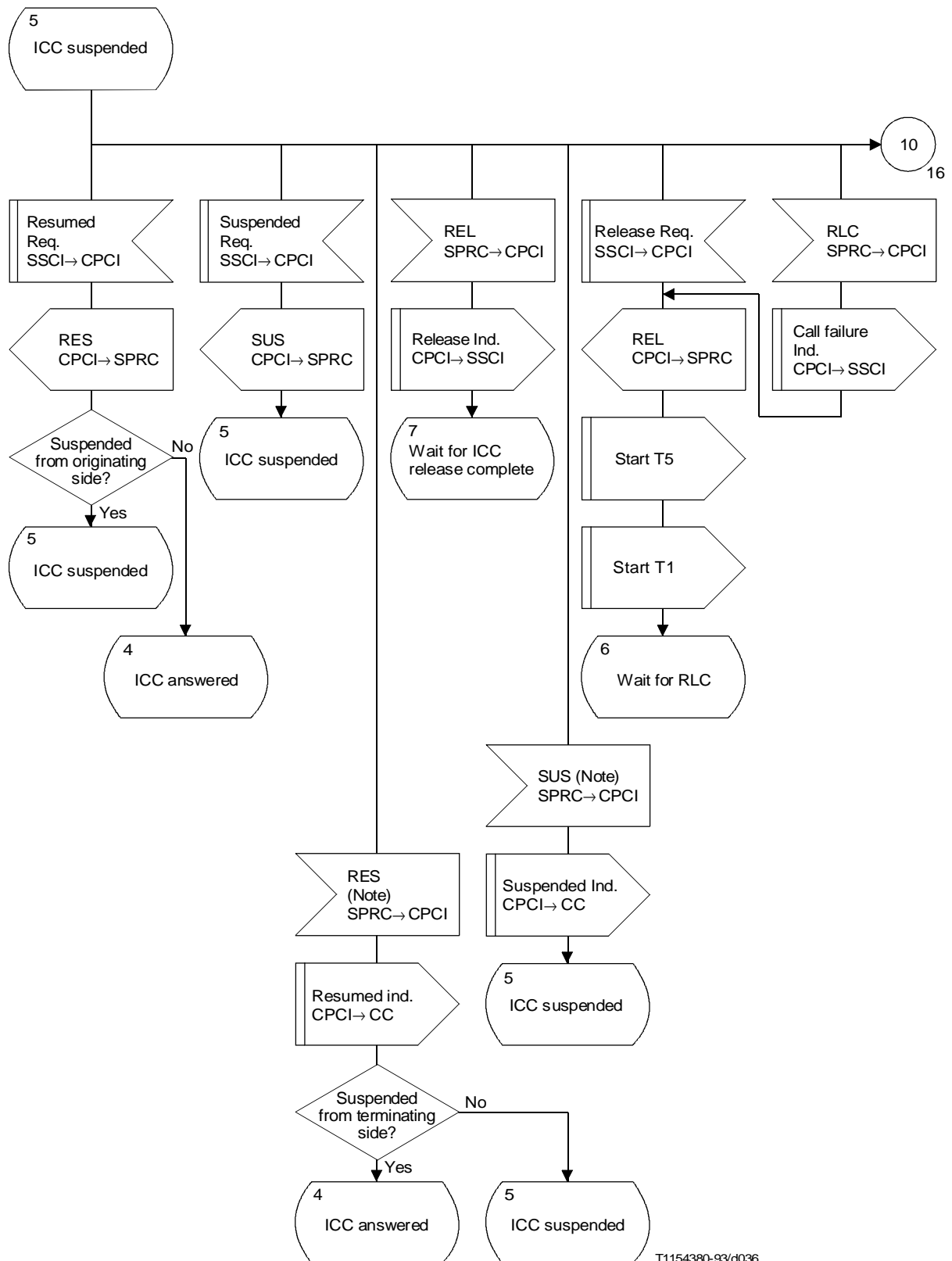
NOTE – CRS, CGRS.

FIGURE H.21/Q.764 (sheet 13 of 20)



NOTE – HGBS, HGBR.

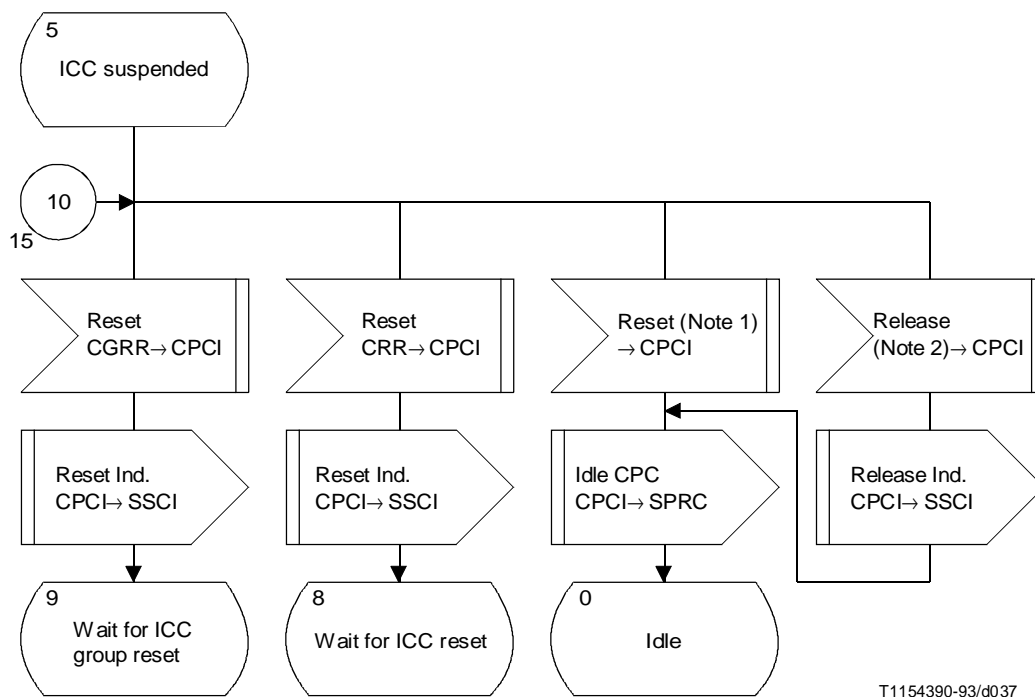
FIGURE H.21/Q.764 (sheet 14 of 20)
Call Processing Control Incoming (CPCI)



T1154380-93/d036

NOTE – Only user-initiated.

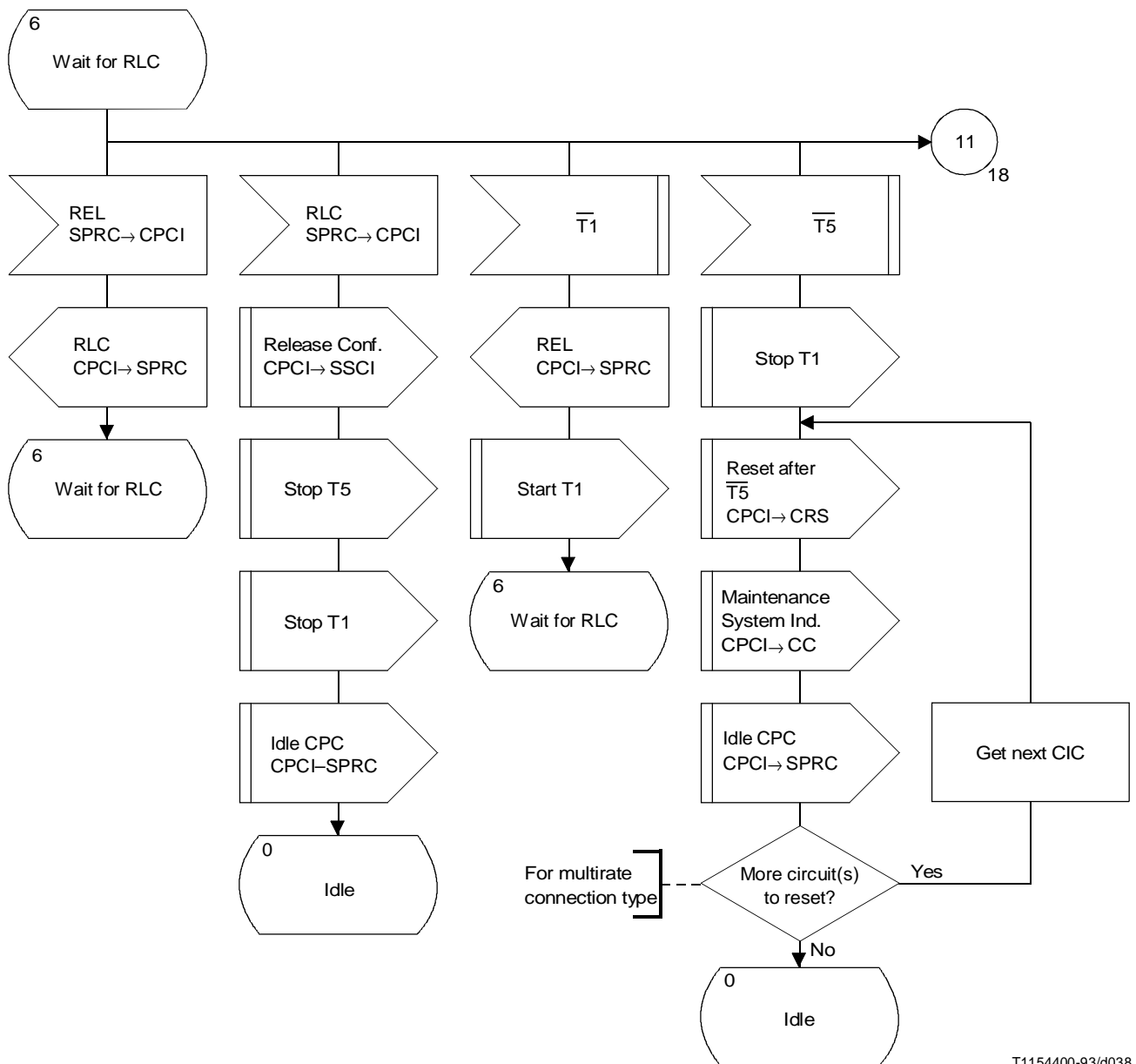
FIGURE H.21/Q.764 (sheet 15 of 20)
Call Processing Control Incoming (CPCI)



NOTES

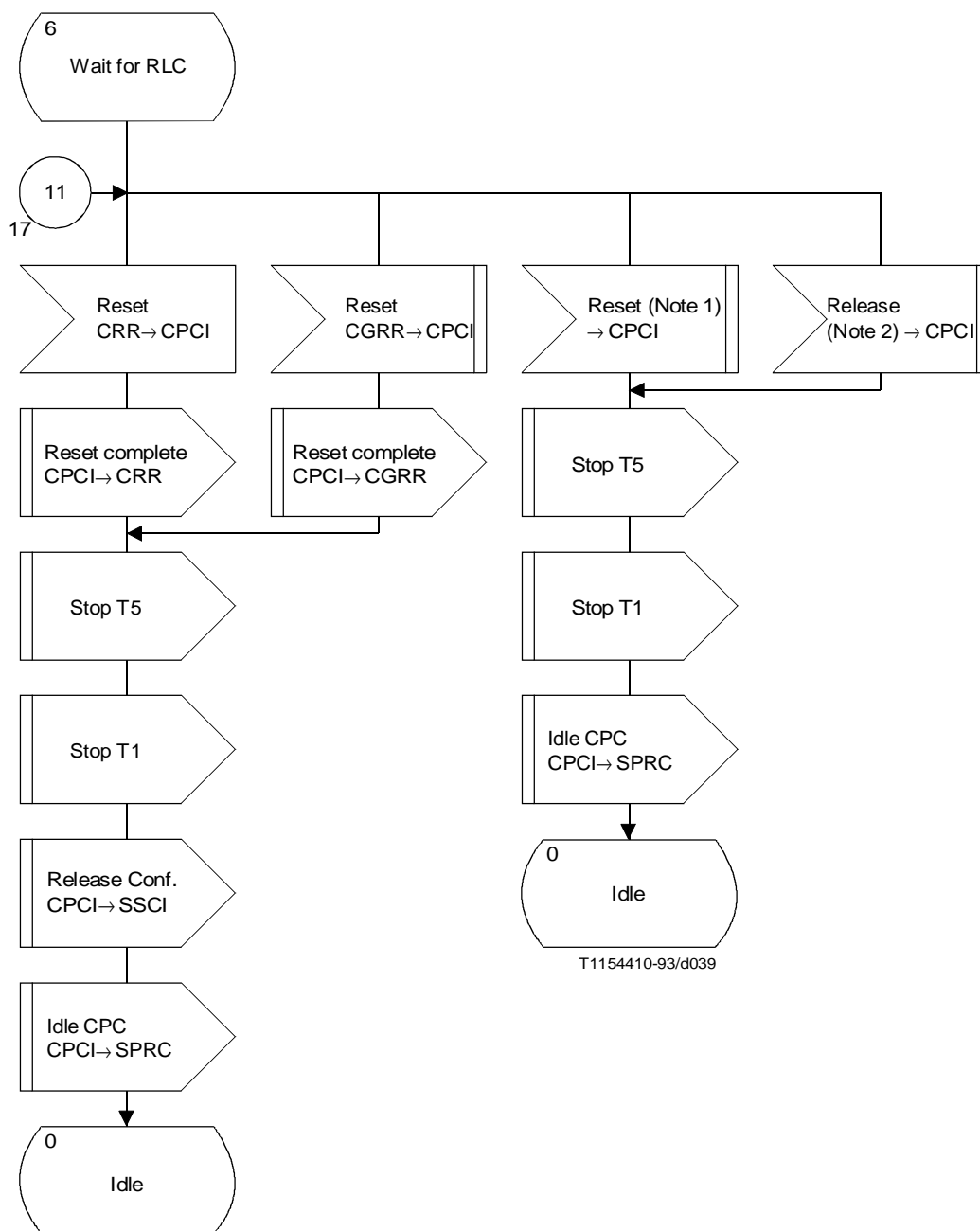
- 1 CRS, CGRS.
- 2 HGBS, HGBR.

FIGURE H.21/Q.764 (sheet 16 of 20)
Call Processing Control Incoming (CPCI)



T1154400-93/d038

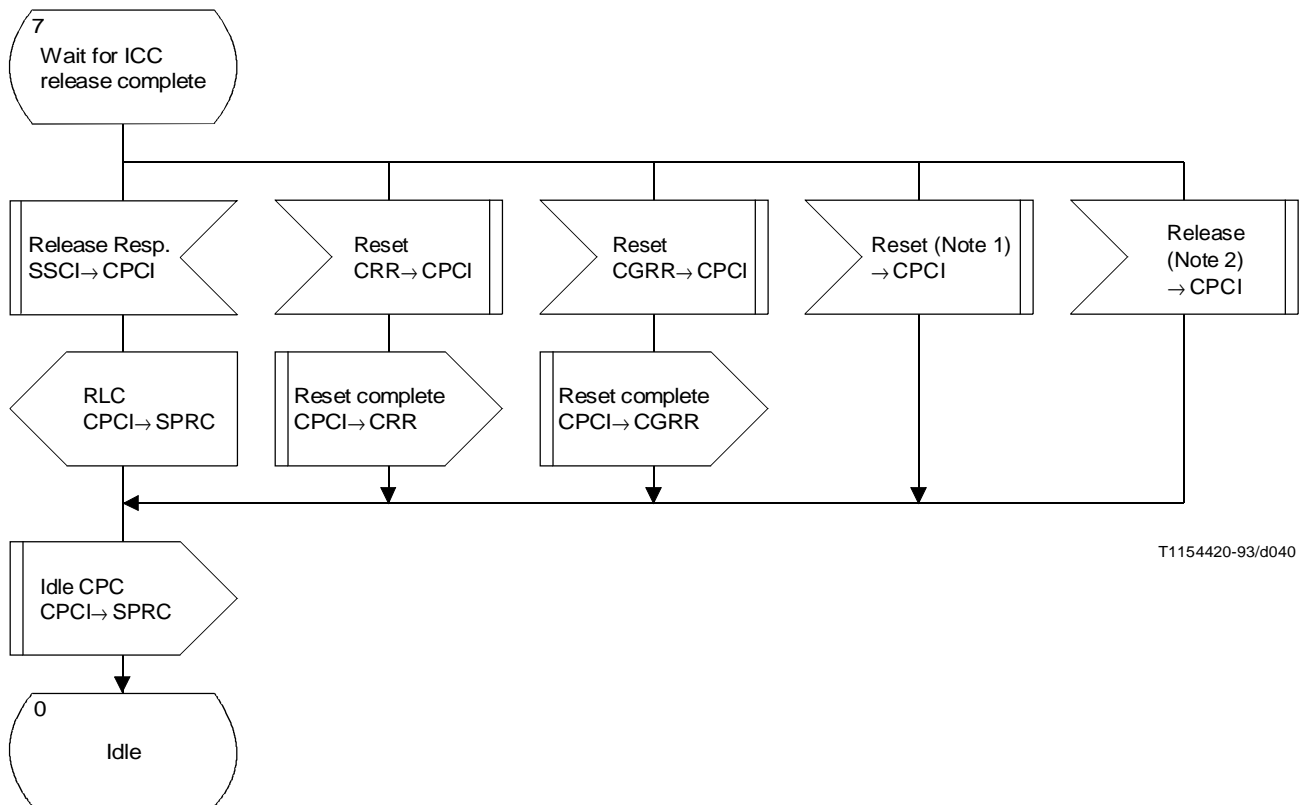
FIGURE H.21/Q.764 (sheet 17 of 20)
Call Processing Control Incoming (CPCI)



NOTES

- 1 CRS, CGRS.
- 2 HGBS, HGBR.

FIGURE H.21/Q.764 (sheet 18 of 20)
Call Processing Control Incoming (CPCI)



NOTES

- 1 CRS, CGRS.
- 2 HGBS, HGBR.

FIGURE H.21/Q.764 (sheet 19 of 20)
Call Processing Control Incoming (CPCI)

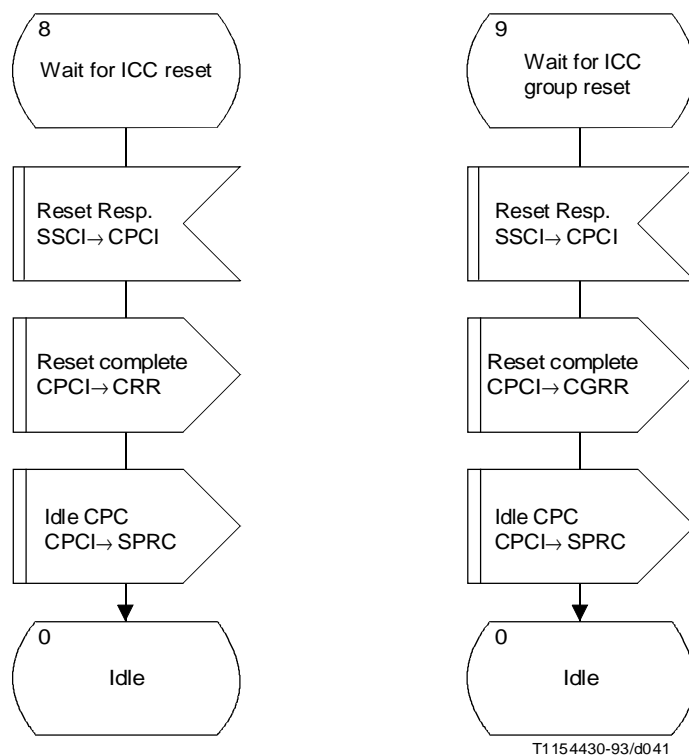


FIGURE H.21/Q.764 (sheet 20 of 20)
Call Processing Control Incoming (CPCI)