TTC STANDARDS

P B X

(Private Branch Exchange)

TTC Original Standards

[JJ-20.10~JJ-21.10]

THE TELECOMMUNICATION TECHNOLOGY COMMITTEE

Telecommunication Technology Committee

Introduction

This document provides the TTC original Standards formulated and put into effect by the Technical Assembly. It contains unabbreviated version of 'JJ-' Standards, which have not been defined as international standards.

In case of dispute, the original to be referred is the Japanese version of the text.

We trust that greater understanding of TTC Standards by a wider range of users will further contribute to the development of telecommunications.

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JJ-20.10 Digital interface between PBX and TDM (channel-associated signalling)
-Outline-

1. Outline

An outline of channel-associated signalling that is applicable to a PBX-TDM digital interface when PBXs are connected by means of digital leased lines and time-division multiplexers will be explained below.
The PBX-TDM digital interface is specified by electrical and physical conditions as well as control signals transmitted and received by PBXs through this inter-face.
Details are provided in Standards JJ-20.11 (electrical and physical conditions) and JJ-20.12 (PBX to PBX Signal Regulations).
The interfaces in this standard have the following functions.

(1) Multiplexing of several communication channels
(2) Transmitting and receiving of control signals corresponding to each communication channel
(3) Alarm transmission for interface faults
(4) Transmission of clock signals

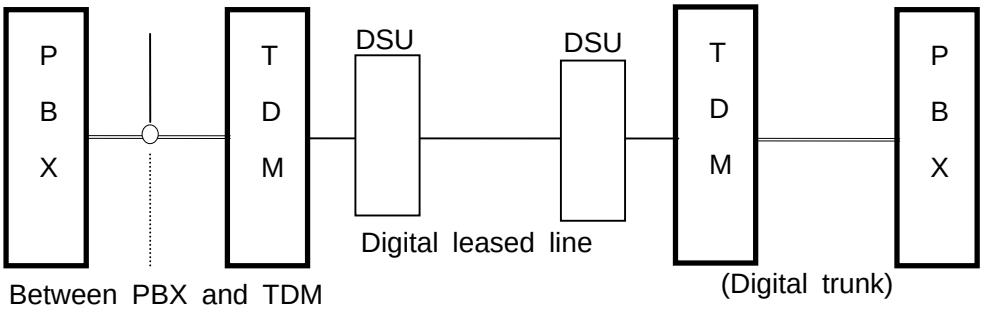
2. Scope of application

Interfaces of this standard are applicable to all connecting configurations shown in Figure 2-1/JJ-20.10. The PBX-PBX Signal Specifications have taken into consideration connection configurations as shown in Figure 2-2/JJ-20.10.

3. Others

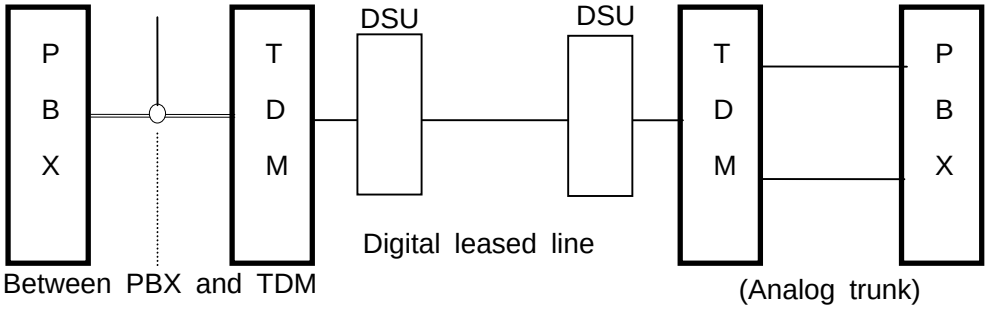
Related standards consist of the following.

(1) JJ-20.10: Outline
(2) JJ-20.11: Electrical and Physical Condition
(3) JJ-20.12 : PBX and PBX signalling specification



Digital interface between PBX and TDM

Figure 2-1/JJ-20.10 Connecting configurations and positioning of interfaces for this standard



Digital interface between PBX and TDM

Figure 2-2/JJ-20.10 Connecting configurations as considered in the PBX-PBX signal specifications

JJ-20.11 Digital interface between PBX and TDM (Channel-associated signalling) -Electrical and Physical Conditions-

1. Scope of specification

This standard specifies electrical and physical conditions (equivalent to Layer 1 of the OSI Standards) of a PBX-TDM interface when PBXs are connected through TDM and digital leased lines.

2. Interface specification points

This standard defines two interface specification points. There are two points on the PBX side and two on the TDM side of the PBX-TDM digital interface as shown in Figure 2-1/JJ-20.11 below. For the physical conditions of the connector, however,only the TDM side is defined.

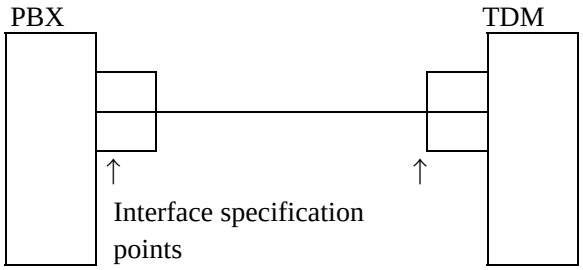


Figure 2-1/JJ-20.11 Interface specification points

3. Electrical/Physical Characteristics

3.1 Major electrical conditions

Major electrical conditions, including transmission codes, rates and conditions,and input/output specifications are shown in Table 3-1/JJ-20.11. The CMI code isshown in Figure 3-1/JJ-20.11.

Table 3-1/JJ-20.11 Major electrical conditions

Item		Specification	Note
Transmission code		CMI Code *1	See Fig.3-1/JJ-20.11.
Transmission rate		2.048 Mbps	
*2	Amplitude	3.0Vp-p ± 0.75V	Measurement to be made by connecting a resistance of 110 ohms to the output
	Duty	50 ± 10% (occupation of binary value "0")	
	Rise/Fall time (10~90% of pulse amplitude)	Less than 50 nsec	
Input specification		Normal reception should be possible when using shielded twisted-pair cable with a maximum loss rate of 13 dB using a sine-wave input with a frequency of 2048 kHz.	
Line interface		Balanced transmission with trans-former coupling	

*1 CMI is described on chapter 4.

*2 Output specification

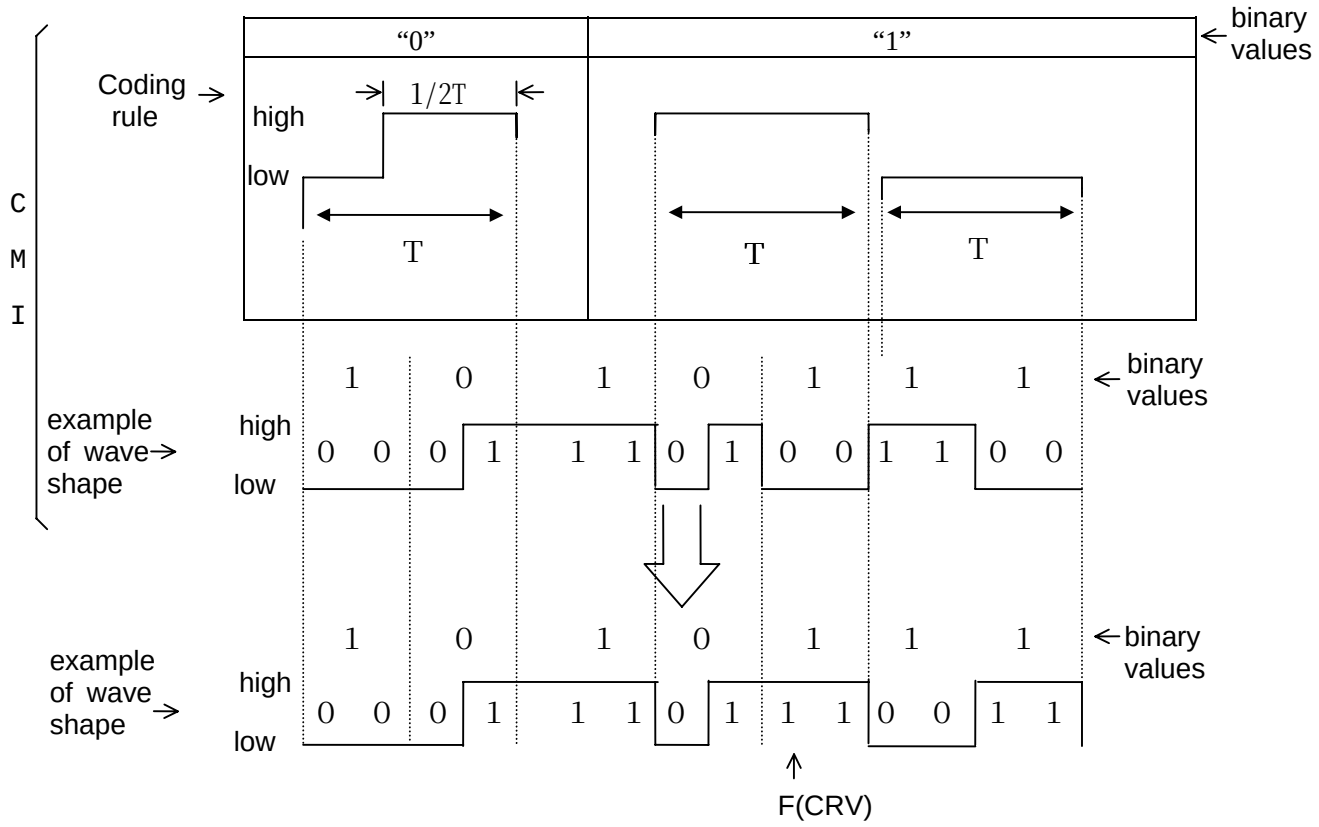


Figure 3-1/JJ-20.11 CMI code

3.2 Frame format

The frame-format signalling time slot and multi-frame format signal time slot are shown in Figure 3-2/JJ-20.11.

TS for voice and data: TS No.1-15 and No.17-3 are used (total 30 channels). TS is the abbreviation for time slot. Signalling TS: TS No. 0 is used.

F: 8 kHz frame-alignment signal bit (1st bit of TS No. 0)

MF: Multiframe alignment signal bit (2nd bit of TS No. 0)

S: Alarm-indication signal bit (the 3rd bit of TS No. 3. As an alarm indication signal, it transmits under normal conditions to interfacing equipment. S="0" and S="1" when detecting a signal interruption or asynchronization.

Ai: The signal bit allocates a single bit to Ts No. 0 for each of MF No. 2 through 7 and for bit 4 to 8 corresponding to Channel i.

X: Not specified

TS No.16: Not specified

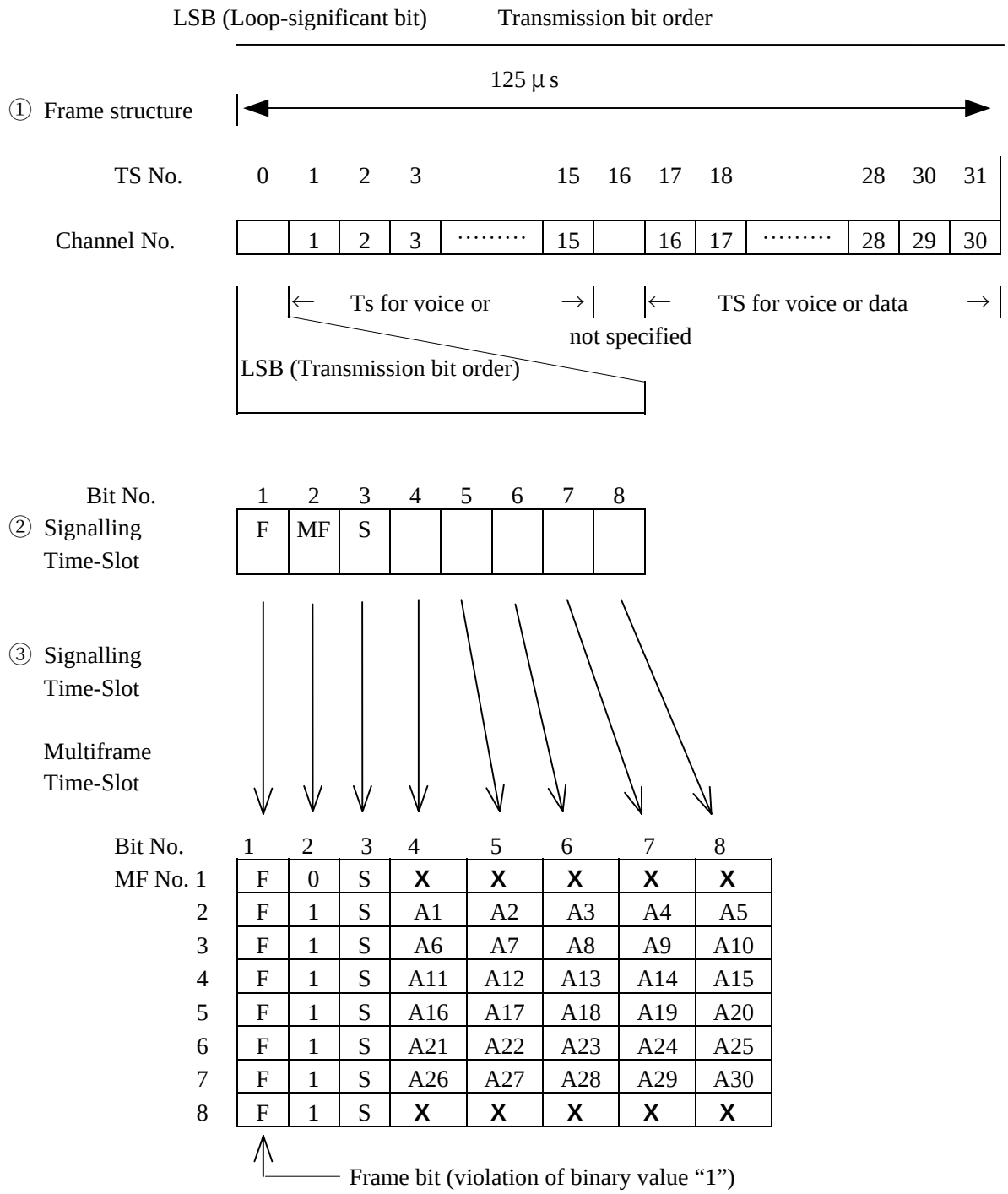


Figure 3-2/JJ-20.11 Frame format (2 Mbps)

3.3 Frame synchronization characteristics

Synchronization is shown in Table 3-2/JJ-20.11.

Table 3-2/JJ-20.11 Framing

Frame synchronization	Note
Detection of CMI violation	See Figures 3-1/JJ-20.11 and 3-2/JJ-20.11,and Chapter 4.

3.4 Signal bit A characteristics

Signal bit A characteristics are shown in Table 3-3/JJ-20.11.

Table 3-3/JJ-20.11 Signal bit A

State	Idle	In-use	Maintenance busy
Value	"1"	"0"	"0"

3.5 Synchronization

(1)Clock synchronization is provided via a master-slave arrangement where the TDM is the master.

(2)The PBX should extract a clock signal from the 2.048 Mbps interface line.

A clock supply system using 64 kHz + 8 kHz composite bipolar coding is shownin Appendix 4 for reference purposes.

(3)This standard has no provisions for clock synchronization other than the PBX being supplied to clocks from the TDM.

3.6 Alarm

The alarm condition is shown in Figure 3-3/JJ-20.11.

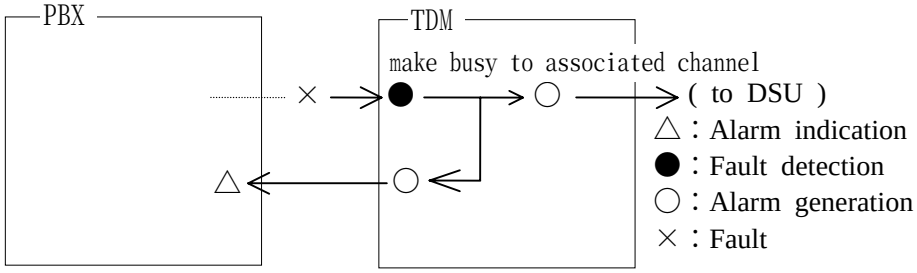


Figure 3-3/JJ-20.11 (1/2) Alarm from TDM to PBX

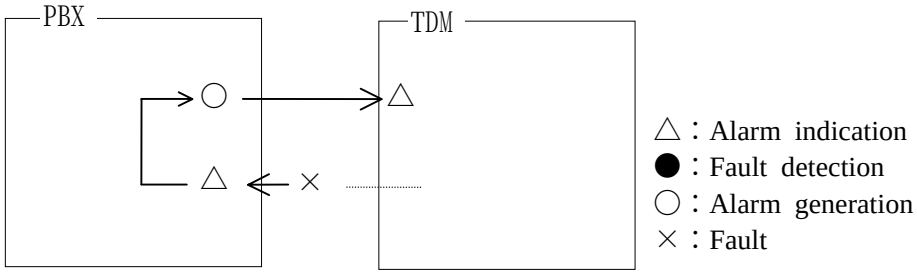


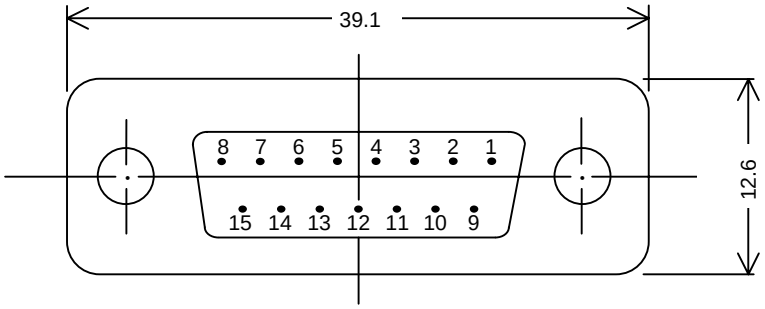
Figure 3-3/JJ-20.11 (2/2) Alarm from PBX to TDM

In Figure 3-3/JJ-20.11, alarm-indication bit S is in no way affected in the event of a transmission system failure occurring between TDMs.

3.7 Physical conditions

3.7.1 Connector

A 15-pin connector (complying with ISO standard IS4903) should be used. For TDM, a connector jack should be used. Figure 3-4/JJ-20.11 shows the dimensions and terminal numbers of the connector (jack).



〔 Dimensions in mm 〕

Notes 1. The connector (jack) on the TDM side is viewed from the connecting side.

2. The connector should be secured with M3 set screws.

Figure 3-4/JJ-20.11 Connector (jack) dimensions and terminal numbers.

3.7.2 Connector (jack) terminal arrangement

Table 3-4/JJ-20.11 shows the connector (jack) terminal arrangement.

Table 3-4/JJ-20.11 Connector (jack) terminal arrangement

Signal	Abbr.		Terminal number*	Polarity	Signal direction		Remarks
					PBX	TDM	
Receiving signal	LINE IN	RA	2	+			Signal recieved by TDM
		RB	9	-			
Sending signal	LINE OUT	TA	4	+			Signal sent by TDM
		TB	11	-			
Ground	G		1				**

* Only terminals 1,2,4,9 and 11 are used.

** This standard does not define the process for the connector (plug).

4.Supplementary explanation

A supplementary explanation of the CMI code and the violation method are presented below.

(1) CMI coding

CMI (Coded-Mark Inversion) code conversion rule

binary "0" → "01"

binary "0" → alternative "00" and "11"

(2) CRV

CRV (Coding-Rule Violation) is a method of furnishing frame-alignment information by violation of the above-mentioned specifications and constitutes a violation of binary value "1".

〔**Appendix**〕

The Appendix does not constitute a part of the standard.

1. False-framing Protection

An example of false-framing protection is shown in Table A 1-1/JJ-20.11.

Table A 1-1/JJ-20.11 Example for protection of frame alignment

Loss of frame	Two successive missing frames
Frame recovery	First violation

2. Interface cable

The maximum length of the cable should be about 400 m when using a 0.4φ multi-pair, shielded, twisted-pair cable.(This applies to both cables in Table 3-1/JJ-20.11 and A 4-1/JJ-20.11.)

3. Interface transmission rate

Regarding the interface transmission rate, it is desirable to have it operatein the range of 2.048 Mbps± 50 ppm.

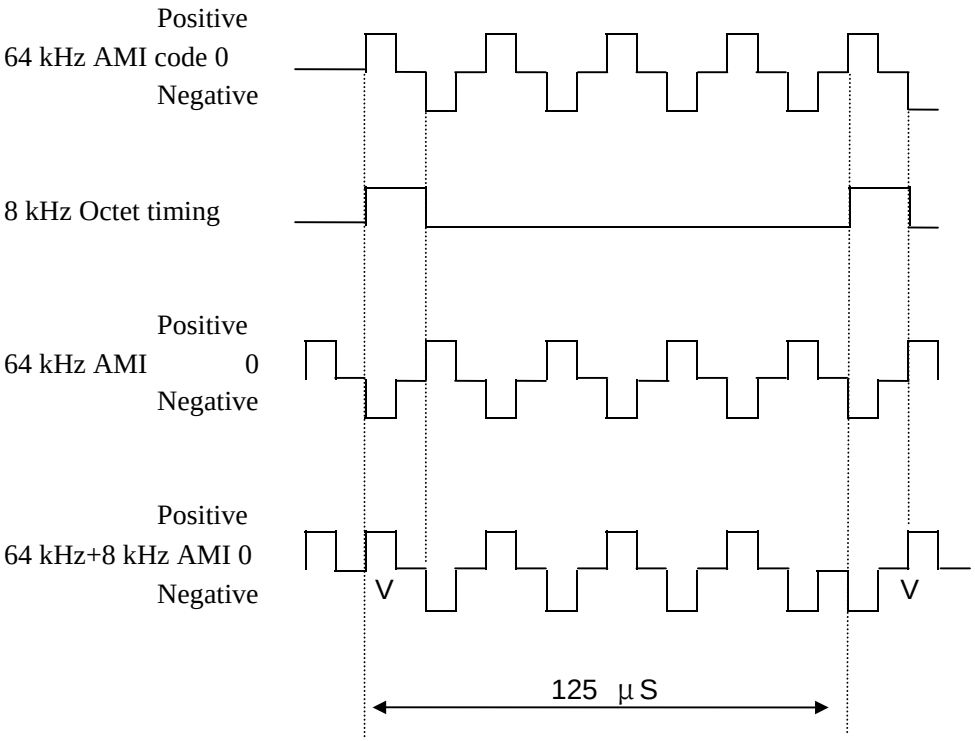
4. Clock-supplying system

Clock-supplying system using 64 kHz +8 kHz composite-bipolar coding is shown in Table A 4-1/JJ-20.11.

Table A 4-1/JJ-20.11 Clock-supplying system using 64 kHz+8 kHz composite- bipolar coding

Item		Specification	Note
Timing Signal		64 kHz+8 kHz Composite Bipolar Coding	See Figure A4-1/JJ-20.11.
Line Coding		AMI code/RZ method	
Output specification	Amplitude	1 Vo-p ± 0.1V	Measurement to be made by connecting a resistance of 110 ohms to the output
	Duty	50 ± 10%	
Input Specification		Normal reception should be possible when using a shielded twisted-pair cable, whose loss from a 64 kHz sine wave is not greater than 5 dB.	
Line Interface		Balanced transmission by connection with a transformer	

Figure A 4-1/JJ-20.11 shows a composite signal of 8 kHz and 64 kHz using the AMI Code (a violation of the AMI Code).



32 AMI/RZ coding is shown in Figure A 4-2/JJ-20.11.

Figure A 4-1/JJ-20.11 Composite timing signal (64 kHz and 8 kHz) with AMI/RZ coding

AMI (Alternate Mark Inversion) means the alternating transmission of a positive polarity pulse and negative polarity pulse each time a binary "1" signal is generated. Figure A 4-2/JJ-20.11 shows one such example together with the mean-ing of RZ (Return to Zero) with 50% duty.

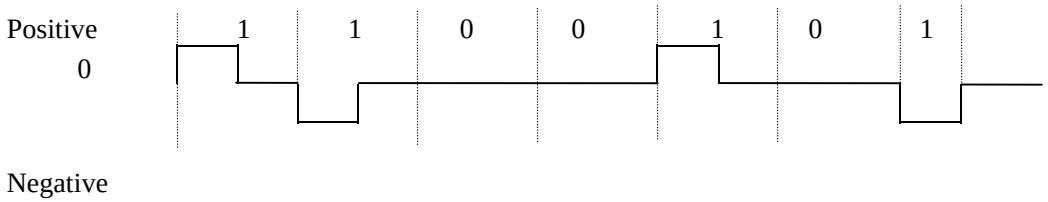


Figure A 4-2/JJ-20.11 (1/2) Example for AMI Coding

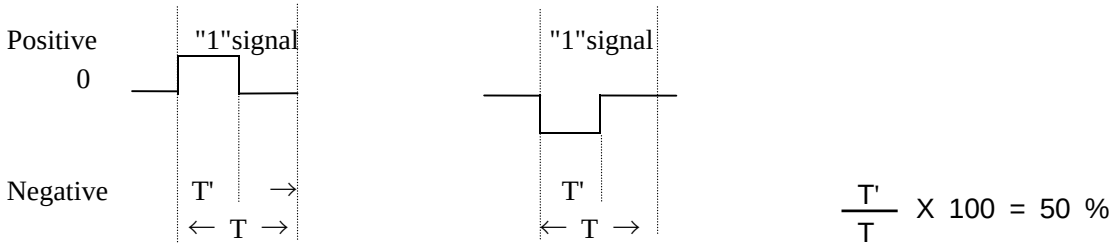


Figure A 4-2/JJ-20.11 (2/2) AMI coding/RZ with 50% duty method

5. Failure of Transmission Lines between TDMs

The alarm-indication bit S for interfacing equipment should not be changed inthis case. (Refer to Paragraph 3.6 of the preceding text.)

The signalling bits A between the PBX and TDM should be "0" to mark as busy the channels related to the failed termination line .

Appendix

1. The relationship between the make duration specified in this standard and the one specified by the Technical Criteria for Terminal Equipments.
2. The relationship between the signal transmission level specified in this standard and the one specified by the Technical Criteria for Terminal Equipment.

JJ-20.12 Digital Interface between PBX-TDM (channel-associated signalling)
PBX-PBX specification

1. Scope of specification

This standard specifies the PBX-PBX signalling characteristics in the channel-associated signalling system when PBXs are connected through TDM and digital leased lines.

2. Interface specification point

The interface specification point defined in this standard is single in the PBX-TDM interface section, and is shown in Figure 2-1/JJ-20.12.

The transmission characteristics specified in this standard define the characteristics by which the PBX transmits signals to the TDM. Receiving characteristicsdefine the means by which the PBX receives signals from the TDM.

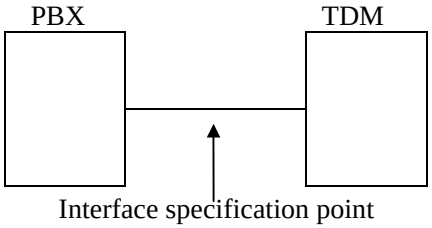


Figure 2-1/JJ-20.12 Interface specification point

3. Signalling system

3.1 Outline

This standard specifies the purpose and method for the usage of signal bit A. It is specified by the physical and electrical characteristics (JJ-20.11) in PBX-TDM Digital Interface (Channel-Associated Signalling).

3.2 Signalling bit A

One bit is used as signalling Bit A corresponding to each channel between the PBX and TDM. Depending on the purpose of usage, it is classified into the following categories as shown in Table 3/JJ-20.12 and is defined at each interface specification.

Table 3/JJ-20.12 Classified signals list

Classified Signals	Purpose of Usage	Interface Specification Point			
		Originating PBX		Terminating PBX	
		TX	RX	TX	RX
Seizure Signal	Signal for the originating PBX to seize the terminating PBX	○			
Incoming Seizure Signal	Signal for the terminating PBX to detect the incoming call				○
Connection Confirma-tion Signal	Signal from the terminating PBX to notify the originating PBX the readiness for address signal reception		○	○	
Address Signals	Signal from the originating PBX to notify the terminating PBX the number of the called party	○			○
Answer Signal	Signal from the terminating PBX to notify the originating PBX that the called party has answered		○	○	
Clear-Back Signal	Signal from the terminating PBX to notify the originating PBX of release		○	○	
Disconnect Signal	Signal from the originating PBX to notify the terminating PBX of the release	○			○
Release Guard Signal	Signal for the terminating PBX to notify the originating PBX that disconnect signal has been detected		○	○	

The binary values that the signal bits can assume are "0" or "1".

In-use channel "0"
During idle-state channe "1"
During make-busy-state channel "0"

3.3 Address Signals

There are two address signalling methods: the dial-pulse address signalling andDTMF (Dual-Tone Multi-Frequency) address signalling.

Dial-pulse address signalling is the method by which a dial signal is generated by the subscriber or the sender circuit in the PBX. It is transmitted by alternating the value of signalling bit A between "0" and "1".

DTMF address signalling is the method by which the dial-signal digits generatedby the subscriber or the sender circuit in the PBX are transmitted using a com-bination of specified frequencies through the channel on as voice. Signal bit A,in this method, is maintained at "0".

3.3.1 Transmission characteristics of address signals

The transmission characteristics of address signals are shown in Tables 3-2/JJ-20.12 and 3-3/JJ-20.12.

Table 3-2/JJ-20.12 Signal transmission characteristics of Dial Pulse

Item		Specification
Dial Pulse		Note 1 0 ～ 9
10PPS	Speed	10 ± 0.8 pps
	Make duration	See Figure 3-2/JJ-20.12
	Minimum Pause	Minimum 650 ms
20PPS	Speed	20 ± 1.6 pps
	Make duration	See Table 3-2/JJ-20.12
	Minimum Pause	Minimum 450 ms

Note 1 Dial-pulse "0" should be 10 pulses.

Note 2 The relationship between the make ratio specified in the Technical Criteria for Terminal Equipment and the one specified in this standard isshown in Appendix 1.

Table 3-3/JJ-20.12 Signal transmission characteristics of DTMF signal

Item	Specification
Tone Duration	Minimum 50 msec
Minimum Pause	Minimum 40 msec
Cycle Time	Minimum 120 msec
Signal Transmission Level	-16.5 ～ -6.5 dBm (low group) Note3 -16.0 ～ -6.5 dBm (high group)
Signal Frequency	1209 / 1336 / 1447 697: 1 2 3 770: 4 5 6 852: 7 8 9 941: * 0 #
Frequency deviation	± 1.5%

Note 3 The relationship between the signal transmission levels specified in the Technical Equipment and the one specified in this standard is shown in Appendix 2.

3.3.2 Receiving characteristics for address signals

Receiving characteristics for address signals are shown in Tables 3-4/JJ-20.12 and 3-5/JJ-20.12. The characteristics limit for receiving signals, however, definesthe range which can be received by PBX. Only the characteristics limit representing the range that should not be received is specified.

Table 3-4/JJ-20.12 Dial-pulse signal-receiving characteristics

Item		Specification
10 pps	Speed make duration	10 ± 1.5 pps See Table 3-1/JJ-20.12.
20 pps	Speed make duration	20 ± 3.0 pps See Table 3-2/JJ-20.12.
Interdigital timing		Minimum 300 msec

Note 1 When using 20 pps dial-pulse signalling with interfacing through digital leased lines and a TDM using an analog interface, the operational setup should be throughly investigated. This is because there is little margin for error in the make duration.

Table 3-5/JJ-20.12 Signal-receiving characteristics

Item	Specification
Signal frequency	The same as Signal Transmission Characteristics
Frequency deviation	A signal with less than ± 1.8% should be detected as a valid signal. A signal with more than ± 4% should not be detected as a valid signal.
Tone-duration accept	Minimum 45 msec
Minimun pause	Minimum 30 msec
Signal-receiving levels	The signal from -3 dBm through -24 dBm should be detected.

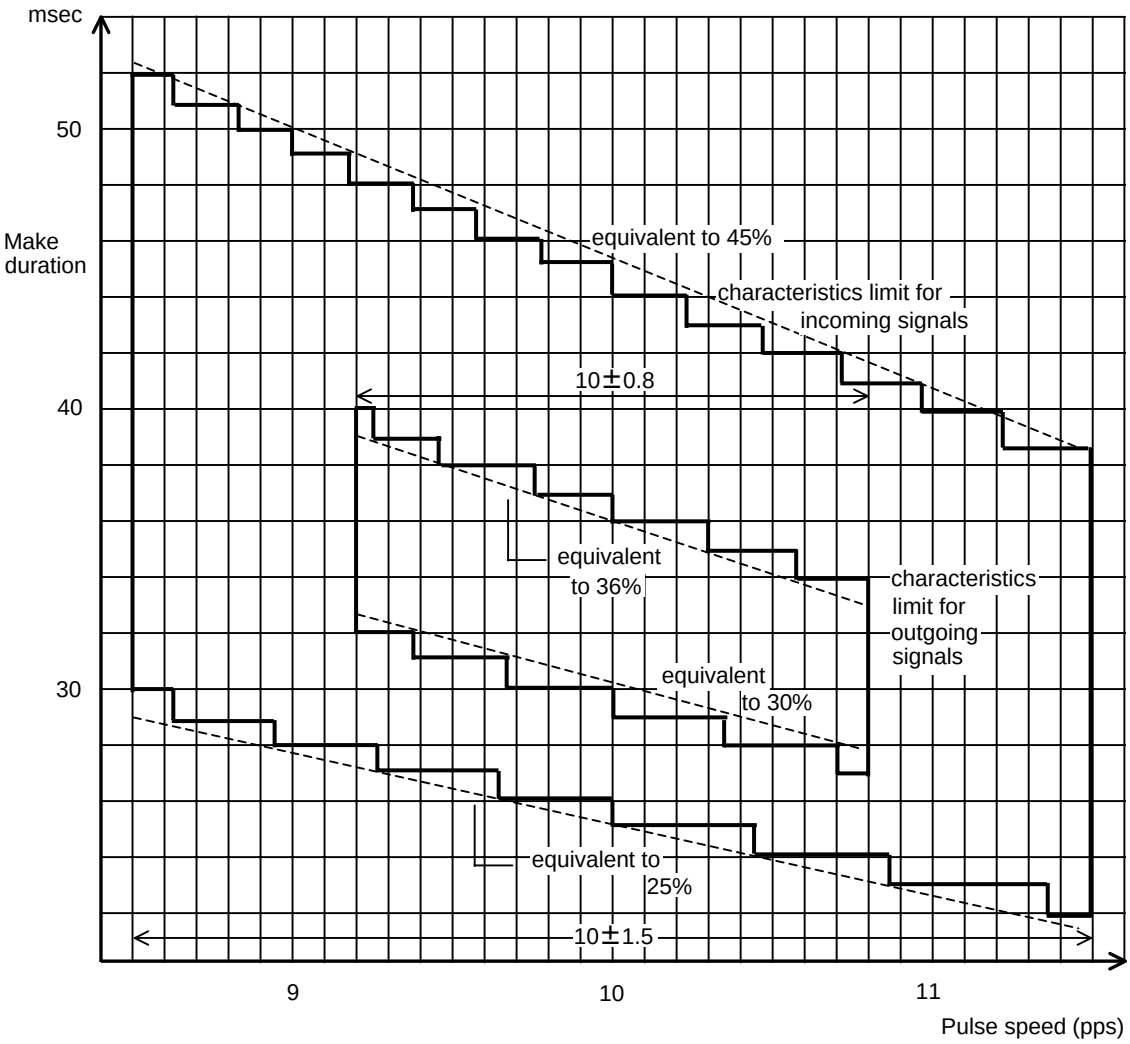


Figure 3-1/JJ-20.12 DP10 pps make duration

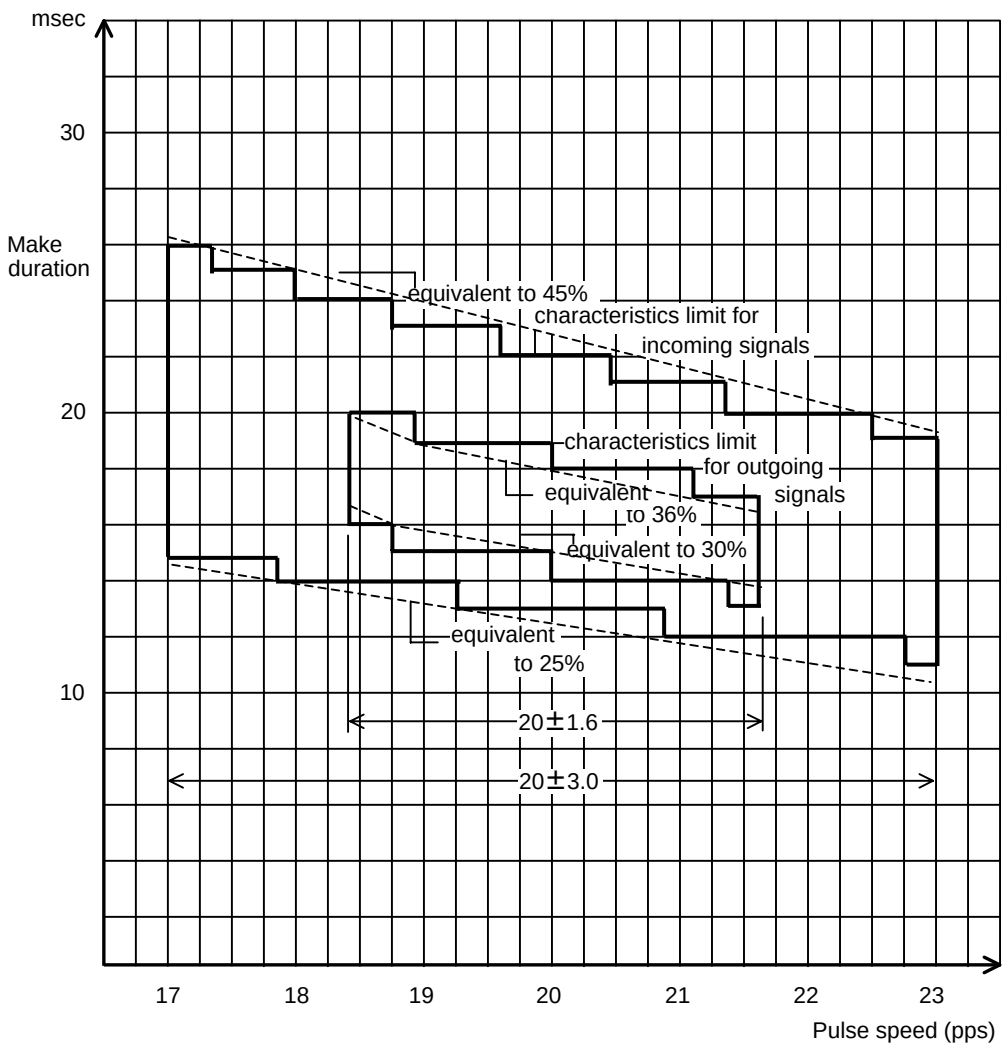


Figure 3-2/JJ-20.12 DP20 pps make duration

4.Call-Sequence Criteria

4.1 Incoming signal

The terminated PBX should recognize receiving-signal bit changes from "1" to "0" as an incoming seizure. To minimize the probability of glare, the terminated PBX should mark the trunk as busy for outgoing service within 100 msec of the start of an incoming seizure.

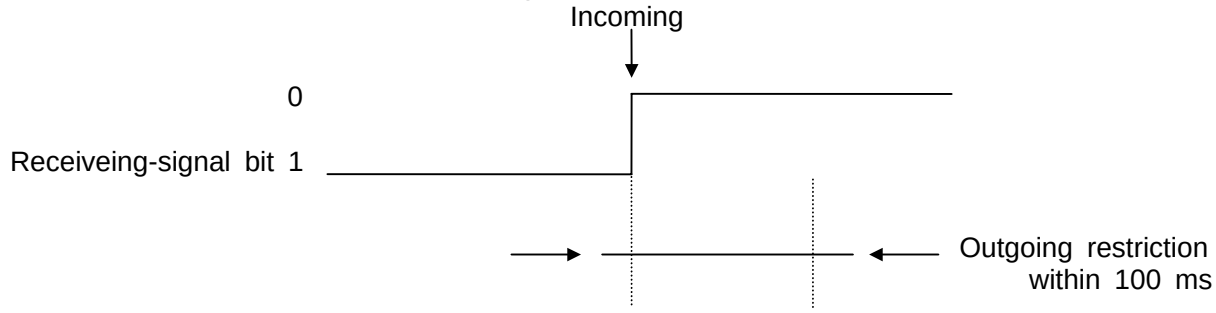


Figure 4-1/JJ-20.12 Receiving-signal sequence

4.2 Incoming-address signal reception

4.2.1 When the terminated PBX receives address signals by the second dial tone system, the terminated PBX should be able to return a dial tone when it is ready to receive address signals within 3 seconds. The dial tone should be removed within 500 msec from the start of the first address character.

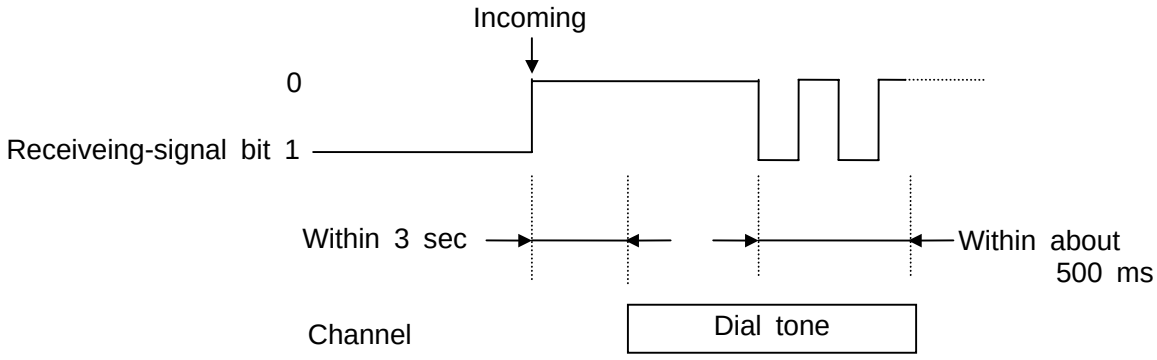


Figure 4-2/JJ-20.12 Second dial-tone system

4.2.2 When the terminating PBX receives address signals by the wink-start system, begin preparations for reception immediately upon completion. Set within5 seconds the signal bit at "0" for between 140 to 290 msec as a connection confirmation signal.

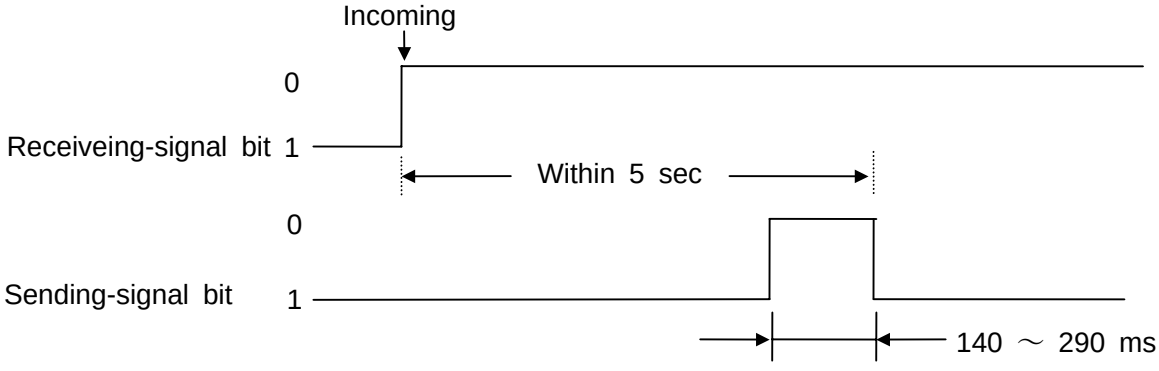


Figure 4-3/JJ-20.12 Wink-Start system

4.3 During alerting

The terminating PBX should send out a ring-back tone upon receiving address signals and continue until it returns an answering signal.

4.4 Returning an answering signal

When the called party has responded to the incoming call, the terminated PBX should change the signal bit A value from "1" to "0" as an answer signal and maintain this condition until the call has been disconnected.

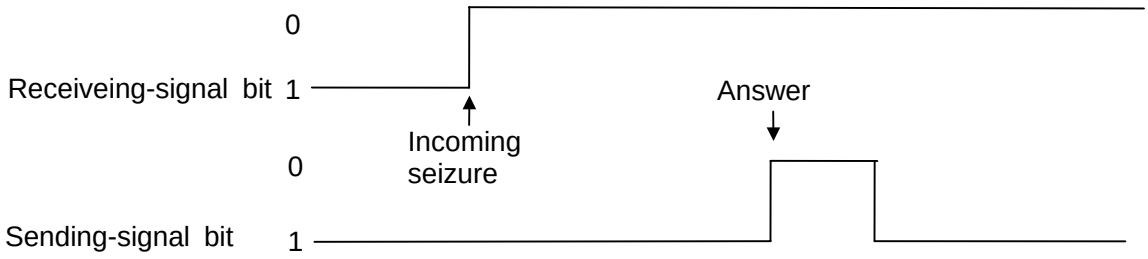


Figure 4-4/JJ-20.12 Answer signal

4.5 Outgoing seizure

Upon selection of the channel for outgoing service, in order to reduce the probability of glare, the originating PBX should change the value of signal bitA from "1"to "0". This will act as a seizure signal and should occur within about 50 msec.

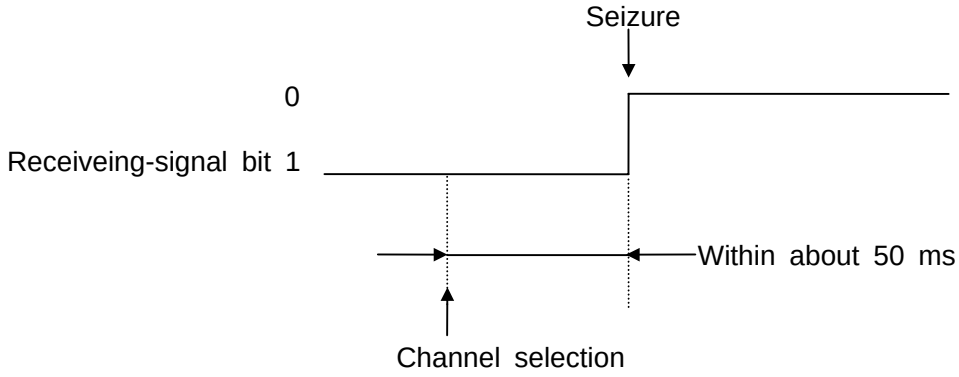


Figure 4-5/JJ-20.12 Outgoing seizure

4.6 Outgoing address signals

4.6.1 When the originating PBX undertakes transmission of address signals by a second dial tone system without confirming the dial tone, transmission should begin immediately after a minimum 3-second interval following transmittion of the seizure signal.

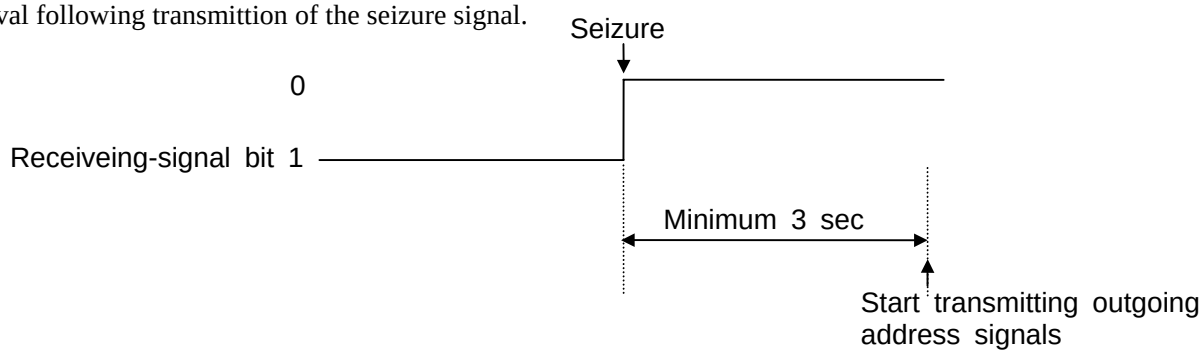


Figure 4-6/JJ-20.12 Second-Dial-Tone system (in case of timing start)

4.6.2 When the originating PBX is to transmit address signals by a second-dial-tone system after confirming the dial tone, transmission must proceed immediately after detection of the dial tone.

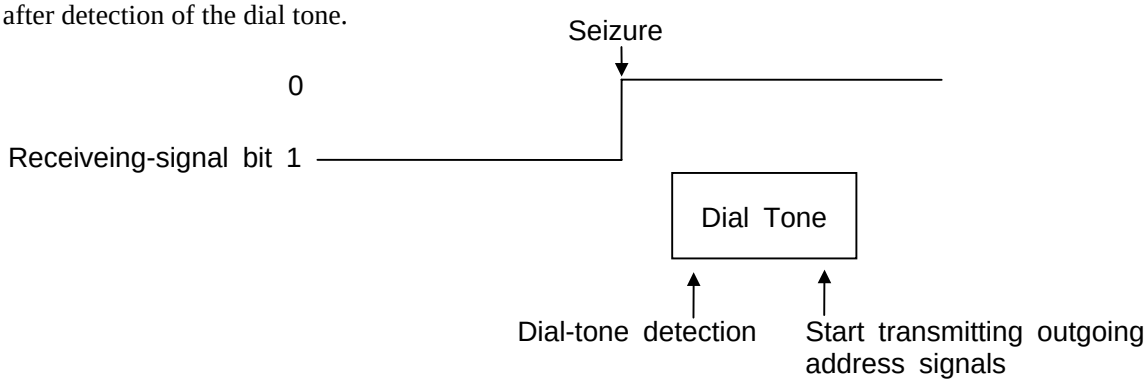


Figure 4-7/JJ-20.12 Second-dial-tone system (when confirming the dial tone)

4.6.3 If the originating PBX transmits address signals by the wink-start system, it is desirable that transmission begins after a minimum of 70 msec following detection of a connection-confirming signal.

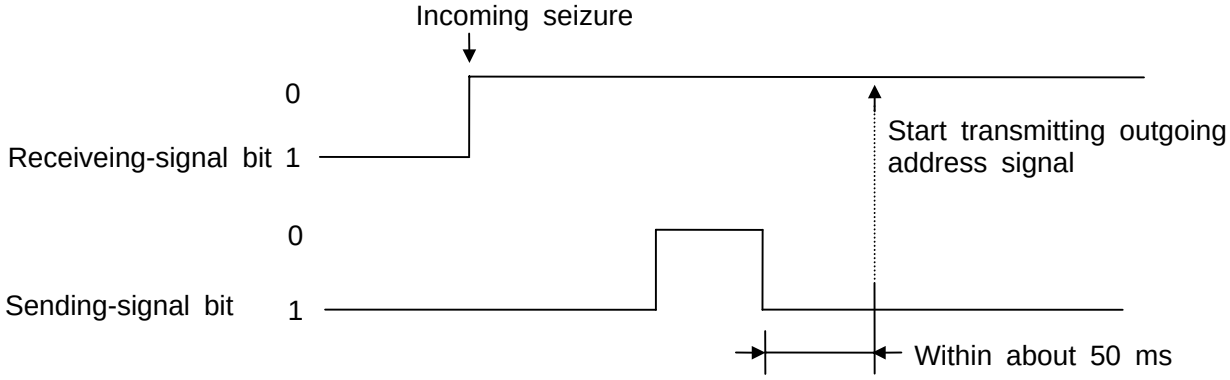


Figure 4-8/JJ-20.12 Wink-start system

4.6.4 In the event that the originating PBX seeks to transmit address signals automatically through the sender circuit or by other means, it is desirable that the channel be connected to the PBX subscriber or others within 500 msec after transmitting all address signals.

4.7 Detection of answer signal

After the signal-bit-A value has changed from "1" to "0", and there has been acontinuation for a minimum 60 msec, the originating PBX should regard this as ananswer signal.

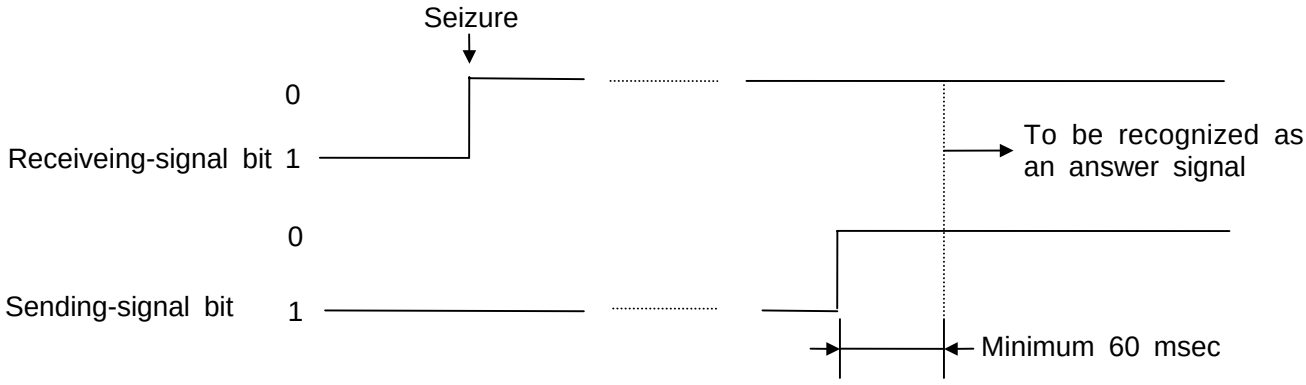


Figure 4-9/JJ-20.12 Detection of answer signal

4.8 Release

The forms of release to be provided for in this standard should be the calling-party release system and the first-party release system. Under these two systems,if the called party goes on-hook first, the signals transmitted by the terminatedPBX are called the release signal. The signal from the originating PBX in response is called the disconnecting signal.

On the other hand, if the calling party goes on-hook first, the signal transmitted from the originating PBX is called the disconnect signal. The signal fromthe terminating PBX is called the release-complete signal.

4.8.1 Release signal

4.8.1.1 The release signal, if the called party goes on-hook first, is the signal transmitted by the terminated PBX that changes the signal bit A value from"0" to "1" and continues for a minimum of 700 msec.

4.8.1.2 The originating PBX will regard as a release signal all signals that continue for a minimum of 90 msec to a maximum of 700 msec after a change in signal bit A's value from "0" to "1". Signals of less than 90 msec will not be regarded as release signals.

4.8.1.3 For a minimum 800 msec, after transmitting the clear-back signal for the terminated PBX and after beginning reception for the originating PBX, neither PBX should use the channel in question for purposes of outgoing service.

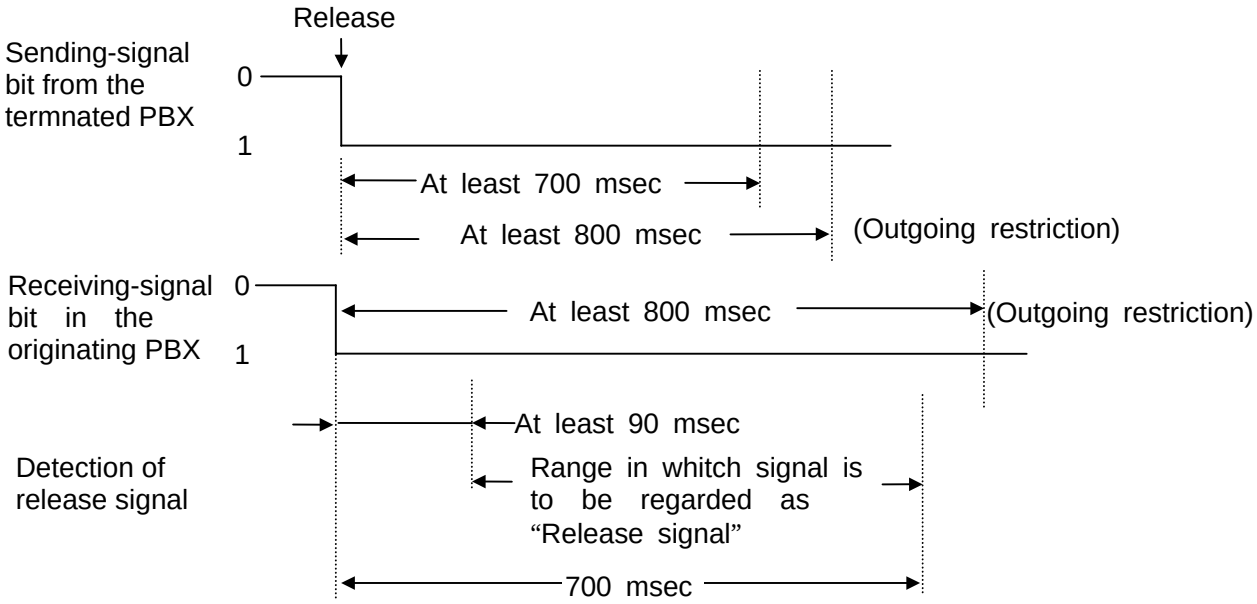


Figure 4-10/JJ-20.12 Release signal

4.8.2 Disconnecting signal

4.8.2.1 The disconnect signal is the originating PBX signal if the calling party goes on-hook first. It is also the signal that is transmitted by the originating PBX after detecting the release signal transmitted from the terminated PBX when the called party goes on-hook first. The originating PBX should change the signal bit A value from "0" to "1" and maintain this fora minimum of 700 msec.

4.8.2.2 The terminated PBX will regard signals that continue for a minimum 90 msec and maximum 700 msec after the signal Bit value has changed from "0" to "1"as disconnect signals. An exception is that signals of less than 90msec will not be regarded as disconnecting signals.

4.8.2.3 For a minimum 800 msec after transmitting the disconnect signal for the originating PBX and after beginning reception for the terminated PBX, nei-ther PBX should use the channel in question for the purposes of outgoing service.

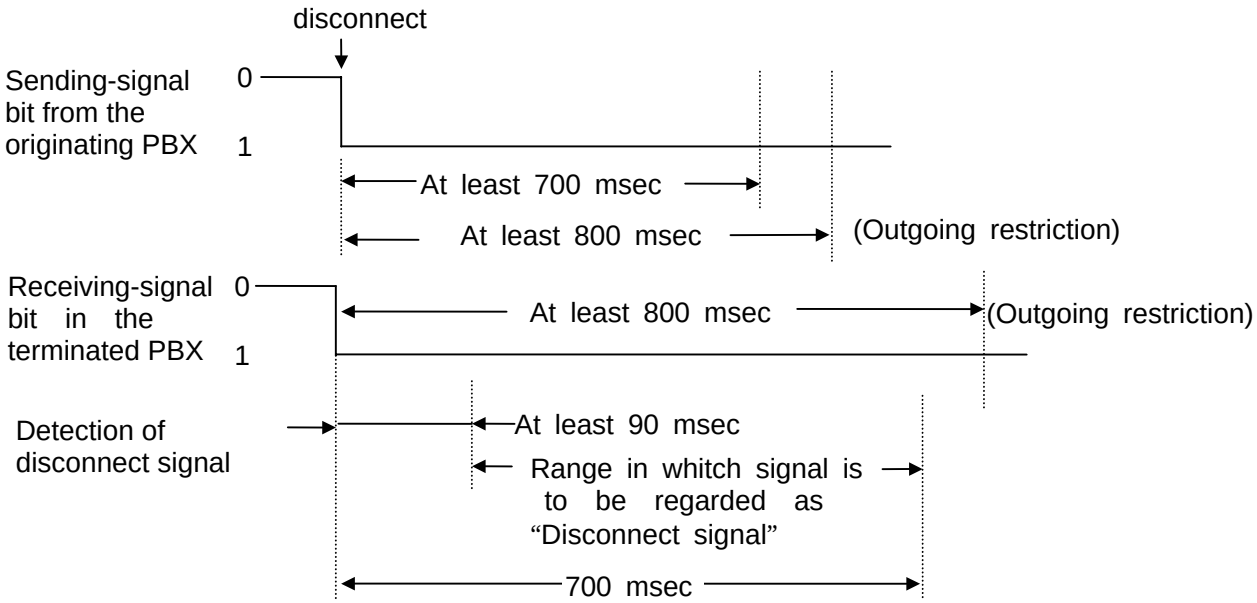


Figure 4-11/JJ-20.12 Disconnect signal

4.8.3 Release-Guard signal

4.8.3.1 The release-guard signal is the signal that is transmittied upon detection of the disconnect signal by the terminating PBX. It should maintain the signal for a minimum 700 msec after a change in the signal bit A value from "0" to "1".

4.8.3.2 The originating PBX will regard signals that continue for a minimum 90 msec and maximum 70 msec after the signal bit A value has changed from "0"to "1" as release guard signals. An exception is that signals of less than90 msec will not be regarded as release-guard signals.

4.8.3.3 For a minimum 800 msec after transmission of a release-guard signal for the terminated PBX and after beginning reception for the originating PBX,neither PBX should use the channel for the purpose of origination.

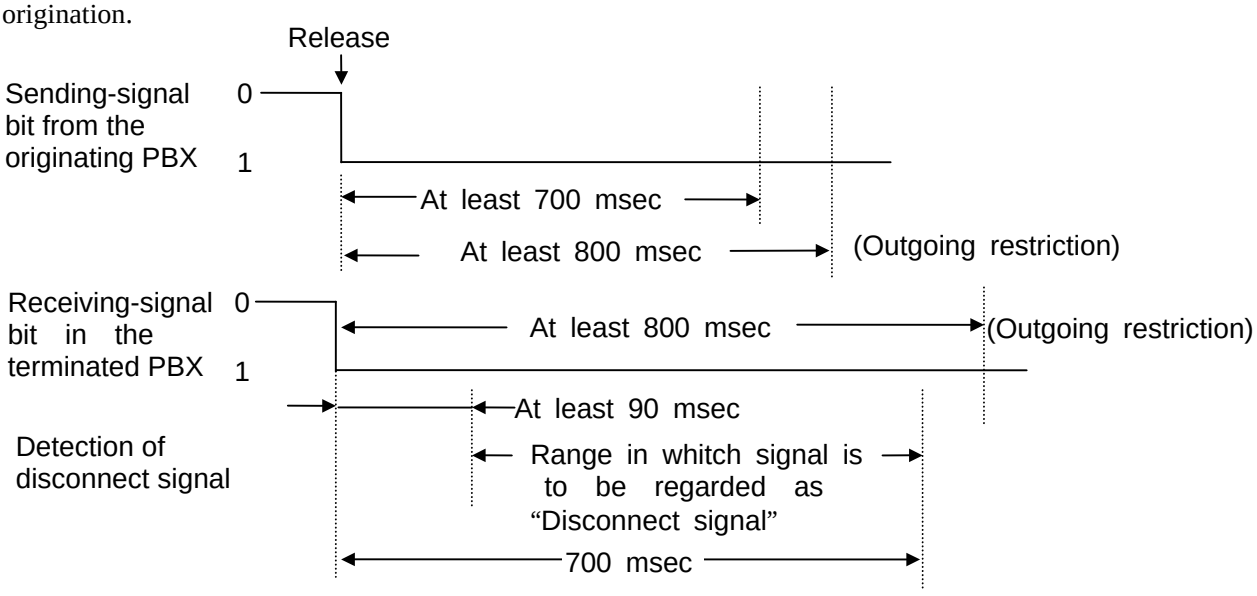


Figure 4-12/JJ-20.12 Release-guard signal

5.Audible signal

5.1 Types of signals

(1) Dial Tone

The signal is transmitted by the terminating PBX to the channel after having completed preparations for address signals by the second dial-tone signalling system.

(2) Busy tone

The signal is transmitted by the terminated PBX to the channel when findingit impossible to reach the called party due to a busy status for all circuitsor because the called station is busy.

Also, when the called party cannot be reached due to a wrong dial, restrict-ions or other factors, a busy tone may be transmitted to the channel.

(3) Ring-Back tone

The signal is transmitted by the terminating PBX when calling the called station or another such station.

(4) Other

Other audible signals are not prescribed in this standard.

5.2 Signal characteristics

The audible-signal characteristics that are to be recommended by this standard are listed in Chart 5-1/JJ-20.12.

Item	Specification	
	Frequency	Transmission level
Dial tone	Intermittently at 400 Hz, 120 times/min	Less than -15 dBm
Busy tone	Intermittently at 400 Hz, 60 times/min	Less than -15 dBm
Ring-back tone	Modulation of 400 Hz at 20 Hz 1st or 2nd OFF	Less than -15 dBm

〔Appendix〕(to TTC Standard JJ-20.12)

The Appendix does not constitute a part of the standard.

1. Relationship between the Make Duration as Designated by this Standard and the Make Ratio as Determined by “The Regulation concerning Terminal Facilities,etc."

The make duration being within 33 ±3% that satisfies the make-ratio requirements as designated by "The Regulations concerning Terminal Facilities, etc." is shownin Figures 3-1/JJ-20.12 and 3-2/JJ-20.12.

2. Relationship between the Signal Transmission Levels as Designated by this Standard and the Signal Transmission Levels as Determined by “The Regulations Concerning Terminal Facilities,etc."

In the PBX-TDM digital interface as prescribed in this standard, there are no losses involved. Thus, the signal transmission loss lovel is prescribed as 0 dB.When connected by an analog interface that includes PBX-TDM losses, the need willarise to abide by the signal transmission levels as designated by "The Regulations Concerning Terminal Facilities, etc."

JJ-20.20 Digital Interface between PBXs (common channel signaling)

-General aspects-

1. General

This standard outlines common channel signaling applicable to PBX-to-PBX digital interfaces when PBXs are connected by a digital dedicated line.

The standards for PBX-to-PBX digital interfaces (common channel signaling) consist of interconnection models, service aspects, layer 1, layer 2, and layer3.

Details are provided in TTC Standards JJ-20.21, JJ-20.22, JT-I431-c, JT-Q921-a,JT-Q931-a, and JJ-20.23.

The standards for digital interfaces between PBXs (common channel signaling) are based on TTC standards JT-I431, JT-Q921, and JT-Q931 published by April 1989.

The first edition of digital interfaces between PBXs (common channel signaling) is applicable to circuit mode basic services required to be standardized at an early stage. Layer 3 specifications for B channel blocking is added in the second edition.

2. Scope of application

The standards related to digital interfaces between PBXs (common channel signaling) are applicable when PBXs are connected by digital dedicated lines (including a PBX connected through TDM and a PBX directly connected with NT1), on which common channel signaling is used for connection control.

An application will be studied for PBXs connected through a public ISDN.

3. Outline of specifications

Table 3-1/JJ-20.20 shows the reference points and an outline of the specifications specified by the guidelines related to this standard.

Table 3-1/JJ-20.20 Reference points and outline of specifications

Configurations	Reference point	Layer 1	Layer 2	Layer 3
Connection through TDM	Between PBX and TDM	JT-I431-c based on JT-I431	JT-Q921-a based on JT-Q921	JT-Q931-a based on JT-Q931
Direct connec-tion to NT1	Between PBX and NT1	Not specified		

4. List of standards

(1) JJ-20.20: General aspects
(2) JJ-20.21: Interconnection models
(3) JJ-20.22: Service aspects
(4) JT-I431-c: Primary-rate layer 1 specification
(5) JT-Q921-a: Layer 2 specification
(6) JT-Q931-a: Layer 3 specification
(7) JJ-20.23 : Layer 3 specifications for B channel blocking

JJ-20.21 Digital Interface between PBXs (common channel signalling)

-Interconnection models-

1. General

This standard specifies the interconnection models for digital interfaces between PBXs (common channel signalling).

2. Interconnection models and reference points

2.1 Interconnection models

Two interconnection models:

- PBX connected to NT1 through TDM (Fig. 2-1/JJ-20.21)
- PBX directly connected to NT1 (Fig. 2-2/JJ-20.21)

are considered.

An interconnection model for ISDN user-network interfaces is shown in Fig. 2-3/JJ-20.21 for comparison.

2.2 Reference points

(a) For a PBX connected to NT1 through TDM:
Interface is specified at the point between PBX and TDM.

(b) For a PBX directly connected to NT1:
Interface is specified at the point between PBX and NT1.

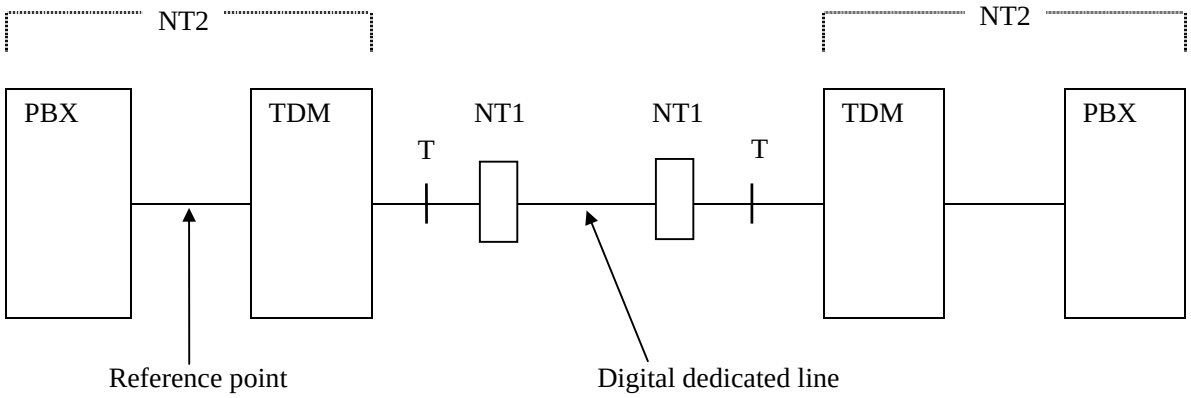


Fig. 2-1/JJ-20.21 PBX connected to NT1 through TDM

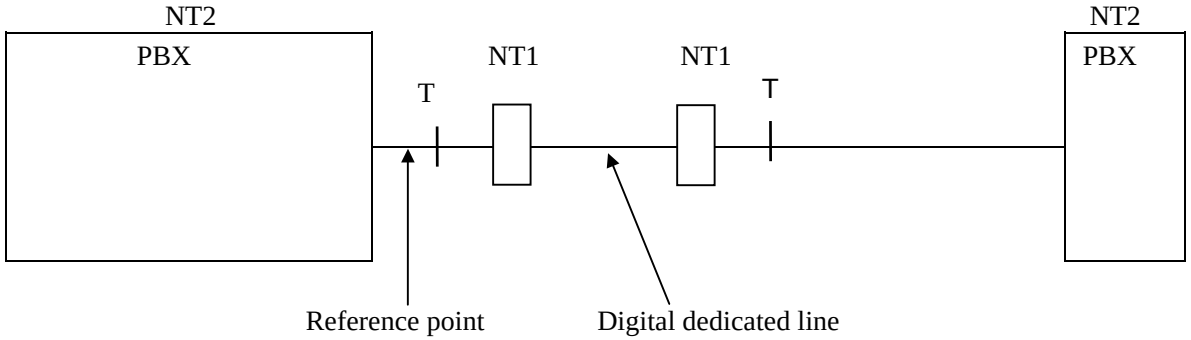


Fig. 2-2/JJ-20.21 PBX directly connected to NT1

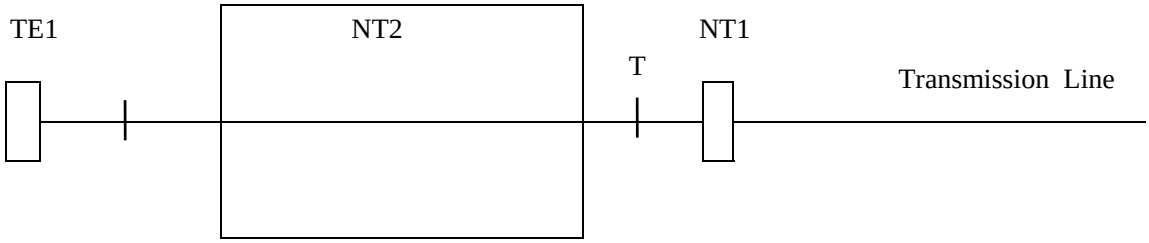


Fig. 2-3/JJ-20.21 A connection model for ISDN user-network interface

3. Channel Types

3.1 B-channel

The B-channel is a 64Kbit/s channel at the reference point.

3.2 H-channels

H-channels have the following bit rates at the reference point:

(1) H0 channel: 384Kbit/s

(2) H1 channel: 1536Kbit/s

3.3 Dp-channel

A Dp-channel is a 64Kbit/s channel as specified in §4, and is primarily intended to carry signalling information for circuit switching.

A Dp-channel uses a layered protocol according to TTC standards JT-Q931-a.

3.4 User-channel

The user-channel is a combination of the channels shown above in §§3.1 through 3.3., assigned on a single physical interface, and intended to carry information between associating PBXs.

More than one user-channel may be allocated between associating PBXs. In general, a user-channel should be allocated to assure 8 kHz integrity throughout the entire transmission section between associating PBXs.

The information transfer rate of a user-channel is 64Kbit/s×N ($1 \leqq N \leqq 24$), wherein the channel number is assigned contiguously from 1 to 24 at the maximum.

4. Interface structures of the user-channel

The interface structure of the user-channel specifies the maximum digitaltransmission capability as represented by the combination of channels.

4.1 Interface configurations

The interface structure of the user-channel at the reference point should conform to one of the interface configurations shown in Table 4-1/JJ-20.21.

Interface structure			Note
Primary rate interface	If the Dp-channel is in the same user- channel as B and/or H-channels	mH0+nB+Dp where 6m+n+1=N	Dp:64Kbit/s
	If the Dp-channel is in a different user-channel from B and/or H-channels	mH0+nB/Dp where 6m+n=N or H1/Dp	

Table 4-1/JJ-20.21 Interface configuration for user-channel

Note 1: m, n: integer ($\geqq$ 0)
N: integer (1 $\leqq$ N $\leqq$ 24)

Note 2: " / " means that the nonassociated signalling is applied using the Dp-channel in another user-channel.

4.2 Nonassociated signalling arrangement

In some cases, the Dp-channel is not allocated in the same user-channel in which B and/or H-channels are allocated. The nonassociated signalling is applied using a Dp-channel in another user-channel between associating PBXs.

5. Access capability

All channels in a user-channel may not be available at all times. In suchinstances, access capability is used to indicate the available capacity for PBX.The access capability is desirably assigned as follows.

User-channel: 54 Kbit/s $\times$ N $\leqq$ 1536 Kbit/s
mH0 + nB + Dp: 6m + n + 1 $\leqq$ N
mH0 + nB / Dp: 6m+ n $\leqq$ N
H1 / Dp
(where m.n: integer ($\geqq$ 0) N: integer (1 $\leqq$ N $\leqq$ 24))

6. Interface conditions between PBXs.

This chapter specifies the required interface conditions between PBXs, so as to apply the Layer 3 specification of common channel signalling between PBXs. This is specified as JT-Q931-a.
Fig. 6-1/JJ-20.21 gives an example of equipment arrangement where interfaces are realized. Fig. 6-2/JJ-20.21 gives an example of associated interface configuration.
"( )" indicates a possible wording omission. In addition, in the Layer 3 specification for common channel signalling. "PBX-to-PBX" is to be omitted unless otherwise noted.

6.1 (PBX-to-PBX) Interface

The (PBX-to-PBX) interface is a logical interface specified between associating PBXs, so as to apply the Layer 3 specification of common channel signalling between PBXs.

6.2 (PBX-to-PBX) Interface group (IFG)

The (PBX-to-PBX) interface group is a logical group that consists of a Dp- channel and one or more associated user channels.

6.3 (PBX-to-PBX) Interface identifier

The (PBX-to-PBX) interface identifier is a logical identification number used to identify each user-channel included in an interface group. The same value should be assigned as the interface identifier.

6.4 (PBX-to-PBX) Channel number

The (PBX-to-PBX) channel number is a logical identification number that identifies B- or H-channels in a user-channel. The same value should be assigned as the channel number between associating PBXs.
The relationship between the time-slot number of a physical interface (between a PBX and either a TDM or NT1) and the channel number should be assigned and maintained at each side of the associating PBXs.

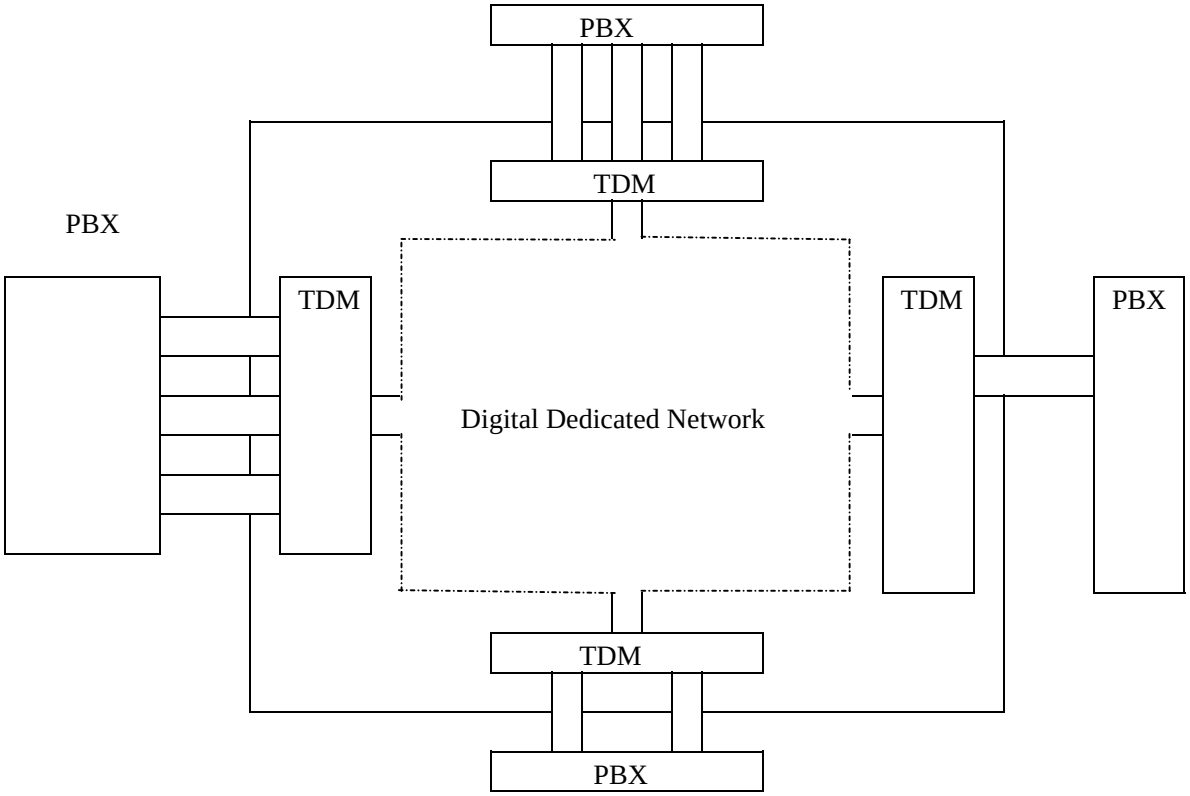


Fig. 6-1/JJ-20.21 Equipment arrangement example

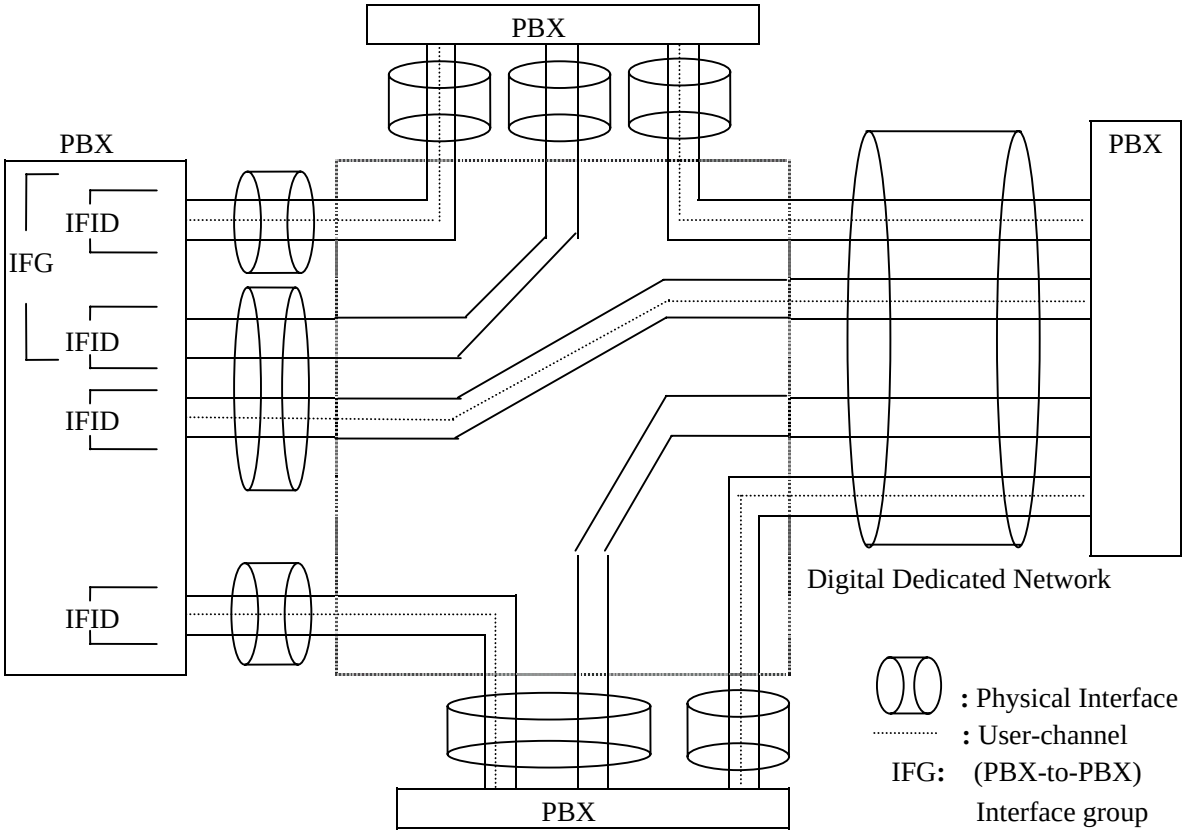


Fig. 6-2/JJ-20.21 Interface configuration example

・JJ－20.22 Digital Interface between PBXs (common channel signalling)

－Service Aspects－

1. Classification of services

The classification of services provided between PBXs is shown below.

(1) Basic service 1

Basic service 1 is a set of basic connection services that can be provided on a Q931 basis, excluding Stimulus signalling and Call suspend/resume.

Basic service 1, however, includes items that require further study for modification of this standard to be applied to the PBX-to-PBX interface.

(2) Basic service 2

Basic service 2 is a set of services which are defined only for PBX-to-PBX interface.

(3) Supplementary service 1

Supplementary service 1 is a set of supplementary services that can be provided on a Q95X basis.

But it includes items that require further study for modification of this standard to be applied to PBX-to-PBX interface.

(4) Supplementary service 2

Supplementary service 2 is a set of supplementary services specified only for PBX-to-PBX interface.

This standard describes the services of Basic service 1 and Basic service 2. For supplementary service 1 and supplementary service 2 were described in the TTC standard JJ-20.40 "Digital Interface between PBXs (supplementary service)".

2. Basic service 1

Basic service 1 described in this edition provides the basic connection service of circuit switching.

The following items described in Q931 are for further study.

Packet switching

Temporary signalling connection

User-to-user signalling transfer services;service 1,2 and 3

Overlap sending/receiving

Optional procedures for Bearer service change
Notification
Transit network selection
Network-specific facility
Message segmentation

3. Basic service 2

The services using TCM (Traveling Class Mark) are added to the PBX-to-PBX interface as the PBX-specific connection services in this edition.

An overview of the service is shown below.

3.1 Services using TCM

TCM is information defined and transfered in the private network so that the PBX receiving the information can provide network-wide service.

TCM has Connection restriction classes and Tenant numbers as follows.

(1) Connection restriction classes

〈 Definition of a connection restriction class 〉

A connection restriction class is assigned to each call and is used to determine whether the connection is allowed. Generally, the following classes are used.

Class A International call origination allowed, include class B
Class B Toll call origination allowed, include class C
Class C Preassigned toll call origination allowed, include class D
Class D Local call origination allowed, include class E
Class E CO termination allowed, include class F
Class F Station to station call/dedicated line access allowed

〈 Use of the connection restriction class 〉

For example, when the existing channel associated signalling system is used, the extension that is properly not allowed to originate local calls could originate a local call by accessing a dedicated line and transmitting from the transit PBX in some cases.
(Note: If a local call from a dedicated line is allowed at the transit PBX.)

Defining TCM enables a connection restriction to be unified across the private network by using the connection restriction class of the originator at the transit PBX and the terminating PBX.

(2) Tenant number

〈 Definition of tenant number 〉

A tenant number is assigned to a group of users and is generally used for identification of each group (ex., enterprise, department, section, unit) in different configurations.

〈 Use of tenant number 〉

A tenant number is treated as a basic component of the data base used for the switching process. The PBX generally executes:

Digital analysis
Determination of operating mode
Connection restriction
Service restriction
Facility restriction
Resource management

on the data base associated with the tenant of the calling party (in some cases, the called party or their combination).

〔An example of connection restriction usage〕

Assume that tenant 1 is group A, and tenant 2 is group B.

Example of connection restriction by tenant number

Origination \ Termination	Tenant 1 (Group A)	Tenant 2 (Group B)
Tenant 1 (Group A)	○	○
Tenant 2 (Group B)	×	○

○ : Connection is allowed.
× : Connection is not allowed.

JJ-20.23 Digital Interface between PBXs (common channel signalling)
- Layer 3 specifications for B channel blocking -

< Reference >

1. Relations with International standards

None.

Note: If ITU-T or ISO/IEC JTC1 specifies relating standards or recommendations regarding to the digital interface between PBXs (common channel signalling), revision of this standard will be considered.

2. Differences from above International standards

None.

3. History of revisions

Version	Date of issue	Contents
1	November 26 , 1993	New edition

4. Others

(1) Recommendations and standards referred

TTC Standards; JJ-20.20, JJ-20.21, JT-Q931-a

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Annex A SDL diagrams between PBXs

Annex B Coding rules specific to this standard

Annex C Coding examples

Supplement I Examples of signalling sequence

Supplement II Relations between blocking procedures and call control procedures

1. General

This standard describes the layer 3 specifications required for PBXs, connected each other by applying TTC standard JJ-20.20, "Digital Interface between PBXs (common channel signalling)", to provide B channel blocking procedure in combination with TTC standard JT-Q931-a.

In other words, procedures and coding rules , required for one of two adjacent PBXs to permit or restrict a new call origination by the other as a result of maintenance requirements or line failure occurrence and recovery, are described.

The object of control is a single B channel on the logical interface (between PBXs), which is defined in TTC standard JJ-20.21, and the procedures can be used equally and independently from each of adjacent PBXs.

2. Definition of terms

2.1 Terms

(1) Blocking PBX

A PBX requesting blocking a B channel of the adjacent PBX.

(2) Blocked PBX

A PBX being requested blocking a B channel of its own.

2.2 State transitions

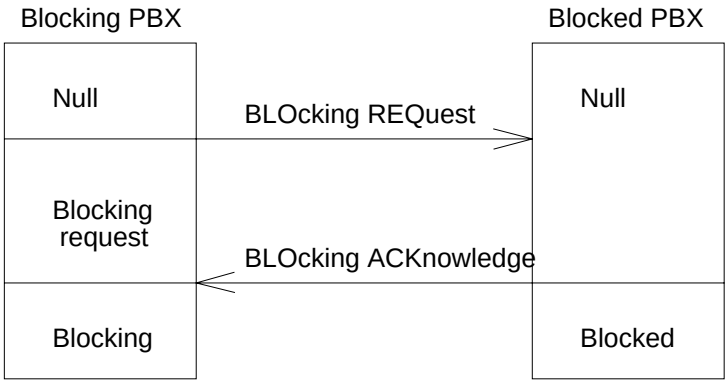


Fig.2-1/JJ-20.23 Example of state transitions

Following are explanations of terms used for blocking state transitions. Each state exists corresponding to each B channel.

(1) Null (S0/D0)

A state indicating no request for blocking exists.

Note: Null state as the blocking PBX (S0) and that as the blocked PBX (D0) is treated independently.

(2) Blocking request (S1)

A state at the blocking PBX: A state for a blocking PBX requesting blocking of a blocked PBX.

(3) Blocking (S2)

A state at the blocking PBX: A state for a blocking PBX receiving an acknowledgment (BLOcking ACKnowledge) of a blocked PBX having been accepted all necessary information.

(4) Unblocking request (S3)

A state at the blocking PBX: A state for a blocking PBX requesting unblocking of a blocked PBX.

(5) Blocked (D1)

A state at the blocked PBX: A state for a blocked PBX sending an acknowledgment (BLOcking ACKnowledge) of having been accepted all necessary information from a blocking PBX.

3. General descriptions of functions

In the course of this standard, following functions are defined.

- Blocking
- Unblocking
- Status enquiry

3.1 Blocking

Blocking is a function which requests a blocked PBX disables a call origination using the indicated B channel to a blocking PBX.

This function can be requested, upon maintenance operations or line failure occurrence and recovery at a blocking PBX, independently from the call status of the B channel.

3.2 Unblocking

Unblocking is a function which requests a blocked PBX enables a call origination using the indicated B channel to a blocking PBX.

This function can be requested, upon maintenance operations or line failure occurrence and recovery at a blocking PBX, independently from the call status of the B channel.

3.3 Status enquiry

Status enquiry is a function which enquires a blocking status of the indicated B channel at a blocking PBX and identifies blocking status (Null or Blocked) at a blocked PBX accordingly.

This function can be requested, upon maintenance operations or line failure occurrence and recovery at a blocking PBX, independently from the call status of the B channel.

4. Detail procedures

Followings describe blocking procedures only, but note that no call state transition occurs in association with the procedures. Procedures regarding sending and receiving of the recognized messages are described. Also, if non mandatory information elements are received, they shall be ignored.

Detail SDL diagrams relating to the procedures described in this section is shown in annex A. If there is any ambiguity in this section, refer to the annex. If there is any inconsistency, this section shall apply.

4.1 Blocking

4.1.1 Actions of Blocking PBX

A blocking PBX sends a BLOcking REQuest message to an adjacent blocked PBX in order to block an indicated channel.

After sending a BLOcking REQuest message at a null state, a blocking PBX shall start timer Tb1, get into a blocking request status, and wait for a BLOcking ACKnowledge message.

If a BLOcking ACKnowledge message is received at a null state, a blocking PBX shall send an UnBLocking REQuest message and stay at the null state.

If a BLOcking ACKnowledge message is received at a blocking request state, a blocking PBX shall stop timer Tb1 and get into a blocking state. If a BLOcking REJect message is received, a blocking PBX shall stop timer Tb1 and get into a null state. And if timer Tb1 expires, a blocking PBX shall send an UnBLocking REQuest message and get into a null state.

4.1.2 Actions of Blocked PBX

If an adequate BLOcking REQuest message is received at a null state, a blocked PBX shall send a BLOcking ACKnowledge message and get into a blocked state. If any of mandatory information elements in the received message does not exist or is not adequate, a blocked PBX shall send a BLOcking REJect message and stay at the null state. If an UnBLocking REQuest message is received , a blocked PBX shall send an UnBLocking ACKnowledge message and stay at the null state.

4.2 Unblocking

4.2.1 Actions of Blocking PBX

A blocking PBX sends an UnBLocking REQuest message to an adjacent blocked PBX in order to unblock an indicated channel.

After sending an UnBLocking REQuest message at a blocking state, a blocking PBX shall start timer Tb1, get into an unblocking request status, and wait for an UnBLocking ACKnowledge message.

If an UnBLocking ACKnowledge message is received at a blocking state, a blocking PBX shall send a BLOcking REQuest message and stay at the blocking state.

If an UnBLocking ACKnowledge message is received at an unblocking request state, a blocking PBX shall stop timer Tb1 and get into a null state. If an UnBLocking REJect message is received, a blocking PBX shall stop timer Tb1 and get into a blocking state. And if timer Tb1 expires, a blocking PBX shall send a BLOcking REQuest message and get into a blocking state.

4.2.2 Actions of Blocked PBX

If an adequate UnBLocking REQuest message is received at a blocked state, a blocked PBX shall send an UnBLocking ACKnowledge message and get into a null state. If any of mandatory information elements in the received message does not exist or is not adequate, a blocked PBX shall send an UnBLocking REJect message and stay at the blocked state. If a BLOcking REQuest message is received , a blocked PBX shall send a BLOcking ACKnowledge message and stay at the blocked state.

4.3 Status enquiry

4.3.1 Actions of Blocked PBX

A blocked PBX sends a BLOcking STATUS REQuest message to an adjacent blocking PBX in order to enquire a status of an indicated channel.

After sending a BLOcking STATUS REQuest message at a null or a blocked state, a blocked PBX shall start timer Tb2, without changing a blocking status, and wait for a BLOcking STATUS ACKnowledge message.

If a BLOcking STATUS ACKnowledge message is received at a null state, a blocked PBX shall stop timer Tb2, if running, and take actions according to the content of the blocking state information element. That is, a blocked PBX shall stay at the null state if the blocking state value indicated is any of "null", "blocking request", or "unblocking request", and shall get into a blocked state if the value is "blocked".

If a BLOcking STATUS ACKnowledge message is received at a blocked state, a blocked PBX shall stop timer Tb2, if running, and take actions according to the content of the blocking state information element. That is, a blocked PBX shall stay at the blocked state if the blocking state value indicated is any of "blocked", "blocking request", or "unblocking request", and shall get into a null state if the value is "null".

If a BLOcking STATUS REJect message is received at a null or a blocked state, a blocked PBX shall stop timer Tb2, if running, and stay at the current state. If timer Tb2 expires before receiving a BLOcking STATUS ACKnowledge or a BLOcking STATUS REJect message, a blocked PBX shall stay at the current state.

4.3.2 Actions of Blocking PBX

If an adequate BLOcking STATUS REQuest message is received at any blocking state, a blocking PBX shall send a BLOcking STATUS ACKnowledge message including the current blocking state in the blocking state information element and stay at the current state. If any of mandatory information elements in the received message does not exist or is not adequate, a blocking PBX shall send a BLOcking STATUS REJect message and stay at the current state.

Table 4-1/JJ-20.23 Timers

Timers	Default value	Blocking state	Starts at	Stops at	Actions at 1st expiry	Actions at 2nd expiry	Remarks
Tb1	10 sec.	Blocking request	BLO REQ sent	BLO ACK or BLO REJ received	send UBL REQ, and inform to the upper layer.	None	mandatory if blocking procedures are implemented
		Unblocking request	UBL REQ sent	UBL ACK or UBL REJ received	send BLO REQ, and inform to the upper layer.	None	mandatory if blocking procedures are implemented
Tb2	10 sec.	Blocking status request	BLO STATUS REQ sent	BLO STATUS ACK or BLO STATUS REJ received	Inform to the upper layer.	None	mandatory if blocking procedures are implemented

4.4 Relations with restart procedures

4.1.1 Actions of Blocking PBX

When a blocking PBX, the blocking state of which is other than a null state, starts restart procedures for the B channel or an interface in which the B channel is located by detecting hardware failures and so on, it gets into a null state. The blocking procedures shall be started after the restart procedures are finished, in case when the B channel shall be blocked finally.

If a blocking PBX can not maintain a blocking state after it starts internal initialization without restart procedures, it shall send a BLOcking REQuest message or a UnBLocking REQuest message according to what is supposed to be an initial blocking state.

When a blocking PBX, the blocking state of which is other than a null state, is informed of restart procedures for the B channel or an interface in which the B channel is located, it gets into a null state. The blocking procedures shall be started after the restart procedures are finished, in case when the B channel shall be blocked finally.

4.1.2 Actions of Blocked PBX

When a blocked PBX, the blocking state of which is other than a null state, starts restart procedures for the B channel or an interface in which the B channel is located by detecting hardware failures and so on, it gets into a null state.

If a blocked PBX can not maintain a blocking state after it starts internal initialization without restart procedures, it shall send a BLOcking STATUS REQuest message to align the blocking state.

When a blocked PBX, the blocking state of which is other than a null state, is informed of restart procedures for the B channel or an interface in which the B channel is located, it gets into a null state.

5. Messages and Information elements

5.1 Messages

The general descriptions of the messages used for the procedures, with each list of information elements in the order of appearance, and explanations if required are shown below.
Each description contains the same content as is described in section 3, JT-Q931-a. However, the direction of a message is expressed by either "from blocking to blocked PBX (->)" or "from blocked to blocking PBX (<-)". And, the indications for the direction of the information element are omitted since it is always the same as that of messages.

5.1.1 BLOcking REQuest

This message is sent from a blocking PBX to a blocked PBX in order to request blocking of an indicated B channel.

Table 5-1/JJ-20.23 BLOcking REQuest message

Message type: Blocking request
Significance: Local
Direction: ->

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be blocked.

5.1.2 BLOcking ACKnowledge

This message is sent from a blocked PBX to a blocking PBX as a positive reply for a BLOcking REQuest message.

Table 5-2/JJ-20.23 BLOcking ACKnowledge message

Message type: Blocking acknowledge
Significance: Local
Direction: <-

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be blocked.

5.1.3 BLOcking REJect

This message is sent from a blocked PBX to a blocking PBX as a negative reply for a BLOcking REQuest message.

Table 5-3/JJ-20.23 BLOcking REJect message

Message type: Blocking reject
Significance: Local
Direction: <-

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Cause	4.5.11/JT-Q931-a	M	4-32
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be blocked.

5.1.4 UnBLocking REQuest

This message is sent from a blocking PBX to a blocked PBX in order to request unblocking of an indicated B channel.

Table 5-4/JJ-20.23 UnBLocking REQuest message

Message type: Unblocking request
Significance: Local
Direction: ->

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be blocked.

5.1.5 UnBLocking ACKnowledge

This message is sent from a blocked PBX to a blocking PBX as a positive reply for an UnBLocking REQuest message.

Table 5-5/JJ-20.23 UnBLocking ACKnowledge message

Message type: Unblocking acknowledge
Significance: Local
Direction: <-

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be blocked.

5.1.6 UnBLocking REJect

This message is sent from a blocked PBX to a blocking PBX as a negative reply for an UnBLocking REQuest message.

Table 5-6/JJ-20.23 UnBLocking REJect message

Message type: Unblocking reject
Significance: Local
Direction: <-

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Cause	4.5.11/JT-Q931-a	M	4-32
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be blocked.

5.1.7 BLOcking STATUS REQuest

This message is sent from a blocked PBX to a blocking PBX in order to enquire a blocking status of an indicated B channel.

Table 5-7/JJ-20.23 BLOcking STATUS REQuest message

Message type: Blocking status request
Significance: Local
Direction: <-

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be enquired.

5.1.8 BLOcking STATUS ACKnowledge

This message is sent from a blocking PBX to a blocked PBX as a positive reply for a BLOcking STATUS REQuest message.

Table 5-8/JJ-20.23 BLOcking STATUS ACKnowledge message

Message type: Blocking status acknowledge
Significance: Local
Direction: ->

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?
Locking shift	4.5.3/JT-Q931-a	M	1
Blocking state	5.2.3	M	3

Note: Used for indicating the B channel to be enquired.

5.1.9 BLOcking STATUS REJect

This message is sent from a blocking PBX to a blocked PBX as a negative reply for a BLOcking STATUS REQuest message.

Table 5-9/JJ-20.23 BLOcking STATUS REJect message

Message type: Blocking status reject
Significance: Local
Direction: ->

Information element	Reference	Type	Length
Protocol discriminator	4.2/JT-Q931-a	M	1
Call reference	5.2.1	M	1
Message type	5.2.2	M	2
Cause	4.5.11/JT-Q931-a	M	4-32
Channel identification (Note)	4.5.12/JT-Q931-a	M	5-?

Note: Used for indicating the B channel to be enquired.

5.2 Information elements

Followings are coding rules regarding code points of the existing information elements specified especially in the context of this standard and coding of new information elements only used for the procedures of this standard.

5.2.1 Call reference

The dummy call reference is used.
(See Figure 4-4b/JT-Q931-a)

5.2.2 Message type

The code point for indication of escape to national use described in Table 4-2/JT-Q931-a is used.
Message types used for this standard are coded as shown in Figure 5-1/JJ-20.23 and Table 5-10/ JJ-20.23.

Bit	8	7	6	5	4	3	2	1	Octet
	Escape to national use								
	0	0	0	0	0	0	0	0	1
	National message type code point								2

Figure 5-1/JJ-20.23 Message type information element

Table 5-10/JJ-20.23 National message type code point (Octet 2)

8	7	6	5	4	3	2	1	Messages for blocking procedures
0	0	1	x	x	x	x	x	
			0	0	0	0	1	Blocking request
			0	0	0	1	0	Blocking acknowledge
			0	0	0	1	1	Blocking reject
			0	0	1	0	1	Unblocking request
			0	0	1	1	0	Unblocking acknowledge
			0	0	1	1	1	Unblocking reject
			0	1	0	0	1	Blocking status request
			0	1	0	1	0	Blocking status acknowledge
			0	1	0	1	1	Blocking status reject

All other values are reserved.

5.2.3 Blocking state

The blocking state information element is used for a blocking PBX to inform a blocked PBX with a blocking state of a B channel.

The information element is contained in a BLOcking STATUS ACKnowledge message, and is defined as a codeset 5 information element (used for a national standard) using the locking shift procedure.

Figure 5-2/JJ-20.23 and Table 5-11/JJ-20.23 show the coding of the information element. The maximum length is 3 octets.

Bit	8	7	6	5	4	3	2	1	Octet
	Blocking state I.E.								
	0	0	0	1	0	0	0	0	1
	Length								
	0	0	0	0	0	0	0	1	2
	1	coding std.		reserve		Blocking			
	Exp.			0	0	state value			3

Figure 5-2/JJ-20.23 Message type information element

Table 5-11/JJ-20.23 Coding of Octet 3

Coding std. (Octet 3)

Bit 7	6	
0	0	TTC standardized coding; as described below.
0	1	reserved.
1	0	reserved.
1	1	Coding standard specified only both sides of the interface. (Note)

Note: This coding standard shall only apply to the case where required blocking states can not be expressed by those of TTC standard.

Blocking state value (Octet 3)

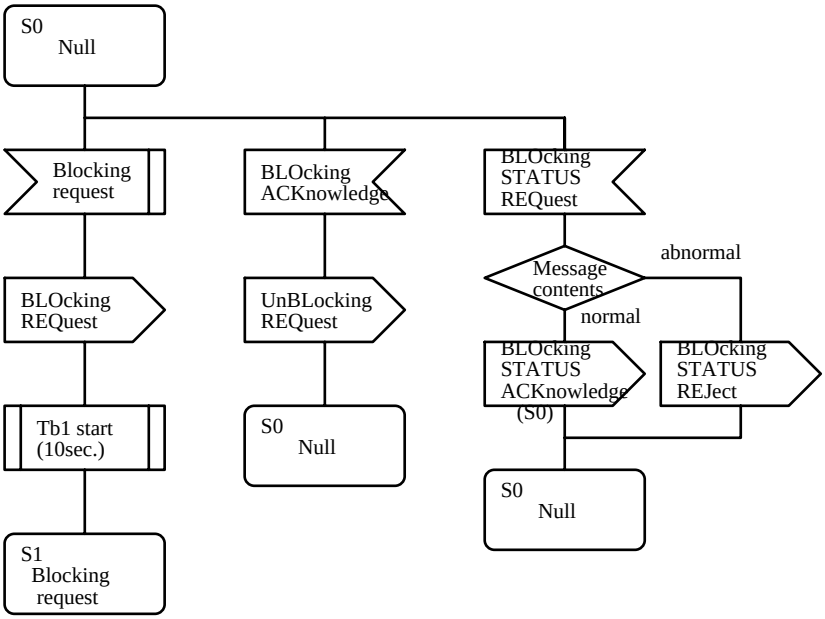
Bit 3	2	1	
0	0	0	Null
0	0	1	Blocking request
0	1	0	Blocking
0	1	1	Unblocking request

All other values are reserved.

****
* Followings are summaries of the rest of this standard. *
****

Annex A SDL diagrams between PBXs

The SDL diagrams are described with regard to each B channel independently.
Following is a part of the diagrams which describes state transitions at a null state of a blocking PBX.
Seven other diagrams are contained in this annex.



Annex B Coding rules specific to this standard

This annex explains coding rules of the existing information elements specific to this standard. Two information elements, the cause and the channel identification, are described in terms of how to interpret existing code points in the context of this standard.

Annex C Coding examples

Coding examples of five typical messages are described in this annex.
The messages are: BLOcking REQuest,
BLOcking ACKnowledge,
BLOcking REJect,
BLOcking STATUS REQuest,
BLOcking STATUS ACKnowledge.

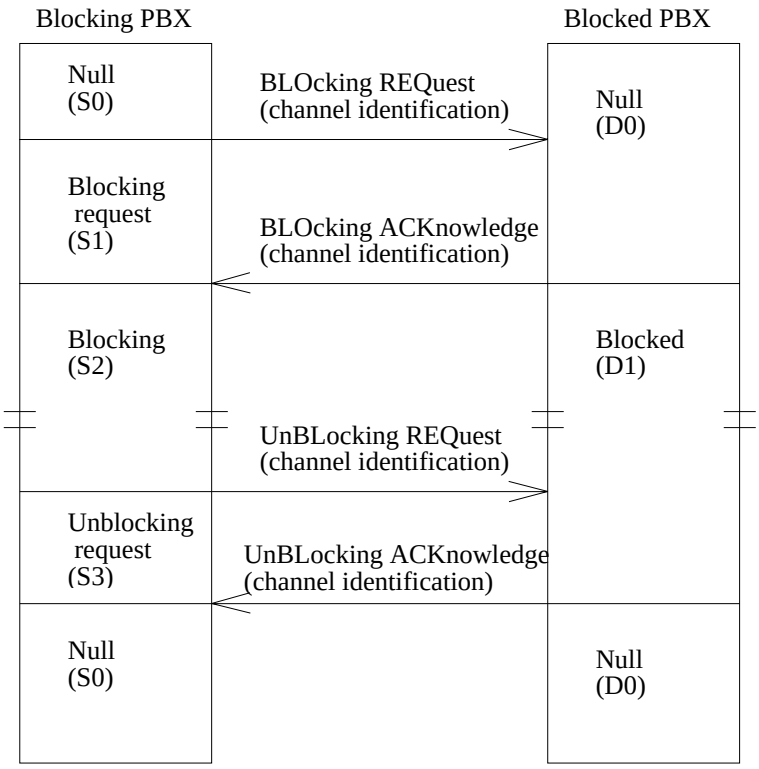
Followings are a part of examples. This is an example of a BLOcking STATUS REQuest message sent from a blocked PBX to a blocking PBX in order to enquire a blocking state of the B channel, the channel number of which is "1", and which is located in a primary rate interface implicitly identified.

Bit	8	7	6	5	4	3	2	1
Protocol discriminator								
	0	1	0	0	0	0	1	0
Call reference					Length			
	0	0	0	0	0	0	0	0
Escape to national use								
	0	0	0	0	0	0	0	0
Massage type								
	0	1	0	0	1	0	0	1
Channel identification								
	0	0	0	1	1	0	0	0
Length								
	0	0	0	0	0	0	1	1
	1	0	1	0	1	0	0	1
	1	0	0	0	0	0	1	1
	1	0	0	0	0	0	0	1

An example of a BLOcking STATUS REQuest message

Supplement I Examples of signalling sequence

Examples of five typical signalling sequences are described in this supplement. The signalling sequences are: Blocking and unblocking,
Blocking status enqiry,
Blocking reject,
Unblocking reject,
Blocking status reject.



An example of blocking and unblocking signalling sequences

Supplement II Relations between blocking procedures and call control procedures

The basic principles with regard to the relations between blocking procedures and call control procedures are described. In addition, some applications where the blocking procedures make senses are also described in order to give better understandings.

JJ-20.30 Digital Interface between TDM and TDM (channel-associated signaling)

-Outline-

1. Outline

The following outlines a digital interface between TDMs that is applicable to connecting TDMs by means of digital leased lines.
The TDMs' digital interface is specified by a logical condition (framing format) that makes it possible for several kinds of signals to be multiplexed into the user channel.
Details are provided in standards JJ-20.31. and JJ-20.32.
The interfaces in this standard have the following functions.

(1) Multiplexing of several kinds of signals into the user channel
(2) Alarm transmission for faults along digital paths

2. Scope of application

Interfaces using this standard are applicable to the connecting configurations
shown in Figure 2-1/JJ-20.30.

3. Others

Related standards consist of the following.
(1) JJ-20.30: Outline
(2) JJ-20.31: Multiplexing Format of Octet Interleaving Method (note 1)
(3) JJ-20.32: Multiplexing Format of Bit Interleaving Method (note 2)

Note 1: In this standard, the octet interleaving method must satisfy the following conditions.
(1) The signals that are less than 64 kbit/s are multiplexed into a 64 kbit/s bit stream. The 64 kbit/s bit stream is then multiplexed with other signals into the user channel.
(2) The multiplexed 64 kbit/s bit stream described above and 64 kbit/s signals cannot be allocated into an across-time-slot boundary.

Note 2: In this standard, the bit interleaving method must satisfy the following conditions.
(1) The signals of the 0.4 kbit/s signaling rate group are multiplexed into a i×8 kbit/s bit stream. The i×8 kbit/s bit stream is then multiplexed with other signals into the user channel.
(2) The multiplexed signals can be allocated into any bit position of the user channel.

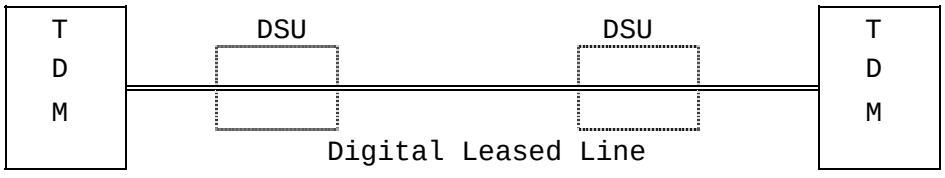


Figure 2-1/JJ-20.30 Connecting configuration

JJ-20.31 Digital Interface between TDM and TDM (channel-associated signaling)
- Octet-Multiplexing Format -

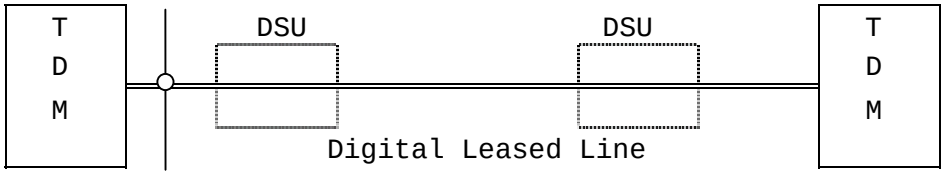
<Reference>

1. Relationship to international recommendation
The logical condition of 5.2.1 in this standard is based on CCITT recommendation X.50 of 1984.

2. Additional items to CCITT recommendation X.50
The following signals are added to the recommendation.
(1) a data signaling rate of 14.4 kbps
(2) a data signaling rate of 19.2 kbps

1. Scope
This standard specifies the logical condition for a multiplexed channel that is open to the user at the user-network interface of a digital leased line for the user information signal, when the user connects TDM with TDM by using the digital leased line.

2. Interface specification point
The interface specification point is shown in Fig. 2-1/JJ-20.31.



TDM-TDM interface

Figure 2-1/JJ20.31 Interface specificaiton point

3. Signaling rate group
The signaling rate group specified in this standard and data-signaling rates in the group are shown in Table 3-1/JJ-20.31.

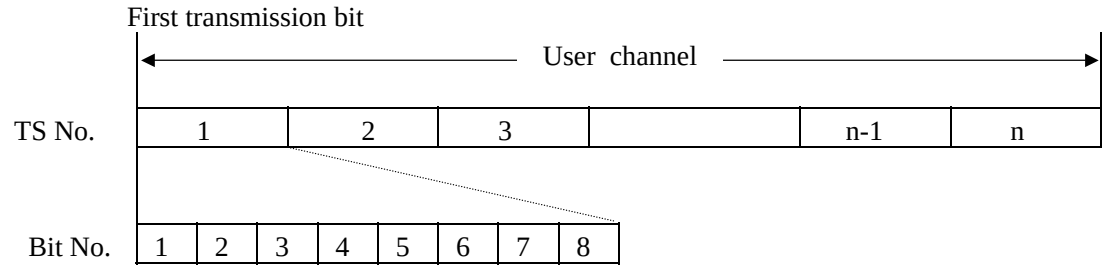
Table 3-1/JJ-20.31 Data signaling rates

Signalingrate group	Data-signaling rates	Description
2.4 kbps	～1.2 kbps	Asynchronous data signal
	2.4, 4.8, 9.6 14.4, 19.2 kbps	Synchronous data signal
48 kbps	48 kbps	ditto
56 kbps	56 kbps	ditto
64 kbps	n x 64 kbps (n: integer)	Synchronous data signal Multiplexed voice signal
8 kbps	8, 16, 32 kbps	Low bit-rate speech signal
0.8 kbps	0.8 kbps	PBX-PBX channel-associated signaling

4. User-channel internal structure

A user-channel internal structure is shown in Fig. 4-1/JJ-20.31.

A time-slot number (TS No.) is assigned to each 8-bit stream.



Note: User-channel interval is 125 μsec.

Figure 4-1/JJ-20.31 User-channel internal structure

5. Frame structure

5.1 Basic condition

(1) The signals that are less than 64 kbps are multiplexed into a 64 kbps bit stream. The 64 kbps bit stream is then multiplexed with other signals into the user channel.

(2) The multiplexed 64 kbps bit stream described above and 64 kbps signals cannot be allocated into an across-time slot boundary.

(3) The logical value of an unused time slot is not specified in this standard.

5.2 Frame structure of each signaling rate group

Details of the frame structure are specified in the following Section.(In thefollowing Section a V series interface refers to CCITT recommendation V.24 or V.35, and an X series interface refers to CCITT X.20 or X.21 recommendation.)

5.2.1. 2.4 kbps signaling rate group

5.2.1.1 Asynchronous signal that is less than 1.2 kbps

This signal is converted to a 2.4 kbps signaling rate group.

5.2.1.2 Synchronous 2.4 kbps signaling rate group

(1) n×2.4 kbps (n=1,2,4) synchronous data signal is converted to n×3.2 kbps signal in a 6 + 2 bit envelope format based on the CCITT X.50 recommendation.

The 8th bit (S) is used as an RS signal for the V series interface or as a C signal for the X series interface.

The frame alignment signal is based on the 20-multiple frame pattern from CCITT Recommendation X.50.

(2) 14.4 or 19.2 kbps data signals are converted to three 4.8 kbps or two 9.6 kbps data signals, respectively, and are multiplexed into a 64 kbps bit stream.

The 8th bit (S) is used to convey an RS signal for the V series interface or a C signal for the X series interface.

The frame structure is shown in Fig. 5-1/JJ-20.31.

Path-alarm bit (A) is used to convey the alarm indication signal that displays an out-of-frame synchronization detected between a TDM and another TDM.

5.2.2 48 kbps data signal

A 48 kbps data signal is converted to a 64 kbps signal in a 6 + 2 bit envelope format. The first bit is not specified. Bits 2 through 7 contain an informationbit stream. The 8th bit (S) is used to convey an RS signal for a V series interface or a C signal for an X series interface. The frame structure is shown in Fig.5-2/JJ-20.31.

5.2.3 56 kbps data signal

A 56 kbps data signal is converted to a 64 kbps signal based on a 7 + 1 bit envelope format. The 8th bit (S) is used to convey an RS signal for a V series interface or a C signal for an X series interface. The frame structure is shown in Fig. 5-3/JJ-20.31.

5.2.4 64 kbps data signaling rate group

n × 64 kbps (n is an integer) signals are multiplexed into any time slots inthe correct sequence.

5.2.5 8 kbps data signaling rate group

n × 8 kbps signals such as a coded voice signal are multiplexed into continuous n bits within one time slot.

The frame structure is shown in Fig. 5-4/JJ-20.31.

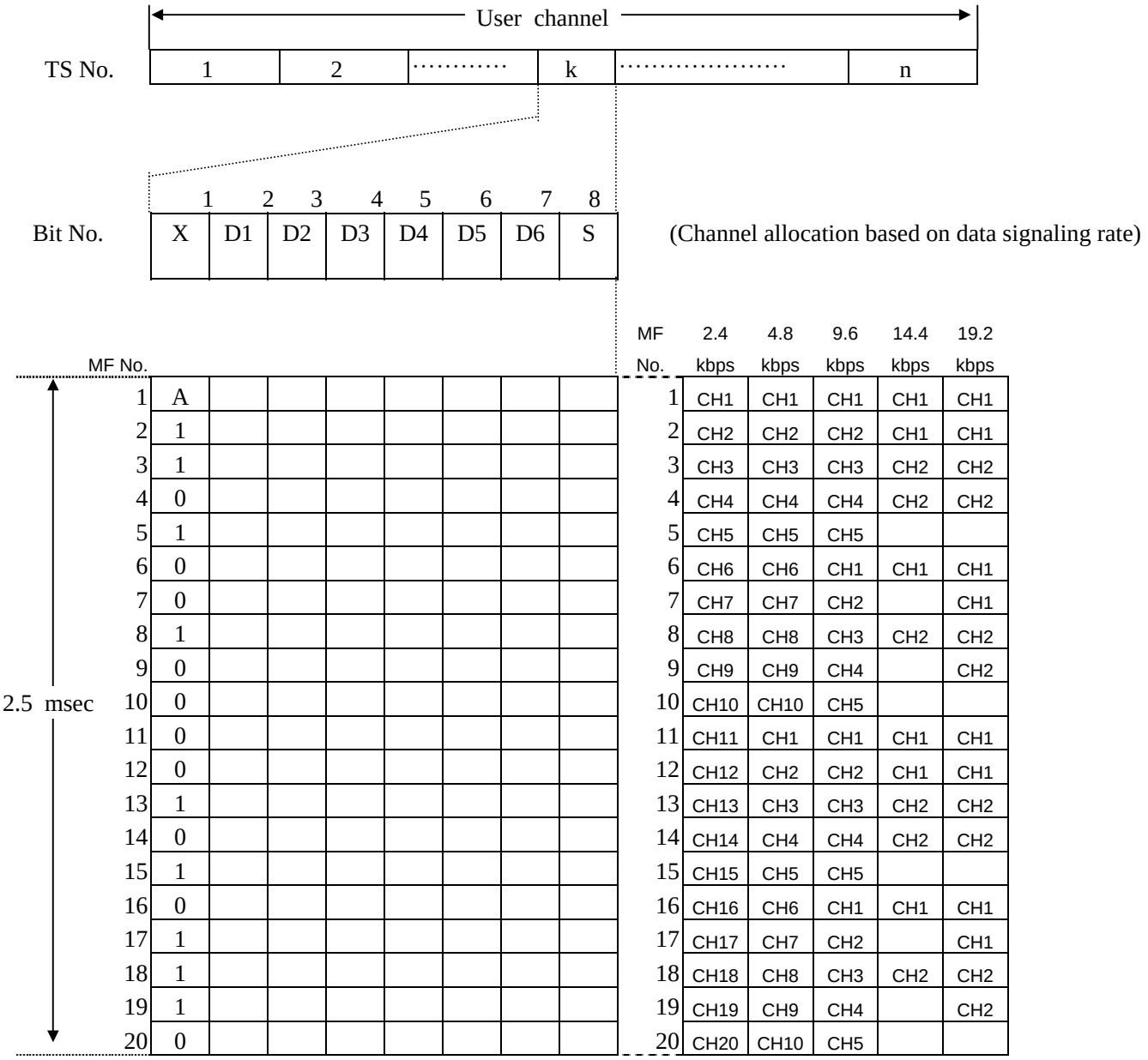
5.2.6 0.8 kbps signal

The control signal for each channel (PBX-PBX channel-associated signaling) issampled at 0.8 kHz and is multiplexed into the 0.8 kbps framing format.

The first bit of the multiple frame is used for a frame synchronization signal (0/1 alternative pattern). The 11th bit is used for a path-alarm indication. Each bit from 2 through 10 and each bit from 12 through 20 is used for each channel.

The relation of the channel position between a coded-voice signal and a control signal is arbitrary. The frame structure is shown in Fig. 5-5/JJ-20.31.

Path-alarm bit (A) in the frame structure is used to convey the alarm indication signal. It indicates that an out-of frame synchronization alarm is detected bet-ween two TDMs.



F: frame-synchronization bit(X.50)

D1～D6: information bit

S: status bit

MF: multiple frame

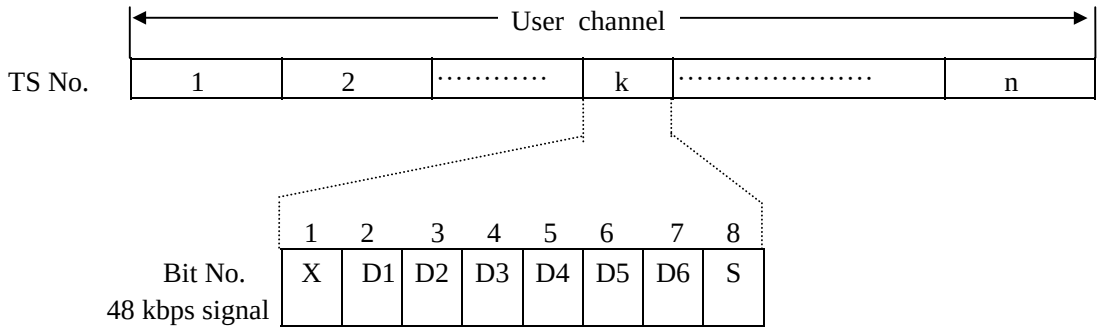
A: path-alarm bit (no-alarm: "1", alarm: "0")

CH1 ～CH20: channel number

(Note)

1. Time slot k is arbitrary.
2. It is possible to mix different rate signals.
3. Logical value of unused channel is not specified.

Figure 5-1/JJ-20.31 2.4 kbps data-signaling rate-group frame structure



X: not specified

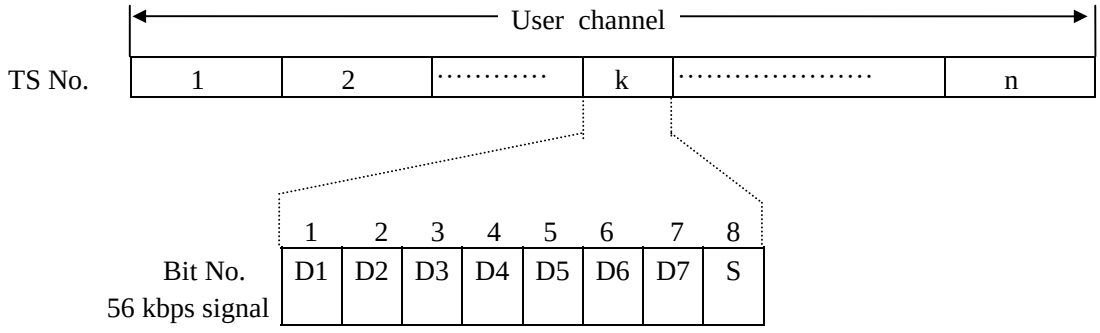
D1～D6: information bit

S: status bit

(Note)

Time slot k is arbitrary.

Figure 5-2/JJ-20.31 48 kbps data-signal frame structure



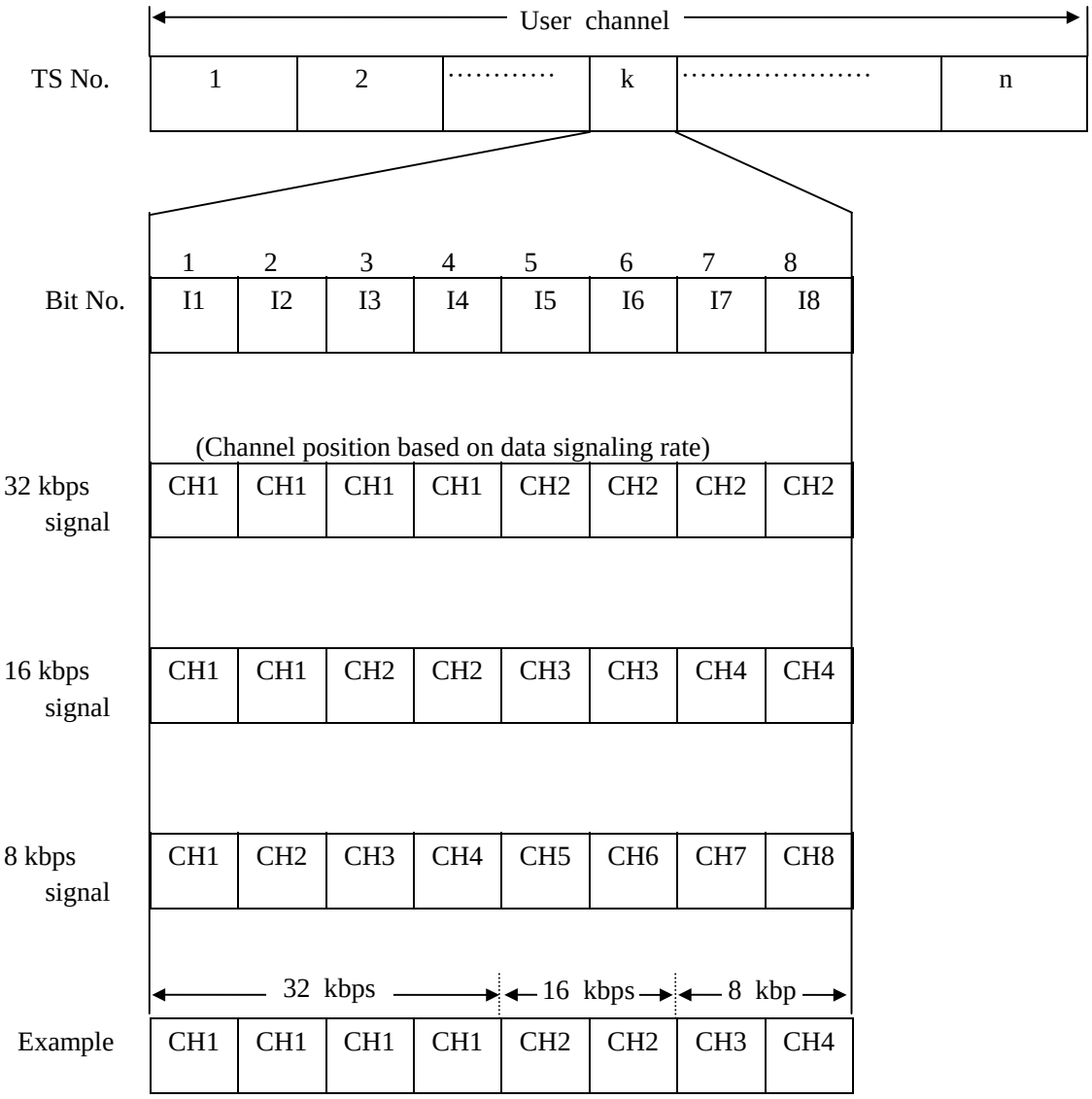
D1～D7: information bit

S: status bit

(Note)

Time slot k is arbitrary.

Figure 5-3/JJ-20.31 56 kbps data-signal frame structure

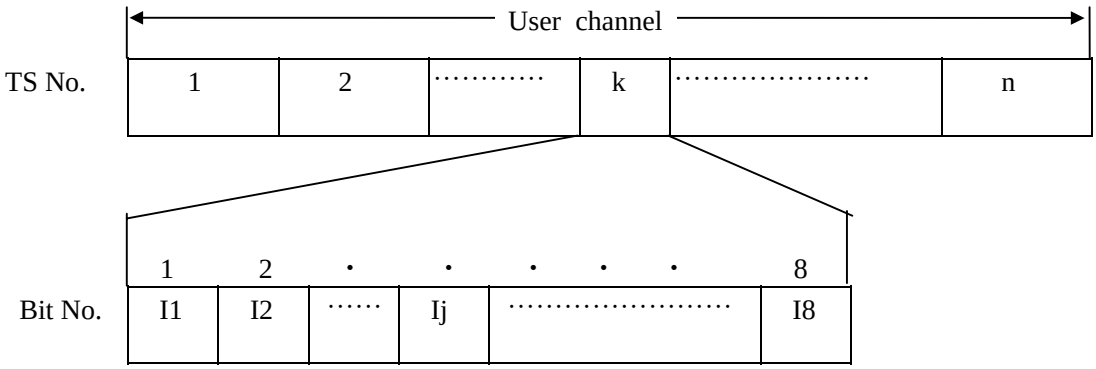


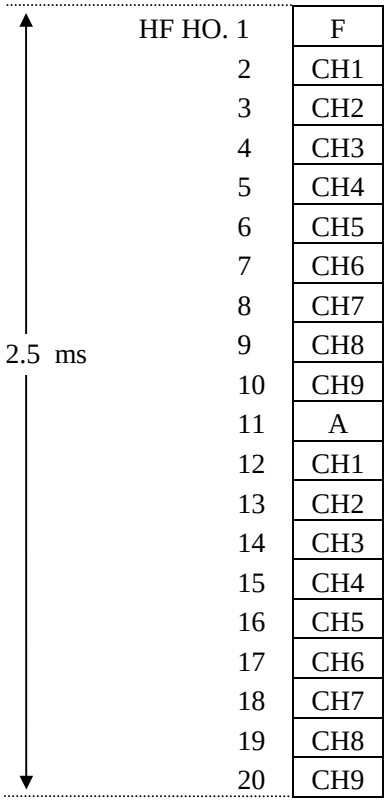
I1～I8: information bit No.
CH1～CH8: channel No.

(Note)

1. Time slot k is arbitrary.
2. n×8 kbps channels are multiplexed into continuous n bits within one TS.
3. It is possible to mix different rate signals.
   32 kbps are allocated into I1～I4 or I5～I8.
   16 kbps are allocated into I1～I2, I3～I4, I5～I6 or I7～I8.
4. The logical value of the unused channel is not specified.

Figure 5-4/JJ-20.31 8 kbps data-signaling rate-group frame structure





(channel position)

I1～I8: information bit No.

CH1～CH9: channel No.

MF: multiple frame

F: frame-synchronization bit
(0/1 alternative pattern)

A: path-alarm bit
(no alarm "0", alarm "1")

(Note)

1. The unused information bit can be used for an 8 kbps signal.
2. Time slot k and j are arbitrary.
3. The logical value of the unused channel is not specified.

Figure 5-5/JJ-20.31 0.8 kbps data-signal frame structure

〔**Appendix**〕

The Appendix does not constitute a part of the standard.

1. Logical value

The multiplexed signals are converted to the logical value on a user-network interface with Table A1-1/JJ-20.31.

Table A1-1/JJ-20.31 Relation of logical value

Logical value of frame	Logical value of user-network interface
0	0
1	1

JJ-20.32 Digital Interface between TDM and TDM (channel-associated signaling)

- Bit Interleaved Multiplexing Format -

1. Scope

This standard specifies the logical condition for a multiplexed channel that is open to the user at he user-network interface of a digital leased line for the user information signal, when the user connects TDM with TDM by using the digital leased line.

2. Interface specification point

The interface specification point is shown in Fig. 2-1/JJ-20.32.

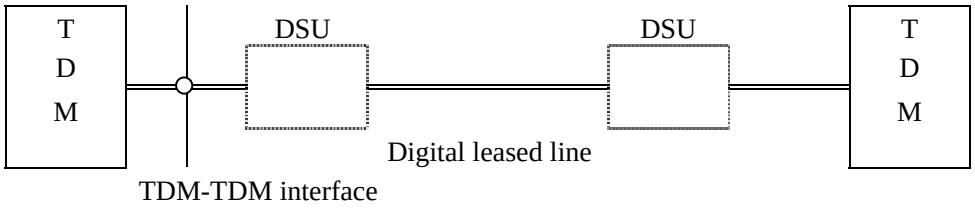


Figure 2-1/JJ-20.32 Interface specification point

3. Signaling Rate Group

The signaling rate group specified in this standard and data signaling rates in the group are shown in Table 3-1/JJ-20.32.

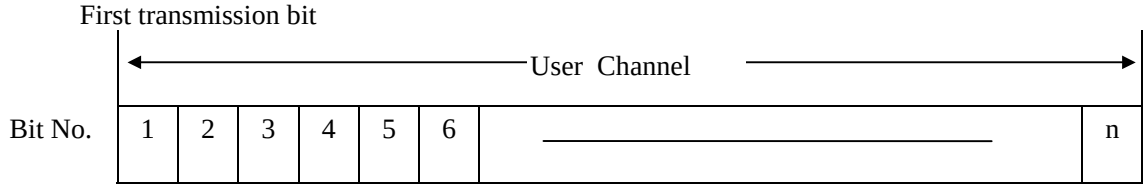
Table 3-1/JJ-20.32 Data Signaling Rates

Signaling rate group	Data signaling rates	Description
0.4 kbit/s	～1.2 kbit/s	Asynchronous data signal
	2.4, 4.8, 9.6 14.4,19.2 kbit/s	Synchronous data signal
48 kbit/s	48 kbit/s	ditto
56 kbit/s	56 kbit/s	ditto
8 kbit/s	n x 64 kbit/s(n: integer)	Synchronous data signal Multiplexed voice signal
	8, 16, 32 kbit/s	Low bit-rate speech signal
0.8 kbit/s	0.8 kbit/s	PBX-PBX channel-associated signaling

4. User-Channel Internal Structure

A user-channel internal structure is shown in Fig. 4-1/JJ-20.32.

A bit number (Bit No.) is assigned to a user-channel bit stream.



Note: User-channel interval is 125 μsec.

Figure 4-1/JJ-20.32 User-channel internal structure

5. Frame Structure

5.1 Basic condition

(1) The signals of the 0.4 kbit/s signaling rate group are multiplexed into a i×8 kbit/s bit stream. The i ×8 kbit/s bit stream is then multiplexed with other signals into the user channel. The signals of the 0.8 kbit/s signaling rate group are multiplexed into an 8 kbit/s bit stream. The 8 kbit/s bit stream is then multiplexed with other signals into the user channel.

(2) The logical value of an unused bit is not specified in this standard.

5.2 Frame structure of each signaling rate group

Details of the frame structure are specified in the following section. (In the following section a V series interface refers to CCITT recommendation V.24 or V.35, and an X series interface refers to CCITT recommendation X.20 or X.21.)

5.2.1 0.4 kbit/s signaling rate group

5.2.1.1 Asynchronous signal that is less than 1.2 kbit/s.

This signal is converted to a 0.4 kbit/s signaling rate group

5.2.1.2 Synchronous 0.4 kbit/s signaling rate group

Synchronous data signals of a 0.4 kbit/s signaling rate group are multiplexed into a multiple frame that consists of 20 frames. In each of the frames, continuous i bits are assigned in the user channel.

The first bit of the continuous i bits in the user-channel is assigned as a multiple frame alignment signal. The frame alignment signal is based on the 20-multiple frame pattern of CCITT Recommendation X.50.

The frame structure is shown in Fig. 5-1/JJ-20.32.

The signals of a 0.4 kbit/s signaling rate group are allocated conti- nuously, starting with any bit of Fig. 5-2/JJ-20.32. The number of necessary bits: signaling rate ÷ 0.4 kbit/s + 1 status bit, are shown in Table 5-1/JJ-20.32.

The transmission sequence of a 0.4 kbit/s signaling rate group is shown in Fig. 5-3/JJ-20.32.

An example applied to a 14.4 kbit/s signal is shown in Fig. 5-4/JJ-20. 32. A status bit (S) is used to convey an RS signal for the V series interface, or a C signal for the X series interface.

Path-alarm bit (A) in the frame structure is used to convey the alarm indication signal. It indicates that an out-of-frame synchronization alarm is detected between two TDMs.

5.2.2 48 kbit/s signal

A 48 kbit/s signal is allocated to 7 continuous bits in the user channel. Bits 1 through 6 contain an information bit stream.

The seventh bit (S) is used to convey an RS signal for a V series inter- face or a C signal for an X series interface. The frame structure is shown in Fig. 5-5/JJ-20.32.

5.2.3 56 kbit/s signal

A 56 kbit/s signal is allocated to 8 continuous bits in the user channel. Bits 1 through 7 contain an information bit stream.

The eighth bit (S) is used to convey an RS signal for a V series interface or a C signal for an X series interface. The frame structure is shown in Fig. 5-6/JJ-20.32.

5.2.4 8 kbit/s signaling rate group

5.2.4.1 n × 64 kbit/s (n is an integer) signals

n × 64 kbit/s signals are allocated to continuous n × 8 bits format in the user channel.

5.2.4.2 8, 16, 32 kbit/s signals

8, 16, 32 kbit/s signals such as a coded voice signal are allocated to continuous m bits (m=1, 2, 4) in the user channel.

The frame structure is shown in Fig. 5-7/JJ-20.32.

5.2.5 0.8 kbit/s signal

The control signal for each channel (PBX-PBX channel-associated signaling) is sampled at 0.8 kHz and is multiplexed into the 0.8 kbit/s framing format.

The first bit of the multiple frame is used for a frame synchronization signal (0/1 alternative pattern). The eleventh bit is used for a path-alarm indication. Each bit from 2 through 10 and each bit from 12 through 20 is used for each channel.

The relation of the channel position between a coded-voice signal and a control signal is arbitrary. The frame structure is shown in Fig. 5-8/JJ- 20.32.

Path-alarm bit (A) in the frame structure is used to convey the alarm indication signal. It indicates that an out-of-frame synchronization alarm is detected between two TDMs.

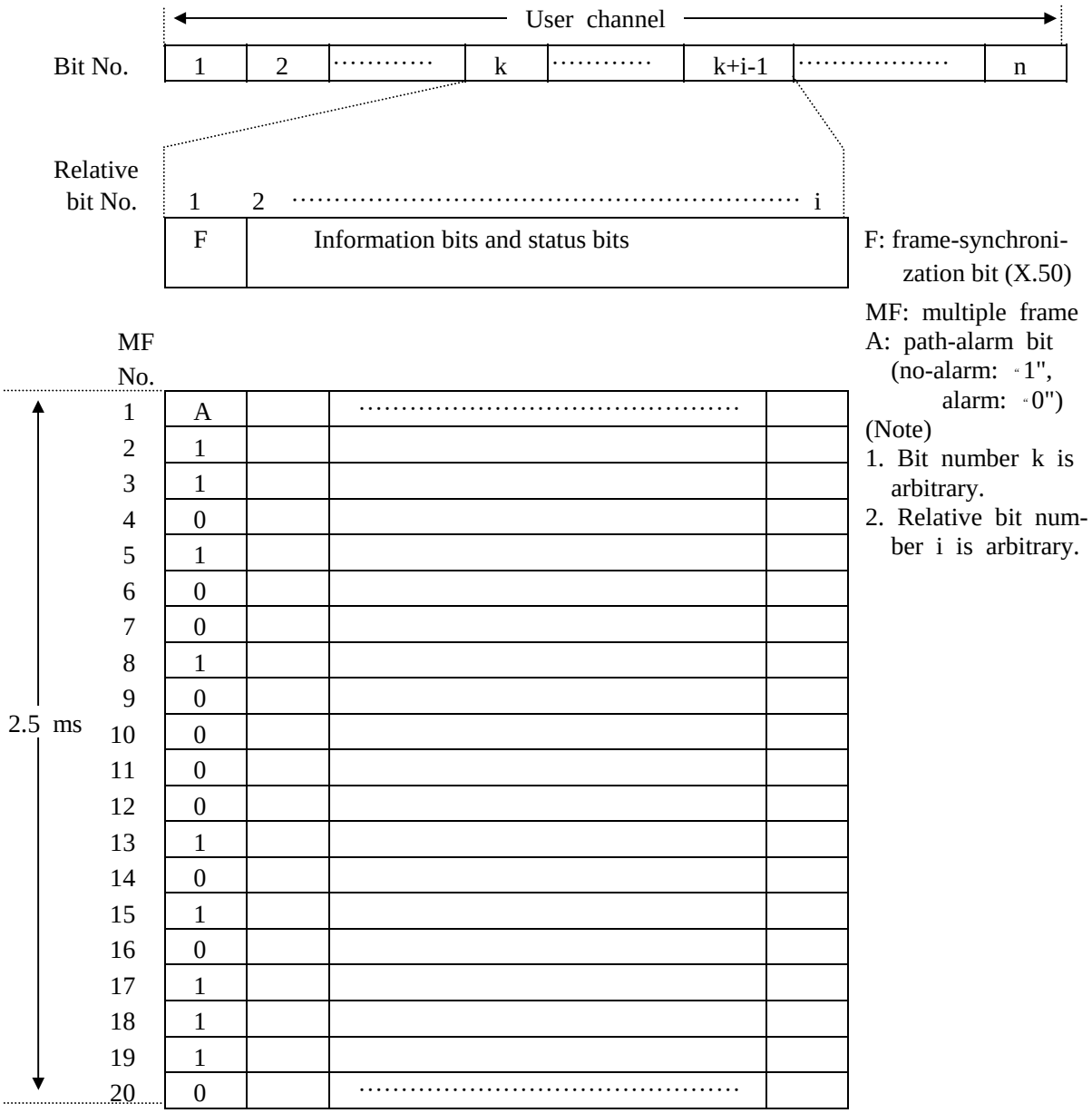


Figure 5-1/JJ-20.32 0.4 kbit/s signaling rate group frame structure

Table 5-1/JJ-20.32 Data Signaling Rates and Number of Necessary Bits

Data signaling rates	Number of necessary bits: N (signaling rate ÷ 0.4 kbit/s・ + 1 status bit)
2.4 kbit/s	7
4.8 kbit/s	13
9.6 kbit/s	25
14.4 kbit/s	37
19.2 kbit/s	49

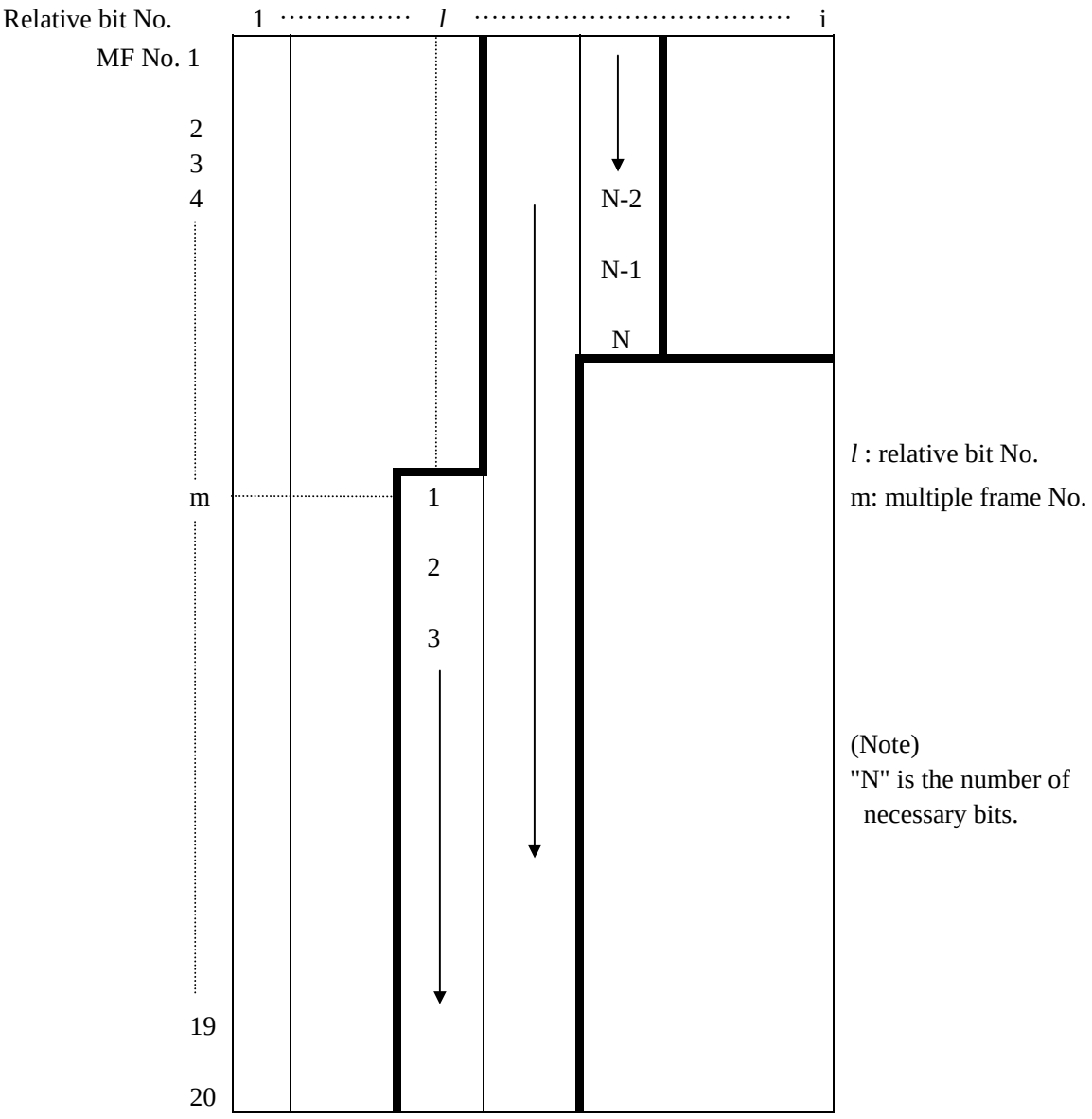


Figure 5-2/JJ-20.32 Allocation of 0.4 kbit/s signaling rate group

First transmission bit

S	D1	D2	D3	D4	……	Dj

S: status bit
D1～Dj: information bit

Figure 5-3/JJ-20.32 Transmission sequence of 0.4 kbit/s signaling rate group

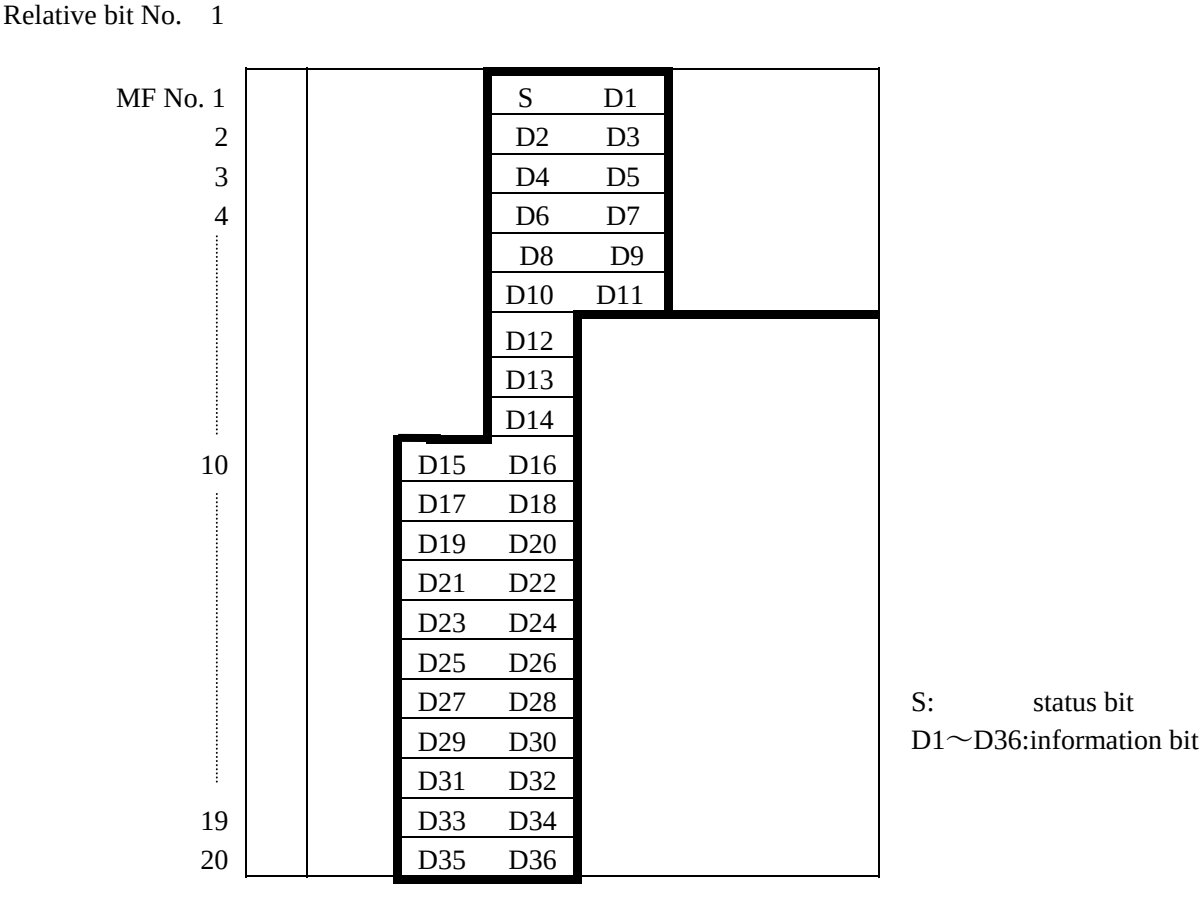


Figure 5-4/JJ-20.32 An example of allocated bits and transmission sequence (at 14.4 kbit/s)

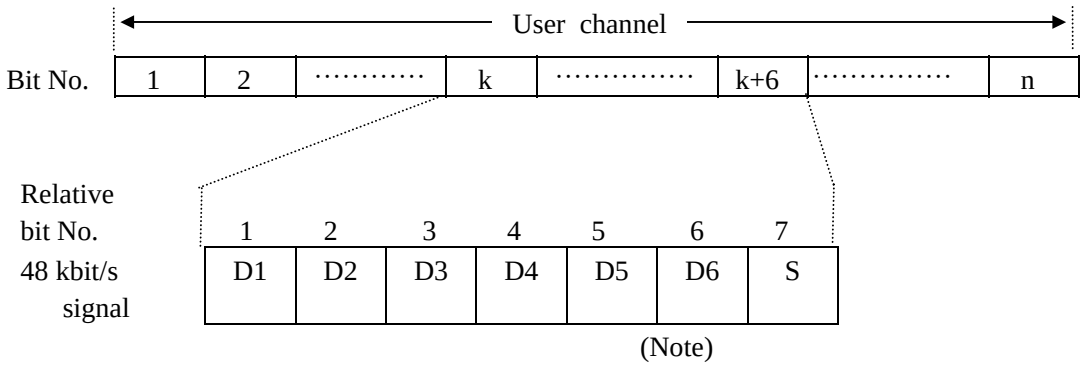


Figure 5-5/JJ-20.32 48 kbit/s signal frame structure

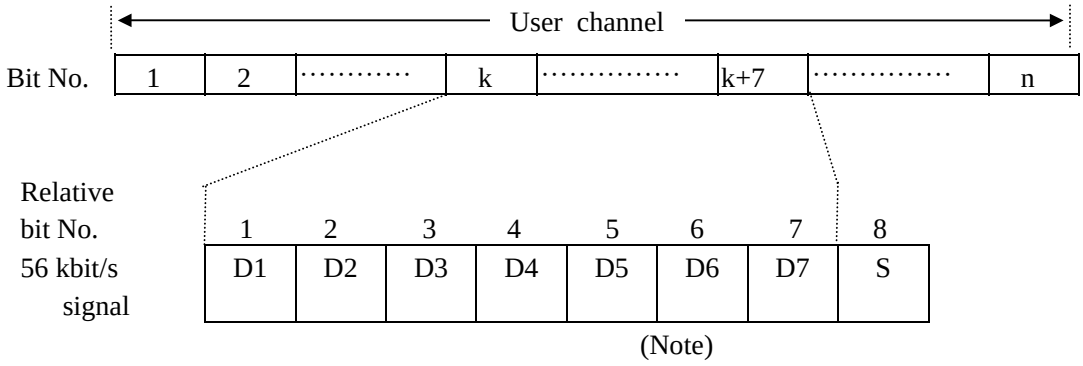


Figure 5-6/JJ-20.32 56 kbit/s signal frame structure

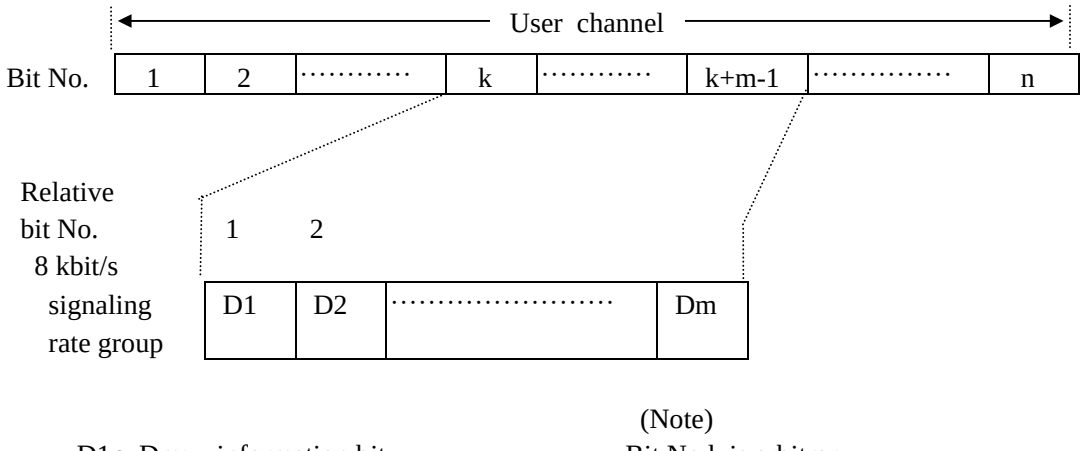


Figure 5-7/JJ-20.32 8 kbit/s signaling rate group frame structure

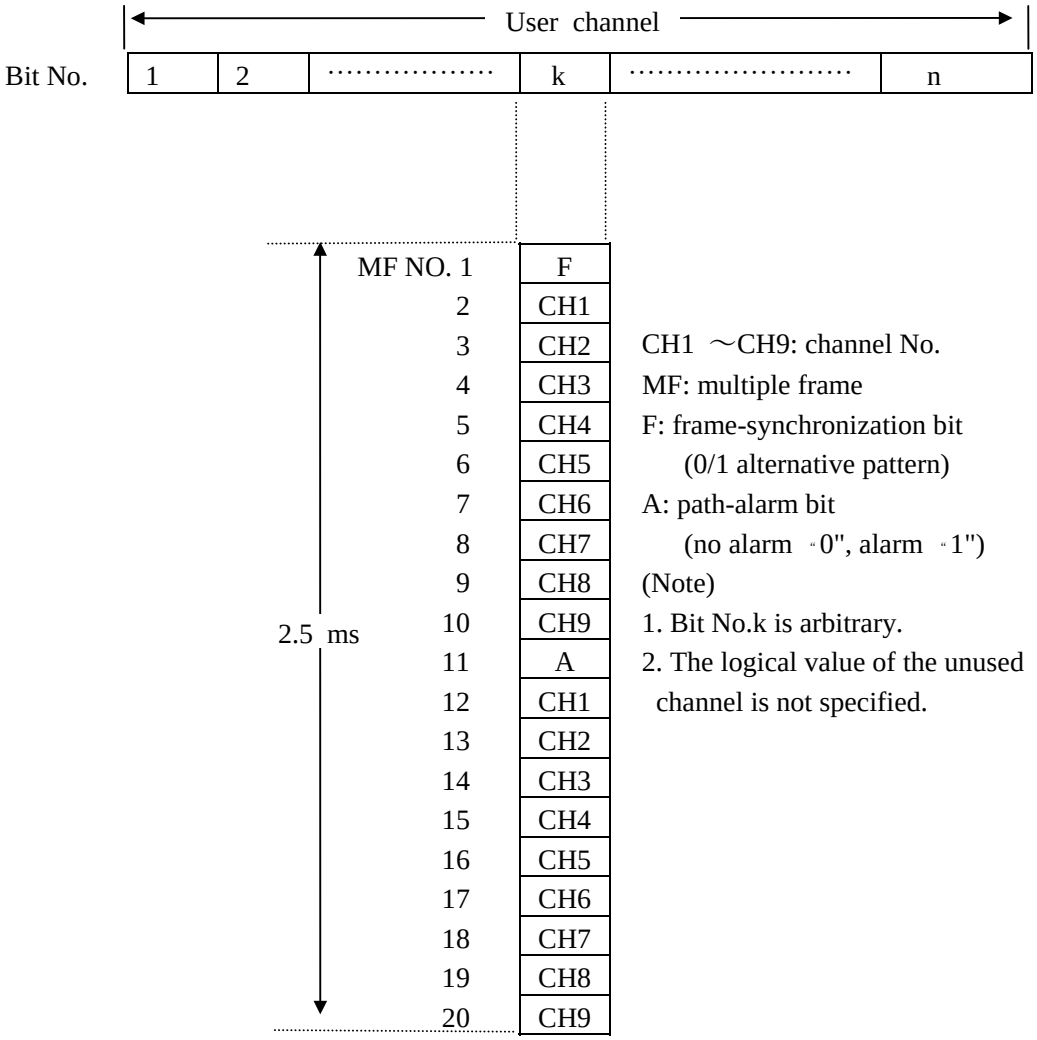


Figure 5-8/JJ-20.32 0.8 kbps signal frame structure

〔**Appendix**〕

The Appendix does not constitute a part of the standard.

1. Logical value

The multiplexed signals are converted to the logical value on a user-network interface with Table A1-1/JJ-20.32.

Table A1-1/JJ-20.32 Relation of logical value

Logical value of frame	Logical value of user-network interface
0	0
1	1

JJ-20.40 Digital Interface between PBXs (supplementary services) –General aspects-

<Remarks>

1.Relations with international standards

There is no international standard relating to this.

Note:

At the time when a standard or a recommendation relating to the digital interface between PBXs (supplementary services) is established, revision of this standard will be considered.

2.Summary of differences from international standards

None.

3.History of revisions

Version	Date of issue	Contents of revision
1	April 1992	Initial issue

4.Others

(1) Referred recommendations and/or standards

TTC standards:	JJ-20.20, JJ-20.21, JJ-20.22,
	JT-Q931-a, JT-Q951-a, JT-Q952-a
CCITT recommendations:	Draft Q.951, Draft Q.952

1.General

This standard describes the outline of the standards regarding layer 3 specifications required for providing supplementary services on a private network which consists of PBXs connected with each other by applying TTC standard JJ-20.20 ”Digital Interface between PBXs (common channel signaling) ”.

Relating standards regarding Digital Interface between PBXs (Supplementary Services) describes layer 3 specifications of number identification services, and call offering services. For details, see TTC standards JT-Q951-a and JT-Q925-a, respectively.

Relating standards regarding Digital Interface between PBXs (Supplementary Services) version 1 has been described considering commonality with and conformity to draft CCITT recommendations Q.951 and Q.952, which were discussed at SGXI meeting in October 1991, describing layer 3 specifications for supplementary services at the ISDN user to network interface.

Supplementary services included in version 1 of the standards are limited to those requested for early standardization based on relevant draft CCITT recommendations.

Layer 3 specifications for other supplementary services are for future study.

2.Scope of application

A set of standards regarding Digital Interface between PBXs (Supplementary Services) applies to a case when supplementary services are provided between PBXs in combination with TTC standard JT-Q931-a.

An application to a case when PBXs are connected with each other through an ISDN public network is for future study.

3.Outline of specifications

The specification point of relating standards is described (at section 2.2) in TTC standard JJ-20.21. The relationship between supplementary services specified in relating standards and classification of services defined in TTC standard JJ-20.22 is shown in table 3-1/JJ-20.40.

Table 3-1/JJ-20.40

Service	Classification
Number Identification	Supplementary Service 1
Call Offering	Supplementary Service 1

Note:

Supplementary Service 1 is a class for services based on CCITT Recommendations Q.95X.

4.Relating standards

A set of relating standards is shown below.

JJ-20.40 :Digital Interface between PBXs (supplementary services)
-General aspects-

JT-Q951-a :Digital Interface between PBXs (supplementary services)
-Layer 3 Specifications of Number Identification Services-

JT-Q952-a :Digital Interface between PBXs (supplementary services)
-Layer 3 Specifications of Call Offering Services-

JJ-20.50 SUMMARY OF TTC PBX-COMPUTER APPLICATIONS INTERFACE (TPCI)

<Reference>

There are no international standards related with an application layer interface between PBXs and computers when the first version of this standard is established. However, the standardization activities have already been started in JTC1 and ITU-T, and the international standards will be released within few years. Under such circumstances, TTC standardized TTC PBX-Computer Applications Interface (TPCI) to comply with the market urgent needs of a standard.

TTC obtained close cooperation from T1S1, which developed Switch-Computer Applications Interface (SCAI), for standardizing TPCI.

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5.7.2 Event notifications.....
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5.8 Agent model.....
ANNEX Alphabetical list of abbreviations used in the document.....

1 General

This document summarizes the architecture and the switching model for TTC PBX-Computer Applications Interface (TPCI). TPCI suits for peer-to-peer data communication between host computer applications and PBX applications, thereby enabling the functional integration of computer systems and PBX systems.

The application-independent architecture underlying TPCI facilitates the creation of a variety of applications involving joint use of telephony and data processing environments.

2 Basic concepts

TPCI supports applications that require the uniform exchange of application process information between the private telecommunication and data processing environments. It provides methods for application processes in one environment to request application processes in another environment to perform some function.

The TPCI architecture and protocol are based on OSI application layer principles.

TPCI defines a simplified model of the relevant aspects of a server application process in order to assist the development of applications. Examples of models included in TPCI are calls and agents. TPCI also provides methods for communicating information between the server application process and the client application process.

3 Functional configuration

A functional configuration for TPCI is shown in Figure 3-1/JJ20.50. A data terminal or a personal computer is connected to a computer. A telephony device (e.g., telephone) is connected to a PBX. The data terminal communicates and interacts with an application in the computer. The computer application in turn communicates with its peer application in the PBX to initiate functions at the telephony device (e.g., make-a-call, answer-a-call, and transfer-a-call). The PBX application in turn communicates with the computer application to inform the computer of events happening relative to telephony devices (e.g., call-initiated, call-arrived, device-alerting, and call-

establishment). Based on the information received from the PBX and the third-party call control functions for telephony devices, the computer can effectively support a wide range of computer applications.

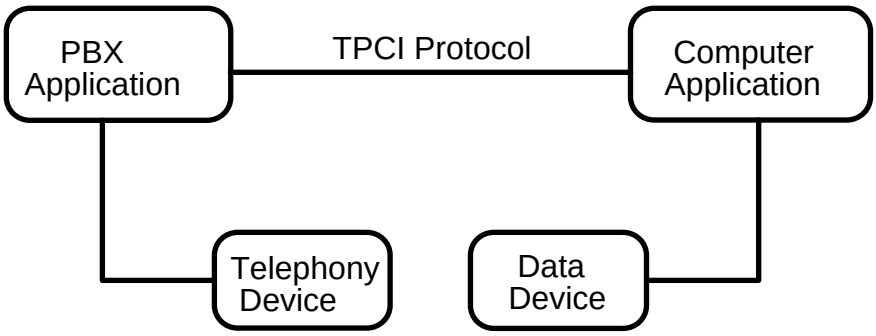

Figure 3-1/JJ20.50 Functional configuration

4 Architecture

The following are characteristics of the TPCI architecture:

1) TPCI is modeled as an application layer protocol.

2) TPCI uses the Remote Operations Service Element (ROSE) and the Association Control Service Element (ACSE).

3) TPCI uses the Abstract Syntax Notation One (ASN.1) for defining the abstract syntax.

4.1 TPCI application service element

The TPCI Application Service Element (ASE) provides access to the TPCI environment. An application process requests TPCI services from the TPCI ASE. TPCI functions may only be requested through the TPCI ASE. The TPCI ASE performs the application specific communications functions necessary to communicate the request to the peer application process.

4.1.1 Overview

The TPCI ASE, as part of the AE, provides services to the APs. Information is exchanged between an AP and the TPCI ASE over an implementation specific Application Program Interface (API). The APs can be classified as client or server. The client requests services form the server by invoking TPCI services.

Client and server are used to indicate the typical relationship between the APs. In TPCI the relationship between APs is peer-to-peer. The role of the PBX or computer may dynamically change between client and server depending on the TPCI service invoked by the AP. Thus the PBX or computer may be viewed as either a client or server depending upon the operation being performed.

The following describes the characteristics of the TPCI ASE:

1) The TPCI ASE consists of functional elements (FEs).

2) The following classes of FEs are identified:
   a) Request: An FE used to request a function to be performed.
   b) Event: An FE used to inform of an event occurrence.
   c) Information: An FE used to provide data, but does not imply a request to perform an action nor imply an event.

4.1.2 Functional groups

Functional elements are categorized into a number of groupings. These groupings may reflect a functional model (e.g., call model and agent model). Since a given action on the PBX may involve more than one of these models, it is possible that events related to more than one model may be generated. A functional group is a grouping of TPCI functional elements.

4.1.2.1 Monitor-filter

The Monitor-filter functional group consists of functions concerned with the monitoring of TPCI objects and the filtering of PBX events.

FE	Description
Initiate_Monitor	This FE is a request to initiate event flow to an application; define the device being monitored; and define the event filter desired for the monitored device. Direction: Computer→PBX.
Cancel_Monitor	This FE is a request to cancel an established monitor. Direction: Computer←→PBX.
Change_Monitor_Filter	This FE is a request to change the filter in effect for an established monitor. Direction: Computer→PBX.
Query_Monitor	This FE is a request to receive information on the established monitor(s). Direction: Computer→PBX.
Monitor_Report	This FE provides information on the established monitor(s). Many reports may be sent depending on the number of established monitors. Direction: PBX→Computer.

4.1.2.2 Basic two-party call

The basic two-party call functional group consists of functions concerned with making, answering, and clearing a two-party call.

FE	Description
Make_Call	This FE is a request to establish a call between two devices. Direction: Computer→PBX.
Answer_Call	This FE is a request to answer an incoming call on behalf of a called device. Direction: Computer→PBX.
Clear_Call	This FE is a request to disconnect an existing call. Direction: Computer→PBX.
Predictive_Make_Call	This FE is a request to establish a call between two devices. This FE first initiates a call to the called device, then to the calling device. Direction: Computer→PBX.

4.1.2.3 Basic two-party call progress

The basic two-party call progress functional group consists of functions concerned with the reporting of events related to call progress as a two-party call is established and terminated.

FE	Description
Service_Initiated	This FE indicates that a device is attempting to place a call to another device or attempting to invoke a service. Direction: PBX→Computer.
Call_Originated	This FE indicates that the completed collection of dialed digit and a call has been initiated to another device. Direction: PBX→Computer.
Call_Delivered	This FE indicates that an outbound call has been assigned to a destination device and the destination device has been or is being alerted. Direction: PBX→Computer.
Call_Arrived	This FE indicates that the arrival of an incoming call and the identification of a destination device for the call. Direction: PBX→Computer.
Call_Received	This FE indicates that a call has been assigned to a device and the device has been or is being alerted. Direction: PBX→Computer.
Call_Established	This FE indicates that a device has answered a call. Direction: PBX→Computer.
Call_Cleared	This FE indicates that a call has ended. Direction: PBX→Computer.
Call_Failed	This FE indicates that a call cannot be completed. Direction: PBX→Computer.

4.1.2.4 Agent events

The agent events functional group consists of functions concerned with the reporting of events related to agent operations.

FE	Description
Agent_Logged_On	This FE indicates that an agent has logged on. Direction: PBX→Computer.
Agent_Logged_Off	This FE indicates that an agent has logged out. Direction: PBX→Computer.
Agent_Ready	This FE indicates that an agent is ready to accept calls. Direction: PBX→Computer.
Agent_Not_Ready	This FE indicates that an agent is not ready to accept calls. Direction: PBX→Computer.
Agent_Working_Ready	This FE indicates that an agent is still occupied with work associated with a call but no longer connected with a call. The agent is available to receive additional calls. Direction: PBX→Computer.
Agent_Working_Not_Ready	This FE indicates that an agent is still occupied with work associated with a call and the work may extend past duration of the call. The call may terminate but the agent should not be sent additional calls at this time. Direction: PBX→Computer.

4.1.2.5 Conference

The conference functional group consists of functions concerned with creating and manipulating a conference.

FE	Description
Conference_Existing_Calls	This FE is a request to join two established two-party calls into a single conference. Direction: Computer→PBX.
Drop_Conference_Party	This FE is a request to release a specified party from the designated conference. Direction: Computer→PBX.
Call_Conferenced	This FE indicates that two established two-party calls have been joined together into a single three party conference. Direction: PBX→Computer.
Conference_Party_Dropped	This FE indicates that a party has been dropped out of a conference. Direction: PBX→Computer.

4.1.2.6 Transfer

The transfer functional group consists of functions concerned with the transfer of a call.

FE	Description
Single_Step_Transfer	This FE is a request to replace a party in an established two-party call with a new party that is not currently participating in the call. Direction: Computer→PBX.
Consultation_Transfer	This FE is a request to join established two-party calls into a single two-party call while ending the transferring device's participation in each two-party call. Direction: Computer→PBX.
Call_Transferred	This FE indicates that a call has been transferred from one device to another device. The device from which the call was transferred was dropped from the call. Direction: PBX→Computer.

4.1.2.7 Hold-retrieve

The hold-retrieve functional group consists of functions concerned with holding and retrieving a call.

FE	Description
Hold_Call	This FE is a request to interrupt communication on an existing call. Direction: Computer→PBX.
Call_Held	This FE indicates that a device's participation in a call has been interrupted. Direction: PBX→Computer.
Retrieve_Call	This FE is a request to re-establish interrupted communication on an existing held call. Direction: Computer→PBX.
Call_Retrieved	This FE indicates communication for the call has been re-established. Direction: PBX→Computer.

4.1.2.8 Feature

The feature functional group consists of functions concerned with observing and manipulating of device features.

FE	Description
Query_Feature	This FE is a request for the current status of the agent feature on a device. Direction: Computer→PBX.
Set_Feature	This FE is a request to set or clear an agent feature on a device. Direction: Computer→PBX.

4.1.2.9 Routing

The routing functional group consists of functions concerned with the routing of a call.

FE	Description
Route_Request	This FE is a request to obtain information relative to the destination of a call. Direction: PBX→Computer.
Route_Selected	This FE is a request to return the routing information requested by the Route_Request FE. Direction: Computer→PBX.
Routing_Toggle	This FE is a request to activate or deactivate the function of the PBX sending the Route_Request FE. Direction: Computer→PBX.

4.1.2.10 Call diversion

The call diversion functional group consists of functions concerned with the diversion of calls at a device.

FE	Description
Call_Diverted	This FE indicates that a call has been forwarded from one device to another device. Direction: PBX→Computer.

4.1.2.11 Device service condition

The device service condition functional group consists of functions concerned with the service halt and restart at a device.

FE	Description
Device_Out_Of_Service	This FE indicates that TPCI services are temporarily halted at a specific device. Direction: PBX→Computer.
Device_Back_In_Service	This FE indicates that TPCI services are restarted at a specific device. Direction: PBX→Computer.

4.1.2.12 Other

The other functional group consists of miscellaneous functions.

FE	Description
Network_Reached	This FE indicates that a call has left the PBX and entered a network where further call progress information may not be available. Direction: PBX→Computer.

5 Switching model

The switching model provides an abstract view of switching objects and their behavior. This view is similar to the behavior perceived by an end-user using an enhanced terminal.

This switching model consists of TPCI objects, their models, and their relationships.

5.1 Switching objects and their relationships

The TPCI switching model objects are:

(1) Call
(2) Device
(3) Party
(4) Agent

Figure 5-1/JJ20.50 shows the call and device classes and their subclasses. The call object represents either a two-party call or conference call.

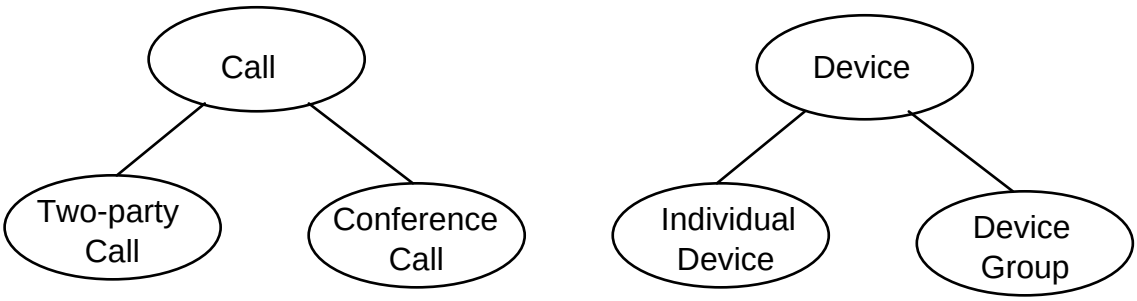

Figure 5-1/JJ20.50 Object classes and subclasses

Figure 5-2/JJ20.50 shows the relationship between some TPCI objects.

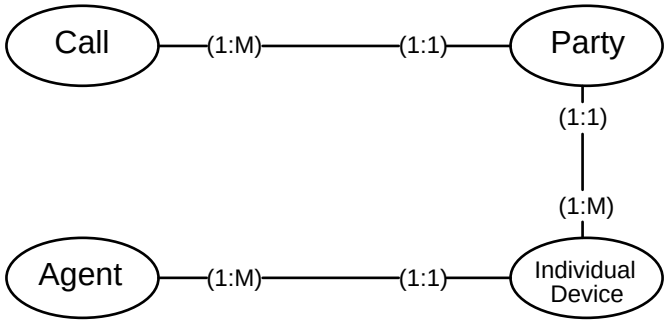

Figure 5-2/JJ20.50 Object relationships

The following relationships exist between the objects in Figure 5-2/JJ20.50:

(1) An agent may sign-on or sign-off at many individual devices(1:M). An individual device may have an agent signed-on(1:1).
(2) A party is a member of a call(1:1). A call may have many parties(1:M).
(3) A party is associated with a device(1:1). A device may have many parties(1:M).

5.2 Call object

A call is a switching function communications relationship between parties. During some circumstances, including set-up and release, there may be only one party.

Calls may be observed and manipulated via TPCI. During some phases of the call (e.g., establishment and release) the call is not completely formed and there may be only a single device involved in the call (e.g., a device initiating a call). Devices in a call may change due to switching operations. In these situations a TPCI call is maintained as long as the telecommunication relationship remains.

5.2.1 Two-party call object

A two-party call object is a subclass of the call object which involves up to two parties.

5.2.2 Conference call object

A conference call object is a subclass of the call object whose purpose is to support more than two parties. This issue of the standard supports up to three parties.

The following conference conditions are defined:

(1) CONFERENCE NULL -no conference exists.

(2) ACTIVE -at least one party, the controller, has a connection to the conference.

(3) FLOAT -the conference is active, but without a controller. This condition is possible when the controller has successfully detached from the conference and the conference continues to exist.

5.3 Two-party call model

The TPCI call model consists of two components:

(1) the single-ended view

(2) the concept of call states and call state transitions

5.3.1 Single-ended view

The single-ended view of a call is the view of call progress and call states from a PBX's perspective of a device. The call model for a two-party call splits into originating and terminating views. For example, for a basic call, when that device is originating a call, the PBX provides the single-ended view incorporating the originating call model events. The actions of the terminating side are implied in those events. When that device is terminating a call, the PBX provides the single-ended view incorporating the terminating call model events. The actions of the originating side are implied in those events. Information available about that device and other devices in the call is made available in the single-ended view by the PBX.

Single-ended views are independent of each other. A PBX may allocate separate call identifies for each single-ended view.

5.3.2 Call states and call state transitions

The call model states are abstractions of the call processing activity in the PBX for a two-party call. Not all call processing activities are reflected in the TPCI call model. A call model state may be a transition wait state. This type of state provides the opportunity for the PBX to interact with the computer prior to proceeding to the next call model state. Call model state transitions are reflected by call progress events which are reported to the computer. These call progress events uniquely indicate the new call model state. Call model events may be qualified by a transition cause from the previous call model state.

5.3.2.1 Originating states

Figure 5-3/JJ20.50 shows the state transition diagram from the originating end perspective. The following originating states are defined:

1) NULL
2) PENDING
3) ORIGINATED
4) DELIVERED
5) ESTABLISHED
6) FAILED

5.3.2.1.1 NULL state

The state where no call exists from the perspective of the TPCI single-ended view. For example, the PBX may verify the authorization of this device to place an outgoing call with given properties (e.g., bearer capability or device restrictions) before exiting the NULL state. The type of authorization may vary for different types of originating resources.

5.3.2.1.2 PENDING state

The PBX is collecting information for the purpose of identifying the destination device of the call. In addition other information may be collected.

5.3.2.1.3 ORIGINATED state

Destination address analysis, route selection, and routing initiation are performed by the PBX. Authorization may be performed.

5.3.2.1.4 DELIVERED state

The terminating end of the call is alerting.

5.3.2.1.5 ESTABLISHED state

The destination device has answered the call and the parties in the call may exchange information.

5.3.2.1.6 FAILED state

Normal call progression has been aborted. Call failure indication is provided to calling party (e.g., busy).

5.3.2.2 Terminating states

Figure 5-4/JJ20.50 shows the state transition diagram from the terminating end perspective. The following terminating states are defined:

1) NULL
2) ROUTING
3) ARRIVED
4) RECEIVED
5) ESTABLISHED
6) FAILED

5.3.2.2.1 NULL state

The state where no call exists from the perspective of the TPCI single-ended view. For example, the authorization to route an incoming call to the terminating device may be performed (e.g., business group restrictions, restricted incoming access to a device, or bearer capability compatibility).

5.3.2.2.2 ROUTING state

The ROUTING state is a transition wait state. The PBX requests additional or alternate information relative to the destination of a call and waits for the computer to provide the requested information. A timeout may occur in the state while waiting for the information from the computer.

5.3.2.2.3 ARRIVED state

A call has arrived at or within the PBX and the destination device (e.g., telephone set, ACD, hunt group, etc.) has been identified. No validation has been done as to the suitability of the selected device for termination of the call (i.e., the device may be busy, out of service, restricted, etc.). Queuing and hunting may be performed.

5.3.2.2.4 RECEIVED state

The terminating end of the call is alerting.

5.3.2.2.5 ESTABLISHED state

The two devices are connected. Information may be exchanged between the two ends of the call.

5.3.2.2.6 FAILED state

Normal call progression has been aborted. Call failure indication is provided to calling party (e.g., busy).

5.3.2.3 State diagrams and transitions

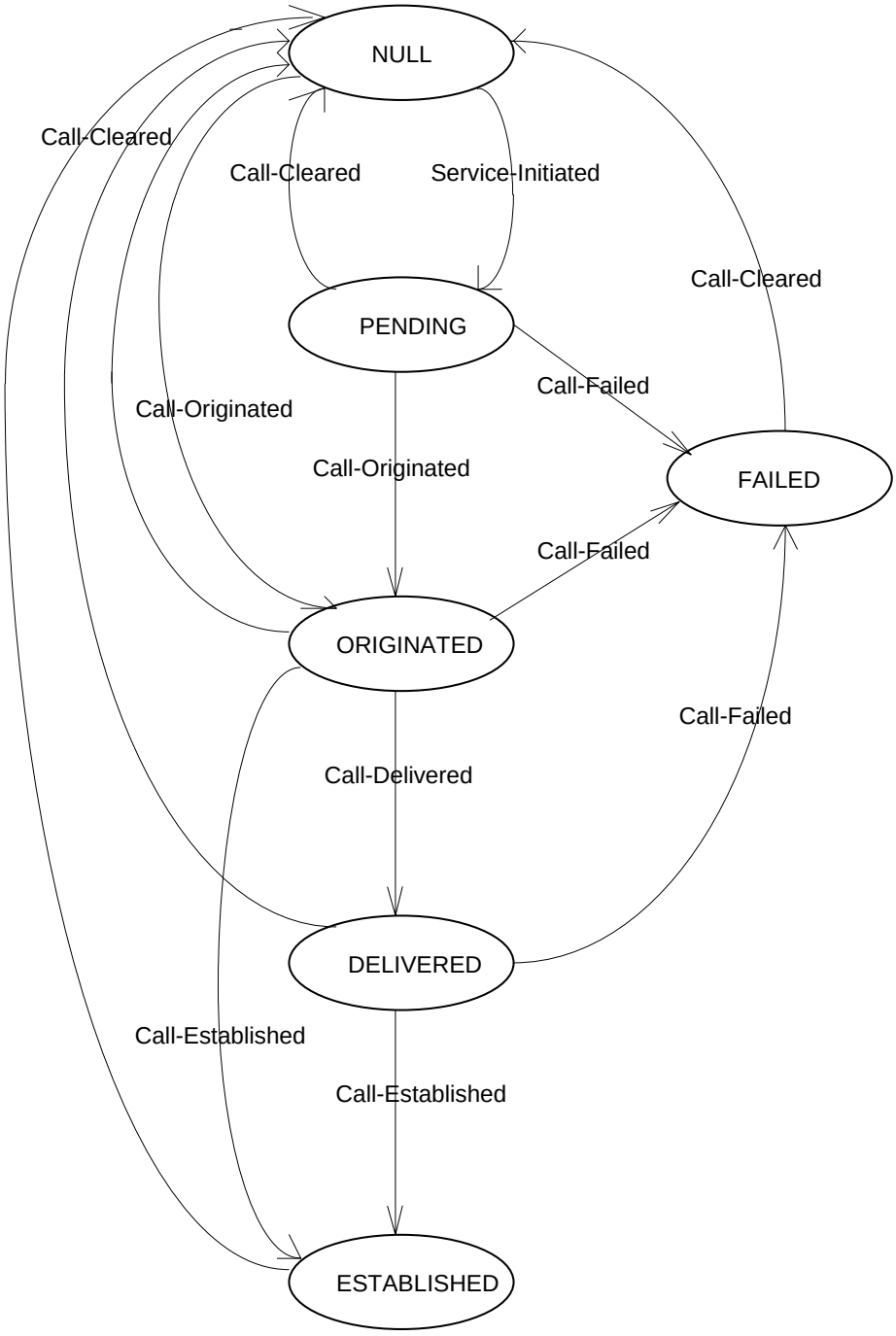

Figure 5-3/JJ20.50 Originating states

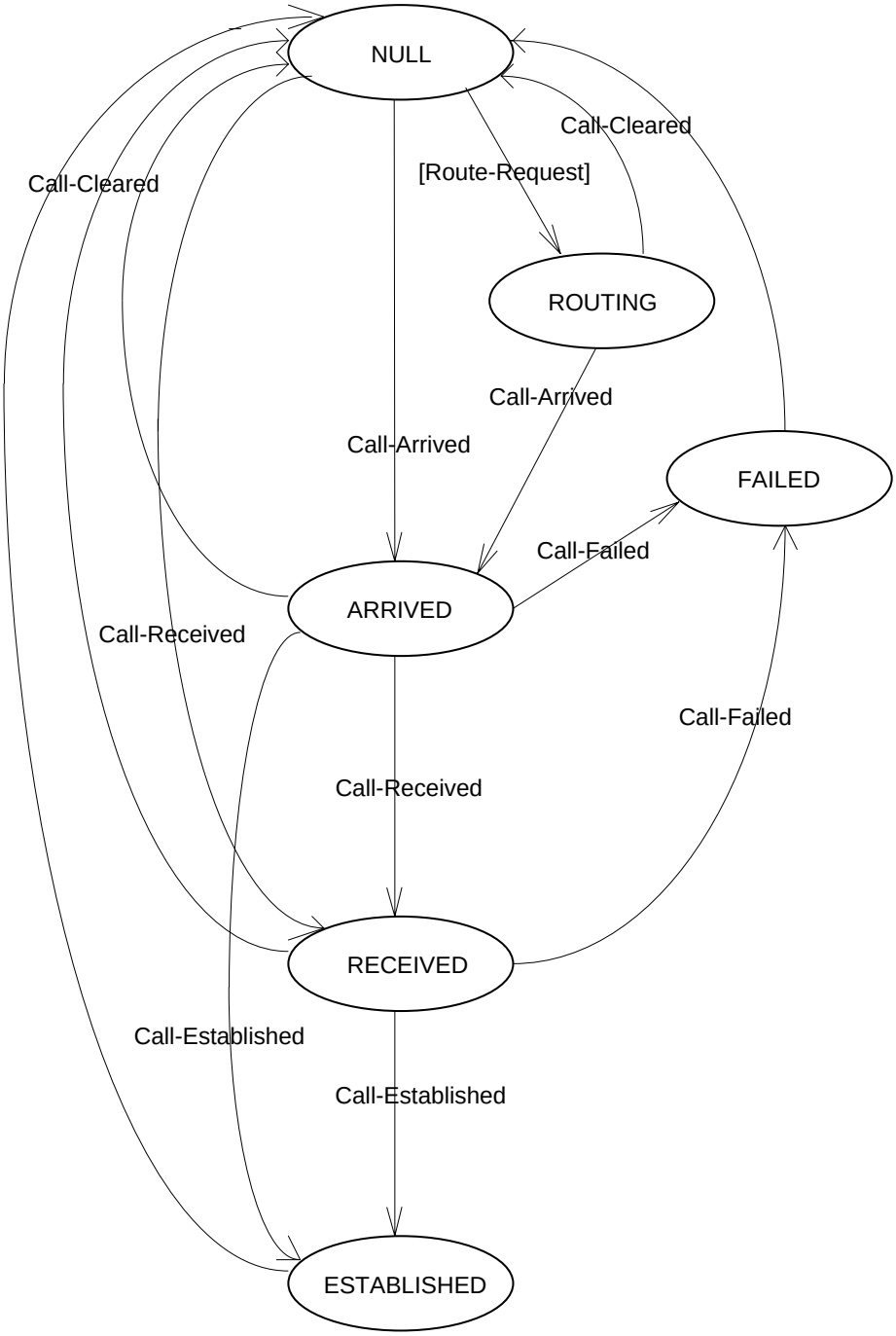

Figure 5-4/JJ20.50 Terminating states

5.4 Device object

A device is an identifiable entity which can participate in a call.
The device subclasses are:

(1) Individual Device
(2) Device Group

5.4.1 Individual device

An individual device identifies a single-line appearance. A single-line appearance is a model of a single-line station (e.g., analogue telephone). Multi-line stations (e.g., ISDN telephone) are modeled as a number of single-line appearances. A device can originate or terminate calls.

5.4.2 Device group

A device group is an entity that distributes incoming calls to devices. The members of a device group are individual or other group devices to which calls may be distributed. Calls may be visible at device groups as calls arrive at a PBX. After calls are distributed to individual devices the calls are no longer visible at the device group. Examples of a device group are ACD groups and hunt groups.

5.4.3 Device service model

The following conditions are defined for device services:

(1) In Service -Originating from the device and terminating to the device are not restricted.
(2) Out of Service -Originating from the device and terminating to the device are restricted. The device is unusable because of maintenance or faults.

5.5 Party object

A party is an identifiable participant of a call. This is an associative object which identifies the relationship between a single device and a single call. A party ceases to exist when the call is cleared or when the device no longer has a relationship to the call.

5.6 Party model

The following conditions are defined for parties:

(1) NULL -No party exists or the party is not a participant in the call.

(2) ACTIVE -The party is a participant in the call. When the information path is reserved or connected so as to allow devices to exchange information, the party condition is defined to be ACTIVE.

(3) HOLD -The party is a participant in the call and the relationship is on hold. The information path has been interrupted. The device is still associated with the call, but cannot exchange information with the other device(s).

5.6.1 Mapping of party conditions to call states

Table 5-1/JJ20.50 defines the relationships between party conditions and call states.

Originating States	Party Conditions(Originating Party)
NULL	NULL
PENDING	ACTIVE
ORIGINATED	ACTIVE, HOLD
DELIVERED	ACTIVE, HOLD
ESTABLISHED	ACTIVE, HOLD
FAILED	ACTIVE

Terminating States	Party Conditions(Terminating Party)
NULL	NULL
ROUTING	NULL
ARRIVED	NULL
RECEIVED	ACTIVE
ESTABLISHED	ACTIVE, HOLD
FAILED	NULL

Table 5-1/JJ20.50 Party conditions to call states

5.7 Agent object

Agents are distinguished from other telephone users by their ability to sign-on or log-on to systems which coordinate and distribute calls. Agents may be members of one or more pools of agents or agent groups. An example of a system which coordinates and distributes calls is an automatic call distribution system.

Agents may control their availability to receive calls by invoking agent operations such as log-on, log-off, and indicating ready or not ready to accept calls. The agent may invoke these operations either via the Set_Feature FE or manually via the telephone set.

Agents have states and agent operations result in state changes. The agent state may be used by the call distribution system to determine the availability of agents. An agent may or may not be in different states in different groups.

Agents events may be reported by the PBX to the computer when an agent invokes an operation at a telephone station or when an agent invokes the Set_Feature FE. Information regarding an agent may also be obtained through the Query_Feature FE.

5.7.1 Operations

The following operations may be performed by an agent:

1) Log On - sign-on at a device into an agent group; the end-user is now an agent of the group but is not ready to accept calls

2) Log Off - sign-off at a device and remove oneself from the group; the end-user is no longer an agent of the group and should not be sent group calls

3) Ready - indicate ready to accept group calls

4) Not Ready - indicate not ready to accept group calls

5) Working Ready - indicate agent is still occupied with work associated with a group call (working), but no longer connected with a group call; available to receive additional group calls (ready)

6) Working Not Ready - indicate agent is still occupied with work associated with a group call (working) and the work may extend past the duration of the call; the call may terminate but the agent should not be sent additional group calls at this time (not ready)

5.7.2 Event notifications

The following events may be reported as a result of invoking an agent operation:

1) Agent_Logged_On
2) Agent_Logged_Off
3) Agent_Ready
4) Agent_Not_Ready
5) Agent_Working_Ready - working and calls allowed
6) Agent_Working_Not_Ready - working and calls not allowed

Table 5-2/JJ20.50 maps the agent Events to the agent operations triggering the events.

Agent Operations	Agent Events
Log On	Agent_Logged_On
Log Off	Agent_Logged_Off
Ready	Agent_Ready
Not Ready	Agent_Not_Ready
Working Ready	Agent_Working_Ready
Working Not Ready	Agent_Working_Not_Ready

Table 5-2/JJ20.50 - Agent Operations to agent events

5.7.3 Feature Information

The agent Set_Feature information is the information which is sent when the agent feature is invoked with the Set_Feature FE. The information sent indicates the device and the agent operation.

5.8 Agent model

The agent model consists of the concepts of agent states and state transitions. The following states are defined for an agent:

1) NULL - the agent is not signed-on at the device
2) READY - the agent is signed-on at the device and ready to accept calls; the agent may be busy with a group call
3) NOT READY - the agent is signed-on at the device but not ready to accept group calls; the agent is occupied with an activity other than servicing group calls
4) WORKING READY - the agent is signed-on at the device doing work and is available to accept calls
5) WORKING NOT READY - the agent is signed-on at the device doing work but is not available to accept calls

Table 5-3/JJ20.50 maps agent operations to agent states (i.e., operations which may be invoked to cause agent state transitions).

NULL	READY	NOT READY	WORKING READY	WORKING NOT READY
Log On				
	Log Off	Log Off	Log Off	Log Off
		Ready	Ready	Ready
	Not Ready		Not Ready	Not Ready
	Working Ready	Working Ready		
	Working Not Ready	Working Not Ready		

Table 5-3/JJ20.50 - Agent operations

Figure 5-5/JJ20.50 shows the agent state model and agent state transitions.

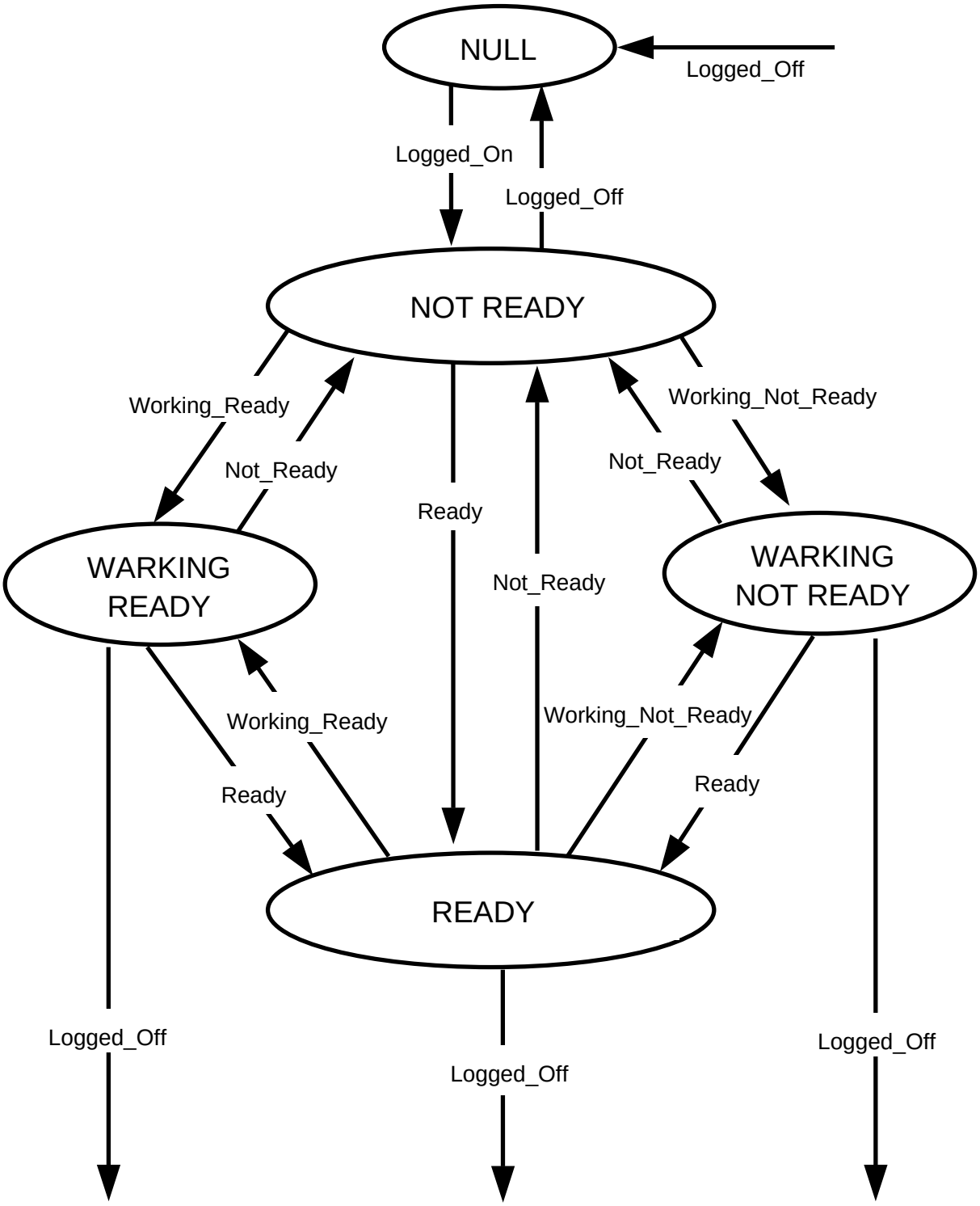

Figure 5-5/JJ-20.50 Agent state model

ANNEX

Alphabetical list of abbreviations used in this document

This standard makes use of the following abbreviations for the names packets.

Abbreviation	Name of Packets
ACD	Automatic Call Distribution
ACSE	Association Control Service Element
AE	Application Entity
AP	Application Process
API	Application Program Interface
FE	Functional Element
ROSE	Remote Operations Service Element
TPCI	TTC PBX-Computer Application Interface

JJ-20.60

Private Integrated Services Networks (Inter-PBX Roaming Supplementary Service) - Inter-PBX Signalling Protocol -

JJ-20.60

Private Integrated Services Networks
(Inter-PBX Roaming Supplementary Service)
- Inter-PBX Signalling Protocol -

<Reference>

1. Relationship with international standards

There are no related standards.

2. The history of revised version

Versions	Date	Outline
1	April 24 , 1996	Established.
1.1	February 9 , 1998	Correcting an editorial error in ASN.1.
2	November 26 , 1998	Adding Authentication scenario 1a.

3. Others

(1) Reference standards and recommendations

- ITU-T recommendations

X.208, X.209, X.219

- ISO/IEC standards

11579-1

- TTC standards

JT-Q931, JT-Q931-a, JT-Q932, JT-Q950, JT-Q951-a, JT-Q952-a, JS-11582

- ARIB standards (Radio System)

RCR STD-28

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1 Scope

This Standard specifies the signalling protocol for the support of the Inter-PBX Roaming Supplementary Service (SS-IPR) within a Private Integrated Service Networks (PISN).

SS-IPR is a supplementary service which enables a Personal Station (PS), which roams between radio service areas of PBXs within a PISN, to update/delete location registration, to make/receive a call and to authenticate the PS, regardless of the PS location within the PISN.

This standard specifies the following procedures to provide basic mobile services to a roaming PS;

- a location registration update procedure
- a location registration delete procedure
- an outgoing call procedure
- an incoming call procedure
- a location information check procedure
- an authentication procedure

As to the authentication procedure, this standard defines the following three scenarios.

- Scenario 1: the authentication algorithm is same for all PBX within the PISN and the authentication key of a PS is available for all PBX within the PISN.
- Scenario 1a: the extension of Scenario 1 with allowing multiple authentication algorithms within the PISN.
- Scenario 2: the other cases.

A PISN shall choose one of these scenarios.

The reference point of this standard is the Q reference point between Private Integrated Service Network Exchanges (PINXs) connected together within a PISN. The Q reference point is defined in ISO/IEC 11579-1.

The signalling protocol for SS-IPR operates on the inter-PINX signalling connection for the control of supplementary services specified in TTC JS-11582.

As to radio interface dependent specification such as PS identification and authentication, this standard assumes that a PS has “Personal Handy Phone System (PHS)” radio interface specified by RCR STD-28. The other radio interfaces are outside the scope of this standard.

2 Conformance

In order to conform to this Standard, a PINX shall satisfy the requirements identified in the Protocol Implementation Conformance Statement (PICS) proforma in annex A.

3 References

ITU-T

- X.208	SPECIFICATION OF ABSTRACT SYNTAX NOTATION ONE (ASN.1)
- X.209	SPECIFICATION OF BASIC ENCODING RULES FOR ABSTRACT SYNTAX NOTATION ONE (ASN.1)
- X.219	REMOTE OPERATIONS: MODEL, NOTATION AND SERVICE DEFINITION

TTC

- JT-Q931	ISDN User-Network Interface Layer 3 -Specification
- JT-Q931-a	Digital Interface between PBXs (Common Channel Signalling) - Layer 3 - Specification
- JT-Q932	Generic Procedures for the Control of ISDN Supplementary Services
- JT-Q950	Supplementary Services Protocols Structure and General Principle Service
- JT-Q951-a	Digital Interface between PBXs (Supplementary Services) - Number Identification Services

- JT-Q952-a Digital Interface between PBXs (Supplementary Services) - Call Transfer Services

- JS-11582 Generic Functional Protocol for the support of Supplementary Services (provisional name)

ISO/IEC

- 11579-1 Information Technology - Telecommunications and information exchange between systems - Private integrated services network - Part 1: Reference configuration for PISN exchange (PINX)

ARIB

- RCR STD-28 Personal Handy Phone System

4 Definitions

4.1 External definitions

This Standard uses the following terms defined in other documents.

- PISN (ISO/IEC 11579-1)
- PINX (ISO/IEC 11579-1)
- Transit PINX (TTC JS-11582)
- Q reference point (ISO/IEC 11579-1)
- Personal station (RCR STD-28)
- PS-ID (RCR STD-28)

4.2 Definitions in this Standard

This Standard uses the following terms defined in this Standard.

4.2.1 Home PINX

The PINX which provides the HLR function for a PS. One Home PINX exists for one PS in the PISN.

4.2.2 Visitor PINX

The PINX other than the Home PINX, where a PS is located during the inter-PINX roaming. The Visitor PINX provides mobile communication services to the PS during the inter-PINX roaming.

4.2.3 Home Location Register (HLR)

The database which stores all information required for providing SS-IPR to the PS. The HLR of PS is controlled by the Home PINX of the PS.

4.2.4 Visitor Location Register (VLR)

The database which stores information required for providing SS-IPR to the PS during the inter-PINX roaming. The VLR is temporarily established to provide HLR-equivalent functions for the PS during the inter-PINX roaming.

4.2.5 Inter-PINX roaming

The action for a PS to move between the radio service areas of PINXs within the PISN.

4.2.6 Authentication

The action of the PISN to verify the validity of a PS.

4.2.7 PS number

The number to uniquely identify a PS in the PISN.

4.2.8 Inter-PINX roaming number

The number assigned temporarily to a PS by the Visitor PINX while the PS is in the inter-PINX roaming. The inter-PINX roaming number is registered in the HLR as the location information.

4.2.9 SS-IPR service profile

The profile which is required to provide SS-IPR, including the authentication and PS information. The SS-IPR service profile is transferred from the HLR to the VLR when the PS conducts the inter-PINX roaming.

5 List of acronyms

The following lists the acronyms used in this Standard.

- GFP Generic Functional Protocol
- HLR Home Location Register
- VLR Visitor Location Register
- PISN Private Integrated Services Network
- PINX Private Integrated services Network eXchange
- PHS Personal Handyphone System
- PS Personal Station
- SS-IPR Inter-PBX Roaming supplementary service

6 Signalling protocol for the support of SS-IPR

6.1 SS-IPR description

This standard is for providing SS-IPR including originating and terminating calls, authentication and updating location registration for a PS which moves through multiple radio service areas constituting the PISN, regardless of the PS location within the PISN.

6.2 SS-IPR operational requirements

The Home PINX and the Visitor PINX shall implement the operations shown in Table 6.1/JJ-20.60.

Table 6.1/JJ-20.60 SS-IPR Operations

Operation	Operation class	Performer	Action
GetSerProfInf	2	Home PINX	To get the service profile of PS. (Call independent operation)
LocRegUpd	2	Home PINX	To update the location registration of PS. (Call independent operation)
LocRegDel	2	Visitor PINX	To delete the location registration of PS. (Call independent operation)
RomCallFwrd	3	Visitor PINX	To forward a incoming call from the Home PINX to the Visitor PINX. (Call related operation)
LocInfChk	2	Home/Visitor PINX	To check the location information between Home PINX and Visitor PINX. (Call independent operation)
AuthCipReq	2	Home PINX	To request authentication cipher for Scenario 2. (Call independent operation)

6.2.1 Requirements on the Home PINX

The connection-oriented procedures, as specified in the TTC JS-11582, shall apply to the Home PINX. Connections between PINXs shall be set up and released in each procedure. However, if a connection already exists between PINXs, it is optional to transfer the necessary information using this connection.

6.2.2 Requirements on the Visitor PINX

The connection-oriented procedures, as specified in the TTC JS-11582, shall apply to the Visitor PINX. Connections between PINXs shall be set up and released in each procedure. However, if a connection already exists between PINXs, it is optional to transfer the necessary information using this connection.

6.2.3 Requirements on the Transit PINX

The connection-oriented procedures, as specified in the TTC JS-11582, shall apply to the Transit PINX.

6.3 SS-IPR operation coding requirements

6.3.1 Operation

The operations defined in Abstract Syntax Notation number 1 (ASN.1) in Table 6.2/JJ-20.60 shall apply.

Table 6.2/JJ-20.60 Operations in Support of SS-IPR

```
Inter-PINX-Roaming-Operations {ccitt(0) administration(2) japan(440) pnw(101) inter-pbx-roaming(2)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN
IMPORTS   OPERATION, ERROR    FROM Remote-Operation-Notation
                              {joint-iso-ccitt(2) remote-operations(4) notation(0)}
          userNotSubscribed, notAvailable, insufficientInformation FROM General-Error-List
                              {ccitt recommendation q950 general-error-list(1)}
          Q931InformationElement FROM Embedded-Q931-Types
                              {ccitt recommendation q932 embedded-q931-types(5)};

ipr OBJECT IDENTIFIER ::=
          {ccitt(0) administration(2) japan(440) pnw(101) inter-pbx-roaming(2) operations(0)}


-- The following operations are commonly used in both Scenario 1 and 2.
GetSerProfInf ::=         OPERATION
                          ARGUMENT          GetSerProfInfArg
                          RESULT            GetSerProfInfRes
                          ERRORS            {userNotSubscribed, notAvailable,
insufficientInformation}
LocRegUpd ::=             OPERATION
                          ARGUMENT          LocRegUpdArg
                          RESULT
                          ERRORS            {notAvailable, insufficientInformation}
LocRegDel ::=             OPERATION
                          ARGUMENT          LocRegDelArg
                          RESULT
                          ERRORS            {notAvailable,insufficientInformation}
RomCallFwrd::=            OPERATION
                          ARGUMENT          RomCallFwrdArg
                          ERRORS            {notAvailable, insufficientInformation}
LocInfChk ::=             OPERATION
                          ARGUMENT          LocInfChkArg
                          RESULT            LocInfChkRes
                          ERRORS            {notAvailable,insufficientInformation}
```

```
-- This operation is ONLY used in Scenario 2.

AuthCipReq ::=              OPERATION
                            ARGUMENT            AuthCipReqArg
                            RESULT              AuthCipReqRes
                            ERRORS              {insufficientInformation, notAvailable}


GetSerProfInfArg ::=        SET   {psn      [2]IMPLICIT     PsNumber}
GetSerProfInfRes ::=        SET   {ps-id    [1]IMPLICIT     Ps-Id,
                                   class    [4]IMPLICIT     SubscriberClass OPTIONAL,
                                   callingPartyNumber       Q931InformationElement   OPTIONAL,
                                   -- The calling party number of the PS which is same type as the
information elements in the TTC JT-Q931.
                                                IMPLICIT CHOICE {
                                                            authkey    [3]IMPLICIT
AuthenticationKey,
                                                             -- These contents are used on Scenario
1.
                                                            Authkeyinf
AuthenticationKeyInformation,
                                                             -- These contents are used on Scenario
1a.
                                                            authinf     AuthenticationInformation }}
                                                             -- These contents are used on Scenario
2.
LocRegUpdArg ::=            SET   {psn      [2]IMPLICIT     PsNumber,
                                   rmnum    [5]IMPLICIT     RoamingNumber}
RomCallFwrdArg ::=          SET   {psn      [2]IMPLICIT     PsNumber,
                                   calledpartyNumber Q931InformationElement OPTIONAL}
                                   -- The called party number of the PS which is same type as the
information elements in the TTC JT-Q931.
LocRegDelArg ::=            SET   {psn      [2]IMPLICIT     PsNumber}
LocInfChkArg ::=            SET   {psn      [2]IMPLICIT     PsNumber,
                                   rmnum    [5]IMPLICIT     RoamingNumber}
LocInfChkRes ::=            SET   {reply    [6]IMPLICIT     Reply}
AuthCipReqArg ::=           SET   {psn      [2]IMPLICIT     PsNumber,
                                   rnd      [8]IMPLICIT     AuthenticationRamdonPattern}
AuthCipReqRes ::=           SET   {authres  [9]IMPLICIT     AuthenticationCipheringPattern}
AuthenticationKeyInformation ::= IMPLICIT SET {authtype[10]IMPLICIT     AuthenticationType,
                                               authkey [3]IMPLICIT      AuthenticationKey}
AuthenticationInformation ::=   IMPLICIT SET  {authtype [10]IMPLICIT     AuthenticationType,
                                                rndlen    [7]IMPLICIT
    AuthenticationRandomPatternLength}
```

```
Ps-Id ::=                       OCTET STRING(SIZE(4))
        -- Refer to the PS-ID information element of Radio frequency transmission management (RT)
        -- defined in the ARIB RCR STD-28. (Without Information element identifier.)
PsNumber ::=                    OCTET STRING(SIZE(7))
        -- Refer to the PS number information element of Mobility management (MM) defined in
        -- the ARIB RCR STD-28. (Without Information element identifier.)
AuthenticationType ::=          OCTET STRING
        -- Refer to the Authentication Type information element of Mobility management (MM) defined in
        -- the ARIB RCR STD-28. (Without Information element identifier.)
AuthenticationKey ::=           OCTET STRING
AuthenticationRandomPatternLength ::= INTEGER
        -- Take the random pattern length for authentication.
SubscriberClass ::=             OCTET STRING
        -- Take the travelling class mark information element without octet 1, octet 2 and octet 3, defined in
        -- the TTC JT-Q931-a in case when coding standard (octet 3) is TTC standardised coding.

RoamingNumber ::=               OCTET STRING(SIZE(1..35))
        -- Take the called party number information element without octet 1 and octet 2, defined in the TTC
JT-Q931.
Reply ::=                       ENUMERATED { locInfChk-correct(0),
                                             locInfChk-incorrect(1),
                                             reserved(2..127) }
AutenticationRamdomPattern    ::= OCTET STRING
AuthenticationCipheringPattern ::= OCTET STRING

getSerProfInf                   GetSerProfInf           ::= { ipr get-Service-profile-information(1) }
locRegUpd                       LocRegUpd               ::= { ipr location-registration-update(2) }
locRegDel                       LocRegDel               ::= { ipr location-registration-delete(3) }
romCallFwrd                     RomCallFwrd             ::= { ipr roaming-call-forwarding(4) }
locInfChk                       LocInfChk               ::= { ipr location-informationnquiry(5) }
authCipReq                      AuthCipReq              ::= { ipr
authenticationCipherRequest(6) }

END         -- of SS-IPR-Operations.
```

6.3.2 Information elements

6.3.2.1 Facility information elements

The Facility Information elements are sent between the Home PINX and Visitor PINX.

See TTC JS-11582 for the details of coding using the facility information elements.

6.3.2.2 Called party number information elements

The operation of roaming call forwarding uses the call related connection-oriented procedures as defined in the TTC JS-11582. During this operation, the Inter-PINX roaming number is used as the Called party number.

Other operations use the call independent connection-oriented procedures as defined in the TTC JS-11582.

6.3.2.3 Other information elements

See TTC JS-11582 for the details of coding using other information elements.

6.3.3 Messages

See TTC JS-11582 for the details of messages.

6.4 SS-IPR state definitions

The SS-IPR procedures are described in the following conceptual states.

6.4.1 States at the Home PINX

6.4.1.1 Inter-PINX location registration update procedure

6.4.1.1.1 IPR-LocUpd-Idl

The inter-PINX location registration update procedure is not operating.

6.4.1.1.2 IPR-LocUpd-Rdy

The GetSerProfInf return result APDU has been sent to the Visitor PINX.

6.4.1.2 Inter-PINX location registration deletion procedure

6.4.1.2.1 IPR-LocDel-Idl

The inter-PINX location registration deletion procedure is not operating.

6.4.1.2.2 IPR-LocDel-Req

The LocRegDel invoke APDU has been sent to the Visitor PINX.

6.4.1.3 Inter-PINX roaming call forwarding procedure

6.4.1.3.1 IPR-CalFwrd-Idl

The Inter-PINX roaming call forwarding procedure is not operating.

6.4.1.3.2 IPR-CalFwrd-Fwrd

The RomCallFwrd invoke APDU has been sent to the Visitor PINX.

6.4.1.4 Inter-PINX location information inquiry procedure

6.4.1.4.1 IPR-LocChk-Idl

The inter-PINX location information inquiry procedure is not operating.

6.4.1.4.2 IPR-LocChk-Chk

The LocInfChk invoke APDU has been sent to the Visitor PINX.

6.4.1.5 Inter-PINX authentication cipher procedure

This procedure is defined only in the case of Scenario 2.

6.4.1.5.1 IPR-Auth-Idl

The inter-PINX authentication cipher procedure is not operating.

6.4.2 States at the Visitor PINX

6.4.2.1 Inter-PINX location registration update procedure

6.4.2.1.1 IPR-LocUpd-Idl

The inter-PINX location registration update procedure is not operating.

6.4.2.1.2 IPR-LocUpd-SerInf

The GetSerProfInf invoke APDU has been sent to the Home PINX.

6.4.2.1.3 IPR-LocUpd-Wait

The GetSerProfInf response has been received from the Home PINX.

6.4.2.1.4 IPR-LocUpd-Upd

The LocRegUpd invoke APDU has been sent to the Home PINX.

6.4.2.2 Inter-PINX location registration deletion procedure

6.4.2.2.1 IPR-LocDel-Idl

The inter-PINX location registration deletion procedure is not operating.

6.4.2.3 Inter-PINX roaming call forwarding procedure

6.4.2.3.1 IPR-CalFwrd-Idl

The Inter-PINX roaming call forwarding procedure is not operating.

6.4.2.4 Inter-PINX location information inquiry procedure

6.4.2.4.1 IPR-LocChk-Idl

The inter-PINX location information inquiry procedure is not operating.

6.4.2.4.2 IPR-LocChk-Chk

The LocInfChk invoke APDU has been sent to the Home PINX.

6.4.2.5 Inter-PINX authentication cipher procedure

This procedure is only defined in Scenario 2.

6.4.2.5.1 IPR-Auth-Idl

The inter-PINX authentication cipher procedure is not operating.

6.4.2.5.2 IPR-Auth-Req

The AuthCipReq invoke APDU has been sent to the Home PINX.

6.5 SS-IPR signalling procedures

SS-IPR signalling procedures are defined in this section. To help the understanding of the protocol, the inter-actions of the Home PINX and Visitor PINX and actions to the PS are written but these are out of the definitions of these procedures.

6.5.1 Inter-PINX location registration update procedure

The inter-PINX location registration update procedure is a generic term for the series of processes including to get service profile, to authenticate PS and to update inter-PINX location registration, which is started by the Visitor PINX when the PS moves into the Visitor PINX area.

6.5.1.1 Actions at the Visitor PINX

6.5.1.1.1 Service profile get

6.5.1.1.1.1 Normal procedure

If a PINX receives a location registration update request and the PS number of the concerned PS is registered neither in the HLR nor the VLR, the PINX shall recognise itself as the Visitor PINX for the PS and starts an inter-PINX location registration update procedure.

The Visitor PINX then shall analyse the PS number of the PS to identify the Home PINX, send the GetSerProfInf invoke APDU to the Home PINX, start timer T1 and enter state IPR-LocUpd-SerInf.

On receipt of the GetSerProfInf return result APDU from the Home PINX, the Visitor PINX shall stop timer T1 and enter state IPR-LocUpd-Wait.

6.5.1.1.1.2 Exceptional procedure

If the GetSerProfInf invoke APDU cannot be sent to the Home PINX, the Visitor PINX shall notify the PS of the failure in location registration update.

On receipt of a GetSerProfInf return error APDU or return reject APDU from the Home PINX, the Visitor PINX shall stop timer T1, notify the PS of the failure in location registration update and enter state IPR-LocUpd-Idl.

If timer T1 expires, the Visitor PINX shall notify the PS of the failure in location registration update and enter state IPR-LocUpd-Idl.

6.5.1.1.2 PS authentication

6.5.1.1.2.1 Normal procedure

In state IPR-LocUpd-Wait, the Visitor PINX shall authenticate the concerned PS, based on the authentication information within the service profile information received from the Home PINX, and continue the location registration update process only if the authentication is complete.

6.5.1.1.2.2 Exceptional procedure

If the PS authentication is incomplete, the Visitor PINX shall notify the PS of the failure in location registration update and enter state IPR-LocUpd-Idl.

6.5.1.1.3 Inter-PINX location registration update

6.5.1.1.3.1 Normal procedure

The Visitor PINX shall send the LocRegUpd invoke APDU including the inter-PINX roaming number of the PS to the Home PINX, start timer T1 and enter state IPR-LocUpd-Upd.

On receipt of the LocRegUpd return result APDU from the Home PINX, the Visitor PINX shall stop timer T1, register the PS in the VLR, notify the PS of the success in location registration update and enter state IPR-LocUpd-Idl.

6.5.1.1.3.2 Exceptional procedure

If the LocRegUpd invoke APDU cannot be sent to the Home PINX, the Visitor PINX shall notify the PS of the failure in location registration update and enter state IPR-LocUpd-Idl.

On receipt of a LocRegUpd return error APDU or return reject APDU from the Home PINX, the Visitor PINX shall stop timer T1, notify the PS of the failure in location registration update and enter state IPR-LocUpd-Idl.

If timer T1 expires, the Visitor PINX shall notify the PS of the failure in location registration update and enter state IPR-LocUpd-Idl.

6.5.1.2 Actions at the Home PINX

6.5.1.2.1 Service profile notification

6.5.1.2.1.1 Normal procedures

On receipt of the GetSerProfInf invoke APDU, a PINX shall recognise itself as the Home PINX.

If the PS number contained in the invoke APDU is registered in the HLR and the inter-PINX roaming service is permitted to the PS, the Home PINX shall send the GetSerProfInf return result APDU to the Visitor PINX, start timer T2 and enter state IPR-LocUpd-Wait.

6.5.1.2.1.2 Exceptional procedures

If the PS number contained in the invoke APDU is not registered in the HLR or the inter-PINX roaming service are not permitted to the PS, the Home PINX shall the a GetSerProfInf return error APDU to the Visitor PINX and enter state IPR-LocUpd-Idl.

6.5.1.2.2 Inter-PINX location registration update

6.5.1.2.2.1 Normal procedures

In state IPR-LocUpd-Wait, on receipt of the LocRegUpd invoke APDU from the Visitor PINX, the Home PINX shall stop timer T2, register the inter-PINX roaming number contained in the invoke APDU into the HLR. The Home PINX shall then send the LocRegUpd return result APDU to the Visitor PINX and enter state IPR-LocUpd-Idl.

6.5.1.2.2.2 Exceptional procedures

If the inter-PINX roaming number is illegal , the Home PINX shall send the Visitor PINX a LocRegUpd return error APDU and enter state IPR-LocUpd-Idl.

If timer T2 expires, Home PINX shall enter state IPR-LocUpd-Idl.

6.5.2 Inter-PINX location registration deletion procedure

In the update or delete of the inter-PINX roaming number into the HLR, if another inter-PINX roaming number (hereafter referred to as the previous inter-PINX roaming number) had already been registered in the HLR, the Home PINX shall start the procedure to delete the previous inter-PINX roaming number.

6.5.2.1 Actions at the Home PINX

6.5.2.1.1 Normal procedures

The Home PINX shall analyse the previous inter-PINX roaming number to identify the previous Visitor PINX, send the LocRegDel invoke APDU, start timer T1 and enter state IPR-LocDel-Req.

On receipt of the LocRegDel return result APDU from the previous Visitor PINX, the Home PINX shall stop timer T1 and enter state IPR-LocDel-Idl.

6.5.2.1.2 Exceptional procedures

If the LocRegDel invoke APDU cannot be sent to the previous Visitor PINX, the Home PINX may restart the inter-PINX location registration deletion procedure.

On receipt of a LocRegDel return error APDU or return reject APDU from the previous Visitor PINX, the Home PINX shall stop timer T1 and enter state IPR-LocDel-Idl.

If timer T1 expires, the Home PINX shall stop timer T1 and enter state IPR-LocDel-Idl.

6.5.2.2 Actions at the previous Visitor PINX

6.5.2.2.1 Normal procedures

On receipt of a LocRegDel invoke APDU, the PINX shall recognise itself as the previous Visitor PINX.

If the PS number contained in the invoke APDU is registered in the VLR, the previous Visitor PINX shall delete the registration concerned and send the Home PINX the LocRegDel return result APDU.

6.5.2.2.2 Exceptional procedures

If the PS number contained in the invoke APDU is not registered in the VLR, the previous Visitor PINX shall send the Home PINX the LocRegDel return error APDU.

6.5.3 Call originating procedure

6.5.3.1 Actions at the Visitor PINX

6.5.3.1.1 Normal procedures

On receipt of a call originating request from a PS, the Visitor PINX shall authenticate the PS based on the service profile information registered in the VLR and continue the call originating process only if the authentication is complete.

Additionally, the calling party number and the subscriber class, if registered in the VLR as the service profile information, might be utilised in the call originating process.

6.5.3.1.2 Exceptional procedures

If the PS authentication is incomplete, the Visitor PINX shall clear the outgoing call in the normal call control procedure.

6.5.3.2 Actions at the Home PINX

The Home PINX is not involved in the PS call originating procedure.

6.5.4 Inter-PINX Roaming call forwarding procedure

6.5.4.1 Actions at the Home PINX

6.5.4.1.1 Normal procedure

On receipt of the call terminating request to a PS, the Home PINX shall search the HLR for the PS. If the PS exists in the Home PINX, the Home PINX shall conduct a normal call terminating process. If the PS does not exist in the Home PINX, the Home PINX shall get the inter-PINX roaming number from the HLR and transfer the incoming call to the inter-PINX roaming number. In this case, the Home PINX shall send the Visitor PINX the RomCallFwrd invoke APDU, start timer T3 and enter state IPR-CalFwrd-Fwrd.

Additionally, Home PINX might set the called party number defined in receipt of the call terminating request in the RomCallFwrd invoke APDU, and then might send it to the Visitor PINX.

If timer T3 expires, the Home PINX shall enter state IPR-CalFwrd-Idl.

If the process of transferring the call to the Visitor PINX is aborted, the Home PINX shall stop timer T3 and enter state IPR-CalFwrd-Idl.

6.5.4.1.2 Exceptional procedure

On receipt of a RomCallFwrd return error APDU or return reject APDU from the Visitor PINX, the Home PINX shall stop timer T3 and enter state IPR-CalFwrd-Idl. In this case, the Home PINX may conduct the HLR recovery process as required.

6.5.4.2 Actions at the Visitor PINX

6.5.4.2.1 Normal procedures

On receipt of the RomCallFwrd invoke APDU, the Visitor PINX shall check if the PS number and the inter-PINX roaming number contained in the APDU agree with the values stored in the VLR. If the agreement is confirmed, the Visitor PINX shall start the call terminating process to the PS.

During the call terminating process, the Visitor PINX shall authenticate the PS based on the authentication information within the service profile information registered in the VLR and continue the call terminating process only if the authentication is complete.

6.5.4.2.2 Exceptional procedures

If the PS number and the inter-PINX roaming number checking is not accorded, the Visitor PINX shall send the Home PINX a RomCallFwrd return error APDU and clear the incoming call using the cause display #41 "Temporary fault". In this case, the Visitor PINX may conduct the VLR recovery process as required.

Note: The RomCallFwrd operation of the Visitor PINX shall end normally when the checking produced a positive result. If the call terminating process to the PS failed because of the PS busy or no-answer state, no signal is sent to the Home PINX in the RomCallFwrd operation.

If the authentication is incomplete, the Visitor PINX shall clear the incoming call in the normal call control procedure.

6.5.5 Inter-PINX location information check procedure

6.5.5.1 Visitor PINX invocation

6.5.5.1.1 Actions at the Visitor PINX

6.5.5.1.1.1 Normal procedures

The Visitor PINX shall send the LocInfChk invoke APDU, start timer T1 and enter state IPR-LocChk-Chk.

On receipt of the LocInfChk return result APDU from the Home PINX, the Visitor PINX shall stop timer T1 and enter state IPR-LocChk-Idl.

The Visitor PINX may delete the PS from the VLR with the negative check result.

6.5.5.1.1.2 Exceptional procedures

If the LocInfChk invoke APDU cannot be sent to the Home PINX, the Visitor PINX may restart the inter-PINX location information check procedure.

On receipt of a LocInfChk return error APDU or return reject APDU from the Home PINX, the Visitor PINX shall stop timer T1 and enter state IPR-LocChk-Idl. The Visitor PINX shall then delete the PS from the VLR.

If timer T1 expires, the Visitor PINX shall stop timer T1 and enter state IPR-LocChk-Idl.

6.5.5.1.2 Actions at the Home PINX

6.5.5.1.2.1 Normal procedures

On receipt of a LocInfChk invoke APDU, the Home PINX shall check if the PS number contained in the invoke APDU is registered in the HLR. The Home PINX shall send the Visitor PINX the LocInfChk return result APDU with check result.

6.5.5.1.2.2 Exceptional procedures

If the PS number contained in the invoke APDU is not registered in the HLR, the Home PINX shall send the Visitor PINX a LocInfChk return error APDU.

6.5.5.2 Home PINX invocation

6.5.5.2.1 Actions at the Home PINX

6.5.5.2.1.1 Normal procedures

The Home PINX shall send the Visitor PINX the LocInfChk invoke APDU, start timer T1 and enter state IPR-LocChk-Chk.

On receipt of the LocInfChk return result APDU, the Home PINX shall stop timer T1 and enter state IPR-LocChk-Idl.

If the checking result of return result APDU is negative, the Home PINX may invalidate the inter-PINX roaming number.

6.5.5.2.1.2 Exceptional procedures

If the LocInfChk invoke APDU cannot be sent to the Visitor PINX, the Home PINX may restart the inter-PINX location information check procedure.

On receipt of a LocInfChk return error APDU or return reject APDU from the Visitor PINX, the Home PINX shall stop timer T1 and enter state IPR-LocChk-Idl. The Home PINX shall initialise the inter-PINX roaming number of the PS in the HLR.

If timer T1 expires, the Home PINX shall stop timer T1 and enter state IPR-LocChk-Idl.

6.5.5.2.2 Actions at the Visitor PINX

6.5.5.2.2.1 Normal procedures

On receipt of the LocInfChk invoke APDU, the Visitor PINX shall check if the PS number contained in the invoke APDU is registered in the VLR. If the checking result is positive, the Visitor PINX shall check the other information included invoke APDU with contents of the VLR. The Visitor PINX shall send to the Home PINX the LocInfChk return result APDU including the checking result.

6.5.5.2.2.2 Exceptional procedures

If the PS number contained in the invoke APDU is not registered in the VLR, the Visitor PINX shall send the Home PINX a LocInfChk return error APDU.

6.5.6 Inter-PINX authentication cipher procedures

In Scenario 2, the Visitor PINX shall conduct the check up by starting the inter-PINX authentication cipher process and acquiring the cipher result from the Home PINX. The timing for starting this procedure shall be up to the implementation decision for the Visitor PINX.

6.5.6.1 Actions at the Visitor PINX

6.5.6.1.1 Normal procedures

The Visitor PINX shall send the Home PINX the AuthCipReq invoke APDU, start timer T1 and enter state IPR-Auth-Req.

On receipt of the AuthCipReq return result APDU, the Visitor PINX shall stop timer T1 and enter state IPR-Auth-Idl.

6.5.6.1.2 Exceptional procedures

If the AuthCipReq invoke APDU cannot be sent to the Home PINX, the Visitor PINX may restart the inter-PINX authentication cipher procedure.

On receipt of an AuthCipReq return error APDU or return reject APDU from the Home PINX, the Visitor PINX shall stop timer T1 and enter state IPR-Auth-Idl. The Visitor PINX shall conduct the authentication failure process to PS.

If timer T1 expires, the Visitor PINX shall stop timer T1 and enter state IPR-Auth-Idl. The Visitor PINX shall conduct the authentication failure process to PS.

6.5.6.2 Actions at the Home PINX

6.5.6.2.1 Normal procedures

On receipt of the AuthCipReq invoke APDU, the Home PINX shall cipher the authentication algorithm based on the service profile information registered in the HLR and send the Visitor PINX the AuthCipReq return result APDU including the cipher result.

6.5.6.2.2 Exceptional procedures

If the PS number contained in the invoke APDU is not registered in the HLR, the Home PINX shall send the Visitor PINX an AuthCipReq return error APDU.

6.6 SS-IPR parameter values

6.6.1 Timer T1

Whenever the PINX sends the operation class 2 invoke APDU defined in SS-IPR, the PINX shall start timer T1 to monitor the response to the invoke APDU.

Timer T1 shall be started when the operation class 2 invoke APDU defined in SS-IPR is sent, and stopped when the corresponding return result APDU, return error APDU or return reject APDU is received. If timer T1 expires, the procedure is as defined in section 6.5.

Timer T1 default value shall be 30 seconds.

6.6.2 Timer T2

On the inter-PINX location registration procedure, the Home PINX shall start timer T2 to monitor the inter-PINX location registration operation will be started.

Timer T2 shall be started by Home PINX when the GetSerProfInf return result APDU is sent, and stopped when a LocRegUpd invoke APDU is received. If timer T2 expires, the procedure is as defined in section 6.5.

Timer T2 default value shall be 30 seconds.

6.6.3 Timer T3

Whenever the PINX sends the operation class 3 invoke APDU defined in SS-IPR, the PINX shall start timer T3 to monitor the error response to the invoke APDU.

Timer T3 shall be started by Home PINX when the operation class 3 invoke APDU defined in SS-IPR is sent, and stopped when the corresponding return error APDU or return reject APDU is received. If timer T3 expires, the procedure is as defined in section 6.5.

Timer T3 default value shall be 30 seconds.

6.7 Interactions between SS-IPR and other supplementary services

6.7.1 Calling Line Identification Presentation (CLIP)

No interaction.

6.7.2 Calling Line Identification Restriction (CLIR)

No interaction.

6.7.3 Connected Line Identification Presentation (COLP)

No interaction.

6.7.4 Connected Line Identification Restriction (COLR)

No interaction.

6.7.5 Call Forwarding Unconditional (CFU)

No interaction.

6.7.6 Call Forwarding Busy (CFB)

No interaction.

6.7.7 Call Forwarding No Reply (CFNR)

No interaction.

6.7.8 Call Deflection (CD)

No interaction.

Annex A Protocol Implementation Conformance Statement (PICS) proforma

(Normative)

A.1 Introduction

The supplier of a protocol implementation which is claimed to conform to this Standard shall complete the following Protocol Implementation Conformance Statement (PICS) proforma.

A completed PICS proforma is the PICS for the implemented protocol in question. The PICS is a statement of which capabilities and options of the protocol have been implemented.

The PICS can have a number of uses, including use:

- by the protocol implementor, as a check list to reduce the risk of failure to conform to the Standard through oversight;

- by the supplier and acquirer, or potential acquirer, of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the Standard's PICS proforma;

- by the user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation; while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible PICSs;

- by a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Instructions for completing the PICS proforma

A.2.1 General structure of the PICS proforma

The PICS proforma is a fixed format questionnaire divided into sub-clauses each containing a group of individual items. Each item is identified by an item reference number of first column. The second column is mentioned the question to answered. The third column is mentioned an item number to the clause that specifies the item in the main body of this Standard.

The "Status" column indicates whether an item is applicable and if so whether support is mandatory or optional.

The following terms and table are used:

m	mandatory (the capability is required for conformance to the protocol);
o	optional (the capability is not required for conformance to the protocol, but if the capability is implemented it is required to conform to the protocol specifications);
o.<n>	optional, but support of at least one of the group of options labelled by the same numeral <n> is required;
x	prohibited;
c.<cond>	conditional requirement, depending on support for the item or items listed in condition <cond>;
<item>:m	simple conditional requirement, the capability being mandatory if item number <item> is supported, otherwise not applicable;
<item>:o	simple conditional requirement, the capability being optional if item number <item> is supported, otherwise not applicable.

Answers to the questionnaire items are to be provided either in the "Support" column, by simply making an answer to indicate a restricted choice (Yes or No), or in the "Not Applicable" column (N/A).

A.2.2 Additional information

Items of Additional Information allow a supplier to provide further information intended to assist the interpretation of the PICS. It is not intended or expected that a large quantity will be supplied, and a PICS can be considered complete without any such information.

Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception information.

A.2.3 Exception information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement.

No pre-printed answer will be found in the "Support" column for this. Instead, the supplier is required to write into the "Support" column an x.<i> reference to an item of Exceptional Information, and to provide the appropriate rationale in the Exception item itself.

Note: An implementation for which an Exception item is required in this way does not conform to this Standard JJ-20.60. A possible reason for the situation described above is that a defect in the Standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.3 PICS proforma

A.3.1 Implementation identification

1. Supplier (*1)	
2. Contact point for queries about the PICS (*1)	
3. Implementation Name(s) and Version(s) (*1&2)	
4.Other information necessary for full identification, e.g. Name(s) and Version(s) for machines and/or operating systems; system name(s)	

*1 Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirements for full identification.
*2 The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g. Type, Series, Model).

A.3.2 Protocol summary, JJ-20.60

1. Protocol version	2.0
2. Addenda implemented (if applicable)	
3. Amendments implemented	
4. Have any exception items been required?	No [ ] Yes [ ] (The answer Yes means that the implementation does not conform to JJ-20.60)
5. Date of Statement	

A.3.3 General

Item	Question/feature	References	Status	N/A	Support
A1	Behavior as Home PINX for this service (Scenario 1)		o.1		YES[ ] NO[ ]
A2	Behavior as Home PINX for this service (Scenario 2)		o.1		YES[ ] NO[ ]
A3	Behavior as Visitor PINX for this service (Scenario 1)		o.1		YES[ ] NO[ ]
A4	Behavior as Visitor PINX for this service (Scenario 2)		o.1		YES[ ] NO[ ]
A5	Behavior as Transit PINX for this service		o.1		YES[ ] NO[ ]
A6	Behavior as Home PINX for this service (Scenario 1a)		o.1		YES[ ] NO[ ]

A7	Behavior as Visitor PINX for this service (Scenario 1a)		o.1		YES[ ] NO[ ]

A.3.4 Procedures

Item	Question/feature	References	Status	N/A	Support
B1	Support of JS-11582 procedures (Home PINX)	6.2.1	A1 :m A2 :m A6 :m		m: YES[ ]
B2	Support of JS-11582 procedures (Visitor PINX)	6.2.2	A3 :m A4 :m A7 :m		m: YES[ ]
B3	Support of JS-11582 procedures (Transit PINX)	6.2.3	A5 :m		m: YES[ ]
B4	Signalling procedures (Home PINX)	6.5.1.2 6.5.2.1 6.5.3.2 6.5.4.1 6.5.5.1.2 6.5.5.2.2	A1 :m A2 :m A6 :m		m: YES[ ]
B5	Signalling procedures (Visitor PINX)	6.5.1.1 6.5.2.2 6.5.3.1 6.5.4.2 6.5.5.1.1 6.5.5.2.1	A3 :m A4 :m A7 :m		m: YES[ ]
B6	Additional signalling procedures (Home PINX)	6.5.6.2	A2 :m		m: YES[ ]
B7	Additional signalling procedures (Visitor PINX)	6.5.6.1	A4 :m		m: YES[ ]
B8	Using a different connection for each procedure	6.2.1 6.2.2	A1 :m A2 :m A3 :m A4 :m A6 :m A7 :m		m: YES[ ]
B9	Using an existing connection when such a connection is available	6.2.1 6.2.2	A1 :o A2 :o A3 :o A4 :o A6 :m A7 :m		YES[ ] NO[ ]

A.3.5 Coding

Item	Question/feature	References	Status	N/A	Support
C1	Receipt of GetSerProfinf invoke APDU and sending of return result and return error APDUs	6.3	A1 :m A2 :m A6 :m		m: YES[]
C2	Sending of GetSerProfinf invoke APDU and receipt of return result and return error APDUs	6.3	A3 :m A4 :m A7 :m		m: YES[]
C3	Receipt of LocRegUpd invoke APDU and sending of return result and return error APDUs	6.3	A1 :m A2 :m A6 :m		m: YES[]
C4	Sending of LocRegUpd invoke APDU and receipt of return result and return error APDUs	6.3	A3 :m A4 :m A7 :m		m: YES[]

C5	Receipt of AuthCipReq invoke APDU and sending of return result and return error APDUs	6.3	A2 :m		m: YES[]
C6	Sending of AuthCipReq invoke APDU and receipt of return result and return error APDUs	6.3	A4 :m		m: YES[]
C7	Sending of LocRegDel invoke APDU and receipt of return result and return error APDUs	6.3	A1 :m A2 :m A6 :m		m: YES[]
C8	Receipt of LocRegDel invoke APDU and sending of return result and return error APDUs	6.3	A3 :m A4 :m A7 :m		m: YES[]
C9	Sending of RomCallFwrd invoke APDU and receipt of return error APDUs	6.3	A1 :m A2 :m A6 :m		m: YES[]
C10	Receipt of RomCallFwrd invoke APDU and sending of return error APDUs	6.3	A3 :m A4 :m A7 :m		m: YES[]
C11	Receipt of LocInfChk invoke APDU and sending of return result and return error APDUs	6.3	A1 :m A2 :m A3 :m A4 :m A6 :m A7 :m		m: YES[]
C12	Sending of LocInfChk invoke APDU and receipt of return result and return error APDUs	6.3	A1 :o A2 :o A3 :o A4 :o A6 :o A7 :o		YES[] NO[]

A.3.6 Timer

Item	Question/feature	References	Status	N/A	Support
D1	Support of timer T1	6.6.1	A1 :m A2 :m A3 :m A4 :m A6 :m A7 :m		m: YES[] Value [....]
D2	Support of timer T2	6.6.2	A1 :m A2 :m A6 :m		m: YES[] Value [....]
D3	Support of timer T3	6.6.3	A1 :m A2 :m A6 :m		m: YES[] Value [....]

Annex B Import ASN.1 definition

(Informative)

This annex shows the ASN.1 definition types and values introduced in other standards such as ISO/IEC, ITU-T and TTC. The ASN.1 module, as defined in JS-11582, is omitted from this annex.

B.1 Error import ASN.1 definition, as in JT-Q950:

```
userNotSubscribe            ERROR::= 0
notAvailable                ERROR::= 3
insufficientInformation     ERROR::= 5
```

B.2 JT-Q931 information elements Tag import ASN.1 definition, as in ITU-T Q932:

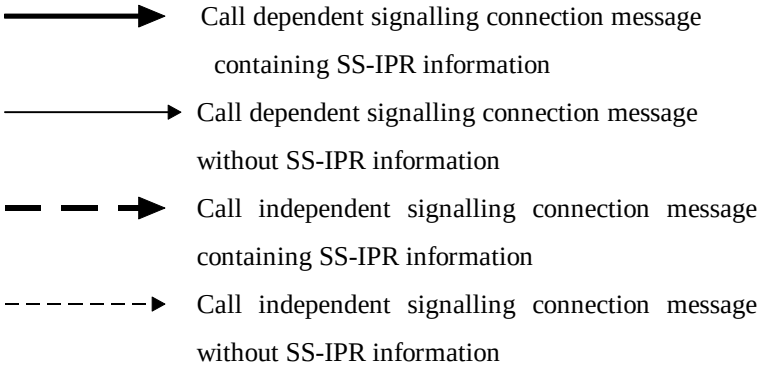
```
Embedded-Q931-Types{ccitt recommendation q932 embedded-q931-types(5)}
DEFINITIONS  EXPLICIT  TAGS  ::=
BEGIN
EXPORTS        Q931InformationElement;
               - -  of information element, as in JT-Q931.
Q931informationelement  ::= [ APPLICATION 0 ] IMPLICIT OCTETSTRING
END            - -  of embedded JT-Q931 types.
```

Annex C Examples of Message Sequences

(Informative)

This annex shows some typical message sequences for SS-IPR.

1. The following notation is used in the figures of this annex.



xxx.inv Invoke APDU for operation xxx

xxx.res Return result APDU for operation xxx

xxx.err Return error APDU for operation xxx

2. The figures show messages sequence via Protocol Control between PINXs involved in SS-IPR.
3. The massage names are show above the arrows representing the massage sequence. The operation names are show below the arrows. Information with no impact on SS-IPR is not described.

C.1 Normal operation of inter-PINX location registration update

Figure C-1/JJ20.60 shows an example of normal operation of inter-PINX location registration update.

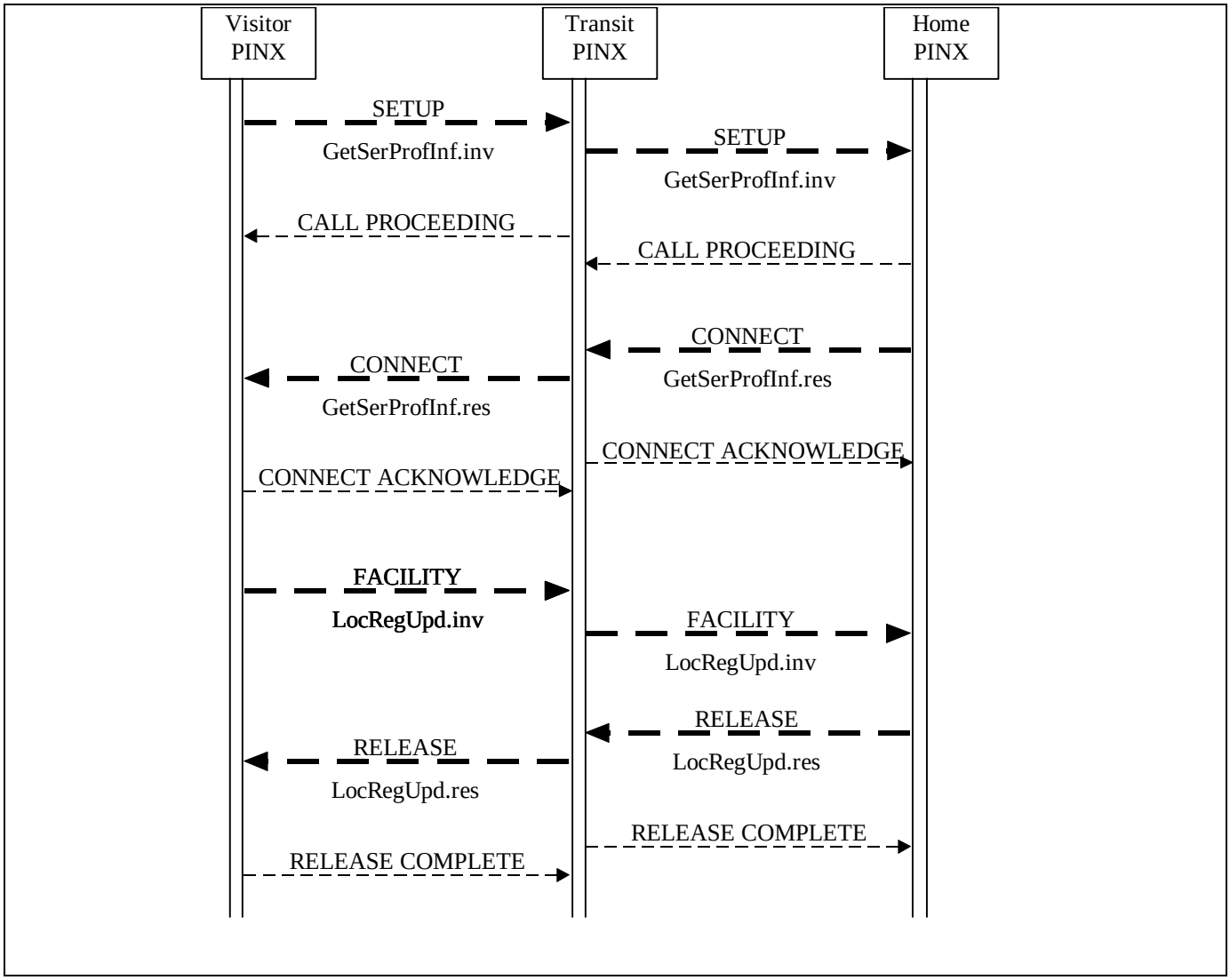


Figure C-1/JJ-20.60 Normal operation of inter-PINX location registration update

C.2 Normal operation of inter-PINX location registration update with inter-PINX authentication

Figure C-2/JJ20.60 shows an example of normal operation of inter-PINX location registration update with inter-PINX authentication.

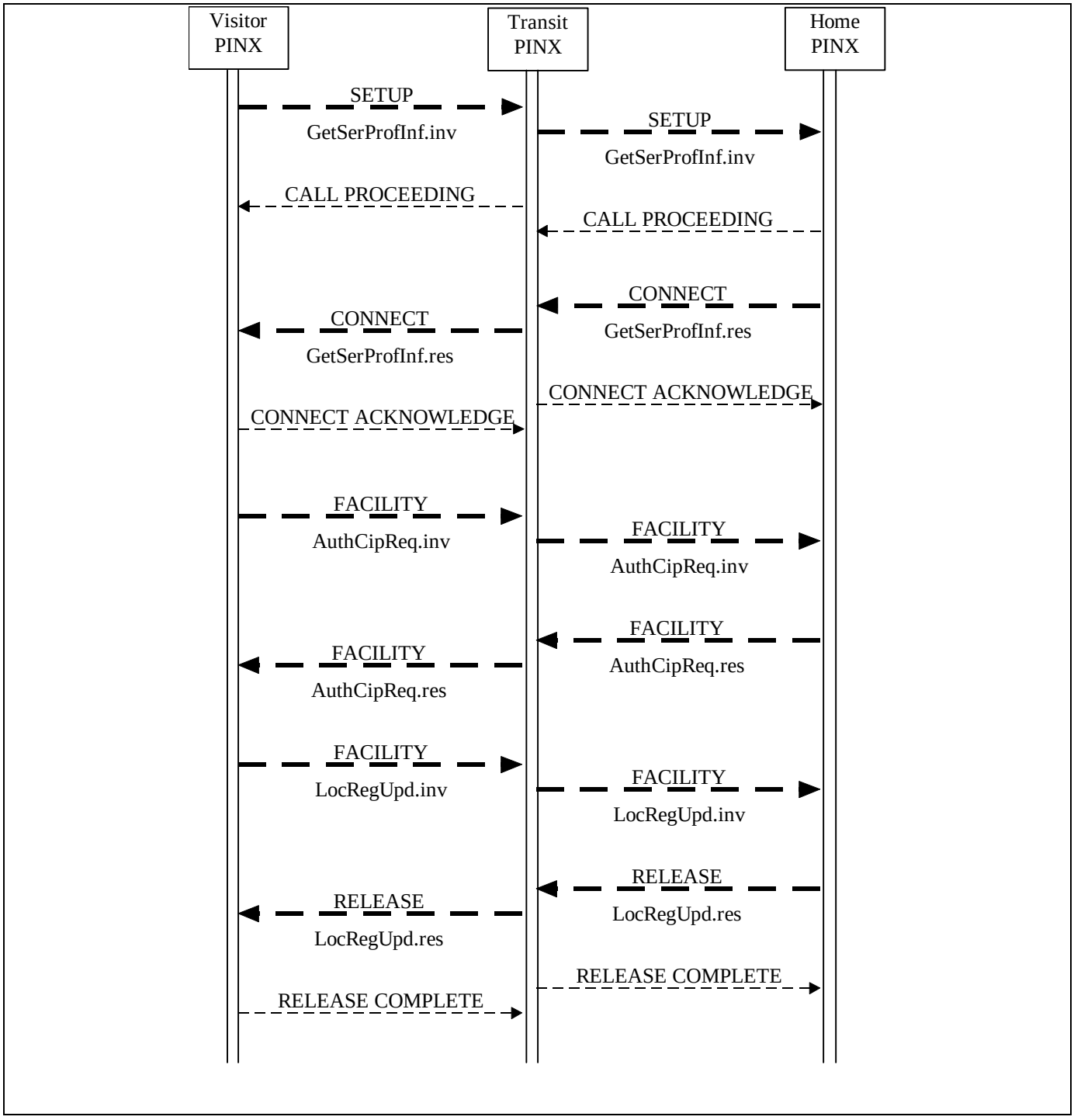


Figure C-2/JJ-20.60 Normal operation of inter-PINX location registration update with inter-PINX authentication

C.3 Unsuccessful operation of inter-PINX location registration update

Figure C-3/JJ20.60 shows an example of unsuccessful operation of inter-PINX location registration update. This operation is performed in the case when the Home PINX restrict roaming to PS

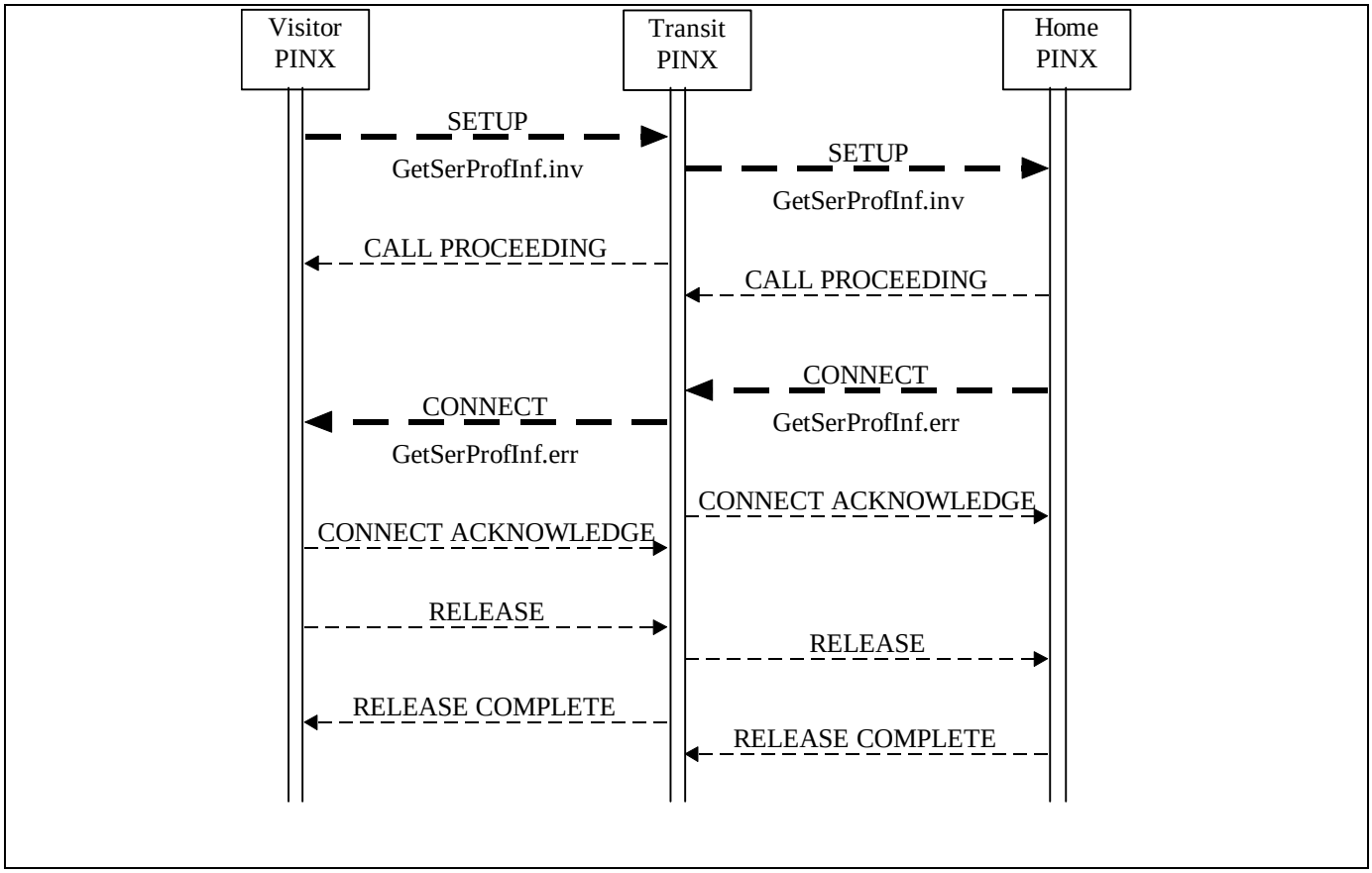


Figure C-3/JJ-20.60 Unsuccessful operation of inter-PINX location registration update

C.4 Normal operation of inter-PINX location registration deletion

Figure C-4/JJ20.60 shows an example of normal operation of inter-PINX location registration deletion.

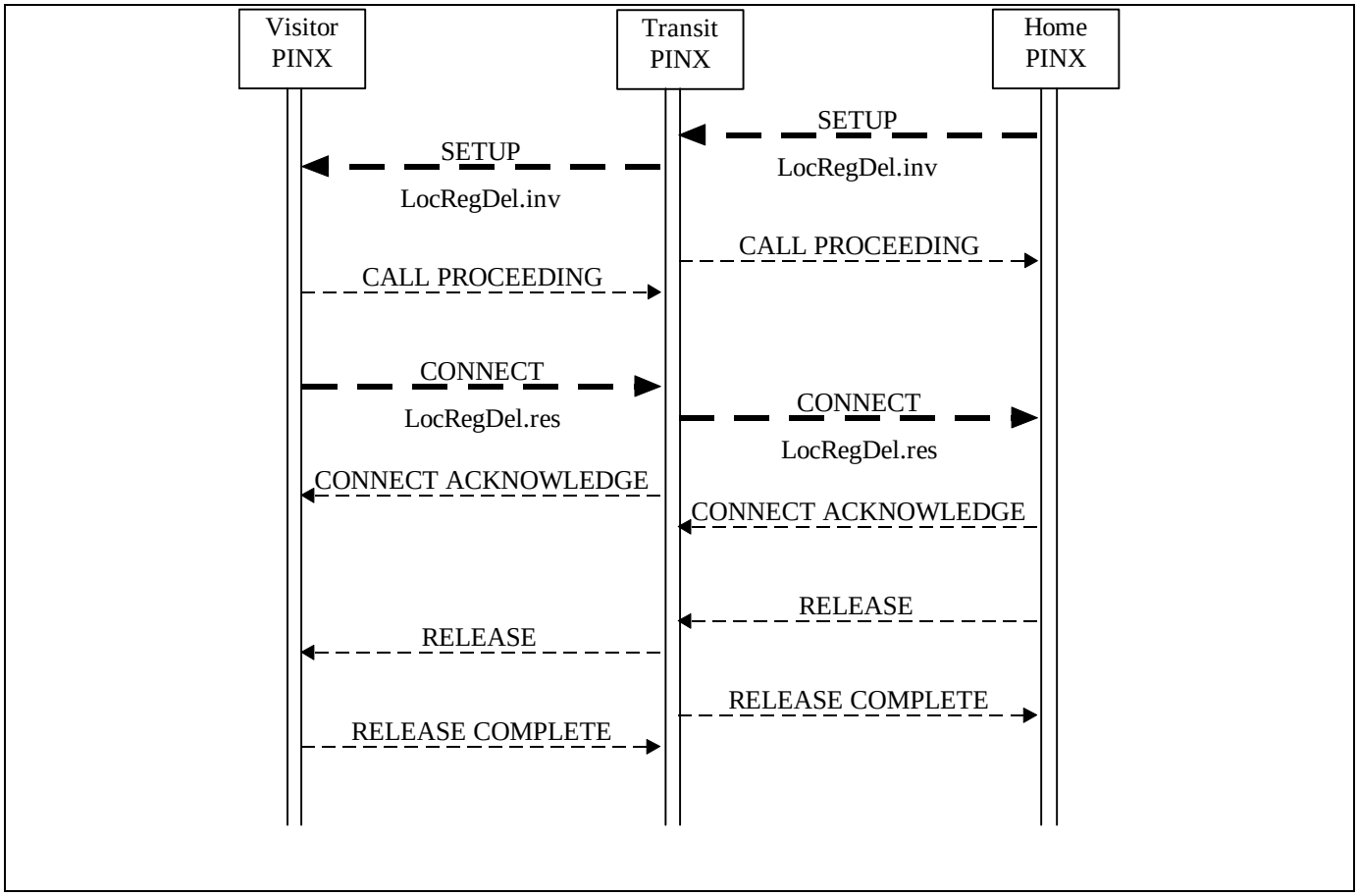


Figure C-4/JJ-20.60 Normal operation of inter-PINX location registration deletion

C.5 Normal operation of inter-PINX roaming call forwarding

Figure C-5/JJ20.60 shows an example of normal operation of inter-PINX roaming call forwarding.

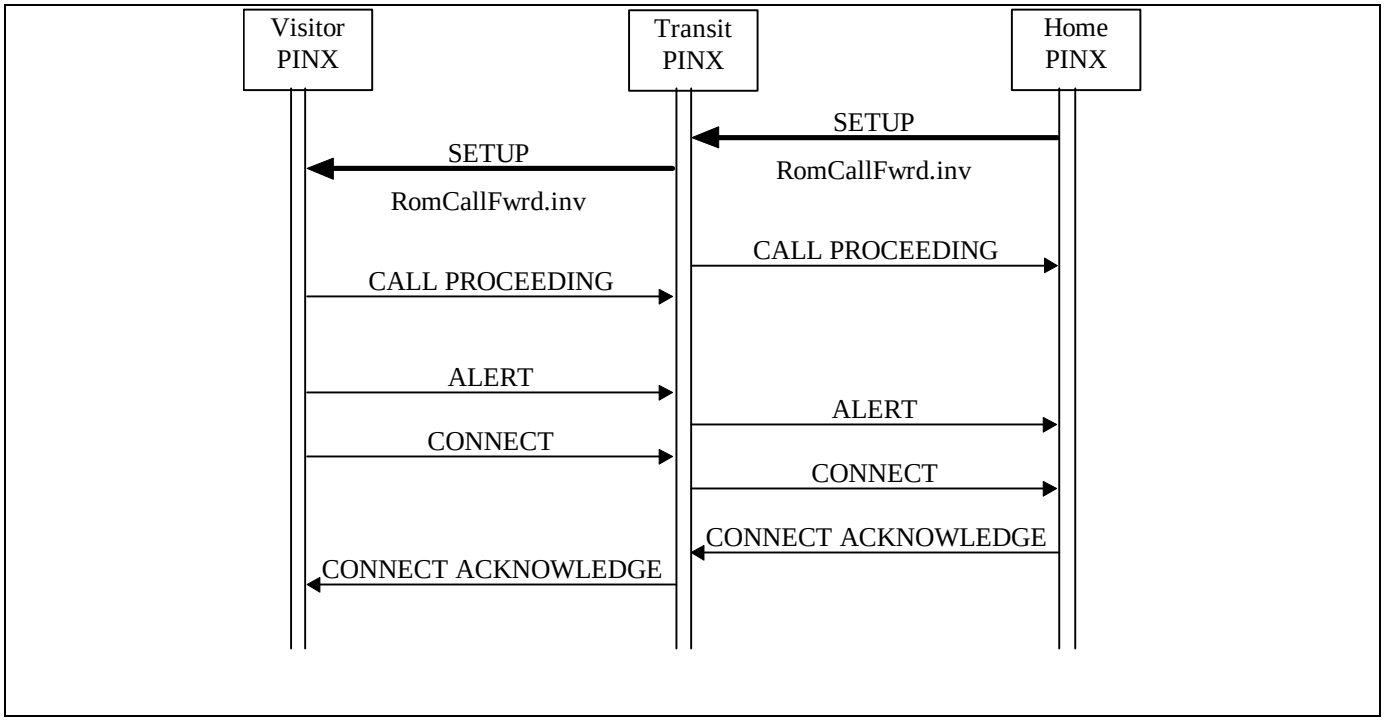


Figure C-5/JJ-20.60 Normal operation of inter-PINX roaming call forwarding

C.6 Normal operation of inter-PINX roaming call forwarding with inter-PINX authentication

Figure C-6/JJ20.60 shows an example of normal operation of inter-PINX roaming call forwarding with inter-PINX authentication.

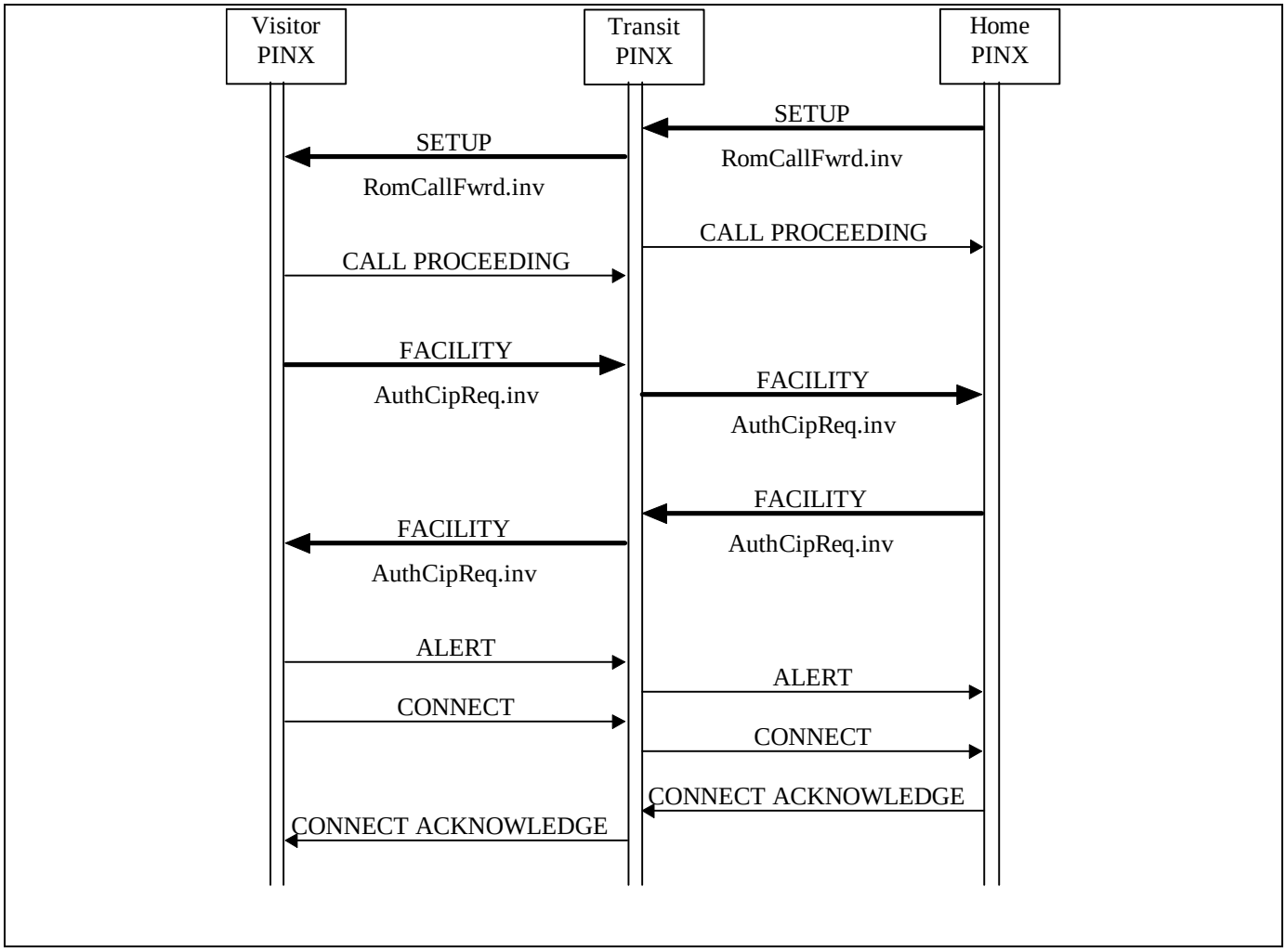


Figure C-6/JJ-20.60 Normal operation of inter-PINX roaming call forwarding with inter-PINX authentication

C.7 Unsuccessful operation of inter-PINX roaming call forwarding

Figure C-7/JJ20.60 shows an example of unsuccessful operation of inter-PINX roaming call forwarding. This operation is performed in the case when the Visitor PINX cannot recognise roaming PS .

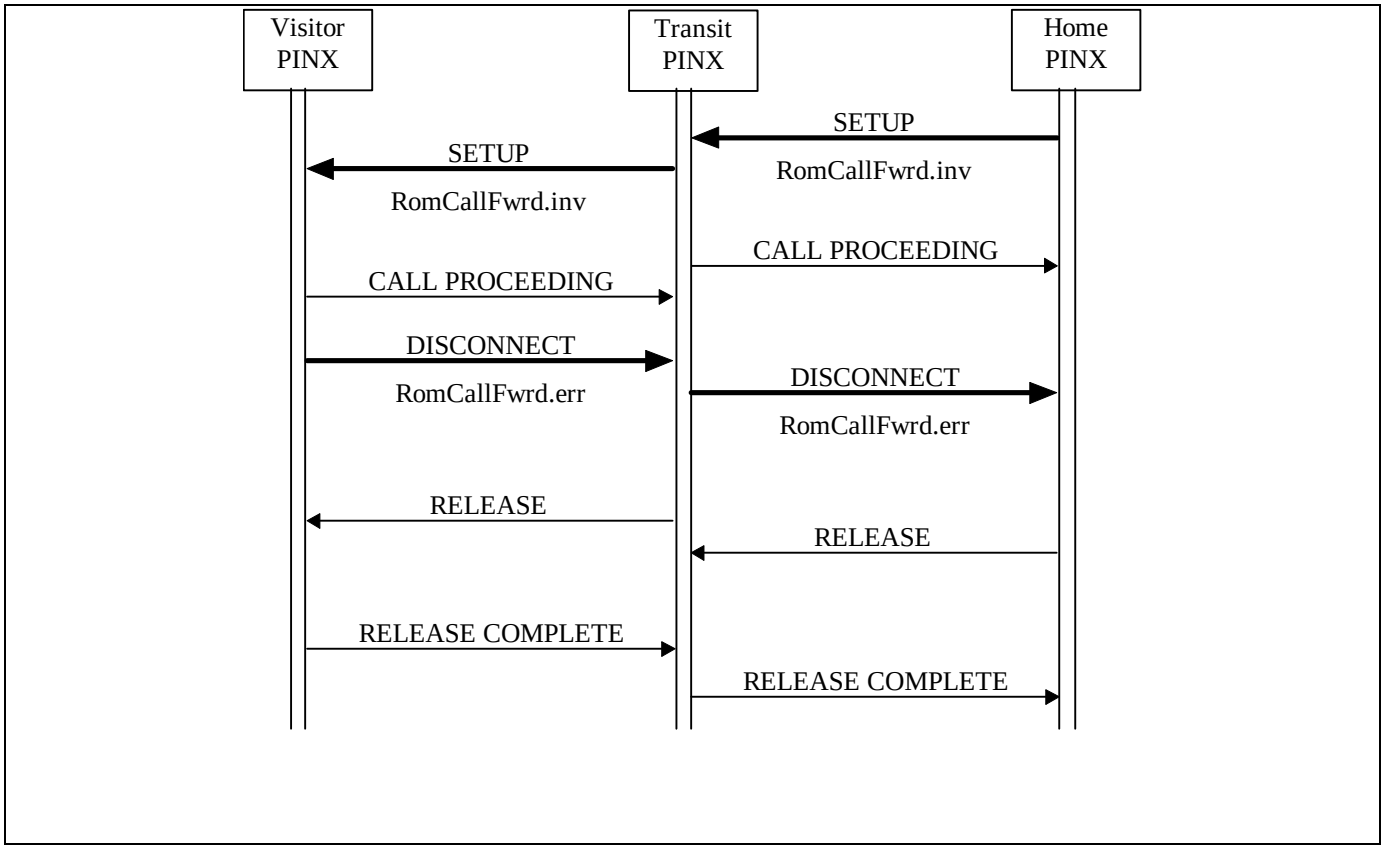


Figure C-7/JJ-20.60 Unsuccessful operation of inter-PINX roaming call forwarding

C.8 Normal operation of inter-PINX location information check

Figure C-8/JJ20.60 shows an example of normal operation of inter-PINX location information check.

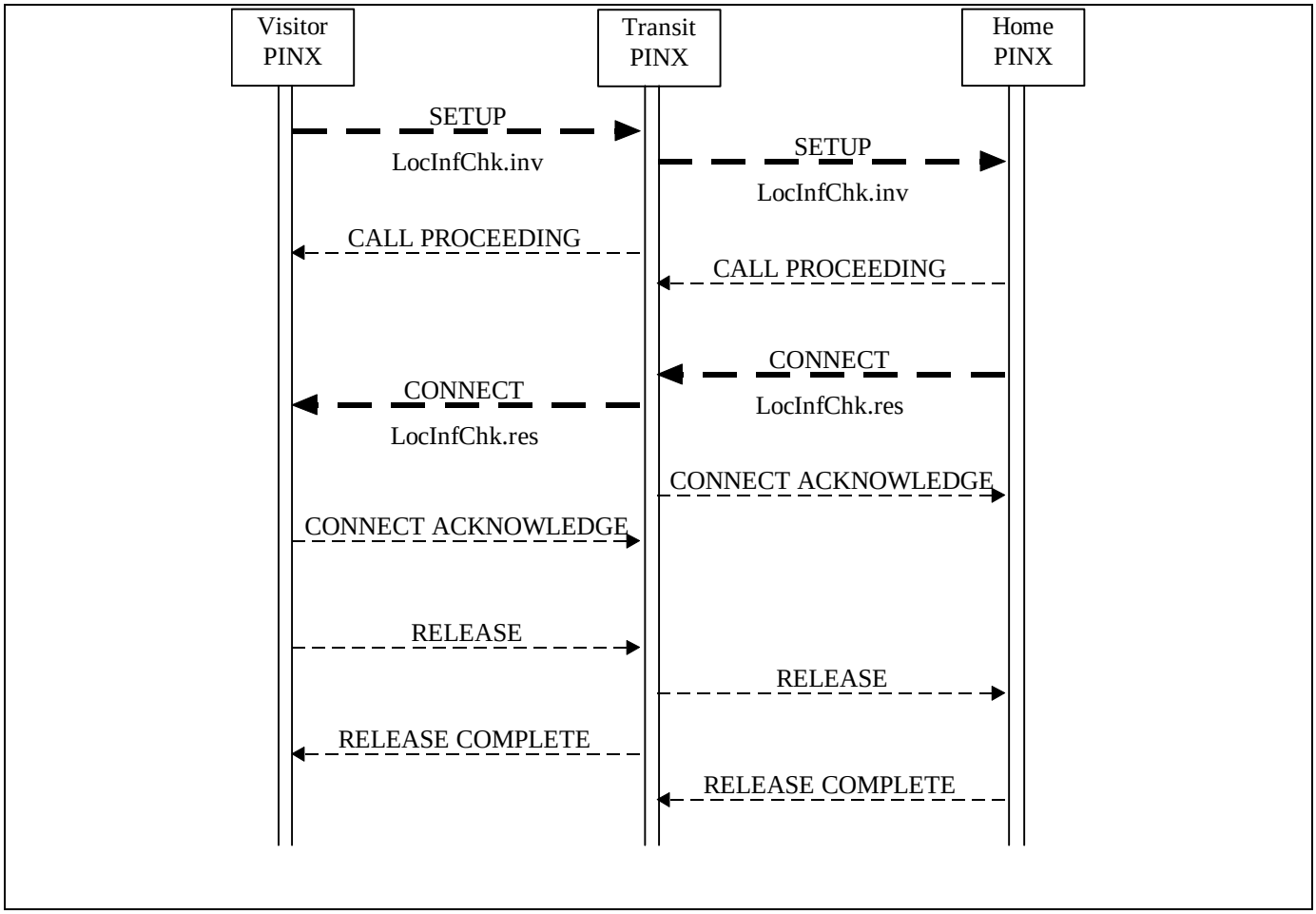


Figure C-8/JJ-20.60 Normal operation of inter-PINX location information check

C.9 Normal operation of inter-PINX authentication

Figure C-9/JJ20.60 shows an example of normal operation of inter-PINX authentication.

This operation is usually performed when location registration update, outgoing call and handover services are proceeding within the Visitor PINX in the case of Scenario 2.

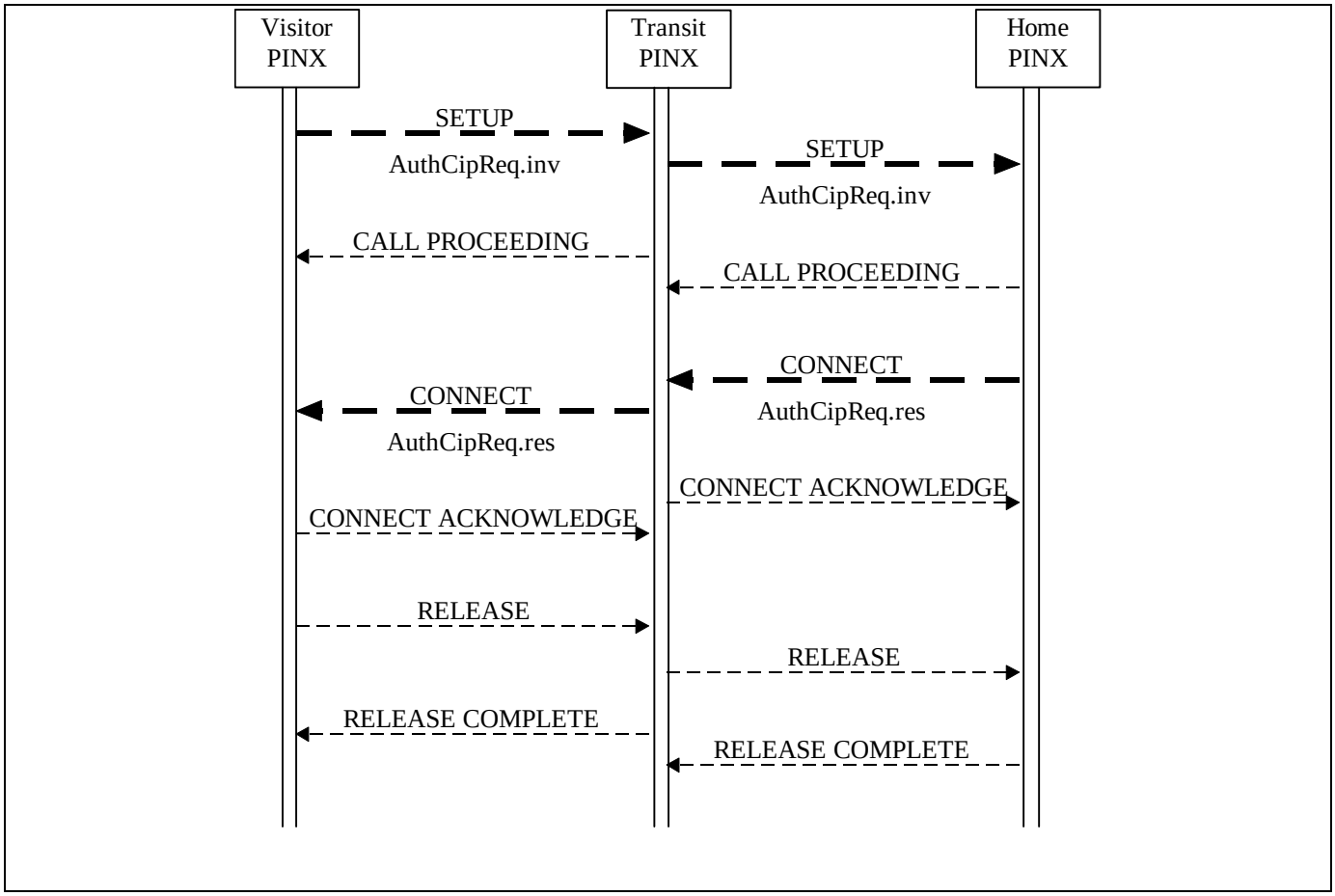


Figure C-9/JJ-20.60 Normal operation of inter-PINX authentication

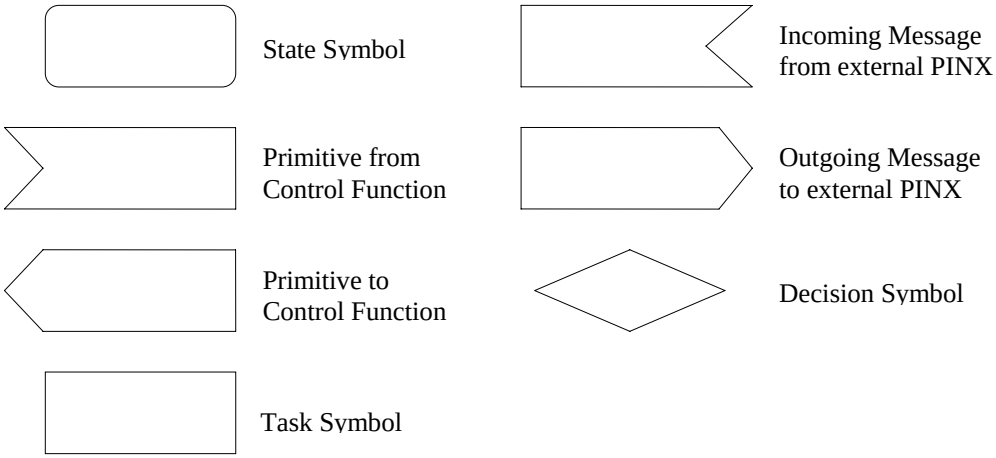
Annex D Specification and Description Language (SDL) Representation of Procedures

(Informative)

The diagrams in this annex represent the signalling procedures described in “6. SIGNALLING PROTOCOL FOR THE SUPPORT OF SS-IPR”.

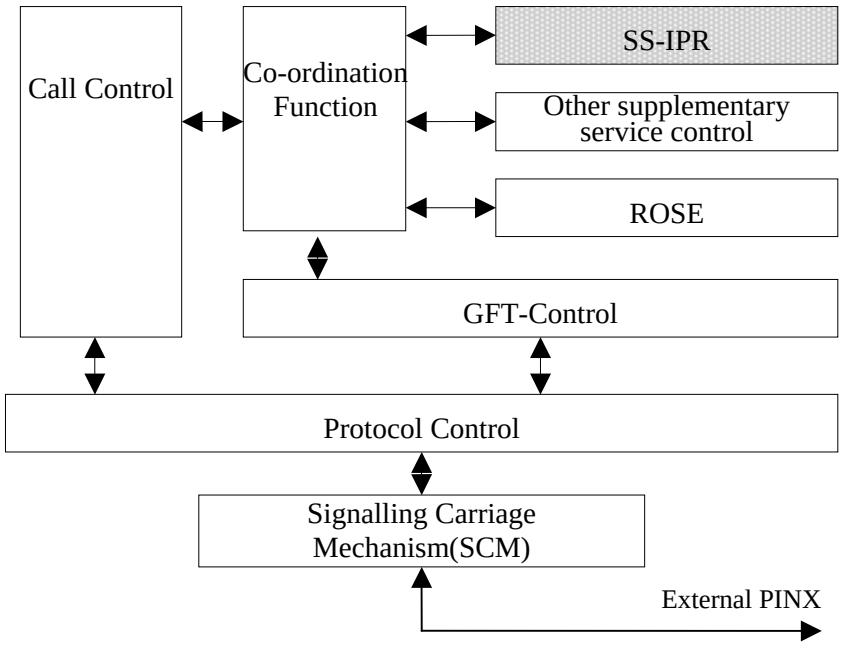
The procedures illustrated are not extend to be exhaustive, and several potential situations that may occur have been omitted from the diagrams (e.g. some error conditions and procedures).

1. In this Annex, symbols shown below are used.



Note - The Control Function in these symbols is equal to Call Control and Co-ordination Function of figure D-1/JJ-20.60. Actions of the Control Function are implementation dependent.

2. Position of Specification and Description Language (SDL) Representation of procedures in this annex



Supplementary service control described in the SDL diagrams in this annex.

Figure D-1/JJ20.60 Position of Specification and Description Language (SDL) Representation of procedures in this annex

Inter-PINX location registration update procedure (1/2)

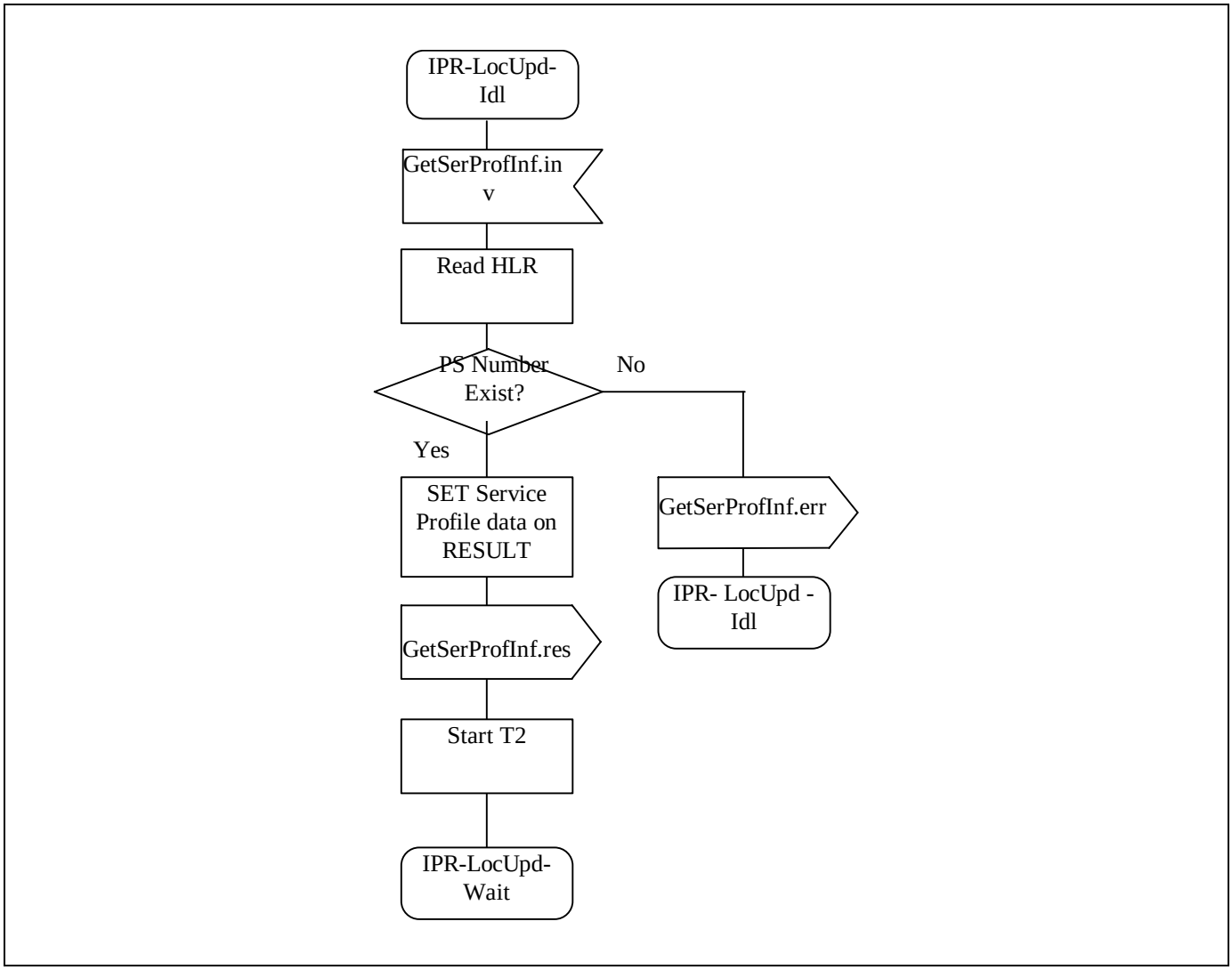


Figure D-2/JJ-20.60 (1/9) SDL representation of Home PINX

Inter-PINX location registration update procedure (2/2)

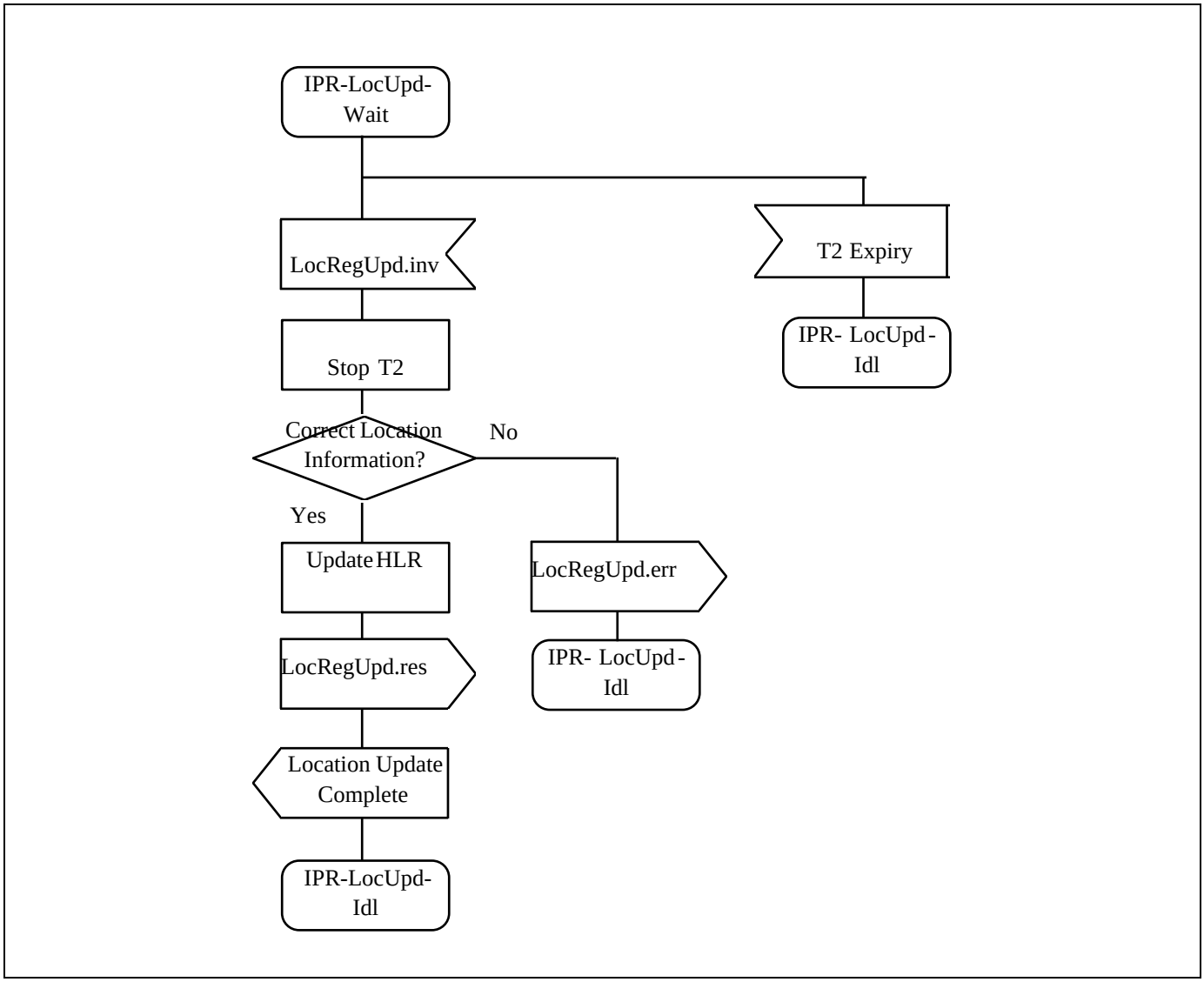


Figure D-2/JJ-20.60 (2/9) SDL representation of Home PINX

Inter-PINX location registration deletion procedure (1/1)

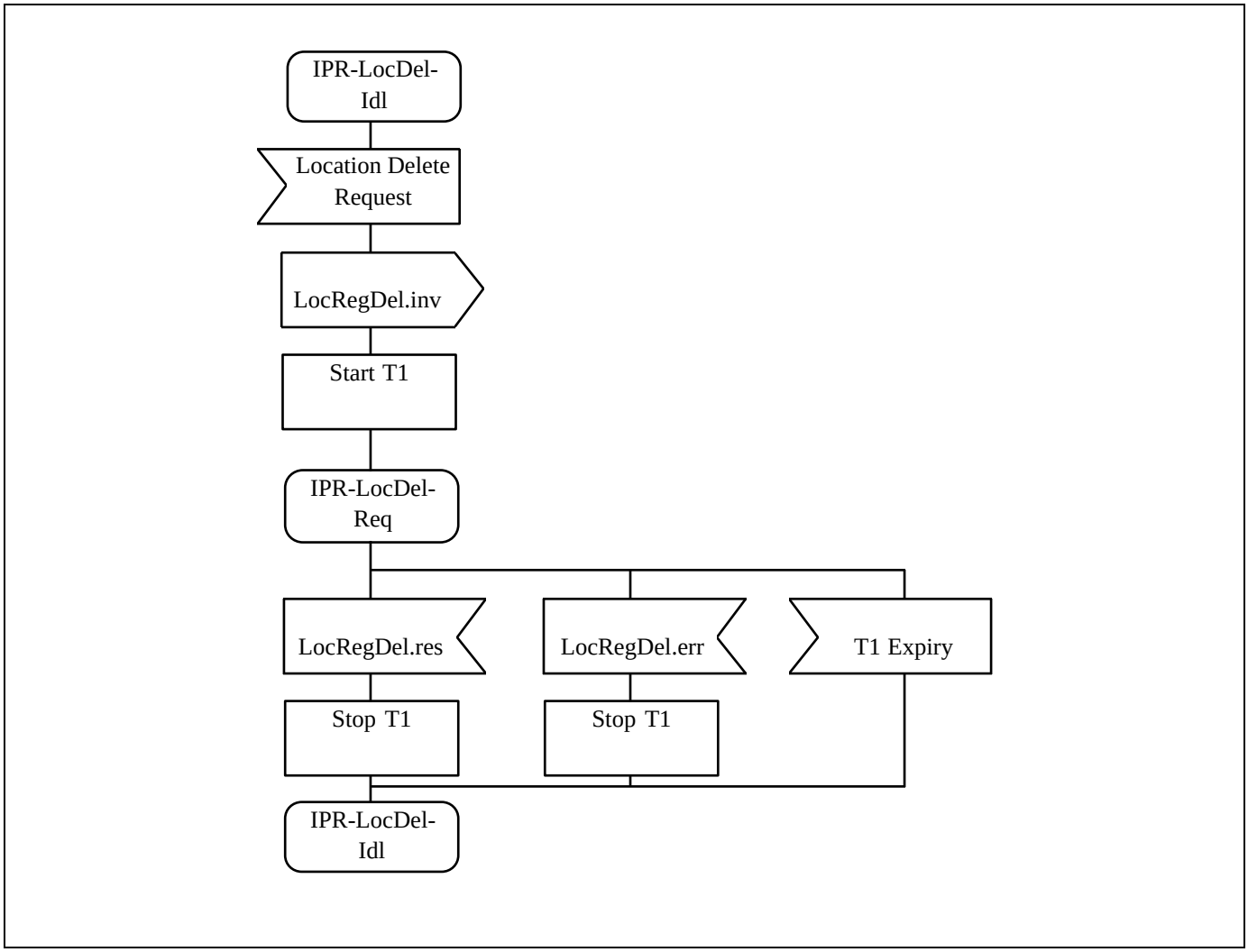


Figure D-2/JJ-20.60 (3/9) SDL representation of Home PINX

Inter-PINX roaming call forwarding procedure (1/1)

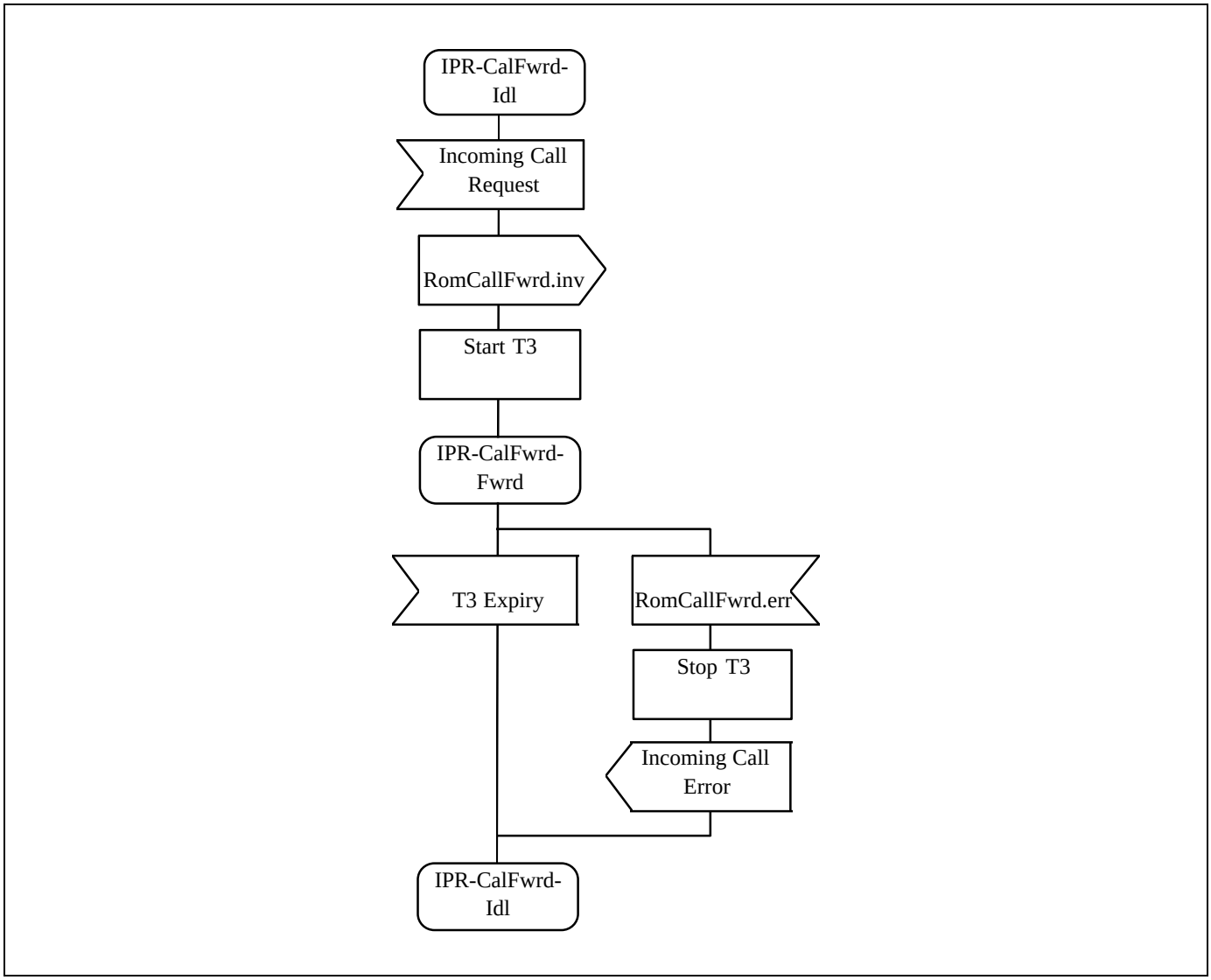


Figure D-2/JJ-20.60 (4/9) SDL representation of Home PINX

Inter-PINX location information check procedure initiated by the Home PINX (1/2)

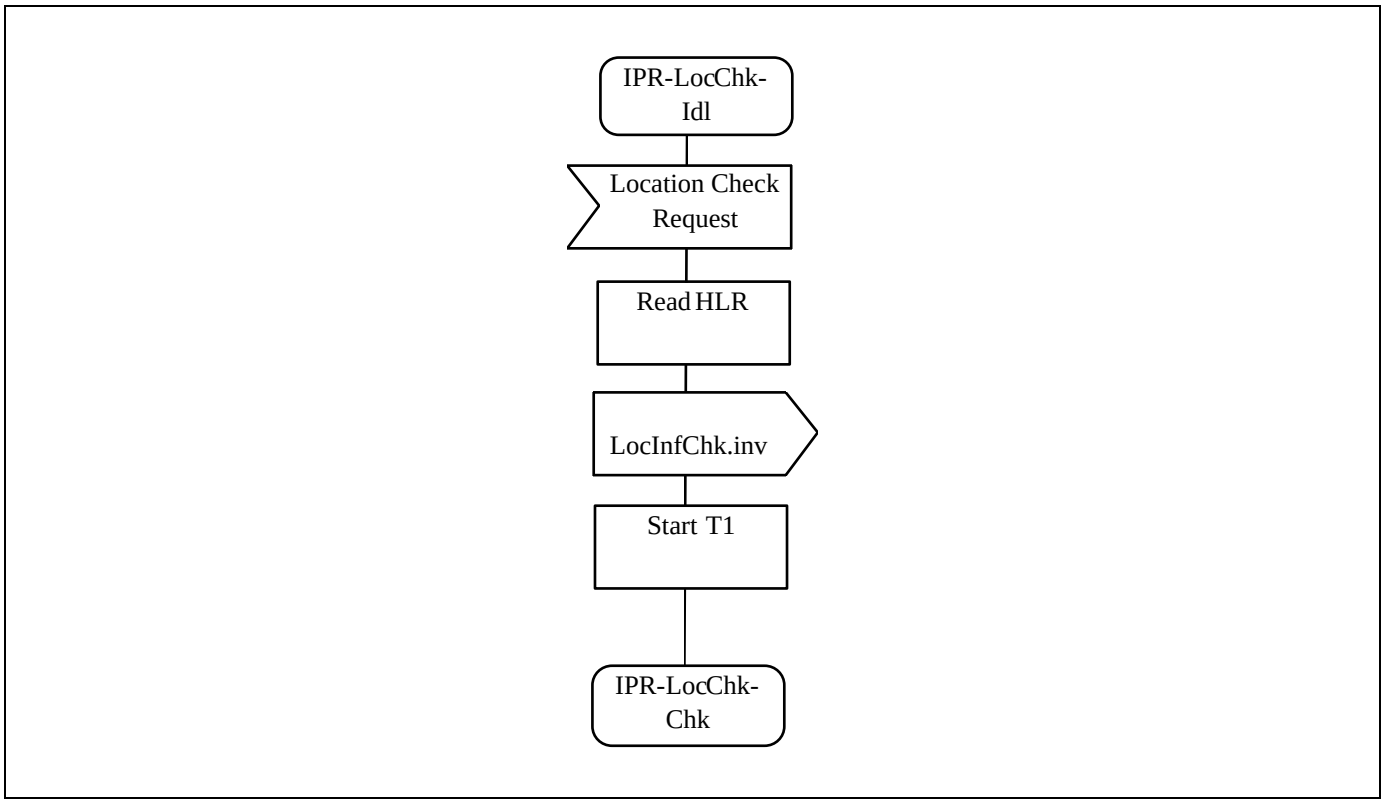


Figure D-2/JJ-20.60 (5/9) SDL representation of Home PINX

Inter-PINX location information check procedure initiated by the Home PINX (2/2)

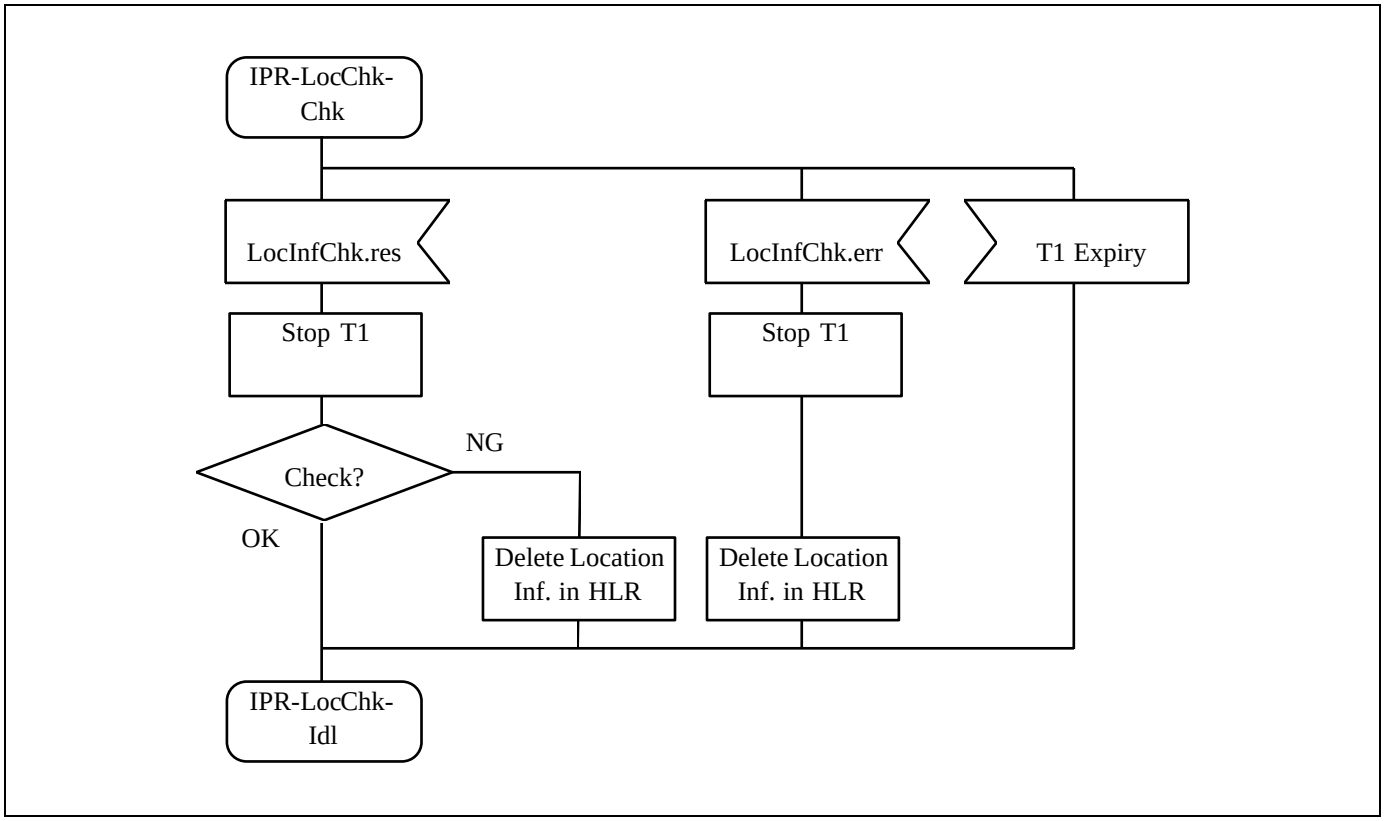


Figure D-2/JJ-20.60 (6/9) SDL representation of Home PINX

Inter-PINX location information check procedure initiated by the Visitor PINX (1/1)

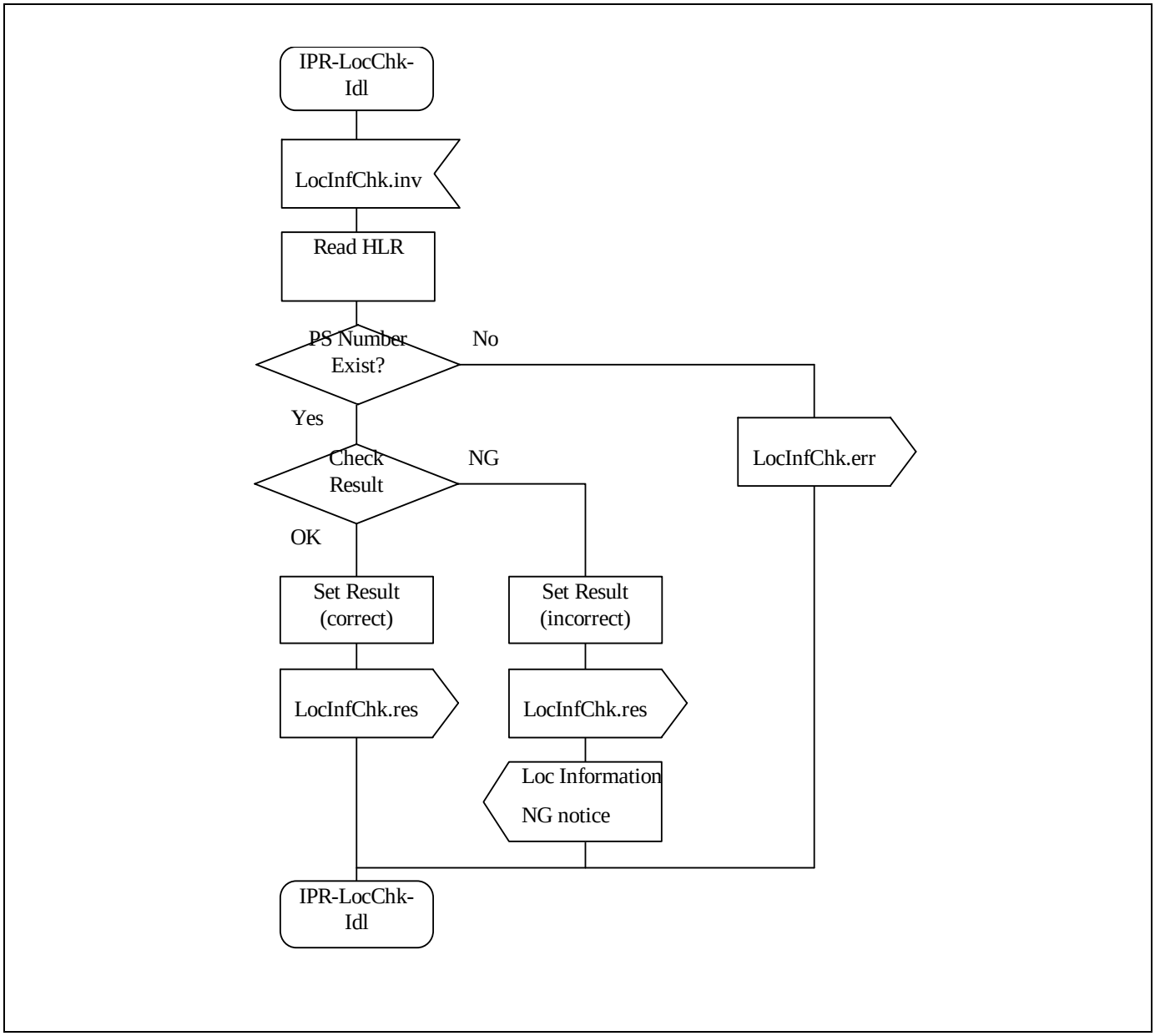


Figure D-2/JJ20.60 (7/9) SDL representation of Home PINX

Inter-PINX authentication cipher procedure (1/1)

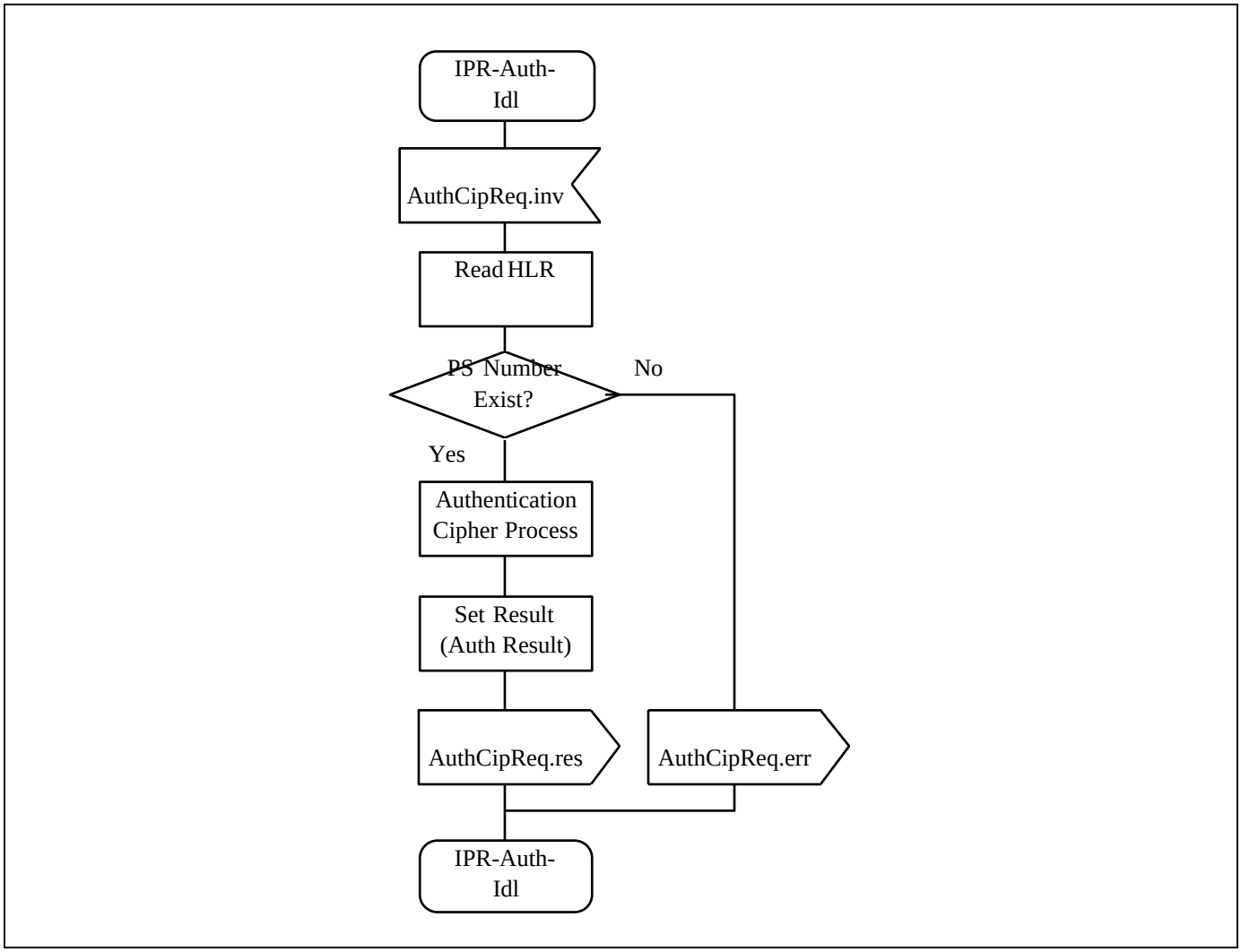


Figure D-2/JJ20.60 (8/9) SDL representation of Home PINX

Others (1/1)

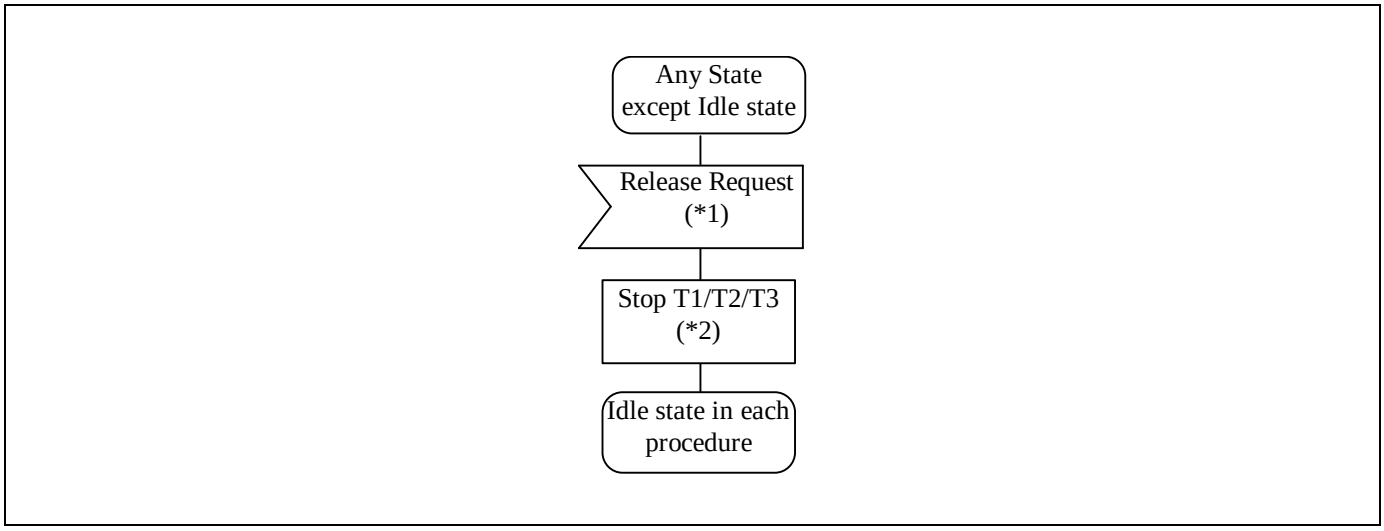


Figure D-2/JJ20.60 (9/9) SDL representation of Home PINX

*1 Receives Release Request when the SS-IPR is abandoned because of an error in the procedure or a premature abort.

*2 Stops if T1/T2/T3 has been started.

Inter-PINX location registration update procedure (1/2)

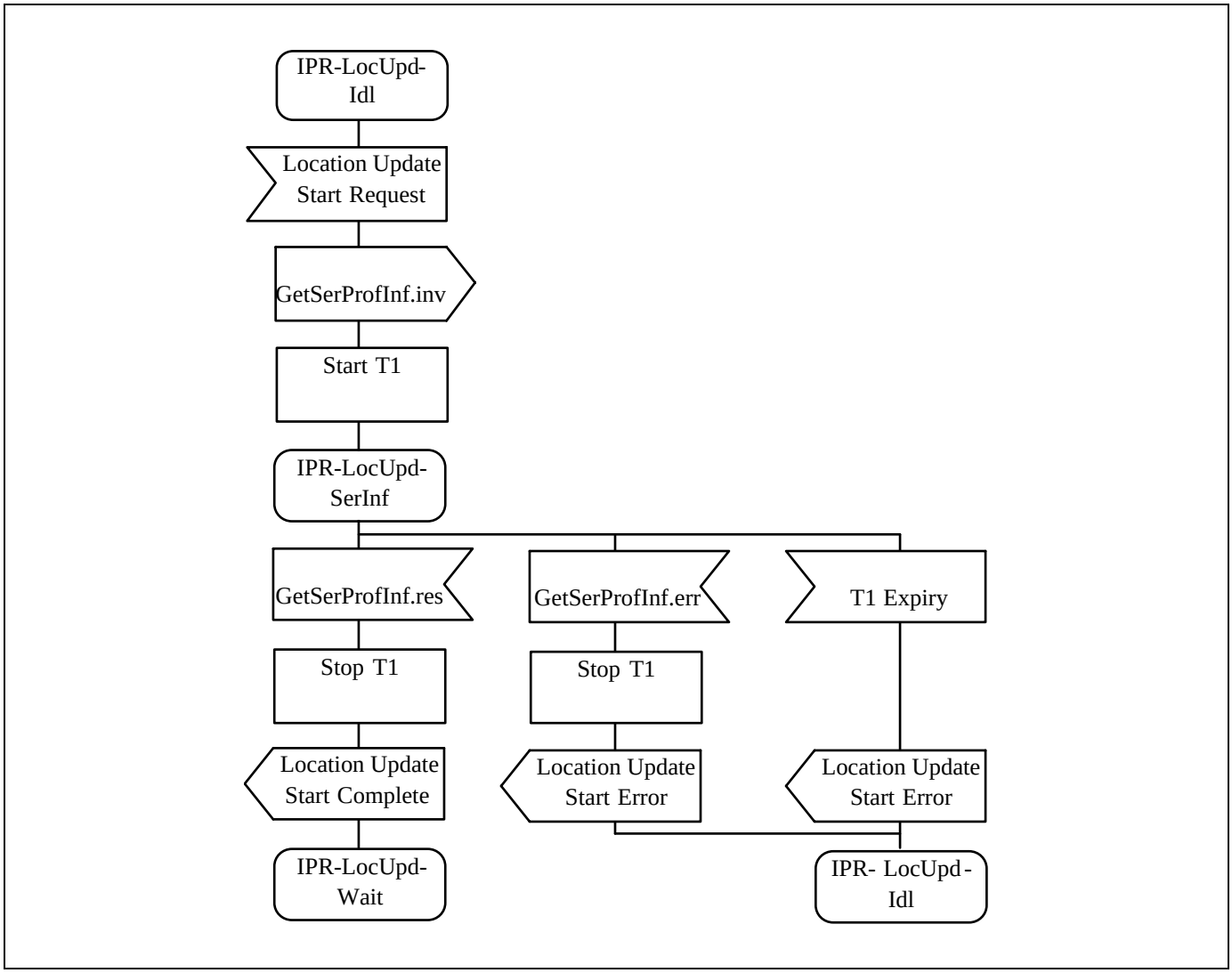


Figure D-3/JJ20.60 (1/10) SDL representation of Visitor PINX

Inter-PINX location registration update procedure (2/2)

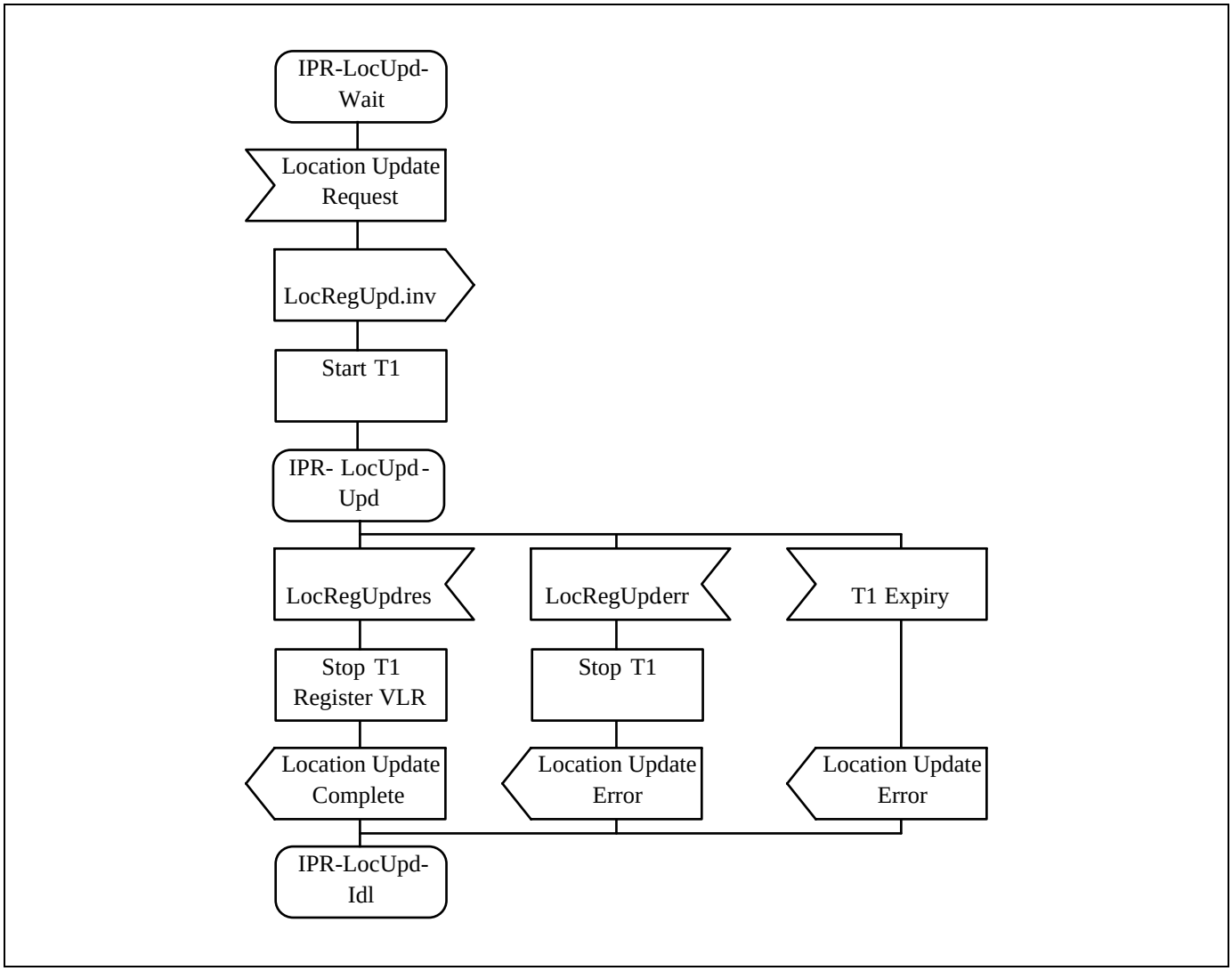


Figure D-3/JJ20.60 (2/10) SDL representation of Visitor PINX

Inter-PINX location registration deletion procedure (1/1)

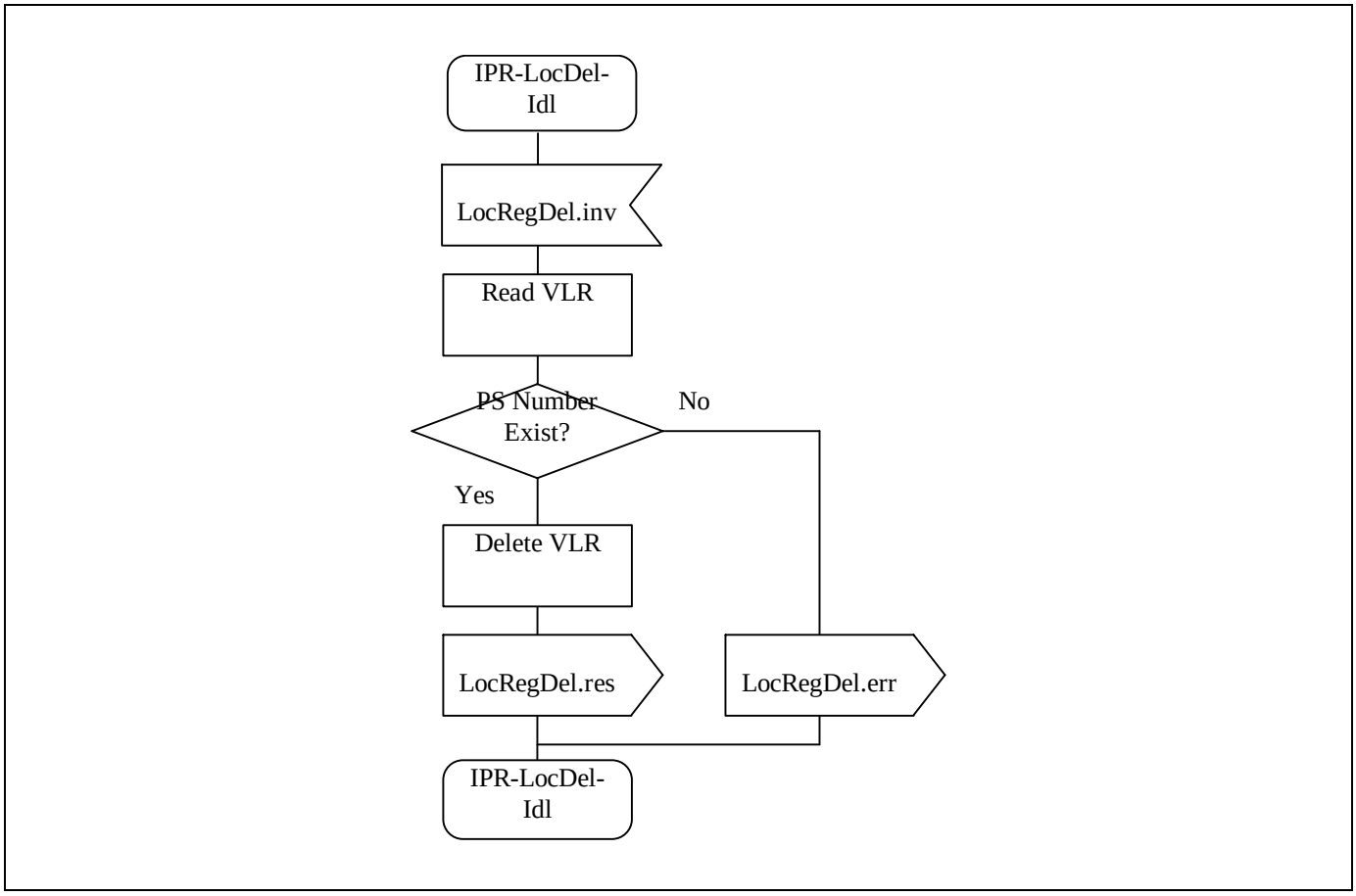


Figure D-3/JJ20.60 (3/10) SDL representation of Visitor PINX

Inter-PINX roaming call forwarding procedure (1/1)

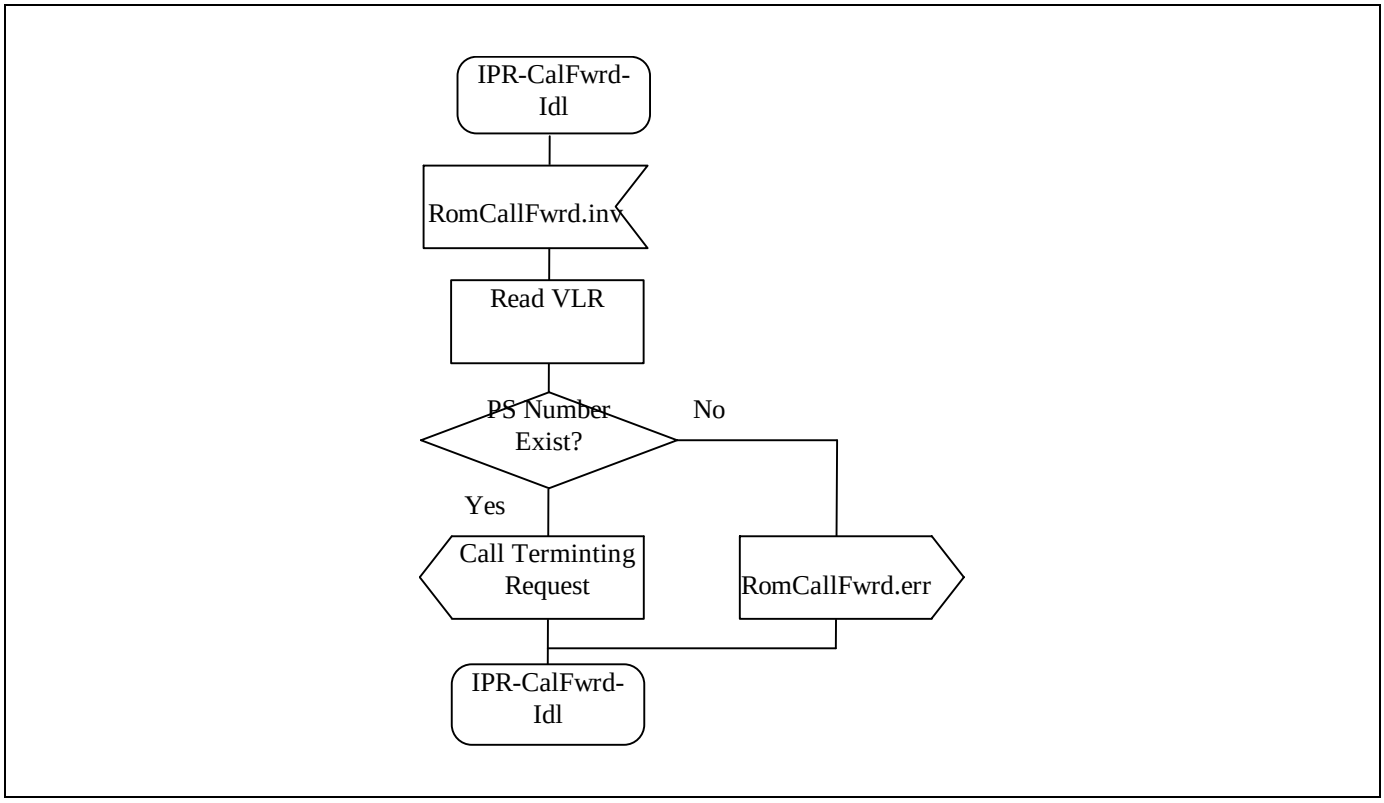


Figure D-3/JJ20.60 (4/10) SDL representation of Visitor PINX

Inter-PINX location information check procedure (Enquiry to Home PINX) (1/2)

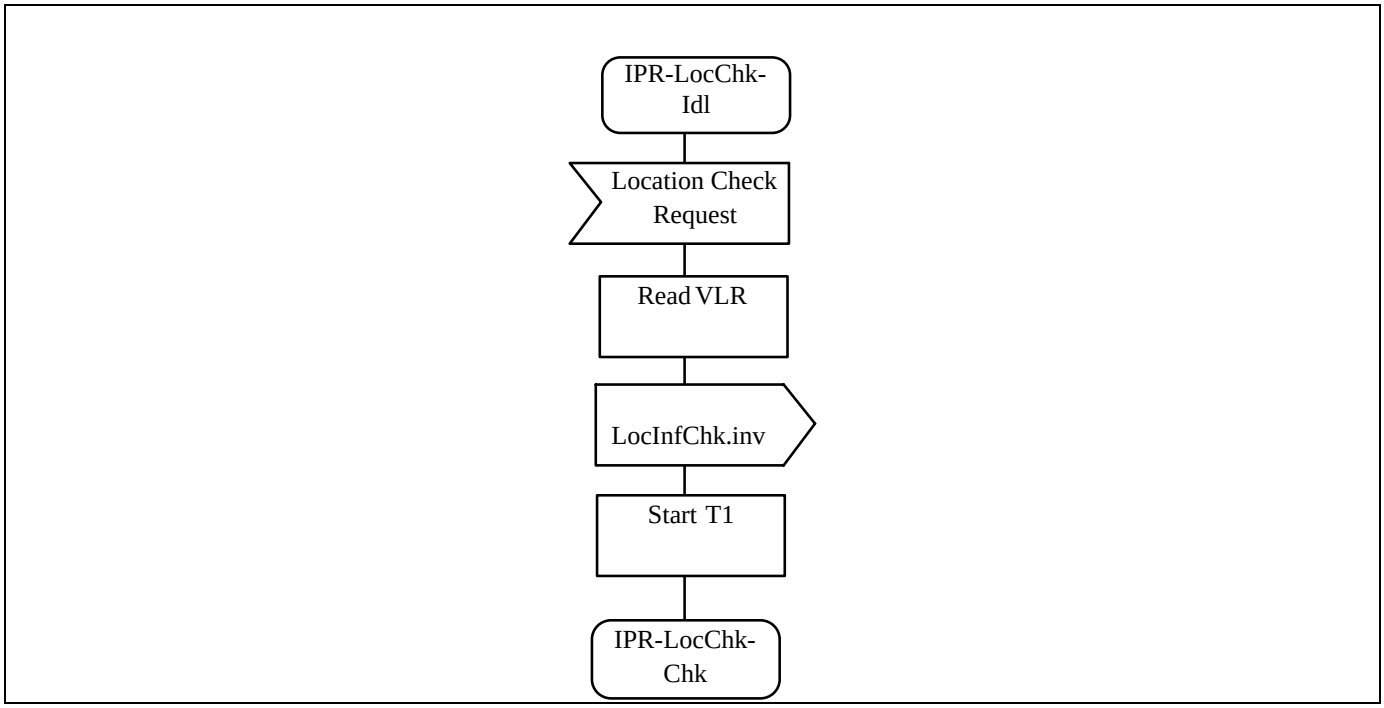


Figure D-3/JJ20.60 (5/10) SDL representation of Visitor PINX

Inter-PINX location information check procedure (Enquiry to Home PINX) (1/2)

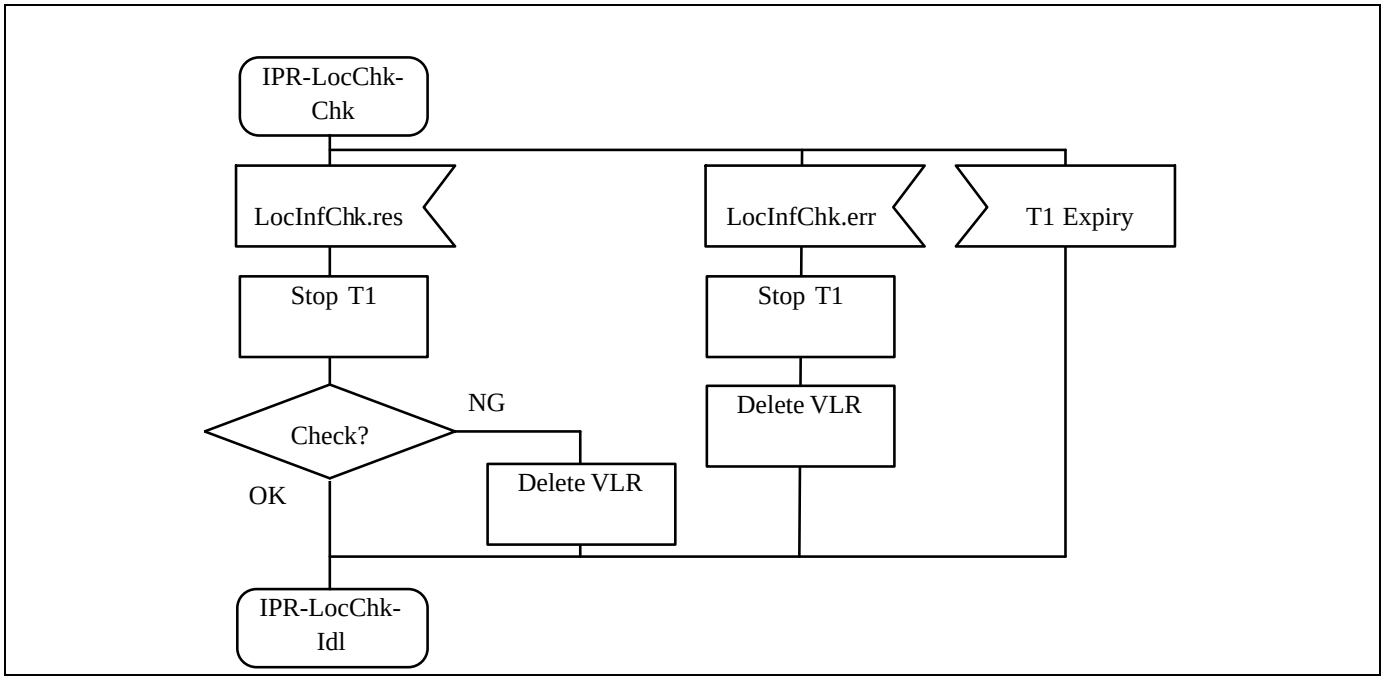


Figure D-3/JJ20.60 (6/10) SDL representation of Visitor PINX

Inter-PINX location information check procedure (Enquiry from Home PINX) (1/1)

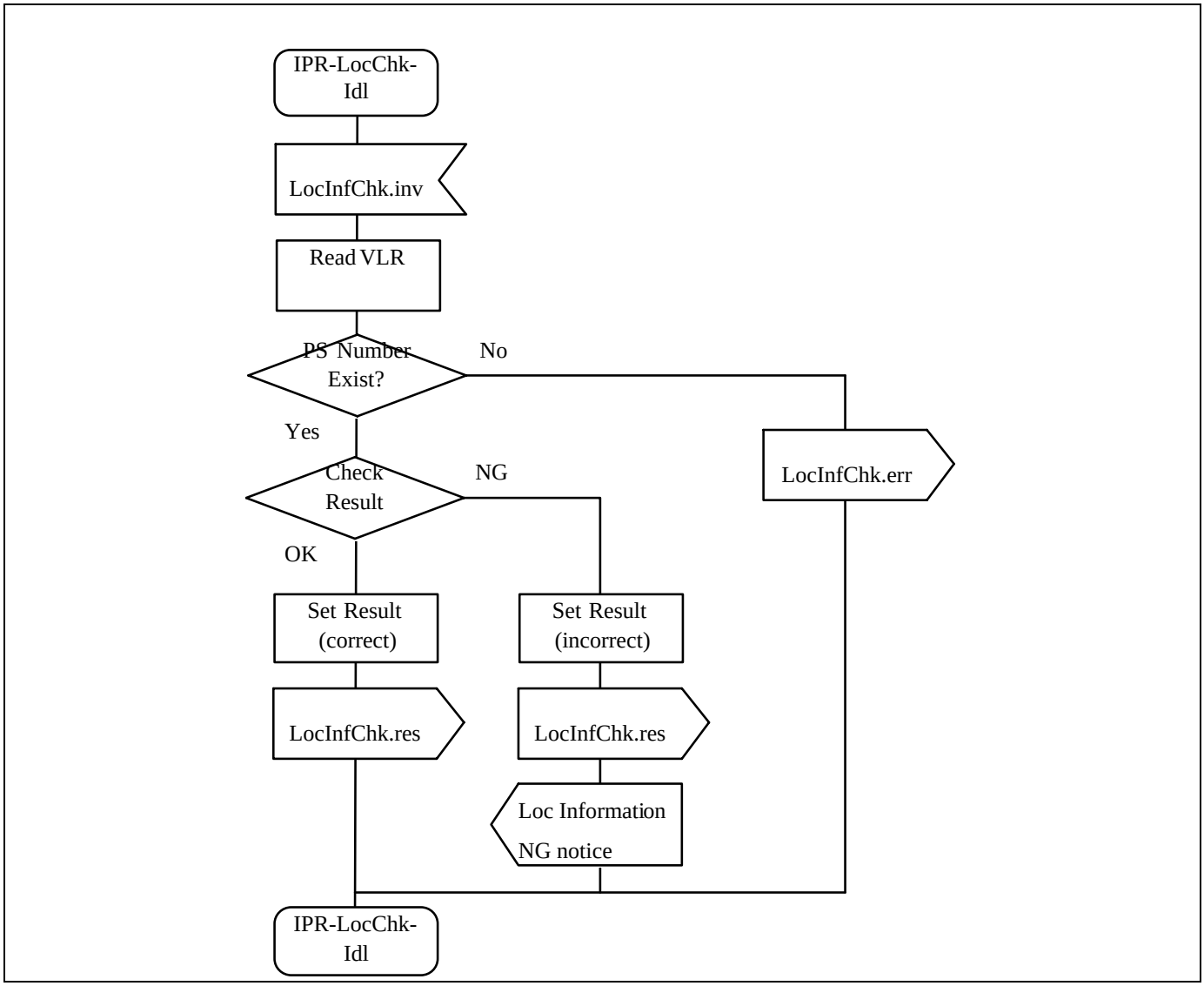


Figure D-3/JJ20.60 (7/10) SDL representation of Visitor PINX

Inter-PINX authentication cipher procedure (1/2)

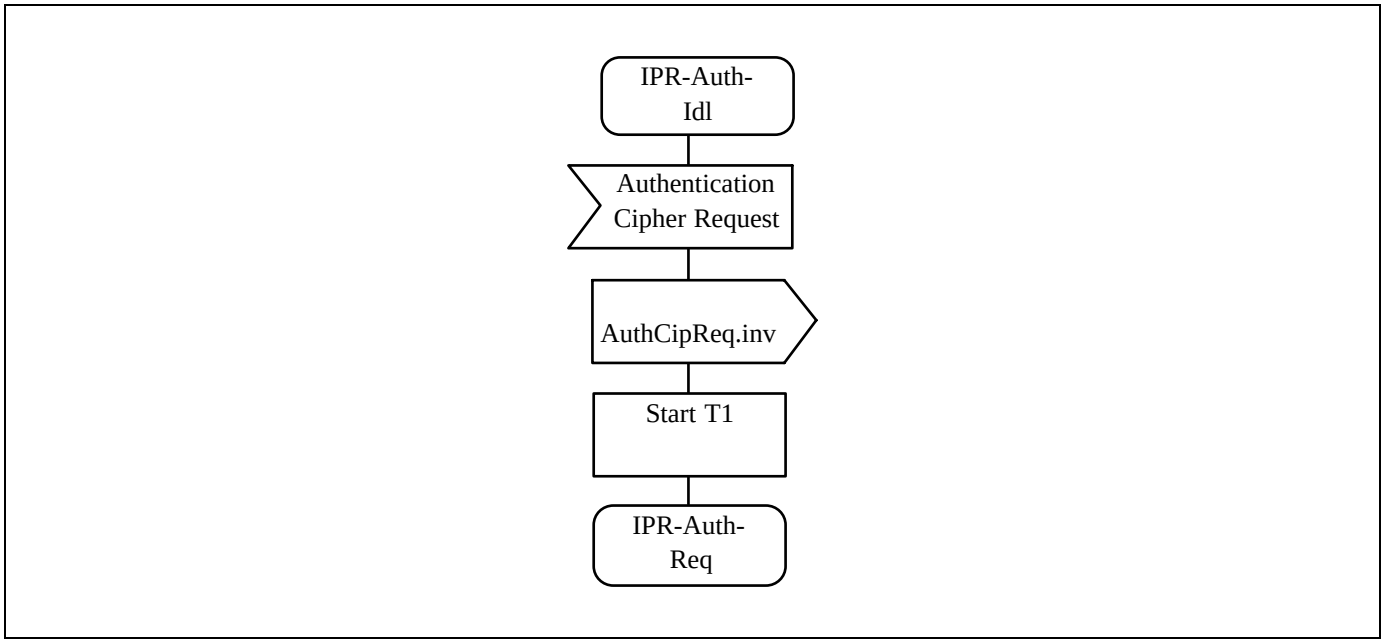


Figure D-3/JJ20.60 (8/10) SDL representation of Visitor PINX

Inter-PINX authentication cipher procedure (2/2)

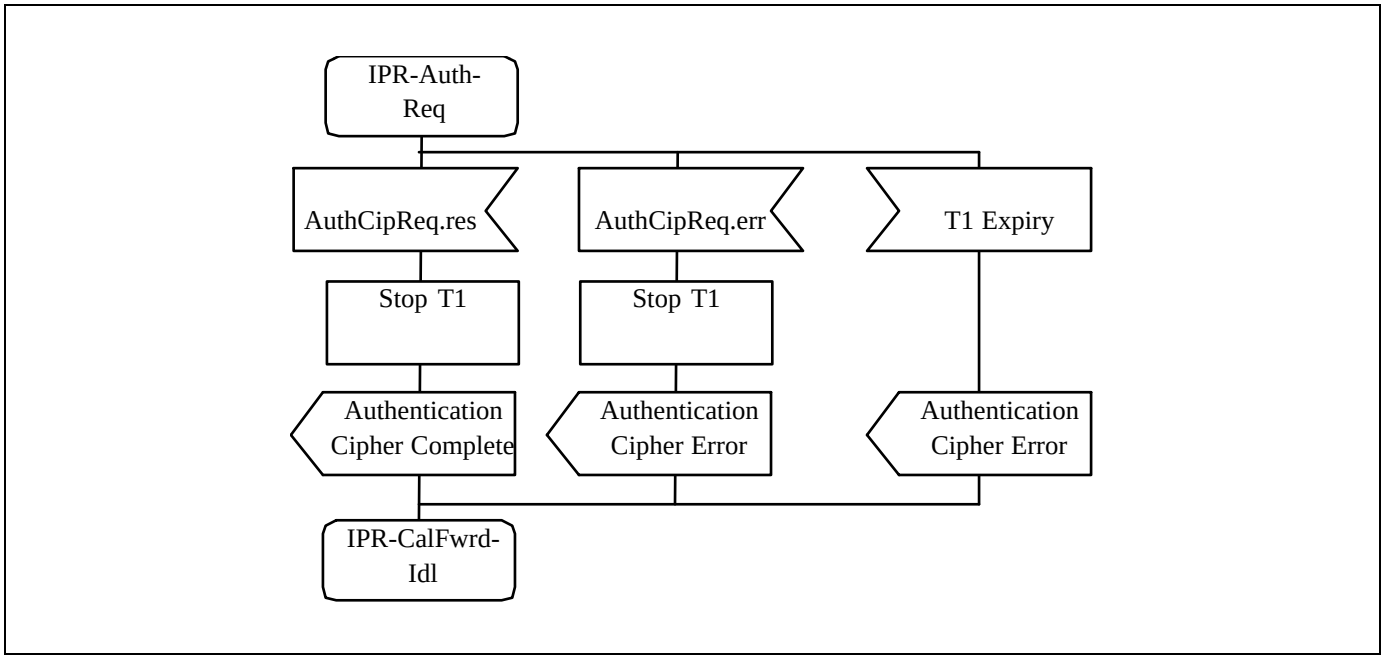


Figure D-3/JJ20.60 (9/10) SDL representation of Visitor PINX

Others (1/1)

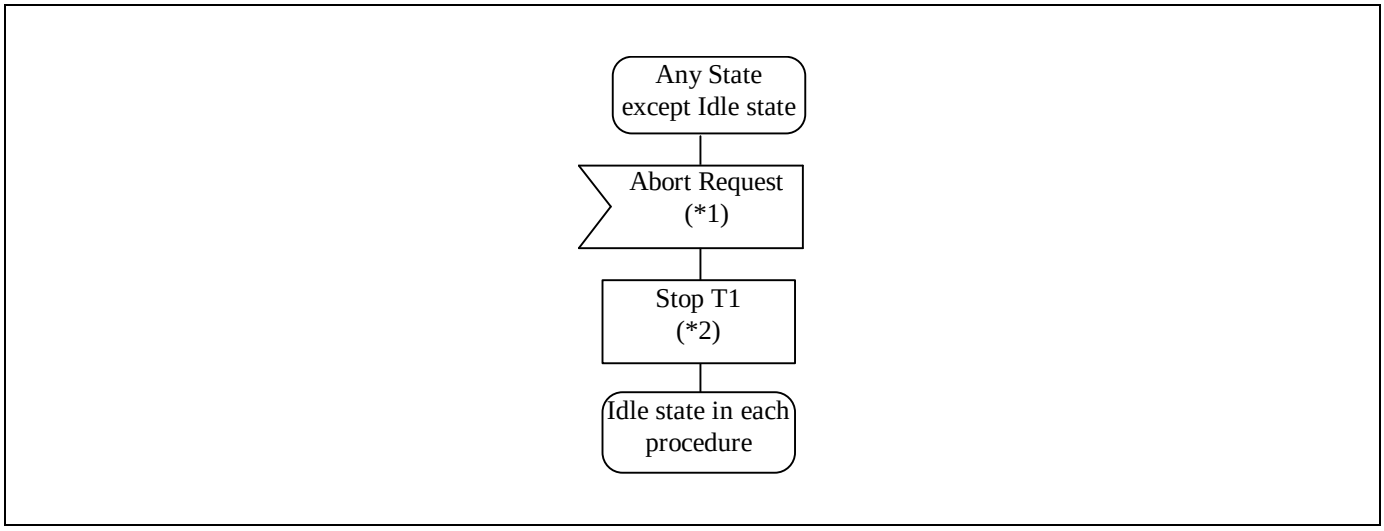


Figure D-3/JJ20.60 (10/10) SDL representation of Visitor PINX

*1 Received when the SS-IPR procedure has been started and must be abandoned because of an authentication failure or an error in the procedure or a premature abort.

*2 Stops if T1 timer has been started.

Annex E SS-IPR stages 1 and 2 description

(Informative)

These annex overviews SS-IPR stages 1 and 2 in order to assist the understanding of the stage 3 described in this Standard.

E.1 SS-IPR stage 1 overview

This section shows the SS-IPR service description.
The SS-IPR is provided by combining the appropriate SS-IPR functions.

E.1.1 Definition of the SS-IPR functions

E.1.1.1 SS-IPR functions

SS-IPR function is a function to operate SS-IPR and offers following basic functions, to receive the authentication cipher result.

(1) Inter-PINX authentication cipher

The function to request the Home PINX of the calculation of the PS authentication algorithm.

(2) Inter-PINX service profile get

The function to inquire the Home PINX of the service conditions (PS-ID, authentication information, etc.) of the PS.

(3) Inter-PINX location information check

The function to check the location information of the PS between the Home PINX and Visitor PINX.

(4) Inter-PINX location registration update

The function to register the PS location information in the Home PINX to forward a incoming call to the Visitor PINX.

(5) Inter-PINX location registration deletion

The function to delete the PS location information stored in the previous Visitor PINX when the PS roams into a new Visitor PINX or comes back into Home PINX.

(6) Call originating

The function to enable the PS to originate a call in the Visitor PINX.

(7) Call terminating

The function to route a call for the PS to the Visitor PINX. All the calls to the PS shall be routed via the Home PINX.

The issues left for the future study are the function to route a originating call via the Home PINX, to terminate a call by re-routing mechanism, inter-PINX handover and so on.

E.1.2 SS-IPR service specifications

E.1.2.1 Registration

The following conditions may apply to the SS-IPR registration.

(1) A PS which supports (or does not support) the SS-IPR shall be registered in the Home PINX.

(2) A PINX to which a PS can (or cannot) roam shall be registered in the Home PINX of the PS.

(3) The Home PINX from which a PS can (or cannot) roam shall be registered in another PINX.

These registration conditions may be used locally by each PINX if the SS-IPR are provided only to specific PSs and/or PINXs.

On receipt of an inter-PINX roaming request from a PS or a PINX which is not allowed the SS-IPR, the Home PINX shall either ignore the request or send a reject response to the Visitor PINX.

On receipt of an inter-PINX roaming request from a PS whose Home PINX is not allowed the SS-IPR, the Visitor PINX shall either ignore the request or send a reject response to the PS.

E.1.2.2 Authentication

This Standard provides the following three authentication Scenarios.

Scenario 1 is the case where the authentication algorithm is same for all PINX within the PISN and the authentication keys of all PS are available for all PINX within a PISN.

Scenario 1a is the extension of Scenario 1 with allowing multiple authentication algorithm.

Scenario 2 is the other cases.

E.1.2.3 SS-IPR service profile

The SS-IPR service profile information of the PS is defined only about the SS-IPR.

E.1.2.4. SS-IPR service profile structure

The SS-IPR service profile information is classified into static and dynamic information. The static information cannot be updated from the Visitor PINX and the dynamic information can be updated from the Visitor PINX through the location registration update, etc.

The SS-IPR service profiles of the PS shall always be stored in the Home PINX. During the inter-PINX roaming, a part of the SS-IPR service profile information shall be stored in the VLR of the Visitor PINX.

E.1.2.4.1 Static information

The following describes the static information which the Visitor PINX can read from the Home PINX.

(1) PS number

The unique number in the PISN used to identify a PS. The PS number includes the Home PINX number by which the Visitor PINX shall identify the Home PINX of the PS.

(2) Subscriber class

The class of a PS subscriber which the Visitor PINX reads from the Home PINX to serve the PS. The subscriber class includes restriction class and tenant number.

(3) Authentication key information

The information which the Visitor PINX reads from the Home PINX to authenticate the PS. This information is readable by Visitor PINX only in Scenario 1.

(4) Authentication information

The information used by the Visitor PINX to generate an authentication random number and receive the result. This information, including authentication type and length of authentication random number, is readable by Visitor PINX only in Scenario 2.

E.1.2.4.2 Dynamic information

The following describes the dynamic information.

(1) Location information

The inter-PINX roaming number is the location information used by the Home PINX to terminate a call to the PS. The inter-PINX roaming number includes the Visitor PINX number.

E.1.2.5 Access to the SS-IPR service profiles

The SS-IPR service profiles shall be accessed by the following procedure. The Home PINX shall send back or update the requested information only if the requesting PINX or PS satisfies the service registration conditions.

(1) SS-IPR service profile get

(2) Inter-PINX location information check

(3) Inter-PINX location registration update

E.1.3 SS-IPR procedures

This section contains the general descriptions of the SS-IPR procedures to support the SS-IPR functions described in E.1.1.1.

E.1.3.1 Inter-PINX location registration procedure

This procedure is shall be executed by the Visitor PINX when the PS roams into the Visitor PINX.

ìInter-PINX location registration procedure is a generic name given for the series of the processes composed of Service profile get, Authentication, Inter-PINX location registration update.

E.1.3. 1.1 SS-IPR service profile get

This procedure shall be used by the Visitor PINX to request to get the SS-IPR service profile from the Home PINX. The SS-IPR service profile shall then be stored in the VLR.

E.1.3.1.2 Authentication of PS

This procedure shall be used by the Visitor PINX to verify the validity of the PS.

The following basic procedure may be executed in Scenario 2.

(1) Authentication

The Inter-PINX location registration update procedure may be aborted because of a failure in the authentication.

E.1.3.1.3 Inter-PINX location registration update

This procedure shall be used by the Visitor PINX to register in the Home PINX the dynamic information indicating the location of the PS. In the location registration update, the Visitor PINX shall assign a inter-PINX roaming number and send it to the Home PINX as the location information.

E.1.3.2 Inter-PINX location registration deletion

This procedure shall be used by the Home PINX to delete from the Visitor PINX the location information and SS-IPR service profiles of the PS.

E.1.3.3 Call originating

The call originating procedure shall be used to originate a call from a PS.

The following procedure may be executed as a part of this procedure.

(1) Authentication

Inter-PINX authentication cipher procedure is invoked in Scenario 2.

The call originating procedure may be aborted because of a failure in the authentication.

E.1.3.4 Call terminating

The call terminating procedure shall be used to terminate a call to the PS. This procedure shall be executed only for the PSs with inter-PINX location registration updated. The call shall be terminated to the PS with the inter-PINX roaming number assigned in the location registration update.

The following procedure shall be executed as a part of this procedure.

(1) Authentication

Inter-PINX authentication cipher procedure is invoked in Scenario 2.

The call terminating procedure may be aborted because of a failure in the authentication.

E.1.3.5 Inter-PINX location information check

This procedure shall be used to check the location information between the Home and Visitor PINX. The Visitor PINX shall request the Home PINX to check the location information of a PS which is registered in the VLR, and the Home PINX shall request the Visitor PINX to check the location information of a PS which is registered in the HLR.

E.1.3.6 Inter-PINX authentication cipher

This procedure shall be used by the Visitor PINX to verify the validity of the PS. Inter-PINX authentication cipher procedure is invoked in Scenario 2. The Visitor PINX shall assign an authentication random number and request authentication cipher to the Home PINX. The Home PINX shall return authentication cipher result. The Visitor PINX shall compare the authentication cipher result from the Home PINX and the response from the PS.

E.1.3.7 Handover

The handover procedure shall be used to hand over within the Visitor PINX.

It is imperative that the call originating or terminating procedure should be successfully completed before this procedure.

The following procedure shall be executed between Visitor PINX and Home PINX as a part of this procedure.

(1) Authentication

Inter-PINX authentication cipher procedure is invoked in Scenario 2.

The handover procedure may be aborted because of a failure in the authentication.

E.2 SS-IPR stage 2 overview

This section shows the functional model and information flow of SS-IPR. Transit PINXs are omitted from figure E-1/JJ20.60 because transit PINXs should have only relaying functions of JS-11582, so they need not have functions of SS-IPR.

E.2.1 Functional model

Figure E-1 shows the functional model of a PISN required to implement SS-IPR.

(Functional model)

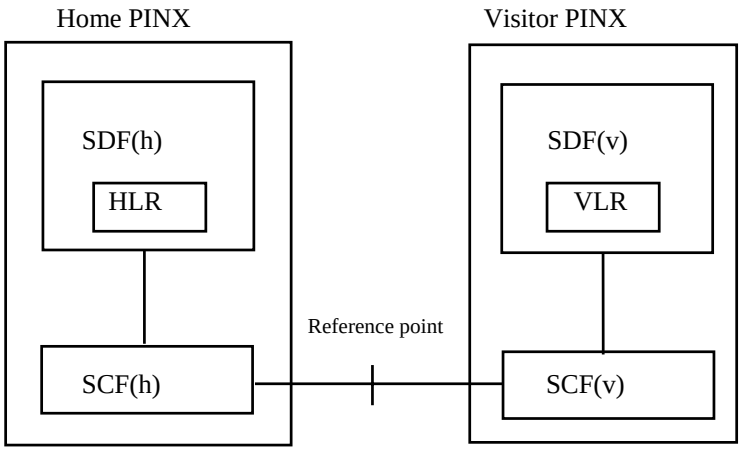


Figure E-1/JJ-20.60 Functional model

Each functional entity in Figure E-1 has the following meaning.

- SCF (h) Service Control Function of the Home PINX; a functional entity controlling the SS-IPR defined in this Standard.
- SCF (v) Service Control Function of the Visitor PINX; a functional entity controlling the SS-IPR defined in this Standard.
- SDF (h) Service Data Function of the Home PINX; a functional entity permanently storing the authentication information, subscriber information and location information of the Home PS.
- SDF (v) Service Data Function of the Visitor PINX; a functional entity temporarily storing the authentication information, subscriber information and location information of a PS within the Visitor PINX.

This Standard does not specify the interfaces between the SCF(v) and the VLR and between the SCF(h) and the HLR because these interfaces depend on the implementation method of each PINX. Additionally, this Standard does not concern the cases where the HLR or VLR is implemented as an external unit of the PINX. The SS-IPR specified in this Standard shall be implemented using the information flow between the SCF(v) and the SCF(h).

E.2.2 Information flow

E.2.2.1 Scenario 1, 1a

In Scenario 1, the Visitor PINX the Home PINX have the same authentication algorithm. The Visitor PINX shall authenticate the PS by getting the PS authentication key information from the Home PINX. The Visitor PINX shall assign the authentication random number, cipher the authentication result and conduct all the other necessary procedures.

The Visitor PINX may store the obtained PS authentication key information in the VLR while the PS is located in the Visitor PINX.

If the PS authentication key information is controlled inside the PISN, sufficient security can be maintained in the PISN and both the authentication-related information traffic and the delay in authentication procedure can be sufficiently minimised.

In this scenario, the following procedures shall be executed.

(1) Inter-PINX location registration update procedure

- The Visitor PINX shall send to the Home PINX a GetSerProfInf request to get the PS service profile.

- The Home PINX shall send to the Visitor PINX a GetSerProfInf return result containing the authentication key information and service class information of the PS.

- The Visitor PINX shall authenticate the PS using the authentication key information. Further authentication procedures are executed by the Visitor PINX.

- If the authentication is successful, the Visitor PINX shall assign an inter-PINX roaming number and send it to the Home PINX by a LocRegUpd request. When the response is sent back from the Home PINX, the inter-PINX location registration update procedure shall be completed.

The following figure shows an example of the information flow.

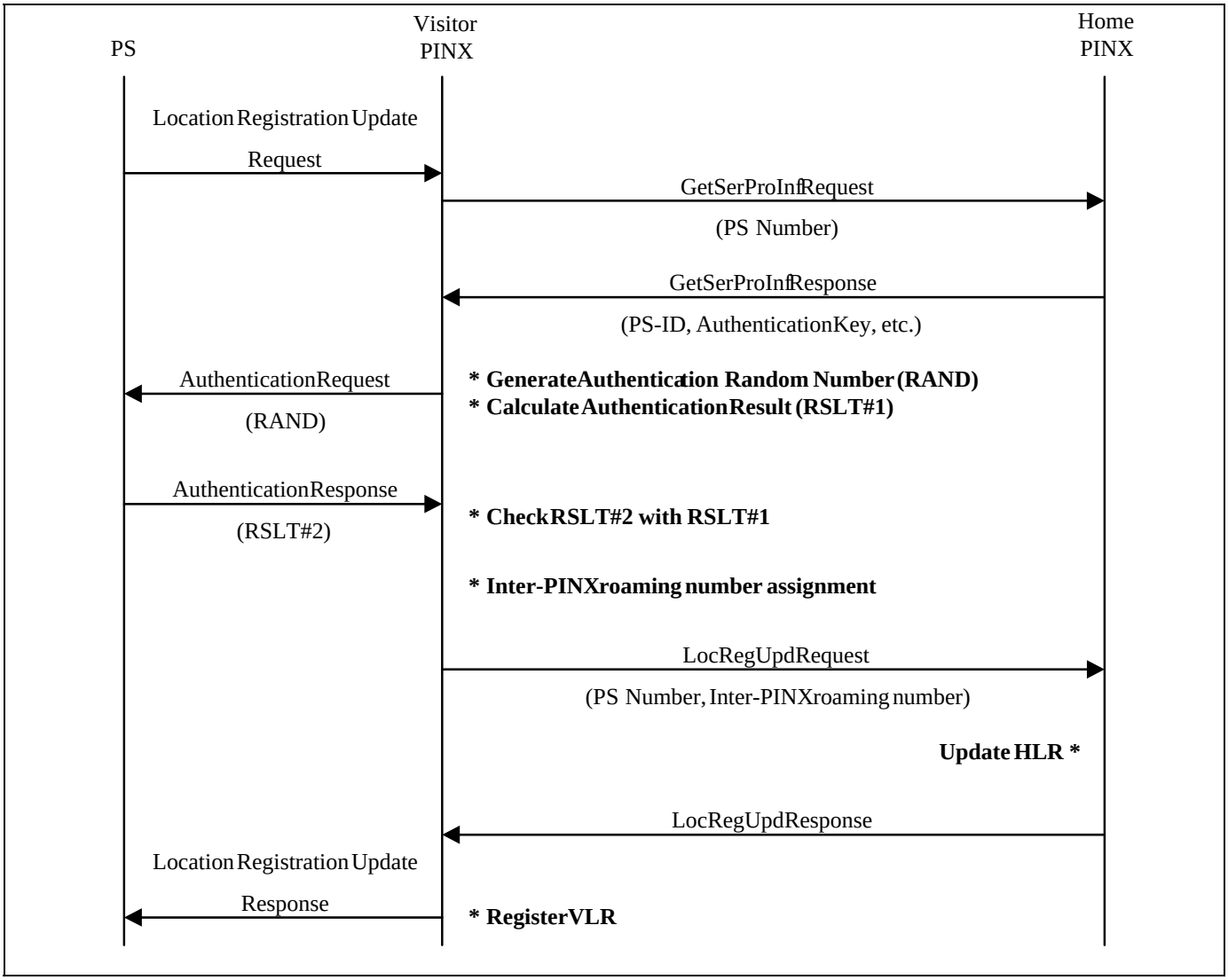


Figure E-2/JJ-20.60 Service profile get and authentication flow (Scenario 1, 1a)

(2) Call originating and handover procedures

Since the call originating and handover procedures shall be conducted only in the Visitor PINX, no inter-PINX message exists.

(3) Call terminating procedure

The call terminating procedure shall be executed using the inter-PINX roaming number assigned in the location registration update.

The following figure shows an example of the information flow.

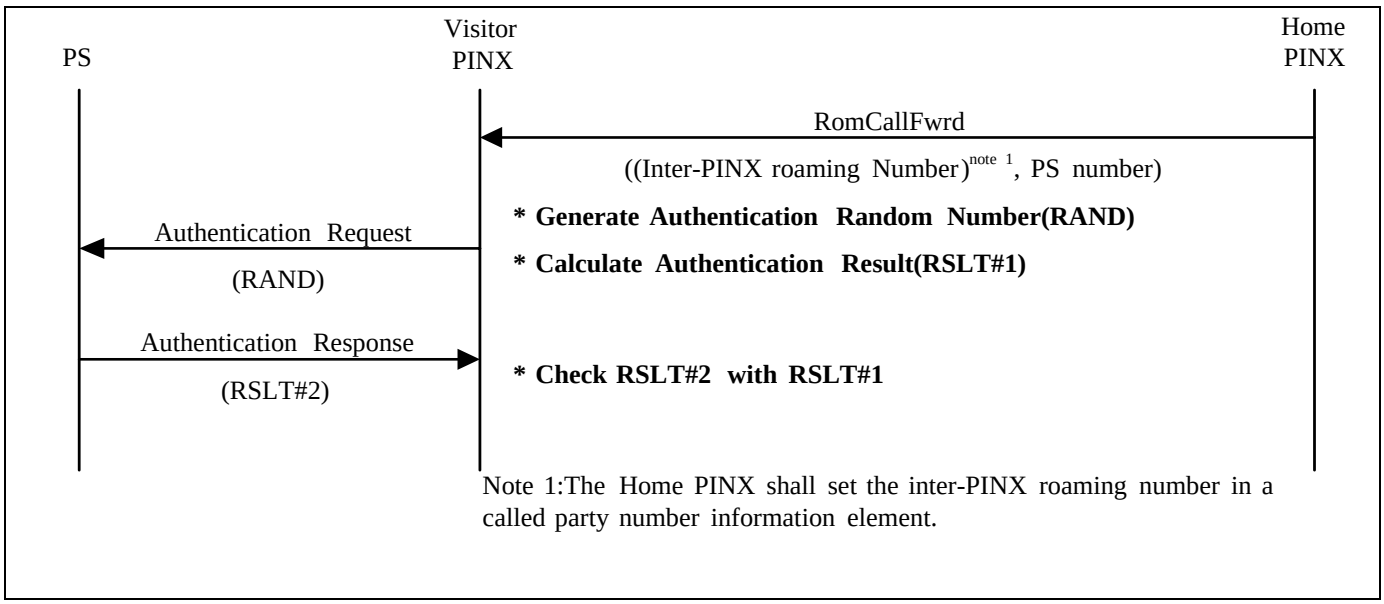


Figure E-3/JJ-20.60 Call terminating flow (Scenario 1, 1a)

(4) Location registration deletion procedure

The following figure shows an example of the information flow.

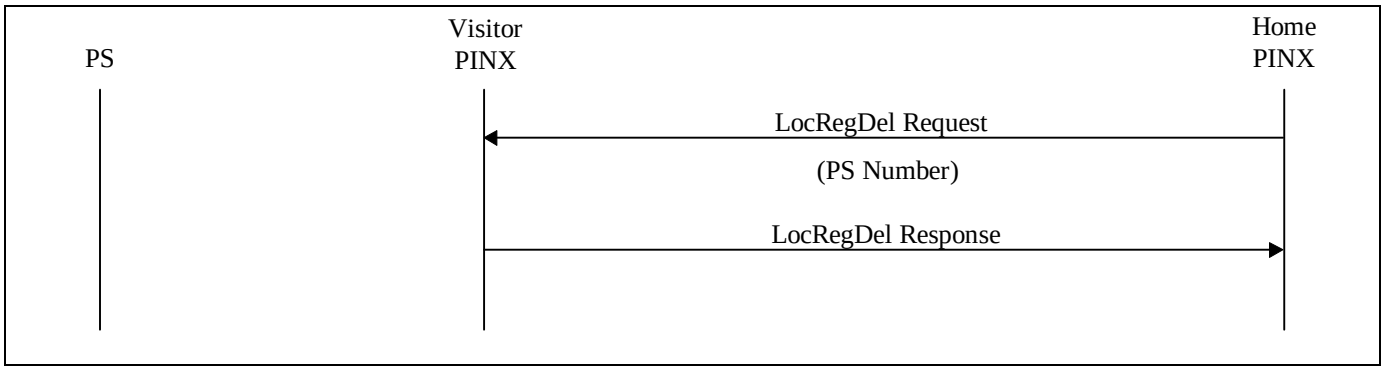


Figure E-4/JJ-20.60 Location registration deletion flow (Scenario 1, 1a)

E.2.2.2 Scenario 2

In Scenario 2, the Visitor PINX shall not need to know the PS authentication algorithm executed in the Home PINX nor the PS authentication key information. The Visitor PINX shall send to the Home PINX the GetSerProfInf request prior to the authentication and get the authentication information (authentication type, authentication random number length, etc.) which are necessary to generate an authentication random number in the Visitor PINX. Using the generated authentication random number, the Visitor PINX shall send to the Home PINX an AuthCipReq and shall send to the PS an authentication request. Then the Visitor PINX shall compare the authentication cipher result from the PS and from the Home PINX. In authenticating the PS during the call originating/terminating or handover procedure, the Visitor PINX shall send an AuthCipReq to the Home PINX but it does not have to simultaneously send the AuthCipReq to the Home PINX and PS. Prior to sending an AuthCipReq request to the PS, for instance, the Visitor PINX may make an inter-PINX AuthCipReq request.

In this scenario, the following procedures shall be executed.

(1) SS-IPR location registration update

- The Visitor PINX shall send to the Home PINX a GetSerProfInf request to obtain the PS service profile.

- The Home PINX shall send to the Visitor PINX a GetSerProfInf return result containing the authentication information (authentication type, authentication random number length, etc.) and service class information of the PS.

- The Visitor PINX shall generate an authentication random number based on the authentication information and send an AuthCipReq to the PS and Home PINX.

- If the authentication cipher results from the PS and Home PINX are found identical by comparison, the authentication shall be considered successful.

- The Visitor PINX shall assign an inter-PINX roaming number and send it to the Home PINX by a LocRegUpd request. When the response is sent back from the Home PINX, the inter-PINX location registration update procedure shall be completed.

The following figure shows an example of the information flow.

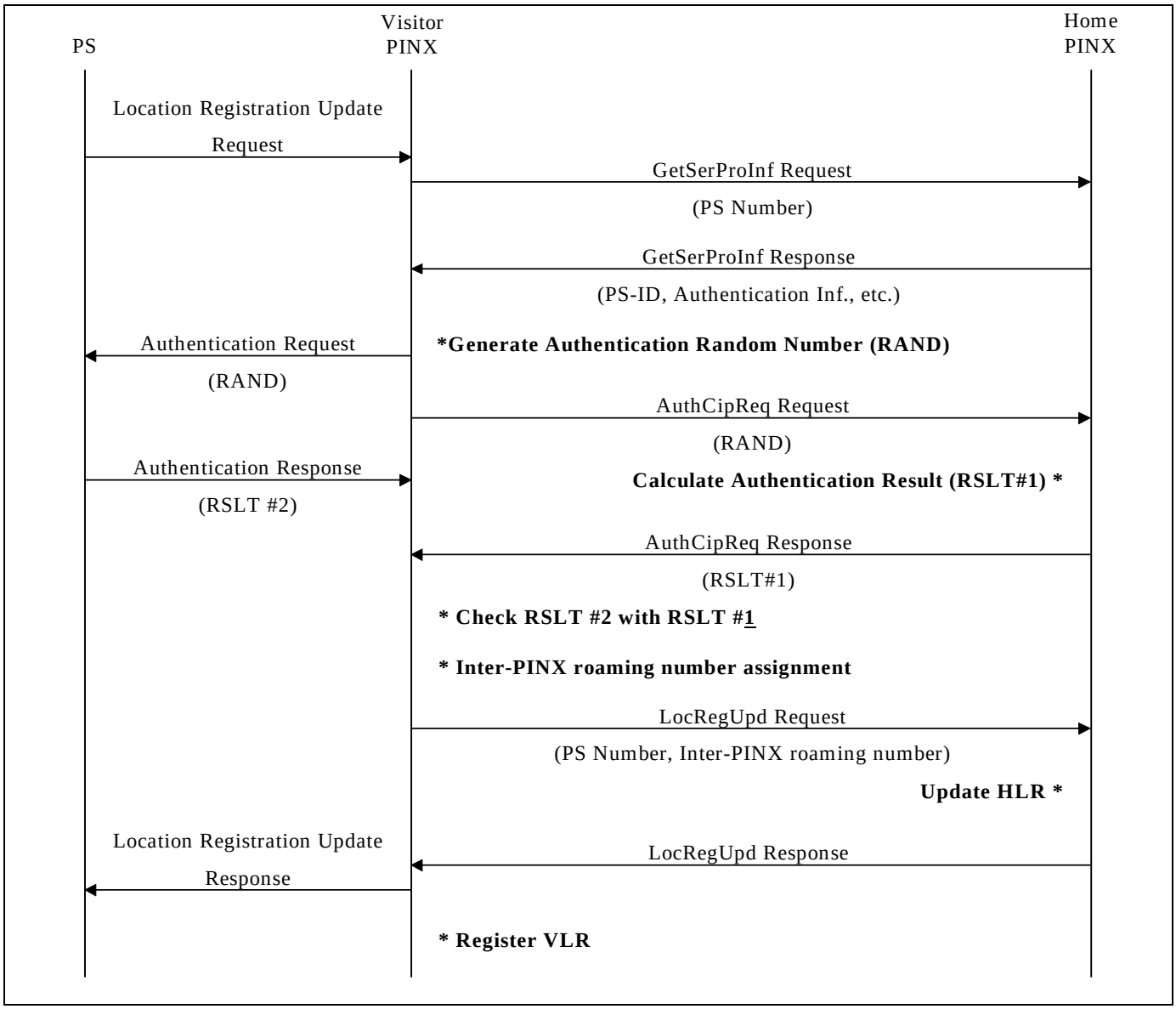


Figure E-5/JJ-20.60 Location registration update flow (Scenario 2)

(2) Call originating procedure

The following figure shows an example of the information flow in the call originating procedure.

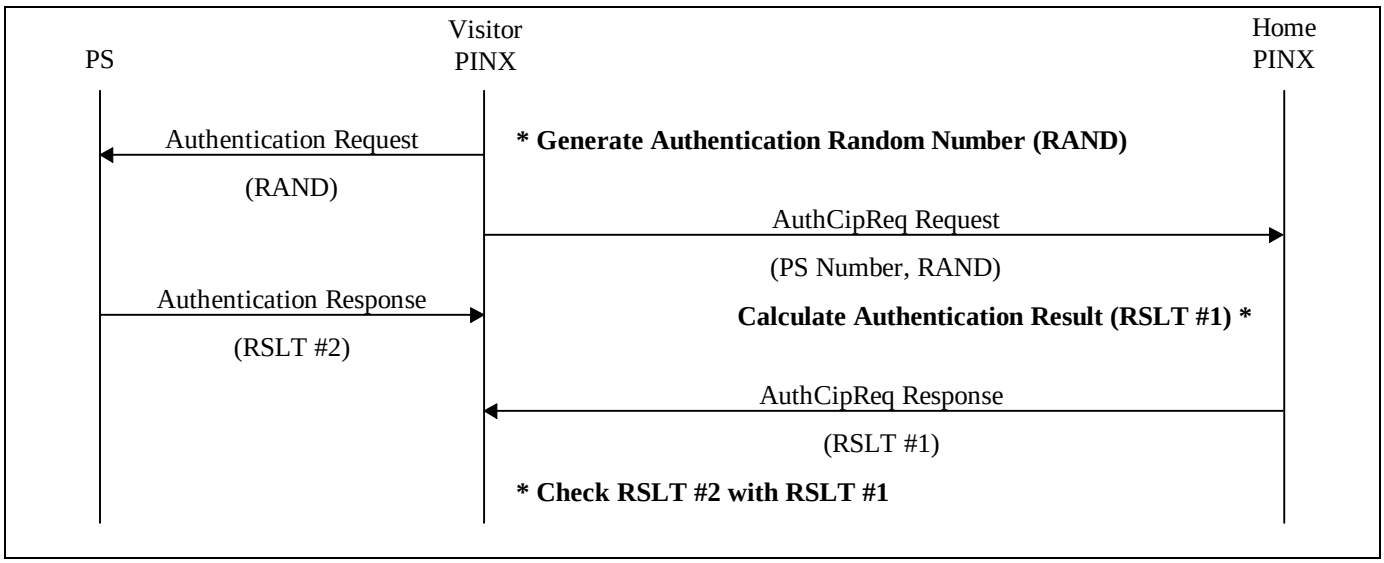


Figure E-6/JJ-20.60 Call originating flow (Scenario 2)

(3) Call terminating procedure

The following figure shows an example of the information flow in the call terminating procedure.

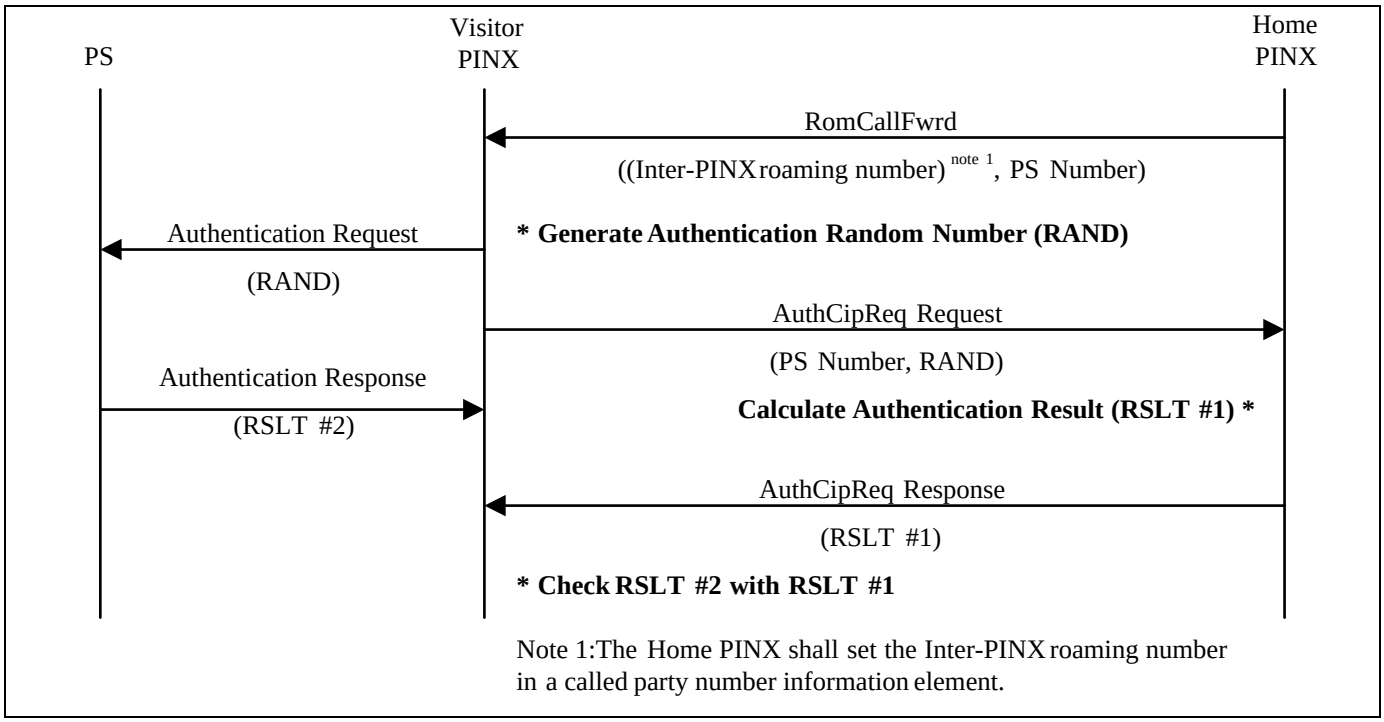


Figure E-7/JJ-20.60 Call terminating flow (Scenario 2)

(4) Handover procedure

There are two types of handover procedure, depending on the authentication method used.

Type 1 uses the previous authentication result as the authentication random number.

Type 2 assigns a new authentication random number.

(a) Type 1 Handover procedures

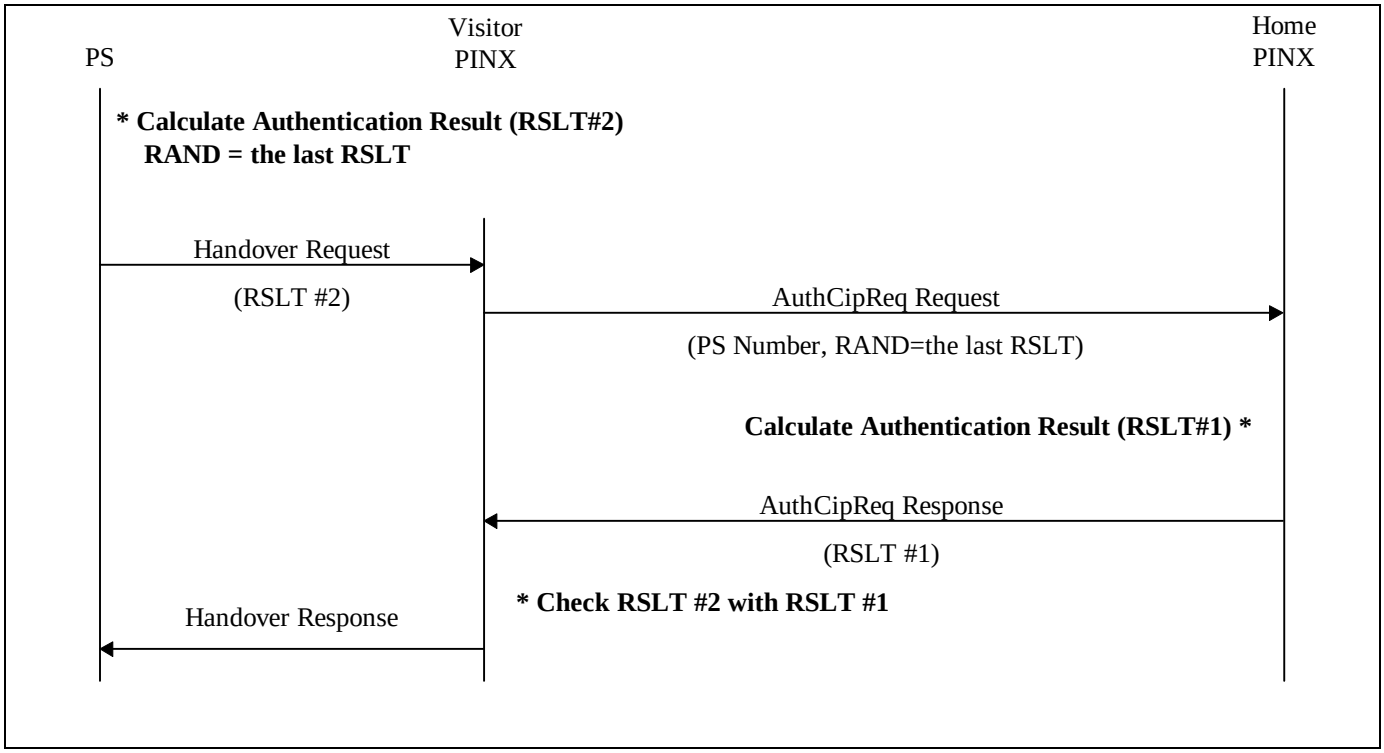


Figure E-8/JJ-20.60 Handover flow (Type 1, Scenario 2)

(b) Type 2 Handover procedures

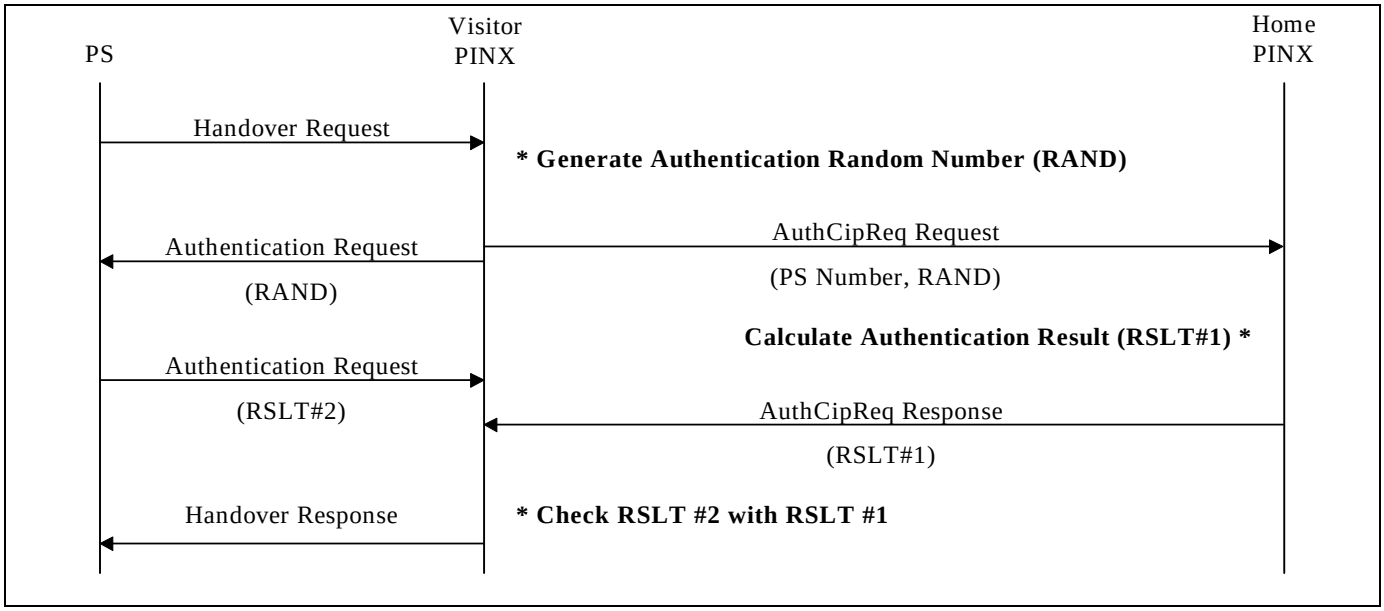


Figure E-9/ JJ-20.60 Handover flow (Type 2, Scenario 2)

(5) Location registration deletion procedure

The procedure is the same as in E.2.2.1 (4).

E.2.2.3 Inter-PINX location information check procedure

Inconsistencies may arise between HLR information and VLR information in such instances as when the Home PINX restarts or when the Visitor PINX is unable to accept a LocRegDel request. Since integration of inconsistent data results in such problems as a VLR capacity shortage, it is desirable that the inter-PINX location information check procedure be initiated at regular intervals to ensure consistency between HLR and VLR data.

The Standard sets forth a location information check procedure as a method of avoiding the inconsistencies noted above. The location information check procedure shall be executed separately from any of the other procedures prescribed herein. If any inconsistency is detected by the check procedure, it is desirable that the processing to remove the inconsistency, a matter of implementation, be carried out quickly.

The details of information covered by the check procedure include the PS number and the inter-PINX roaming number.

This procedure applies to both Scenarios 1, 1a and 2.

(1) Location information check procedure initiated by the Home PINX

The location information check procedure for the Home PINX to request of the Visitor PINX shall be used when the Home PINX restarts or when the information in the HLR is questionable. The procedure checks the location information specified by the Home PINX with the Visitor PINX.

The following figure shows an example of the information flow in the location information check procedure initiated by the Home PINX.

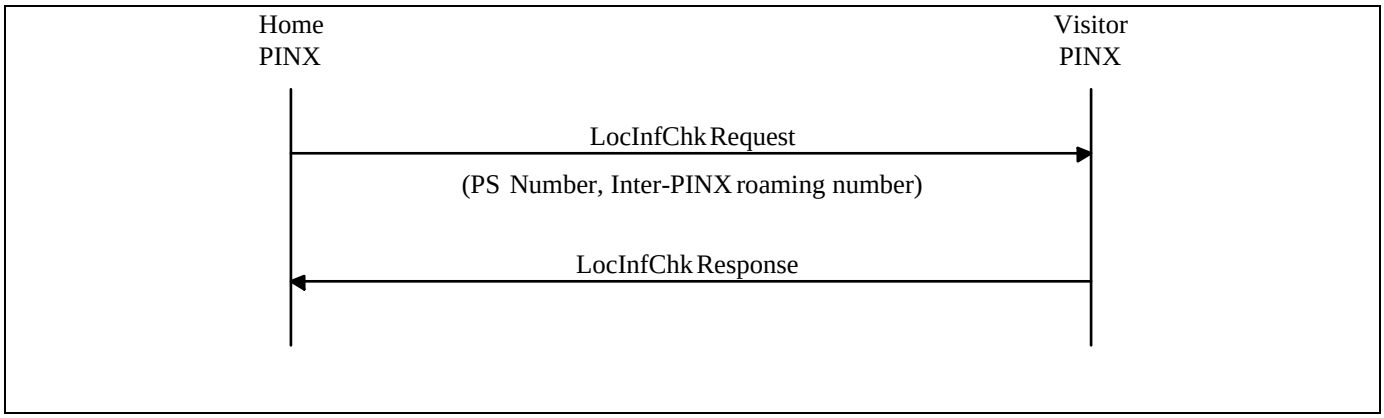


Figure E-10/ JJ-20.60 Inter-PINX location information check procedure initiated by the Home PINX

(2) Location information check procedure initiated by the Visitor PINX of the Home PINX

The location information check procedure for the Visitor PINX to request of the Home PINX shall be used when the Visitor PINX restarts or when such information is needed for a scheduled check to avoid a possible VLR data mismatch during irregularities in the inter-PINX procedure. The following figure shows an example of the information flow in the location information check procedure initiated by the Visitor PINX.

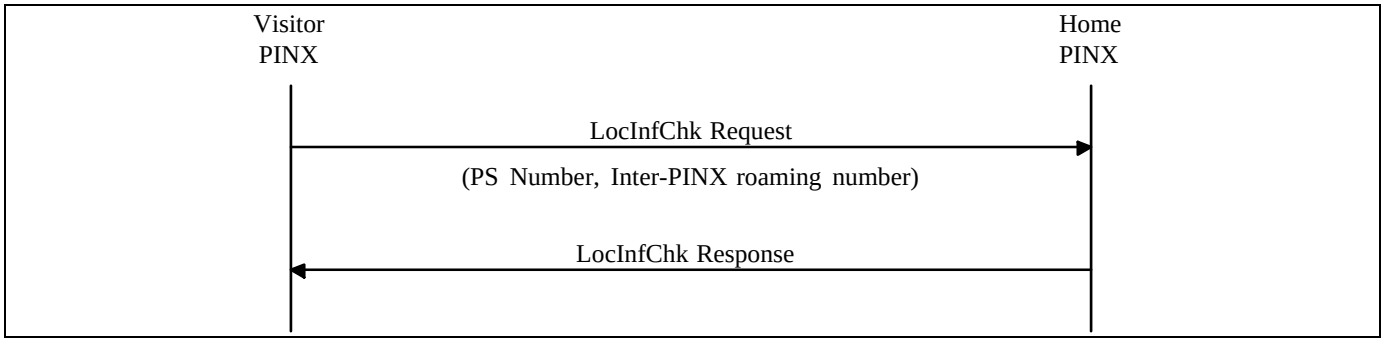


Figure E-11/JJ-20.60 Inter-PINX location information check procedure initiated by the Visitor PINX

JJ-21.10 Analog Interface for PBX and Key Telephone Terminal Equipment (SR-Signaling System)

<References>

1. Relations to the international recommendations

No international recommendations are related to this Standard.

2. Application of this Standard

This Standard may not restrict the conditions of analog interfaces for the existing equipment.

3. Reference materials

This Standard has made reference to the specification of "JJ-20.12, Digital Interface PBX-TDM (Channel Associated Signaling)"

Contents

1.Scope of specifications

2.Interface specification point

3.Electrical and physical characteristics
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- 3.2 Major electrical characteristics

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- 4.2 SS line and SR line
- 4.3 Address signals

5.Call-Sequence criteria
- 5.1 Incoming signal
- 5.2 Incoming address signal reception
- 5.3 During alerting
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- 5.5 Outgoing seizure
- 5.6 Outgoing address signals
- 5.7 Detection of answer signals
- 5.8 Release

Appendix 1 Audible signals

1. Scope of specification

This Standard specifies the SR signaling characteristics in the interface of terminal equipment for PBX and key telephone through the analog leased lines.

2. Interface specification point

The interface specification point defined in this standard is located at the terminal and the carrier frequency equipment as shown in Figure 2.1/JJ-21.10.

The transmission characteristics in this Standard define the characteristics by which the terminal equipment transmits signals to the carrier frequency equipment.

The receiving characteristics define the means by which the terminal equipmentreceives signals from the carrier frequency equipment.

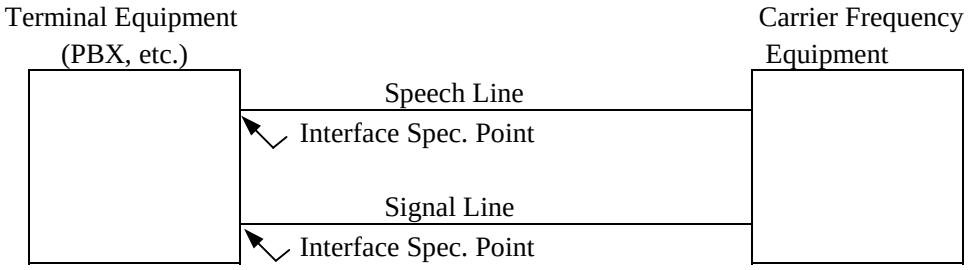


Figure 2.1/JJ-21.10 Interface specification point

3. Electrical and physical characteristics

3.1 Classification of signals

The classification of signals is defined as shown in Table 3.1/JJ-21.10.

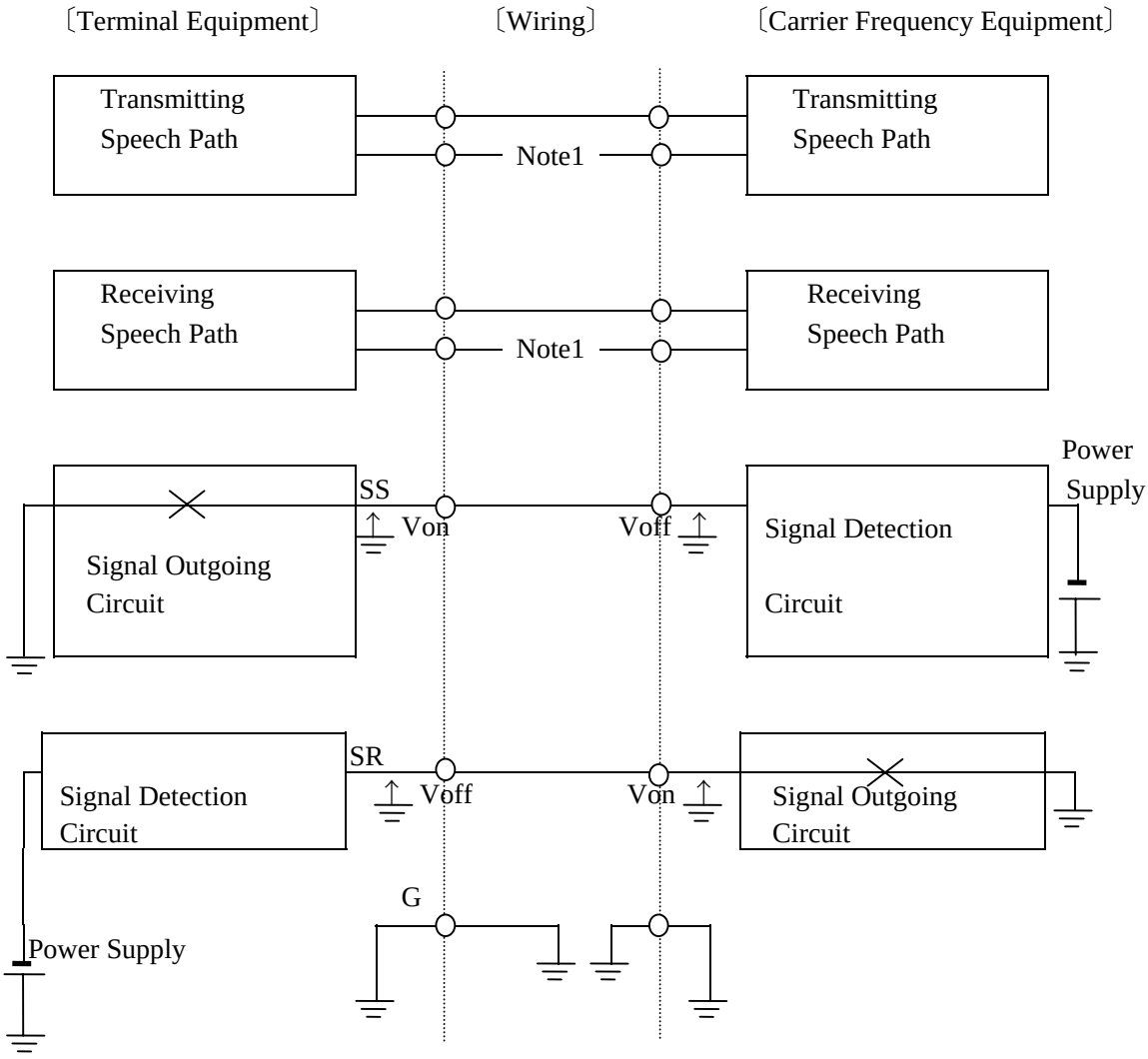
Table 3.1/JJ-21.10. Classification of signals

Signal	Description
SS	Signal from terminal equipment to carrier frequency equipment
SR	Signal from carrier frequency equipment to terminal equipment

3.2 Major electrical characteristics

3.2.1 Circuit and connection block diagram

Figure 3.1/JJ-21.10 shows the circuit and connection system of the SR signal-ing interface.



Note 1 : There is cuit and 2-wire and 4-wire circuit for the speech path
Note 2 : "G" means grounding terminal

Figure 3.1/JJ-21.10 Circuit and connection block diagram

3.2.2 Electrical specifications

Figure 3.2/JJ-21.10 shows the electrical specifications of the SR signaling interface.

Table 3.2/JJ-21.10 Electrical specifications

Item	Specification
Speaking circuit	Nominal balancing resistance: 600 Ω (0.3 to 3.4 kHz), No DC superimposition
Maximum input current in signal detection circuit	40 mA
Voff for input off in signal detection circuit	-56.5 V ≦ Voff ≧ -10.8V
Von for output on in outgoing signal circuit	-5 V ≦ Von ≧ 0V
Input characteristics in signal detection circuit	The operation should be normal at the wiring resistance of cable, etc., with less than 150 Ω. The input at the grounding resistance with more than 40 KΩ should not cause false detection.

Note 1 : Each demarcation point of the terminal and carrier frequency equipment should be specified by the electrical specification.

Note 2 : There should be no potential difference in the grounding between terminal and carrier frequency equipment.

4. Signaling system

4.1 Outline

This Standard specifies the purpose and method for the usage of the SS/SR lines, and the physical and electrical characteristics of address signals in the (SR-signaling system) interface through the analog leased lines for the terminal and carrier frequency equipment.

4.2 SS line and SR line

Each line is used as an SS line and SR line corresponding to each speech pathbetween the terminal and carrier frequency equipment.

Depending on the purpose of usage, it is classified into the following catego-ries as shown in Table 4.1.1/JJ-21.10, and is defined at each interface specification point.

Table 4.1.1/JJ-21.10 Classified signals list

Classified Signals	Purpose of Usage	Interface Specification Point			
		Originating Terminal Equipment		Terminating Terminal Equipment	
		SS	SR	SS	SR
Seizure Signal	Signal for the originating terminal equipment to seize the terminating terminal equipment	○			
Incoming Signal	Signal for the terminating terminal equipment to detect the incoming call				○
Connection Confirmation Signal	Signal from the terminating terminal equipment to notify the originating terminal equipment that it is ready for address signal reception		○	○	
Address Signal	Signal from the originating terminal equipment to notify the terminating terminal equipment the number of the called party	○			○
Answer Signal	Signal from the terminating terminal equipment to notify the originating terminal equipment that the called party has answered		○	○	
Clear-Back Signal	Signal from the terminating terminal equipment to notify the originating terminal equipment ofrelease		○	○	
Disconnect Signal	Signal from the originating terminal equipment to notify the terminating terminal equipment of release	○			○
Release Guard Signal	Signal for the terminating terminal equipment to notify the originating terminal equipment that a disconnect signal has been detected		○	○	

The binary values and physical characteristics that SS/SR lines can assume areshown in Table 4.1.2/JJ-21.10.

Table 4.1.2/JJ-21.10 Binary values and physical characteristics

	Binary Value	Physical Characteristics
In Use of Trunk	"0"	Grounding
In Idle-State of Trunk	"1"	Open

4.3 Address signals

There are two address signaling methods: the dial-pulse address signaling andDTMF (Dual-Tone Multi-Frequency) address signaling.

Dial-pulse address signaling is the method by which a dial signal is generatedby the subscriber or the sender circuit in the terminal equipment.

It is transmitted by alternating the binary value of SS/SR lines between "0" and "1".

DTMF address signaling is the method by which the dial signal digits generated by the subscriber or the sender circuit in the terminal equipment are transmitted using a combination of the specified frequencies through the speech path as voice. The binary value of SS/SR lines in this method is maintained at "0".

4.3.1 Transmission characteristics of address signals

The transmission characteristics of address signals are shown in Tables 4.2/JJ-21.10 and 4.3/JJ-21.10.

Table 4.2/JJ-21.10 Signal transmission characteristics of Dial-Pulse

Item		Specification
Dial-Pulse		0 to 9 Note 1
10 pps	Speed	10 ± 0.8 pps
	Make Duration	33 ± 3%
	Minimum Pause	Minimum 600 msec
20 pps	Speed	20 ± 1.6 pps
	Make Duration	33 ± 3%
	Minimum Pause	Minimum 450 msec

Note 1: Dial-pulse "0" should be 10 pulses.

Table 4.3/JJ-21.10 Signal transmission characteristics of DTMF signal

Item	Specification			
Tone Duration	Minimum 50 msec			
Minimum Pause	Minimum 10 msec			
Cycle Time	Minimum 120 msec			
Signal Frequency				1209
	697	1	2	3
	770	4	5	6
	852	7	8	9
	941	※	0	#
Frequency Deviation	± 1.5 %			

4.3.2 Receiving characteristics for address signals

Receiving characteristics for address signals are shown in Tables 4.4/JJ-21.10and 4.5/JJ-21.10. The characteristics limit for receiving signals, however, defines the range that can be received by terminal equipment. Only the characteristics limit representing the range that should not be received is specified.

Table 4.4/JJ-21.10 Dial-pulse signal receiving characteristics

Item		Specification
10 pps	Speed Make Duration	10 ± 1.5 pps 35 ± 10%
20 pps	Speed Make Duration	20 ± 3.0 pps 35 ± 10%
Minimum Pause		Minimum 300 msec

Table 4.5/JJ-21.10 DTMF signal receiving characteristics

Item	Specification
Signal Frequency	The same as signal transmission characteristics
Frequency Deviation	A signal deviation of less than ±1.8% should be detected as a valid signal. A signal deviation of more than ±4.0% should not be detected as a valid signal
Tone-Duration Accept	Minimum 45 msec
Minimum Pause	Minimum 30 msec

5. Call-Sequence criteria

5.1 Incoming signal

The terminating terminal equipment should recognize the reception of a signalbinary value of an SR line changing from "1" to "0" as an incoming seizure.

To minimize the probability of interference, the terminating terminal equipment should mark the trunk as busy for outgoing service within 100 msec of the start of an incoming seizure.

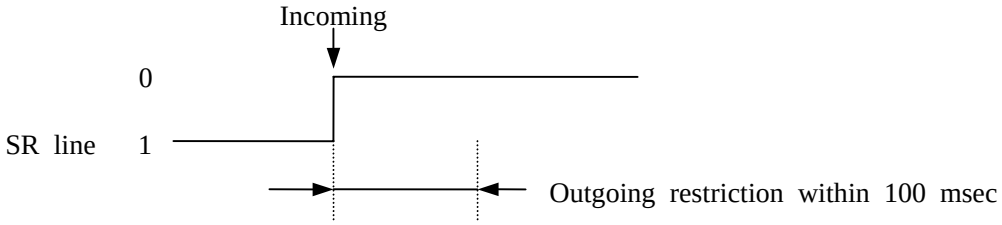


Figure 5.1/JJ-21.10 Receiving-signal sequence

5.2 Incoming-address signal reception

5.2.1 Second dial-tone system

When the terminating terminal equipment receives address signals by the seconddial-tone system, the terminating terminal equipment should be able to return adial tone within 3 seconds when it is ready to receive address signals.

The dial tone should be removed within 500 msec from the start of the first address character.

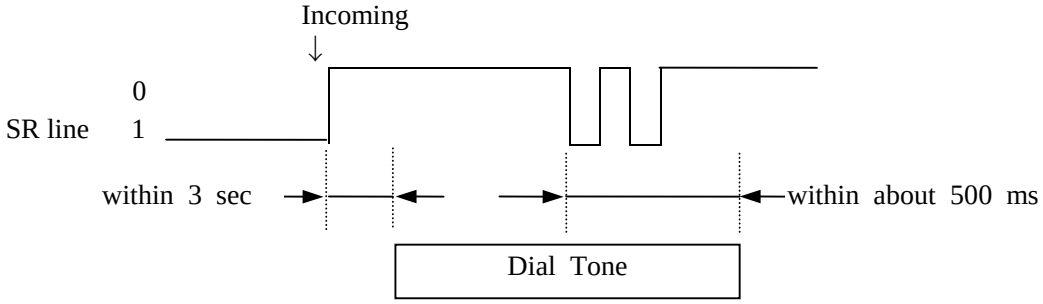


Figure 5.2/JJ-21.10 Second dial-tone system

5.2.2 Wink-start system

When the terminating terminal equipment receives address signals by the wink-start system, within 5 seconds, the terminating terminal equipment should set the SS line at "0" for between 140 msec to 290 msec as a connection confirmationsignal, when it is ready to receive address signals.

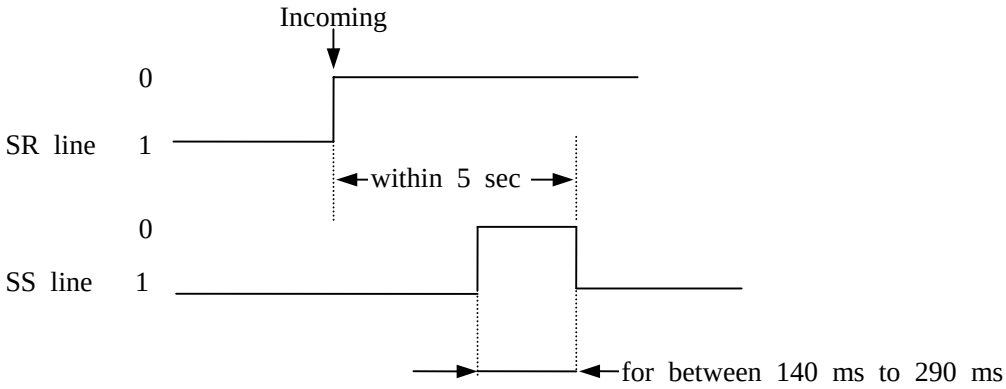


Figure 5.3/JJ-21.10 Wink-start system

5.3 During alerting

The terminating terminal equipment should send out a ring-back tone upon receiving address signals and continue until it returns an answering signal.

5.4 Returning alerting

When the called party has responded to the incoming call, the terminating termi-nal equipment should change the binary value of the SS line from "1" to "0" as an as an answer signal and maintain this condition until the call has been disconnected.

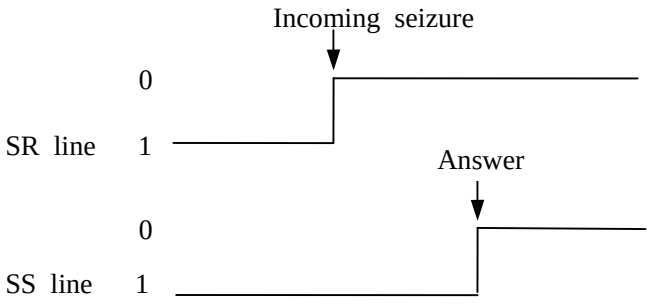


Figure 5.4/JJ-21.10 Answer signal

5.5 Outgoing seizure

Upon selection of the trunk for outgoing service, to reduce the probability of interference, the originating terminal equipment should change the binary value of the SS line from "1" to "0". This will act as a seizure signal and should occur within about 50 msec.

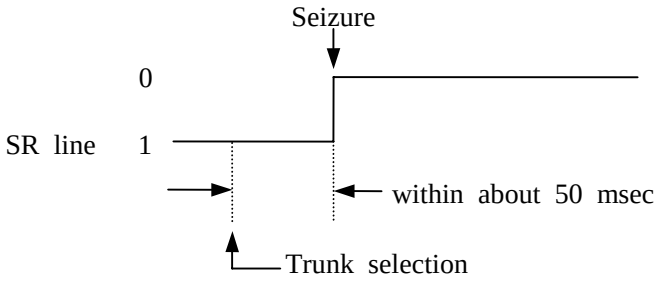


Figure 5.5/JJ-21.10 Outgoing seizure

5.6 Outgoing address signals

5.6.1 Second dial-tone system (Timing start)

When the originating terminal equipment undertakes transmission of address signals by a second dial-tone system without confirming the dial-tone, the transmission should be started immediately after a minimum 3 second interval following transmission of the seizure signal. The transmission, however, may be started within 3 seconds after the completion of preparations for reception at the terminating terminal equipment.

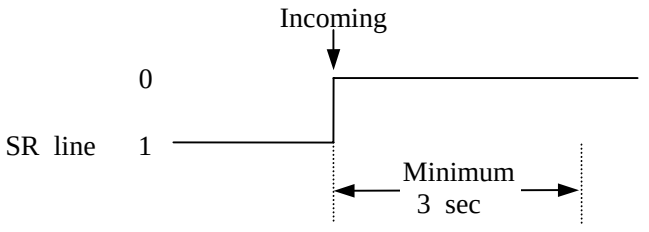


Figure 5.6/JJ-21.10 Second dial-tone system
(In case of timing start)

5.6.2 Second dial-tone system (Confirming dial-tone)

When the originating terminal equipment transmits address signals by a seconddial-tone system after confirming the dial-tone, the transmission should be immediately started after the detection of a dial-tone.

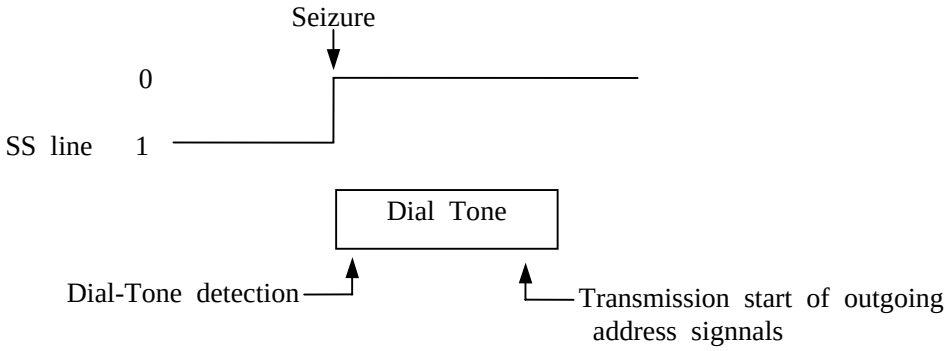


Figure 5.7/JJ-21.10 Second dial-tone system
(In case of confirming dial-tone)

5.6.3 Wink-start system

When the originating terminal equipment transmits address signals by the wink-start system, the transmission should be started after a minimum of 70 msecfollowing detection of the connection confirming signal.

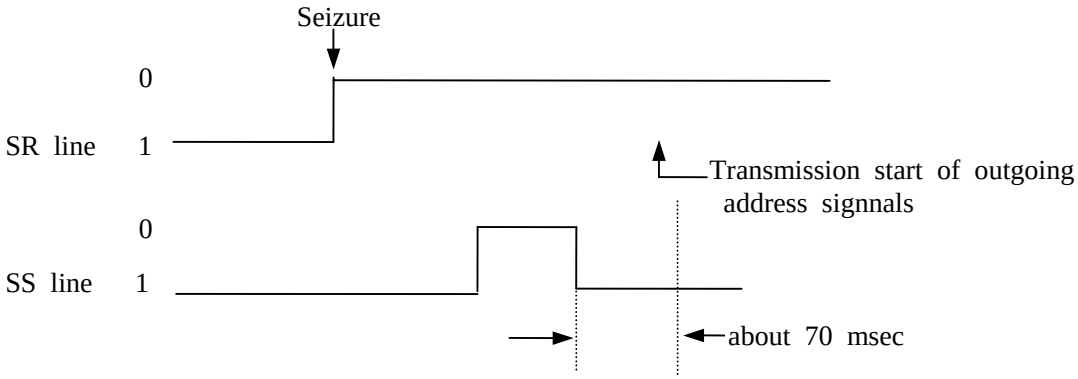


Figure 5.8/JJ-21.10 Wink-start system

5.6.4 Automatic outgoing of address signals

When the originating terminal equipment automatically transmits address signals through sender circuits, it is recommended to connect the trunk bus with the calling party at the terminal equipment within about 500 msec after the completion of all the outgoing address signals.

5.7 Detection of answer signals

After the binary value of the SR line is changed from "1" to "0" and there hasbeen a continuation for a minimum of 60 msec, the originating terminal equipmentshould regard this as an answer signal.

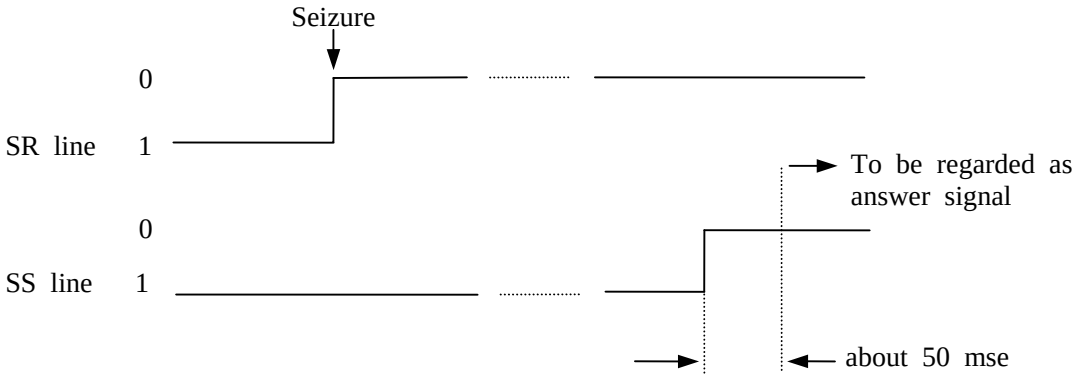


Figure 5.9/JJ-21.10 Detection of answer signal

5.8 Release

The forms of release specified in this Standard should be the calling party release system. Under the system if the called party goes on-hook first, the signals transmitted by the terminating terminal equipment is called the release signal. The signal from the originating terminal equipment in response is called a disconnecting signal.

On the other hand, under the system, if the calling party goes on-hook first,the signal transmitted from the originating terminal equipment is called a disconnect signal. The signal from the terminating terminal equipment is calleda release-complete signal.

5.8.1 Release signal

(1) The release signal, if the called party goes on-hook first, is the signal transmitted by the terminating terminal equipment that changes the binary value of the SS line from "0" to "1" and continues for a minimum of 700 msec.

(2) The originating terminal equipment should regard as a release signal all signals that continue from a minimum of 90 msec to a maximum of 700 msec after a change in the binary value of the SR line from "0" to "1".

(3) Neither terminal equipment should use the related trunk for outgoing service for a minimum of 800 msec, after transmitting the release signal forthe terminating terminal equipment, and after starting reception of the release signal for the originating terminal equipment.

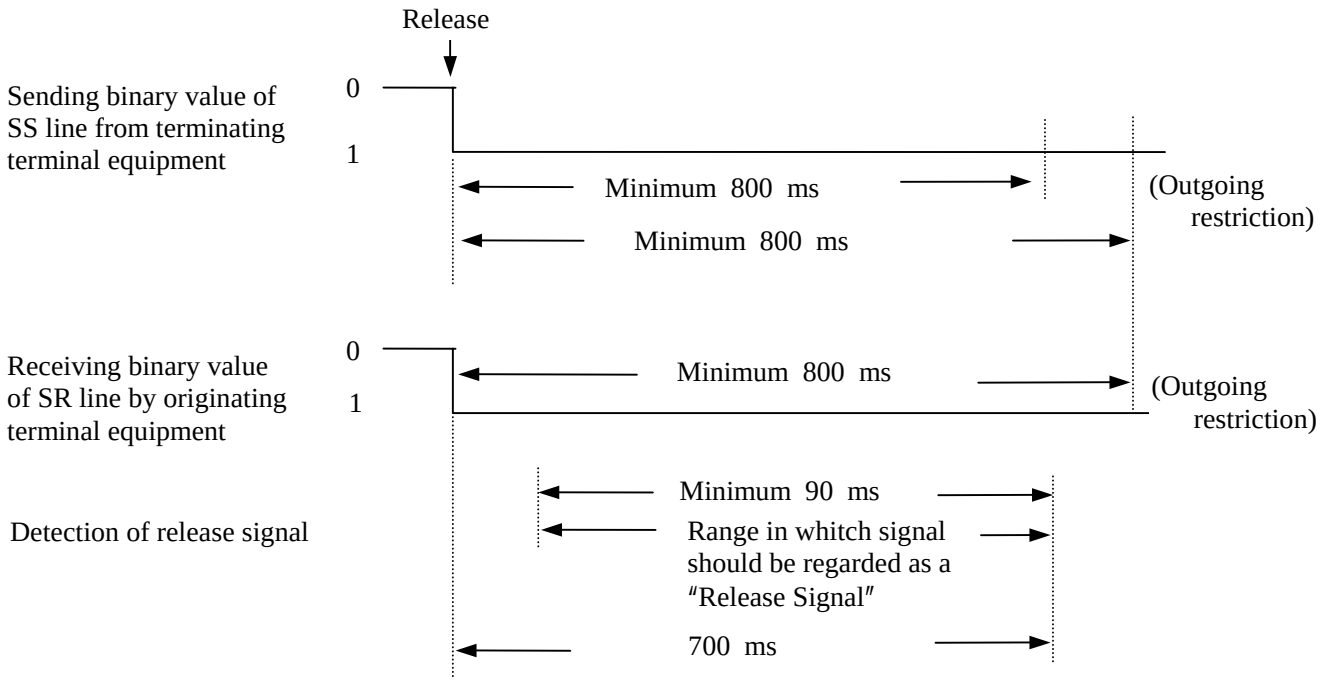


Figure 5.10/JJ-21.10 Release signal

5.8.2 Disconnect signal

(1) The disconnect signal is transmitted by the originating terminal equipment if the calling party goes on-hook first. It is also the signal that is transmitted by the originating terminal equipment after detecting the
release signal transmitted from the terminating terminal equipment when thecalled party goes on-hook first. The originating terminal equipment shouldchange the binary value of the SS line from "0" to "1" and maintain this for a minimum of 700 msec.

(2) The terminating terminal equipment should regard signals that continue from a minimum of 90 msec to a maximum of 700 msec after the binary value of the SR line has changed from "0" to "1" as disconnect signals.

(3) Neither terminal equipment should use the related trunk for outgoing
service for a minimum of 800 msec, after transmitting the disconnect signalfor the originating terminal equipment, and after starting reception of thedisconnect signal for the terminating terminal equipment.

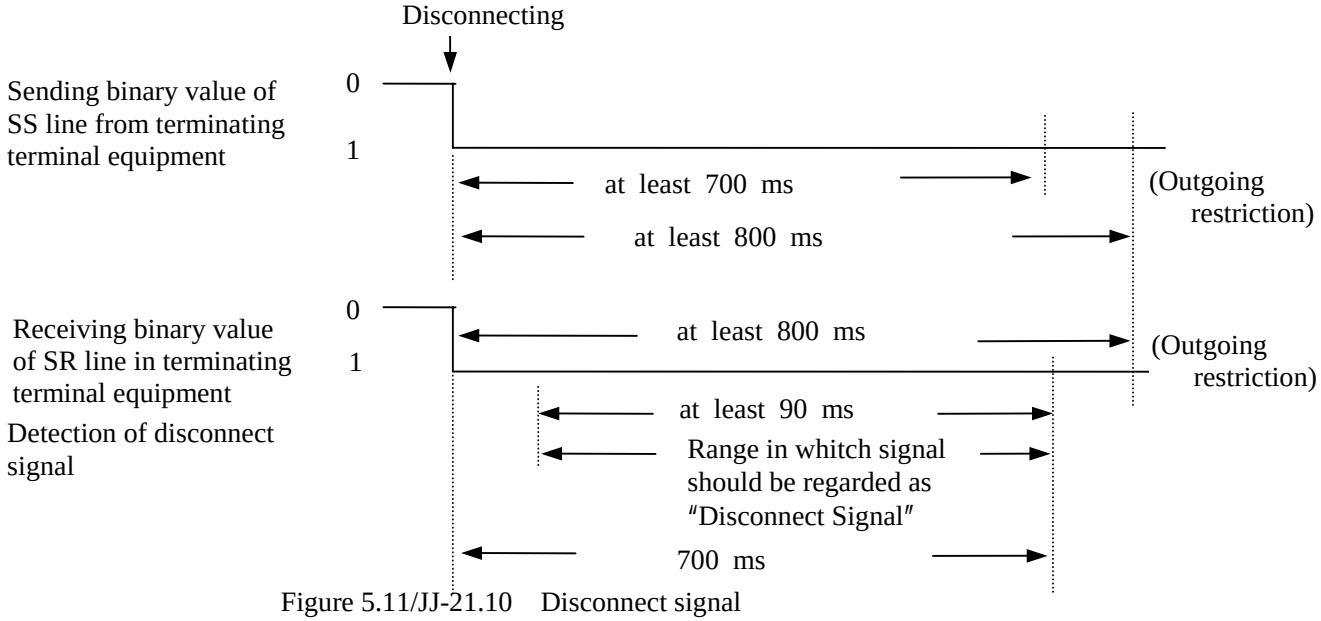


Figure 5.11/JJ-21.10 Disconnect signal

5.8.3 Release-guard signal

(1) The release-guard signal is the signal that is transmitted upon detection of the disconnect signal by the terminating terminal equipment.

It sould maintain the signal for a minimum of 700 msec after a change in the binary value of the SS line from "0" to "1".

(2) The originating terminal equipment should regard signals that continue from a minimum of 90 msec to a maximum of 700 msec after the binary value ofthe SR line has changed from "0" to "1" as release-guard signals.

(3) Neither terminal equipment should use the related trunk for outgoing service for a minimum of 800 msec, after transmitting the release-guard signal for the terminating terminal equipment, and after starting receptionof the release-guard signal for the originating terminal equipment.

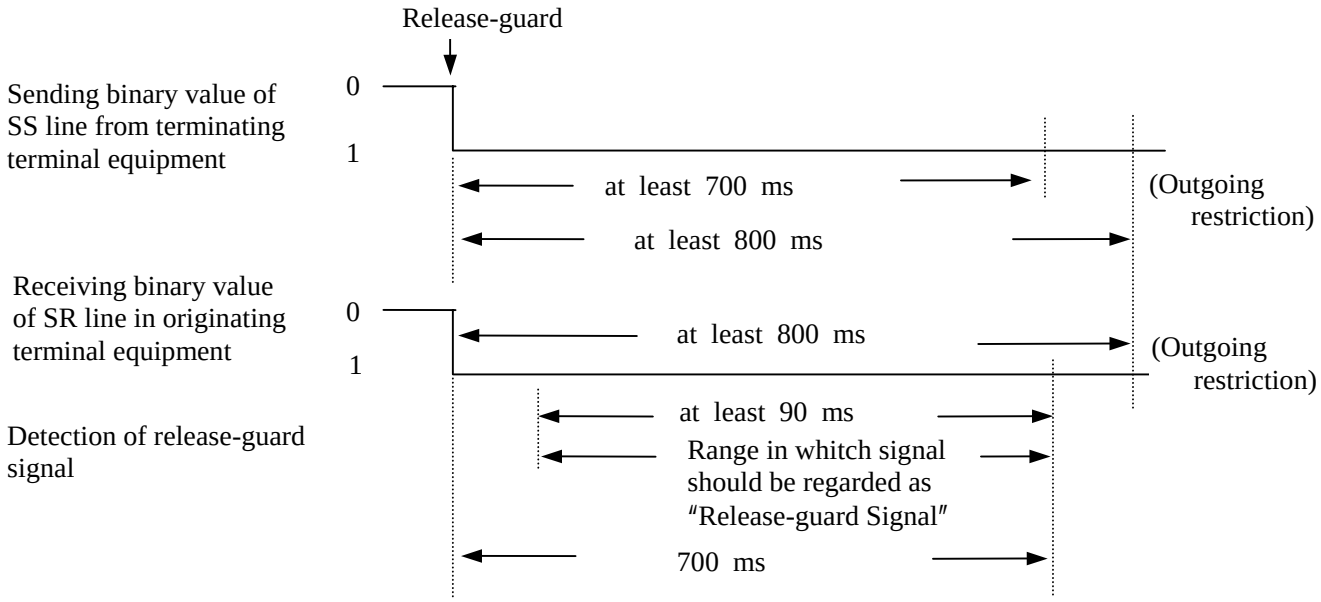


Figure 5.12/JJ-21.10 Release-guard signal

Appendix 1 Audible signals

The following characteristics should be recommended as an audible signal.

1.1 Type of signals

(1) Dial-tone

The signal is transmitted by the terminating terminal equipment to the speech path after having completed preparations for address signals by the second dial-tone signaling system.

(2) Busy tone

The signal is transmitted by the terminating terminal equipment to the speech path when finding it impossible to reach the called party because of a busy status for all circuits or because the called station is busy.

Also, when the called party cannot be reached because of a wrong number, restrictions, or other factors, a busy tone may be transmitted to the speech path.

(3) Ring-back tone

This signal is transmitted by the terminating terminal equipment to the speech path when calling the called station or another such station.

1.2 Signal characteristics

Table Appendix 1.1/JJ-21.10 Audible signals

Item	Specification	
	Frequency	Transmission level, Note 1
Dial-tone	Intermittently at 400 Hz 120 times / Minute	less than -15 dBm
Busy tone	Intermittently at 400 Hz 60 times / Minute	less than -15 dBm
Ring-back tone	Modulation of 400 Hz at 20 Hz 1 sec on, 2 sec off	less than -15 dBm

Note 1. This specification may not be applied to the speech path of the terminal equipment when a pad is inserted.

PBX

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