Title: PHS-FWA System : Interface Specification between Fixed Wireless Access Controller and Service Node -Analogue Subscriber Interface -

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History of Revised Versions

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01	Dec. 17, 1996	Established
02	June 7, 2000	Changed all WLL into FWA. Sub-clause 2.1 is changed.

C-IF3.01-02-TS

**PHS-FWA System : General Description
of Interface Specifications between Fixed Wireless Access Controller
and Service Node - Analogue Subscriber Interface**

Contents

1. General

This specification describes about analogue subscriber interface between WAC and SN. As analogue subscriber interface should be compatible for PSTN, the actual specification depends on the administrator or operating company.

2. Interface

Following sections describe the items that should be considered in the administrator or operating company's specification regarding WAC analogue subscriber interface.

2.1 Function

WAC shall have the following functions. The administrator or operating company will decide which functions should be implemented.

(1) Voice transmission

transmit voice and modem data in both way.

(2) Loop close sending

send the loop closed to SN.

(3) Loop open sending

send the loop open to SN.

(4) Dial sending

send the dial pulse or DTMF to SN.

(5) Hooking signal sending

send the hooking signal to SN.

(6) Ringing signal detection

detect ringing signal from SN.

(7) Ring trip

send the answer to SN during ringing signal receiving.

(8) Over voltage and current protection

protect over voltage and current from outside.

(9) Test

Further study.

(10) Loop polarity reverse steady signal receiving

receive loop polarity reverse for answer signal.

(11) Loop polarity reverse pulse receiving

receive loop polarity reverse pulse for mate party on hook. This signal is also receipt as metering signal.

(12) Metering signal receiving

receive metering signal. the administrator or operating company shall choose the metering signal type.

i)   Loop polarity reverse pulse

ii)   12kHz tone pulse

iii)   16kHz tone pulse

(13) Ground Start Sending

send off hook for ground start PBX.

(14) Calling Line Identification Presentation (CLIP)

receive the signals for CLIP service.

(15) Tone and Signal Reception

The used tone are selected by administrator or operating company.

i)   Dial tone

ii)   Busy tone

iii)   Congestion tone

iv)   Ring back tone

v)   Howler tone

vi)   Announcement

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2.2 DC characteristics

The administrator or operating company shall specify the followings;

(1)   loop close and open impedance

(2)   DP sending

(3)   Hooking sending

(4)   Ground start sending

(5)   Loop polarity reverse pulse detection

2.3 AC characteristics

The administrator or operating company shall specify the followings;

(1)   DTMF sending

(2)   Ringing signal input impedance

(3)   Ring trip

(4)   Metering Signal Detection Characteristics

(5)   CND Detection Characteristics

(6)   Transmission Characteristics

i)   Transmission characteristics

ii)   Echo suppression

2.4 Subscriber cable

The administrator or operating company shall specify the followings;

(1)   loop resistance

(2)   insulation resistance

(3)   capacitance between wires

2.5 Over voltage and current protection

refer to ITU-T K.20.

3. Comments for Implementation

3.1 Power Feeding

4. References

(1)   ITU-T K.20

5. Items for Further Study

5.1 Test functions

ANNEX A

ANNEX A describes the analogue subscriber interface of WAC application examples.

1. Definition of Signals, Messages and Timers Examples

Figure 1-1/C-IF3.01 shows the WSU functional block diagram.
Table 1-1/C-IF3.01 shows the signal definitions that are used in state transition tables.
Table 1-2/C-IF3.01 shows the state definitions that are used in state transition tables.
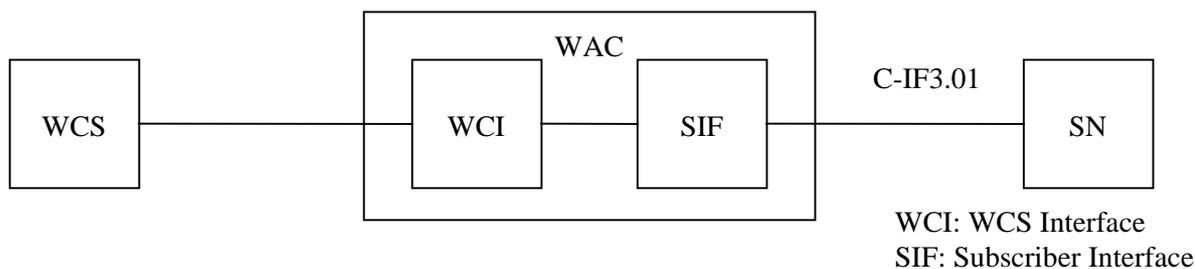

WCI: WCS Interface
SIF: Subscriber Interface

Figure 1-1/C-IF3.01 WAC Functional Block Diagram

Table 1-1/C-IF3.01 Signal Definition

signal	direction	meanings
SN dt	SN to SIF	SN sends DT to WAC.
SN bt	SN to SIF	SN sends BT to WAC.
SN howler	SN to SIF	SN sends Howler tone to WAC.
SN ringing	SN to SIF	SN sends Ringing Signal to WAC>
SN normal polarity	SN to SIF	SN makes two wire polarity normal.
SN reverse polarity	SN to SIF	SN makes two wire polarity reversal.
SN loop closed	SN to SIF	SN makes two wire loop closed.
SN loop open	SN to SIF	SN makes two wire loop open.
SN dp/dtmf	SN to SIF	SN sends digit dial to WAC using DP or DTMF.
SN g on tip	SN to SIF	SN sends ground on tip wire.
SN meter pulsing signal	SN to SIF	SN sends meter pulsing signal to WAC.
loop closed	SIF to SN	WAC makes two wire loop closed.
loop open	SIF to SN	WAC makes two wire loop open.
dp/dtmf	SIF to SN	WAC sends meter pulsing signal to SN.
normal polarity	SIF to SN	WAC makes two wire polarity normal.
reverse polarity	SIF to SN	WAC makes two wire polarity reversal.
g on tip with loop	SIF to SN	WAC sends ground on tip wire with loop closed.
SEIZURE ACK	SIF to WCI	indicate seizure ack detection at SIF
SEIZURE NAK	SIF to WCI	indicate seizure nak detection at SIF
RELEASE	SIF to WCI	indicate release detection at SIF
ANSWER	SIF to WCI	indicate answer detection at SIF
METER PULSING SIGNAL	SIF to WCI	indicate meter pulsing signal detection at SIF
REVERSE POLARITY	SIF to WCI	indicate reverse polarity detection at SIF
NORMAL POLARITY	SIF to WCI	indicate normal polarity detection at SIF
TERMINATING	SIF to WCI	indicate terminating detection at SIF
HOWLER	SIF to WCI	indicate howler tone detection at SIF
DIGIT DIAL	SIF to WCI	sends digit dial that is receipt at SIF
off hook	WCI to SIF	make SIF off hook state.
on hook	WCI to SIF	make SIF on hook state
digit dial	WCI to SIF	sends digit dial that SIF should send
normal polarity	WCI to SIF	makes SIF normal polarity
reverse polarity	WCI to SIF	makes SIF reverse polarity

Table 1-2/C-IF3.01 State Definition

state		individual	LS PBX	GS PBX	coin box	DDI PBX		NTT individual	NTT DDI
						origination	termination		
0	idle	loop open	loop open	loop open	loop open	loop open	WCS: normal pwr SN: normal pwr	loop open	loop open
1	off hook	loop closed	loop closed	loop closed	loop closed	loop closed	WCS: reverse pwr SN: loop closed	loop closed	loop closed
2	terminating	ringing signal reception	ringing signal reception	ringing signal reception	ringing signal reception	ringing signal reception	WCS: normal pwr SN: loop closed	ringing signal reception	ringing signal reception
3	clear forward reception	none	none	none	none	none	WCS: reverse pwr SN: loop open	none	none
4	clear back sending	none	none	none	none	none	WCS: normal pwr SN: loop open	none	none

2. State Transition Table Examples

2.1 Individual Subscriber

Table 2-1/C-IF3.01 shows the WAC analogue subscribe interface state transition table for individual subscriber.

Table 2-1/C-IF3.01 Interface State Transition Table, Individual subscriber

state event	ST 0	ST 1	ST 2
SN dt	/	SEIZURE ACK	/
SN bt	/	/	/
SN howler	/	/	/
SN ringing	TERMINATING, ST 2	/	/
SN normal polarity	/	/	/
SN reverse polarity	/	/	/
SN loop closed	/	/	/
SN loop open	/	/	/
SN dp/dtmf	/	/	/
SN g on tip	/	/	/
SN meter pulsing signal	/	/	/
off hook	loop closed, ST 1	/	loop closed, ST 1
on hook	/	loop closed, ST 0	/
digit dial	/	dp/dtmf	/
reverse polarity	/	/	/
normal polarity	/	/	/

- = No state change; / = Unexpected event, no state change;

2.2 Coin Box

Table 2-2/C-IF3.01 shows the WAC analogue subscribe interface state transition table for coin box.

Table 2-2/C-IF3.01 Interface State Transition Table, Coin Box

state event	ST 0	ST 1	ST 2
SN dt	/	SEIZURE ACK	/
SN bt	/	/	/
SN howler	/	/	/
SN ringing	TERMINATING, ST 2	/	/
SN normal polarity	/	/	/
SN reverse polarity	/	/	/
SN loop closed	/	/	/
SN loop open	/	/	/
SN dp/dtmf	/	/	/
SN g on tip	/	/	/
SN meter pulsing signal	/	METER PULSING SIGNAL	/
off hook	loop closed, ST 1	/	loop closed, ST 1
on hook	/	loop closed, ST 0	/
digit dial	/	dp/dtmf	/
reverse polarity	/	/	/
normal polarity	/	/	/

- = No state change; / = Unexpected event, no state change;

2.3 Loop Start PBX

Table 2-3/C-IF3.01 shows the WAC analogue subscribe interface state transition table for loop start PBX.

Table 2-3/C-IF3.01 Interface State Transition Table, Loop Start PBX

state event	ST 0	ST 1	ST 2
SN dt	SEIZURE ACK	SEIZURE ACK	/
SN bt	/	/	/
SN howler	/	/	/
SN ringing	TERMINATING, ST 2	/	/
SN normal polarity	NORMAL POLARITY	NORMAL POLARITY	/
SN reverse polarity	/	REVERSE POLARITY	/
SN loop closed	/	/	/
SN loop open	/	/	/
SN dp/dtmf	/	/	/
SN g on tip	/	/	/
SN meter pulsing signal	/	/	/
off hook	loop closed, ST 1	/	loop closed, ST 1
on hook	/	loop open, ST 0	/
digit dial	/	dp/dtmf	/
reverse polarity	/	/	/
normal polarity	/	/	/

- = No state change; / = Unexpected event, no state change;

2.4 Ground Start PBX

Table 2-4/C-IF3.01 shows the WAC analogue subscribe interface state transition table for ground start PBX.

Table 2-4/C-IF3.01 Interface State Transition Table, Ground Start PBX

state event	ST 0	ST 1	ST 2
SN dt	SEIZURE ACK	SEIZURE ACK	/
SN bt	/	/	/
SN howler	/	/	/
SN ringing	TERMINATING, ST 2	/	/
SN normal polarity	NORMAL POLARITY	NORMAL POLARITY	/
SN reverse polarity	/	REVERSE POLARITY	/
SN loop closed	/	/	/
SN loop open	/	/	/
SN dp/dtmf	/	/	/
SN g on tip	/	/	/
SN meter pulsing signal	/	/	/
off hook	g on tip with loop, ST 1	/	loop closed, ST 1
on hook	/	loop open and remove g on tip, ST 0	/
digit dial	/	dp/dtmf	/
reverse polarity	/	/	/
normal polarity	/	/	/

- = No state change; / = Unexpected event, no state change;

2.5 DDI PBX

Table 2-5/C-IF3.01 (1/2) shows the WAC analogue subscribe interface state transition table for DDI PBX, originating.

Table 2-5/C-IF3.01 (2/2) shows the WAC analogue subscribe interface state transition table for DDI PBX, terminating.

Table 2-5/C-IF3.01 (1/2) Interface State Transition Table, DDI PBX, Originating

state event	ST 0	ST 1
SN dt	SEIZURE ACK	SEIZURE ACK
SN bt	/	/
SN howler	/	/
SN ringing	/	/
SN normal polarity	NORMAL POLARITY	NORMAL POLARITY
SN reverse polarity	/	REVERSE POLARITY
SN loop closed	/	/
SN loop open	/	/
SN dp/dtmf	/	/
SN g on tip	/	/
SN meter pulsing signal	/	/
off hook	loop closed, ST 1	/
on hook	/	loop open, ST 0
digit dial	/	dp/dtmf
reverse polarity	/	/
normal polarity	/	/

- = No state change; / = Unexpected event, no state change;

Table 2-5/C-IF3.01 (2/2) Interface State Transition Table, DDI PBX, Terminating

state event	ST 0	ST 1	ST 2	ST 3	ST 4
SN dt	/	/	/	/	/
SN bt	/	/	/	/	/
SN howler	/	/	/	/	/
SN ringing	/	/	/	/	/
SN normal polarity	/	/	/	/	/
SN reverse polarity	/	/	/	/	/
SN loop closed	TERMINATING, ST 2	/	/	/	/
SN loop open	/	RELEASE, ST 3	/	/	RELEASE, ST 0
SN dp/dtmf	/	/	DIGIT DIAL	/	/
SN g on tip	/	/	/	/	/
SN meter pulsing signal	/	/	/	/	/
off hook	/	/	/	/	/
on hook	/	/	/	/	/
digit dial	/	/	/	/	/
reverse polarity	/	/	reverse polarity, ST 1	/	reverse polarity, ST 1
normal polarity	/	normal polarity, ST 4	/	normal polarity, ST 0	/

- = No state change; / = Unexpected event, no state change;

2.6 NTT individual Subscriber

State transition table of NTT individual subscriber is same as loop start PBX

2.7 NTT DDI PBX

State transition table of NTT DDI PBX, originating is same as loop start PBX.

Terminating table is in table 2-6/C-IF3.01

Table 2-6/C-IF3.01 Interface State Transition Table, NTT DDI PBX, Terminating

event \ state	ST 0	ST 1	ST 2
SN dt	/	/	/
SN bt	/	/	/
SN howler	/	/	/
SN ringing	TERMINATING, ST 2	/	/
SN normal polarity	/	/	/
SN reverse polarity	REVERSE POLARITY	/	/
SN loop closed	/	/	/
SN loop open	/	/	/
SN dtmf	/	DIGIT SIGNAL	/
SN g on tip	/	/	/
SN meter pulsing signal	/	/	/
off hook	loop closed, ST 1	/	loop closed, ST 1
on hook	/	loop open, ST 0	/
digit dial	/	/	/
reverse polarity	/	/	/
normal polarity	/	NORMAL POLARITY	/

- = No state change; / = Unexpected event, no state change;

3. Message Sequence Examples

3.1 Originating-Answer (Individual DP Line Sub.)

Figure 3-1/C-IF3.01 shows a WIF3 sequence of originating answer (Individual DP Line Subscriber).
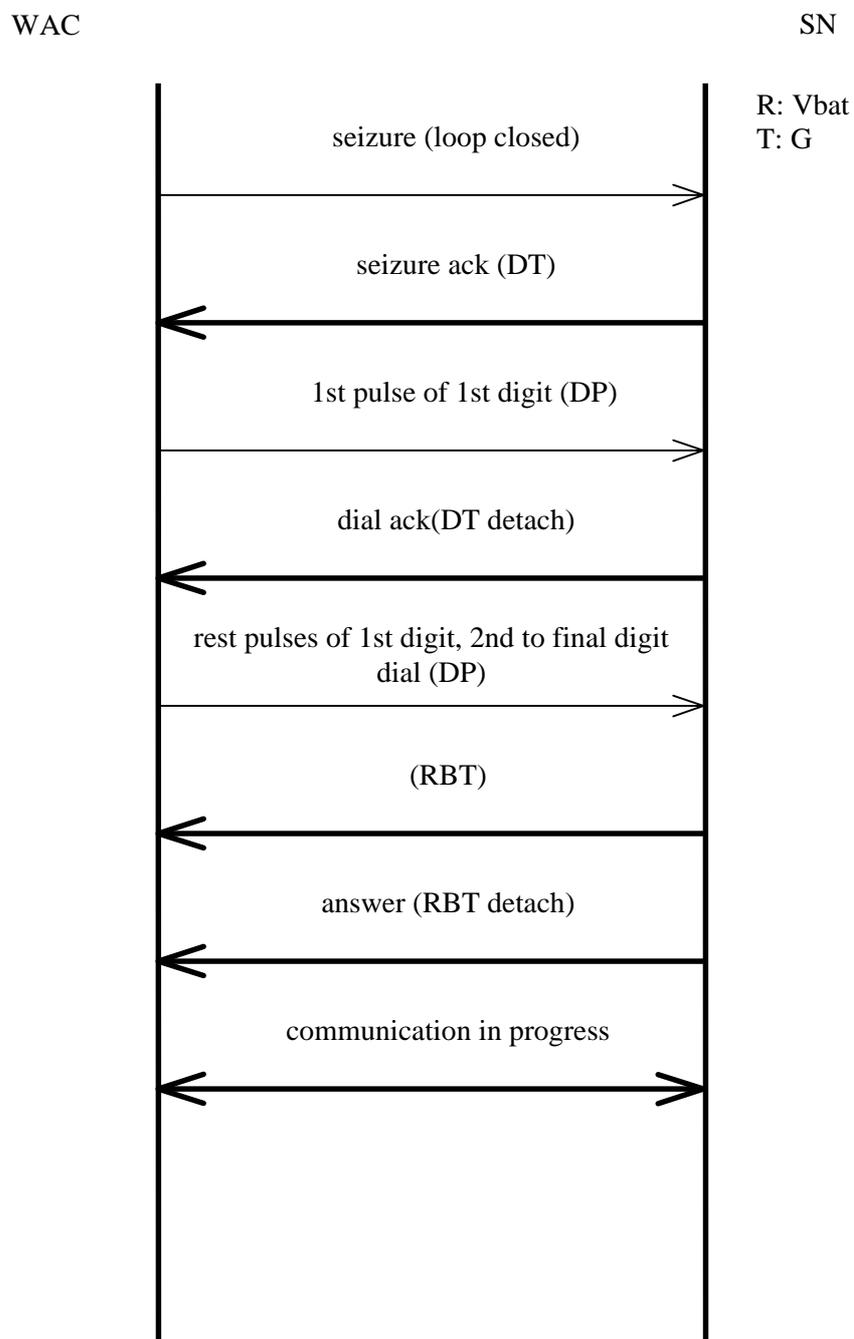

Figure 3-1/C-IF3.01 Originating - Answer (Individual DP Line Sub.)

3.2 Originating-Answer (Individual DTMF Line Sub.)

Figure 3-2/C-IF3.01 shows a WIF3 sequence of originating answer (Individual DTMF Line Subscriber).
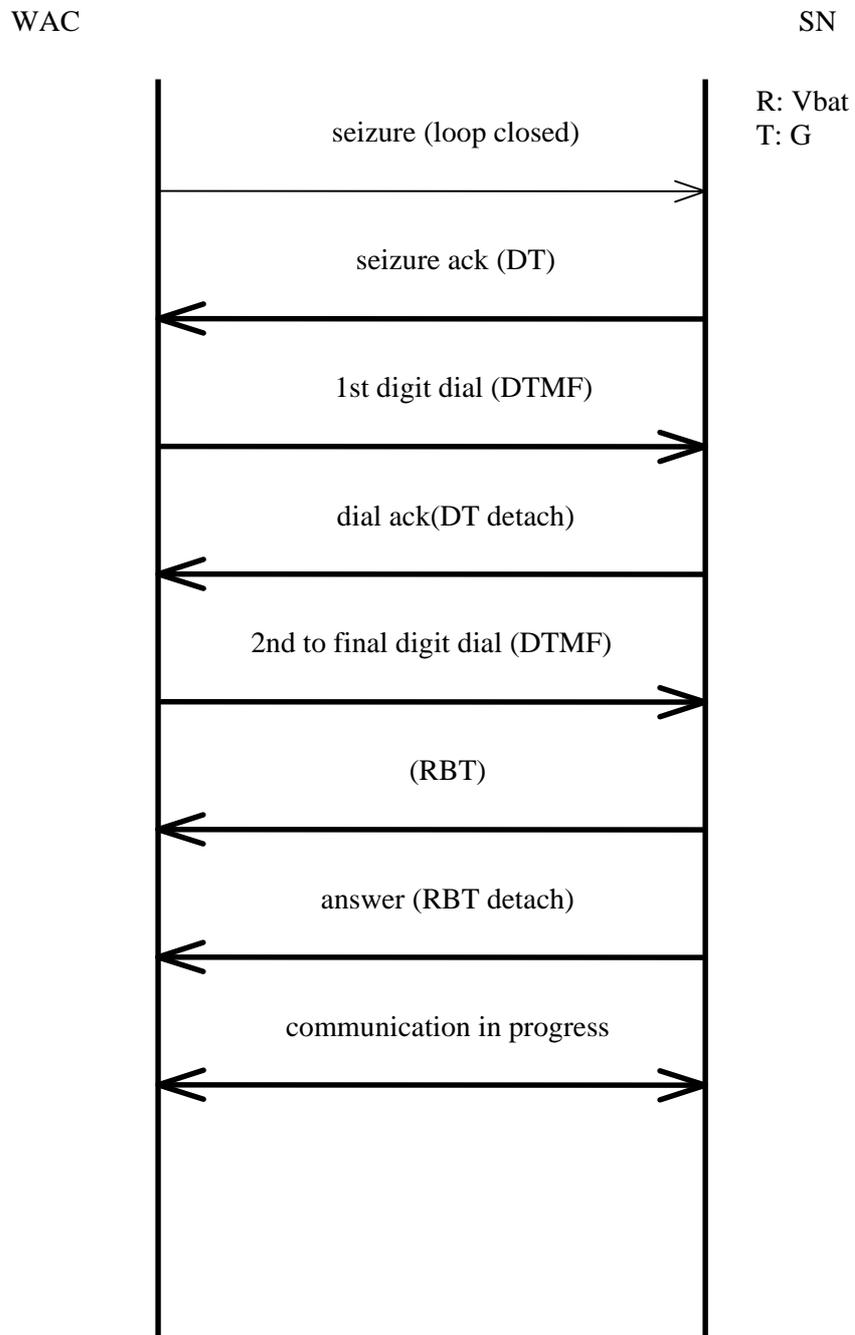
Figure 3-2/C-IF3.01 Originating - Answer (Individual DTMF Line Sub.)

3.3 Originating-Answer (Loop Start PBX)

Figure 3-3/C-IF3.01 shows a WIF3 sequence of originating answer (Loop Start PBX).

WAC   SN

                                             R: Vbat
seizure (loop closed)   T: G

seizure ack (DT)

1st digit dial (DP/DTMF)

dial ack(DT remove)

2nd to final digit dial (DP/DTMF)

(RBT)

answer
(RBT remove, reverse polarity)

                                             R: G
                                             T: Vbat
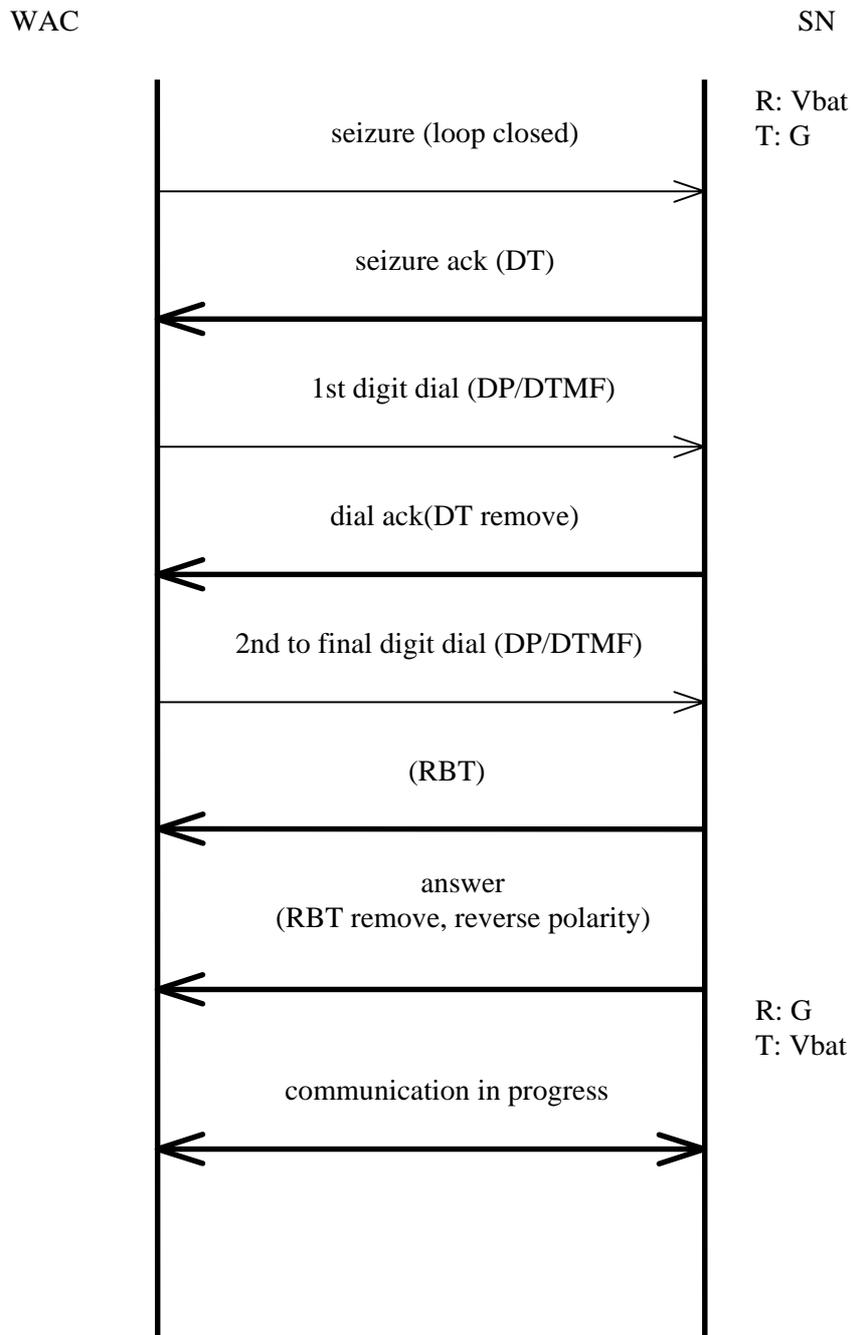communication in progress

Figure 3-3/C-IF3.01 Originating - Answer (Loop Start PBX)

3.4 Originating-Answer (Ground Start PBX)

Figure 3-4/C-IF3.01 shows a WIF3 sequence of originating answer (Ground Start PBX).

WAC   SN

R: Vbat
T: open

seizure(ground on T with loop)

seizure ack(G on T)

R: Vbat
T: G

(DT)

1st digit dial (DP/DTMF)

dial ack(DT remove)

2nd to final digit dial(DP/DTMF)

(RBT)

answer
(RBT remove, reverse polarity)

R: G
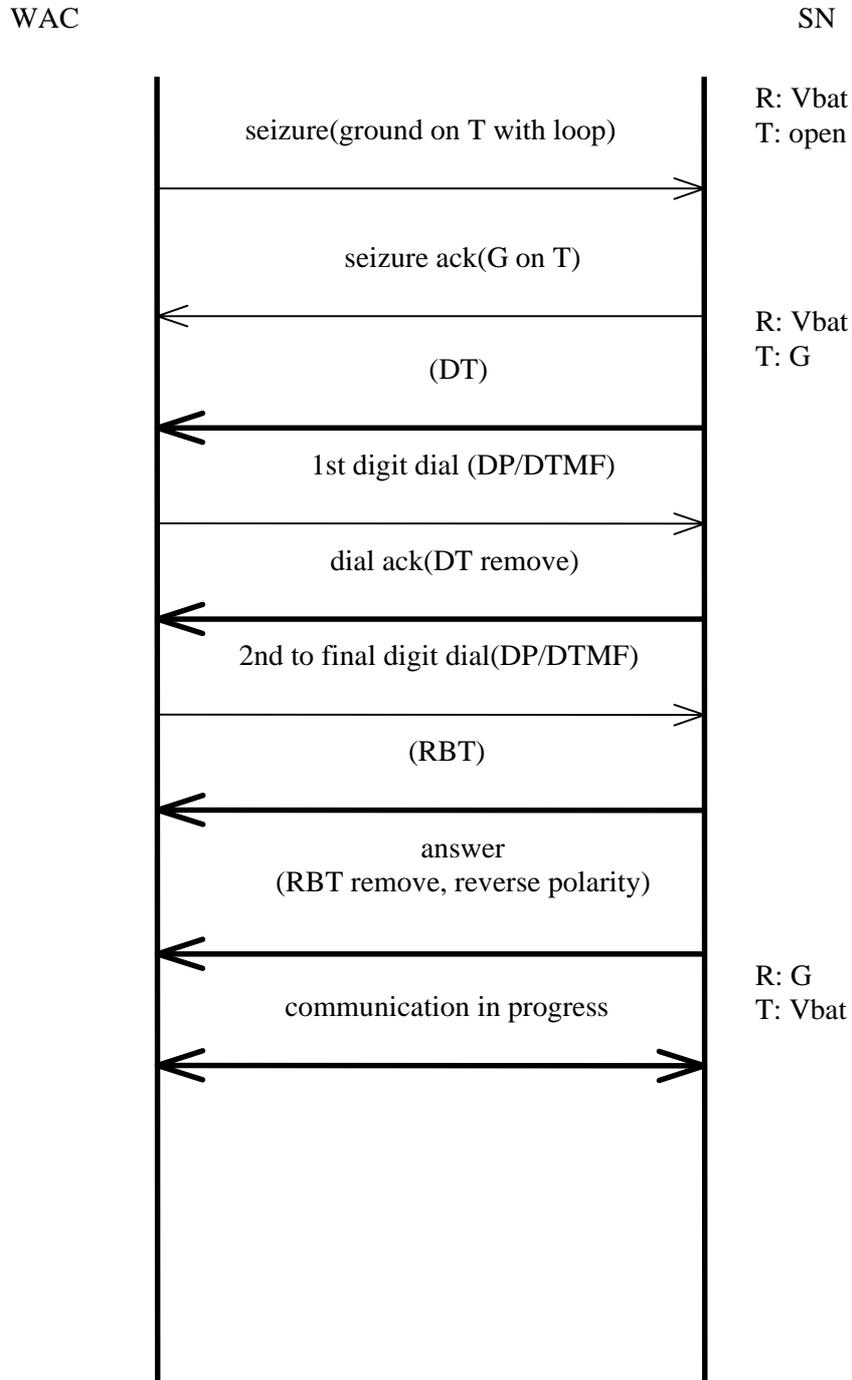T: Vbat

communication in progress

Figure 3-4/C-IF3.01 Originating - Answer (Ground Start PBX)

3.5 Release-before Dialling

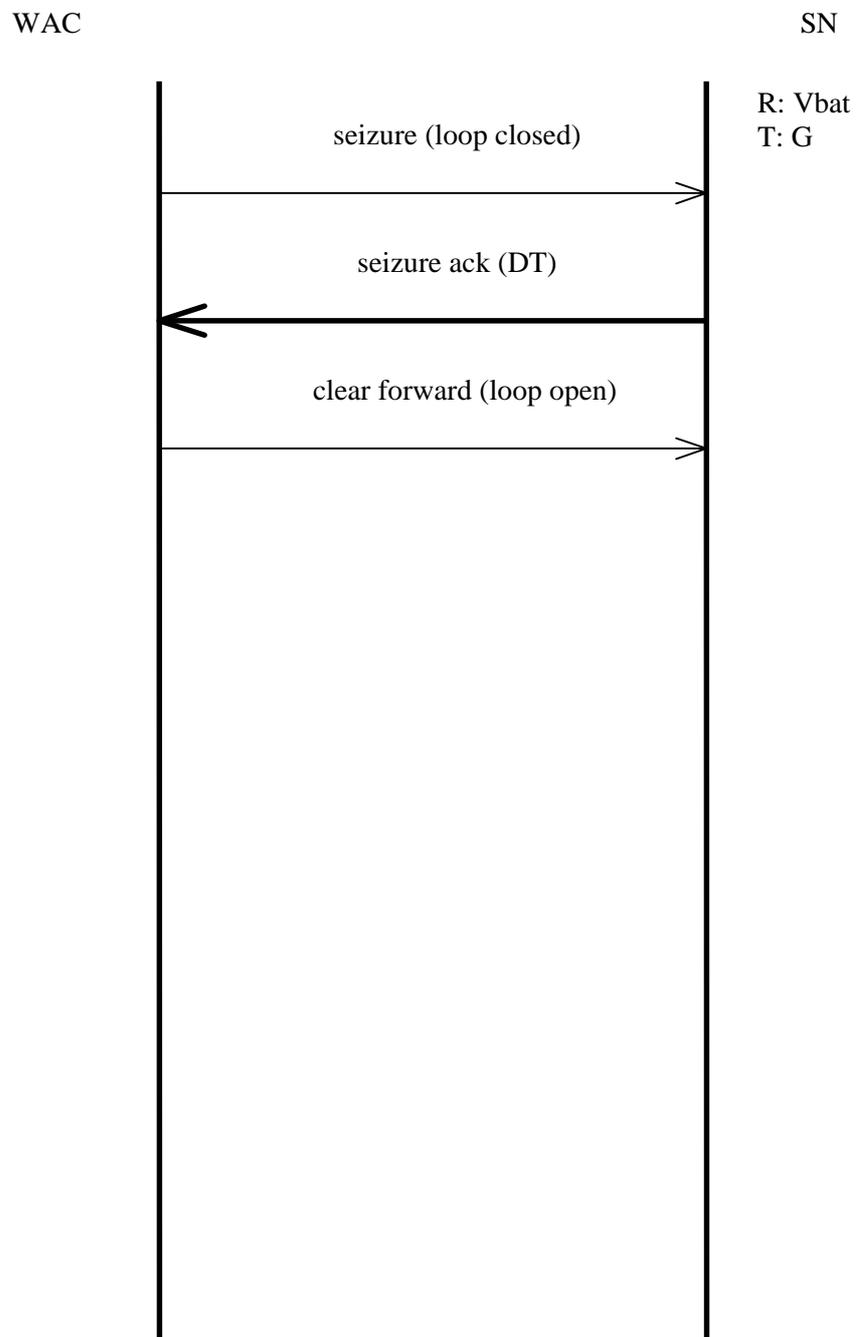Figure 3-5/C-IF3.01 shows a WIF3 sequence of release before dialling.

WAC   SN

R: Vbat
T: G

seizure (loop closed)

seizure ack (DT)

clear forward (loop open)

Figure 3-5/C-IF3.01 Release - before Dialling

3.6 Release-during Dialling

Figure 3-6/C-IF3.01 shows a WIF3 sequence of release during dialling.

WAC   SN

R: Vbat
T: G

seizure (loop on)

seizure ack (DT)

1st digit dial (DP/DTMF)

dial ack(DT detach)

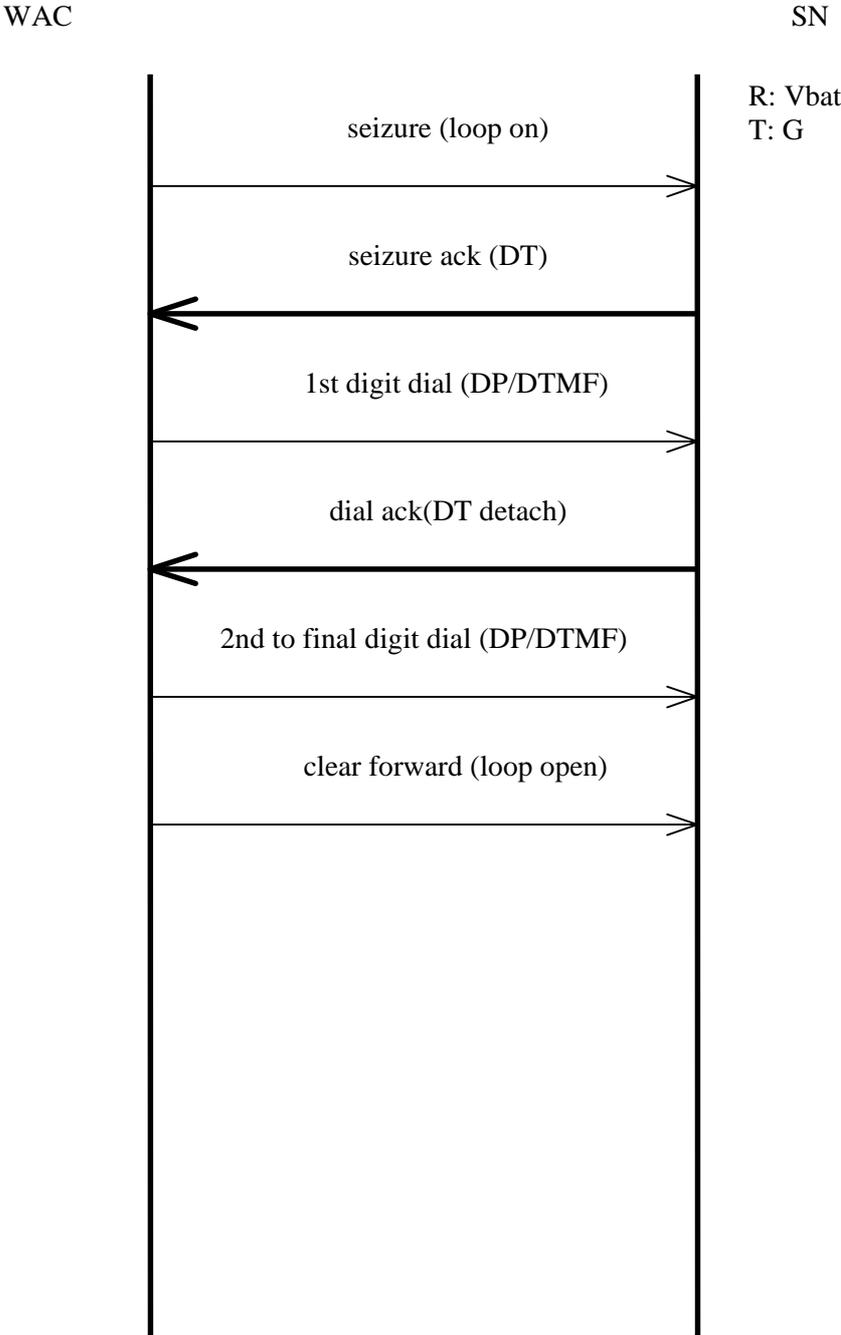2nd to final digit dial (DP/DTMF)

clear forward (loop open)

Figure 3-6/C-IF3.01 Release - during Dialling

3.7 Release-During Ringing

Figure 3-7/C-IF3.01 shows a WIF3 sequence of release during ringing.

WAC   SN

R: Vbat
T: G

seizure (loop closed)

seizure ack (DT)

1st digit (DTMF)

dial ack(DT detach)

2nd to final digit dial (DTMF)
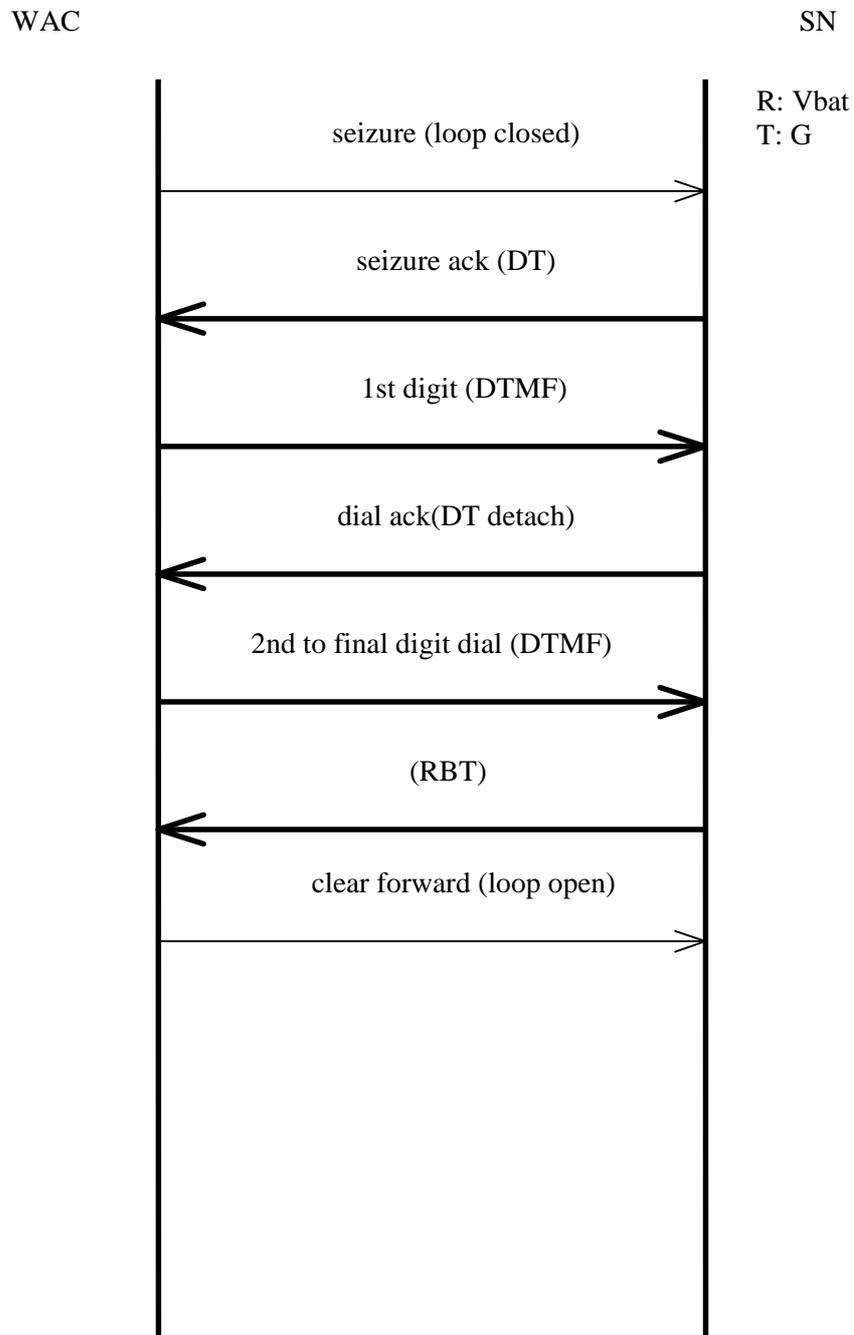
(RBT)

clear forward (loop open)

Figure 3-7/C-IF3.01 Release - during Ringing

3.8 Call Collision

Figure 3-8/C-IF3.01 shows a WIF3 sequence of call collision.

(This sequence is completely same as originating sequence.)

Figure 3-8/C-IF3.01 Call Collision

3.9 Calling Party Release-Individual Sub. Originating

Figure 3-9/C-IF3.01 shows a WIF3 sequence of calling party release individual subscriber originating.
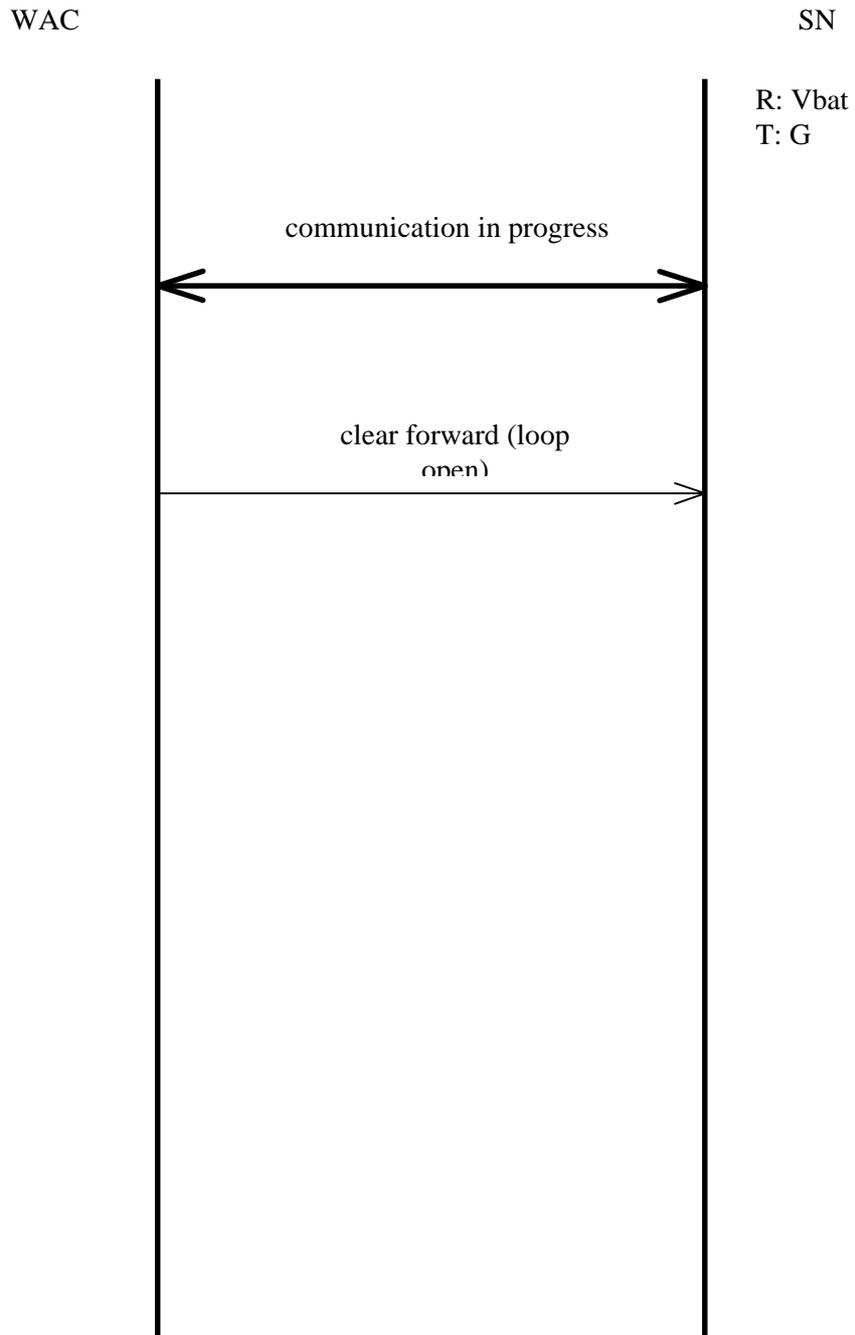

Figure 3-9/C-IF3.01 Calling Party Release - Individual Sub Originating

3.10 Called Party Release-Individual Sub. Originating

Figure 3-10/C-IF3.01 shows a WIF3 sequence of called party release individual subscriber originating.

WAC   SN

R: Vbat
T: G

communication in progress

called party
release

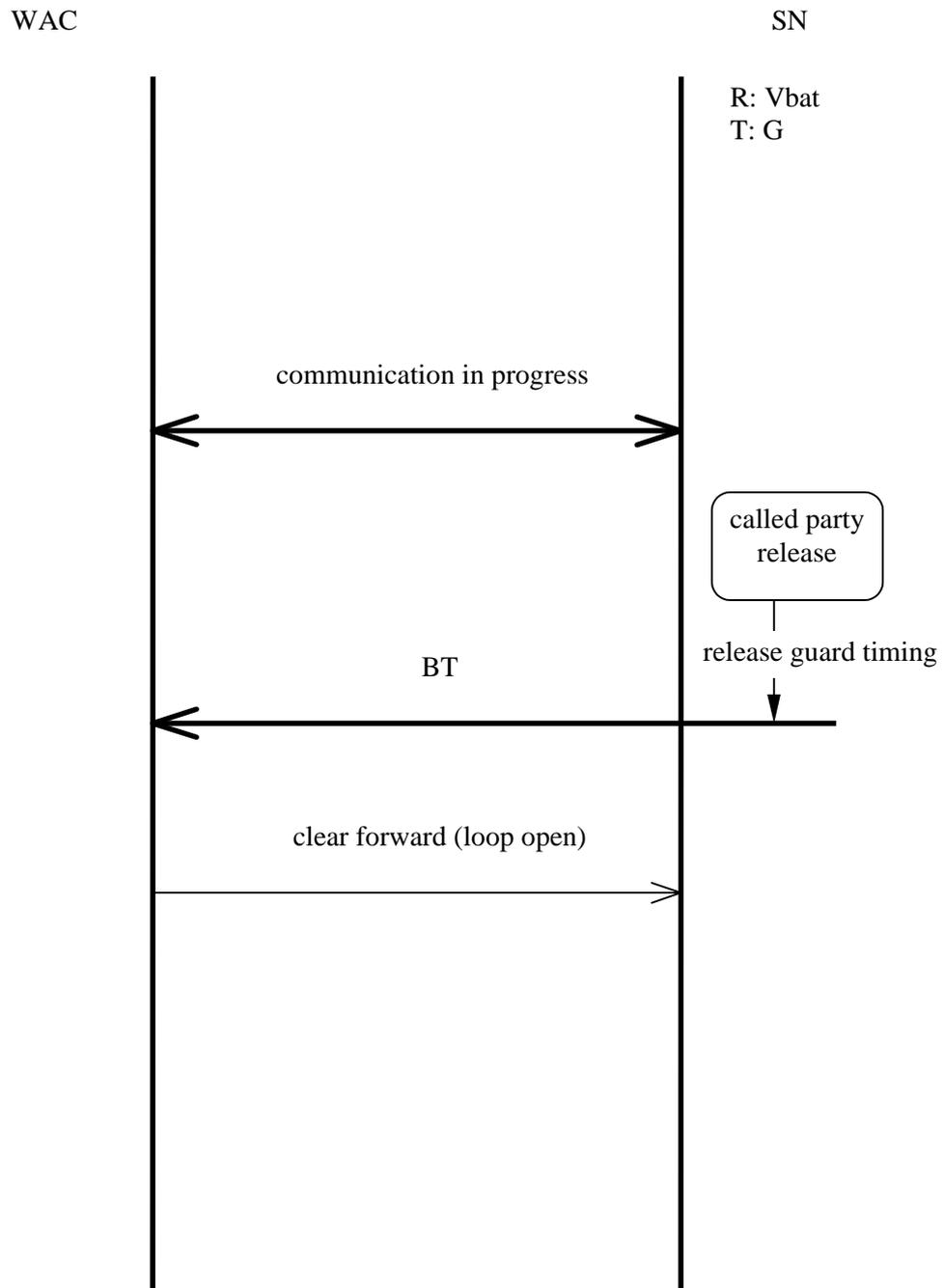release guard timing

BT

clear forward (loop open)

Figure 3-10/C-IF3.01 Called Party Release - Individual Sub Originating

3.11 Terminating-Answer

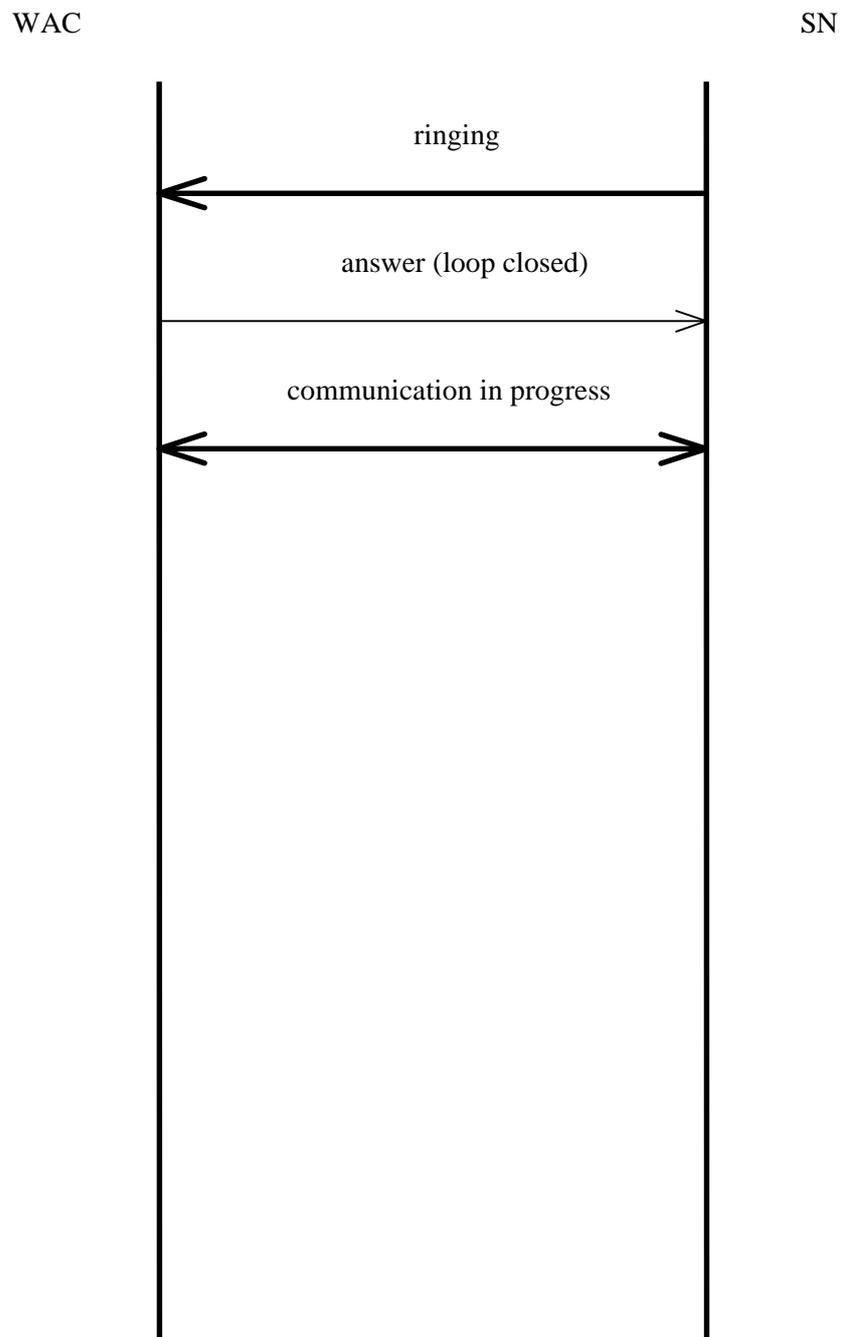Figure 3-11/C-IF3.01 shows a WIF3 sequence of terminating answer.

Figure 3-11/C-IF3.01 Terminating - Answer

3.12 Terminating-Ringing Resource Hunt NG

Figure 3-12/C-IF3.01 shows a WIF3 sequence of terminating ringing resource hunt NG.
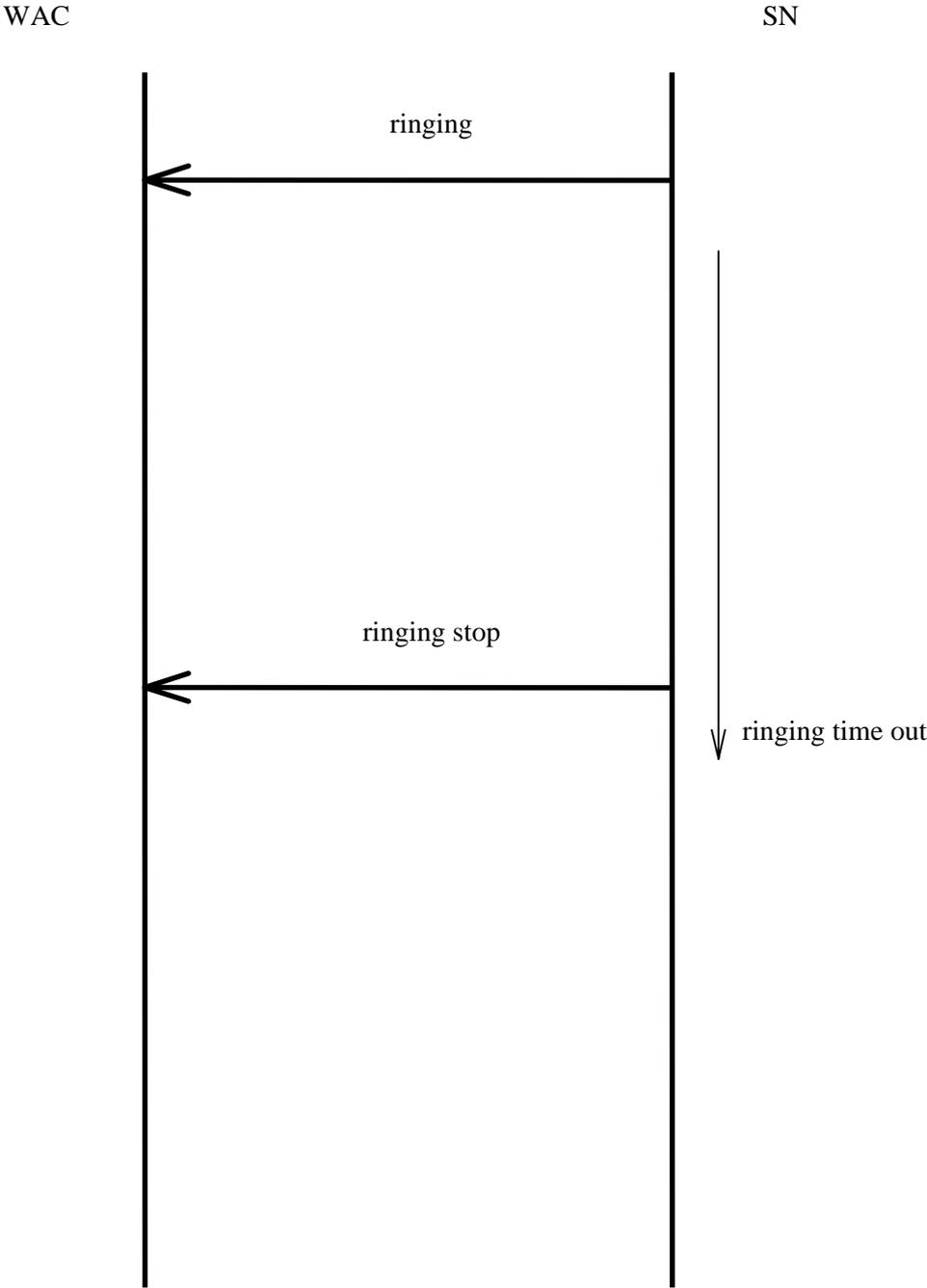

Figure 3-12/C-IF3.01 Terminating - Ringing Resource Hunt NG

3.13 Terminating-Answer (NTT DDI Spec.)

Figure 3-13/C-IF3.01 shows a WIF3 sequence of terminating answer (NTT DDI Specification).

WAC   SN

seizure(reverse polarity)

ringing

1st answer (loop closed)

signalling(DTMF)

signalling ack(loop open)

2nd answer (loop closed)

2nd answer ack (normal polarity)
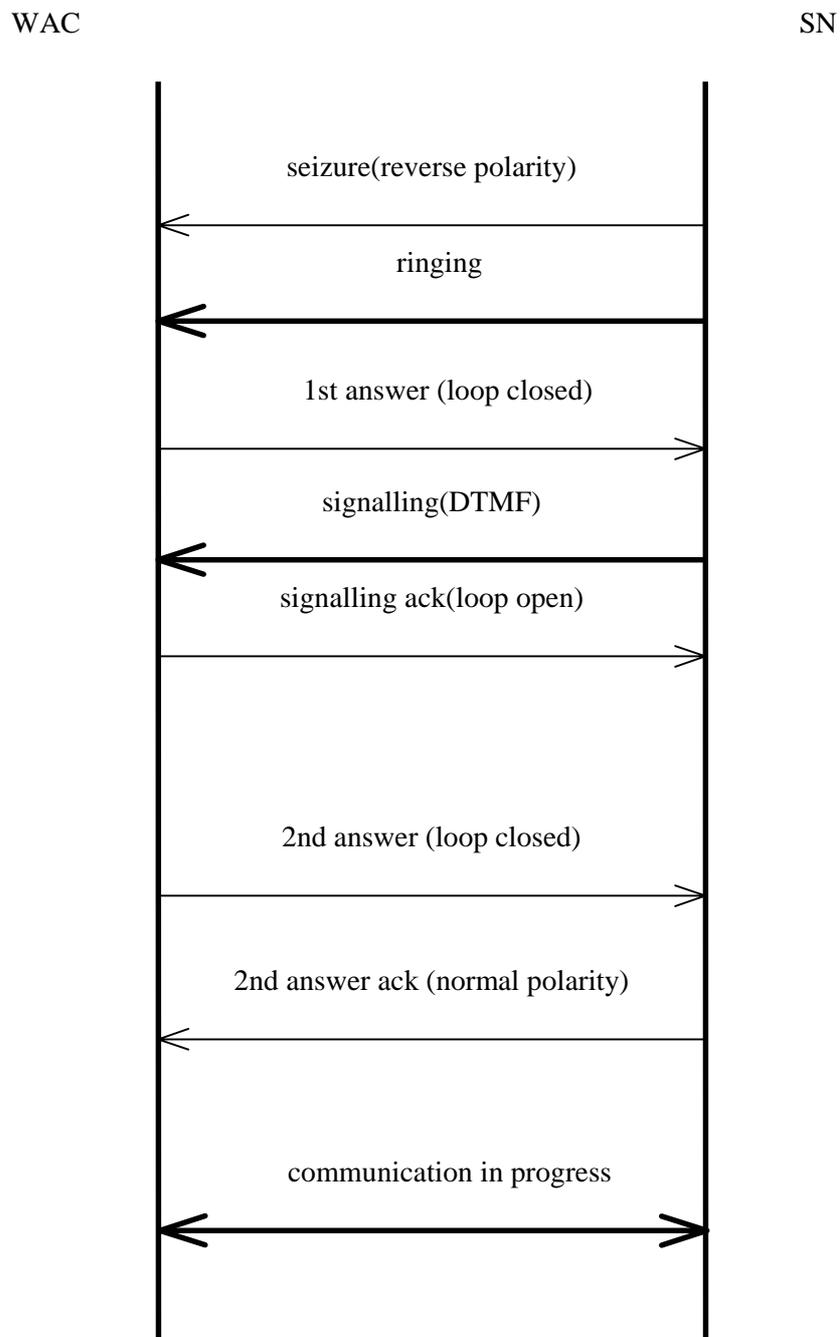
communication in progress

Figure 3-13/C-IF3.01 Terminating - Answer (NTT DDI Spec)

3.14 Terminating-Answer (DP type DDI)

Figure 3-14/C-IF3.01 shows a WIF3 sequence of terminating answer (DP type DDI).

WAC   SN

R: Vbat   R: Vbat
T: G   seizure(loop closed)   T: G

                                                                        R, T loop
                              signalling(DP)

                          answer (reverse polarity)

R: G
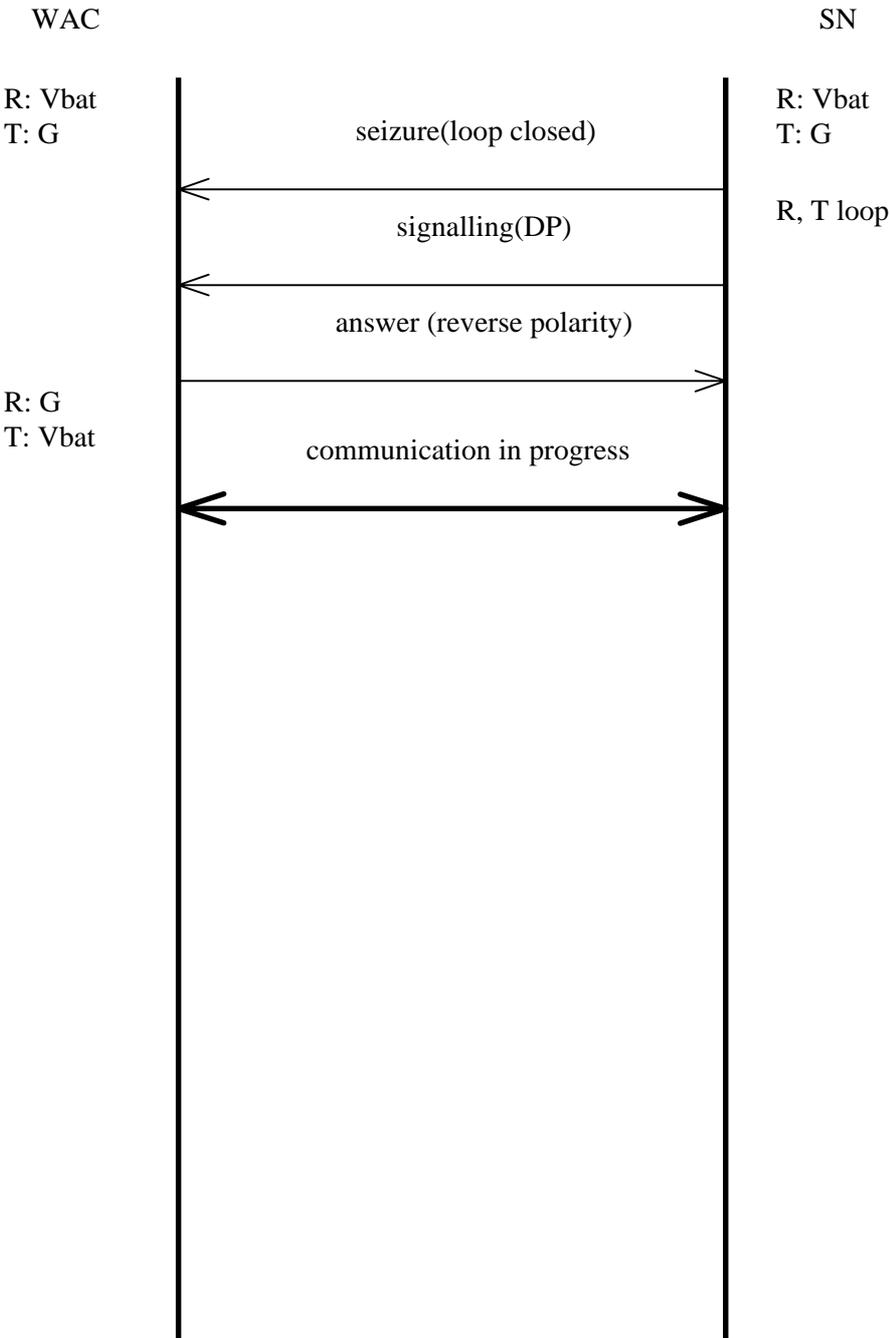T: Vbat   communication in progress

Figure 3-14/C-IF3.01 Terminating - Answer (DP Type DDI)

3.15 Terminating-Answer (DTMF Type DDI)

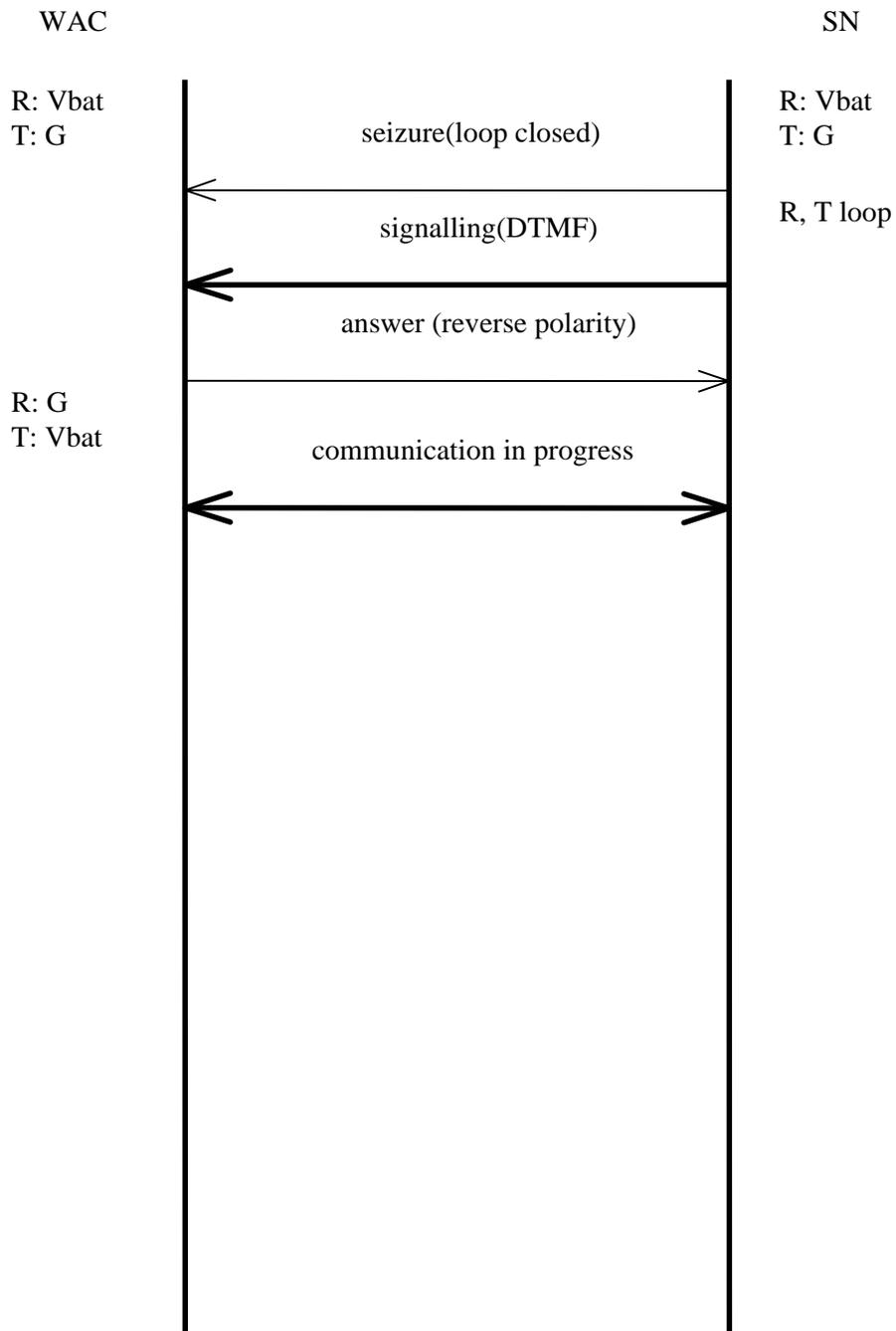Figure 3-15/C-IF3.01 shows a WIF3 sequence of terminating answer (DTMF type DDI).

Figure 3-15/C-IF3.01 Terminating - Answer (DTMF Type DDI)

3.16 Calling Party Release-Individual Sub. Terminating

Figure 3-16/C-IF3.01 shows a WIF3 sequence of calling party release individual subscriber terminating.
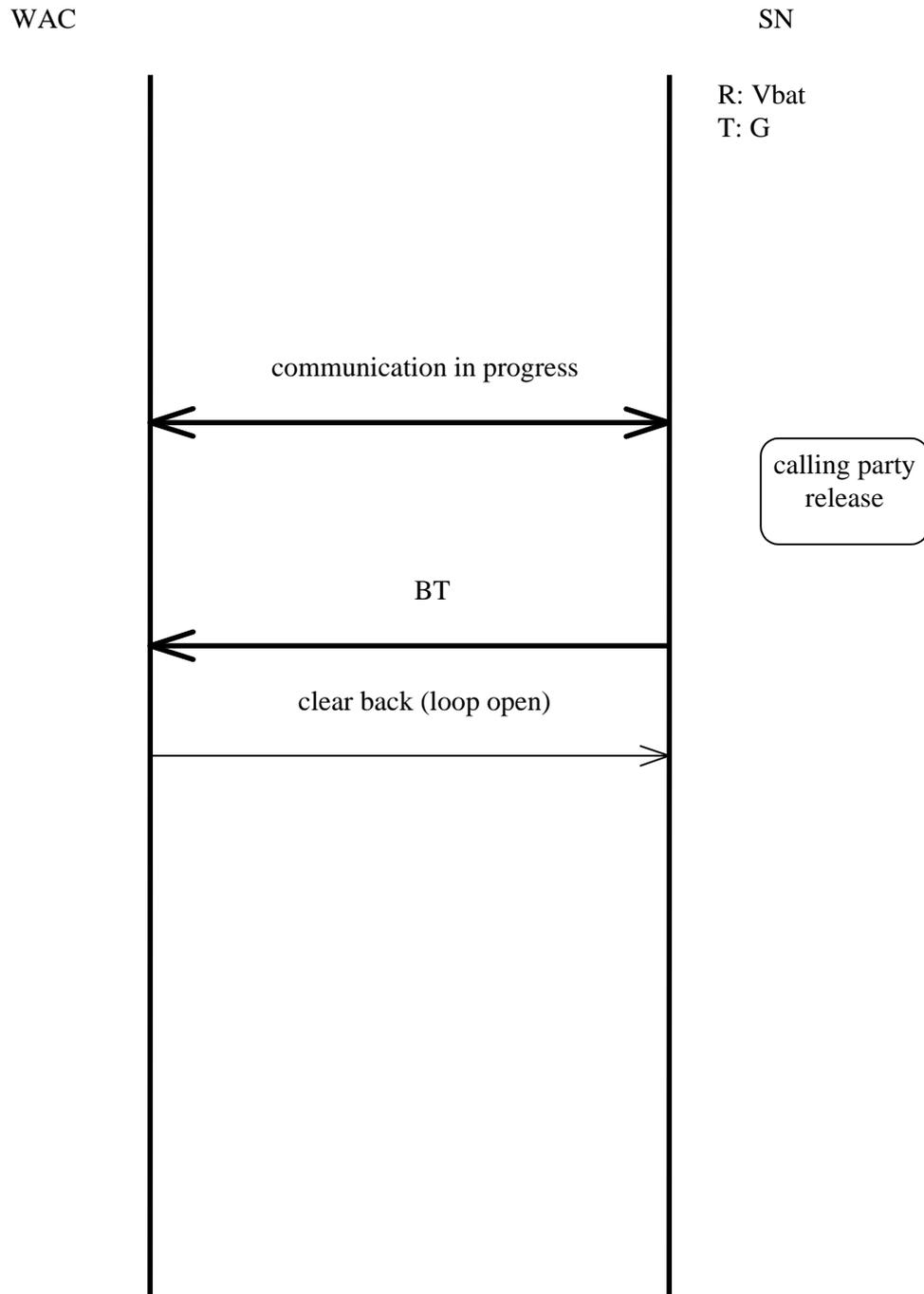
WAC   SN

                                                                R: Vbat
                                                                T: G

communication in progress

calling party
release

BT

clear back (loop open)

Figure 3-16/C-IF3.01 Calling Party Release - Individual Sub Terminating

3.17 Called Party Release-Individual Sub. Terminating

Figure 3-17/C-IF3.01 shows a WIF3 sequence of called party release individual subscriber terminating.
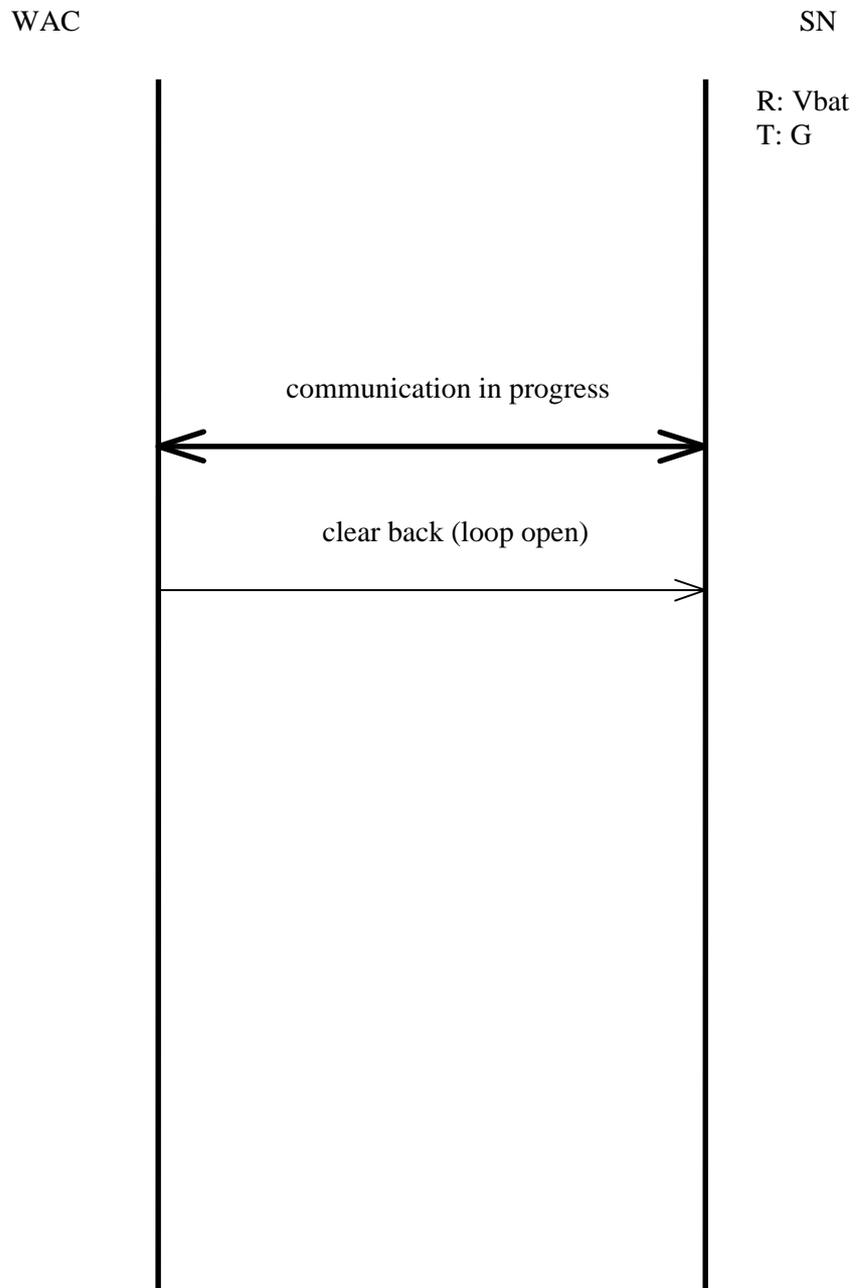

Figure 3-17/C-IF3.01 Called Party Release - Individual Sub Terminating

3.18 Hooking Monitoring

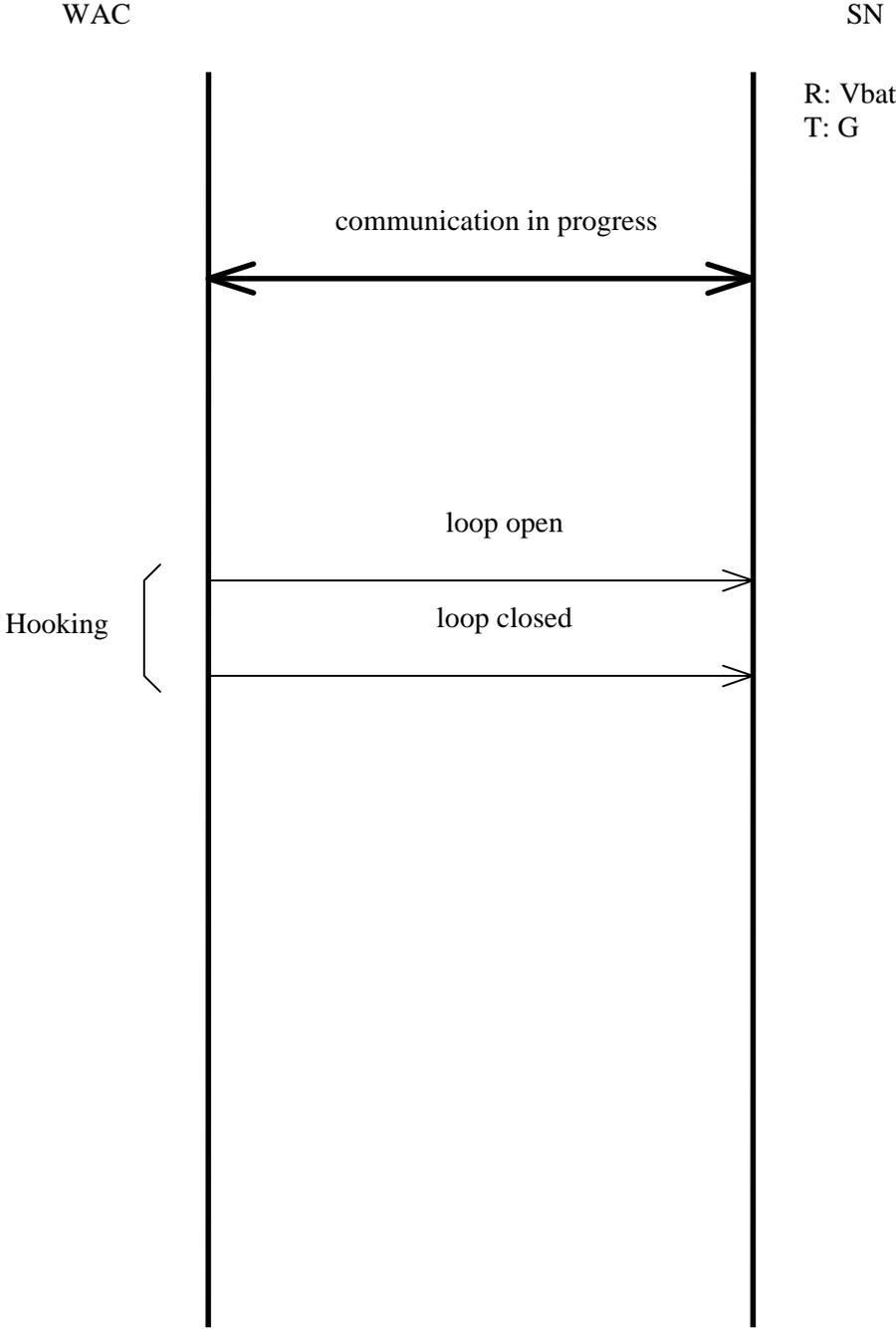Figure 3-18/C-IF3.01 shows a WIF3 sequence of hooking monitoring.

WAC

SN

R: Vbat
T: G

communication in progress

loop open

Hooking

loop closed

Figure 3-18/C-IF3.01 Hooking Monitoring

3.19 Meter Pulsing Signal Sending

Figure 3-19/C-IF3.01 shows a WIF3 sequence of meter pulsing signal sending.

WAC   SN

R: Vbat
T: G

seizure (loop closed) →

← seizure ack (DT)

1st digit dial (DP/DTMF) →

← dial ack(DT remove)

2nd to final digit dial (DP/DTMF) →

← (RBT)

← answer (RBT detach)

← meter pulsing signal

meter pulsing signal
(pulsed reverse polarity or
12 kHz tone or 16 kHz
tone, sending periodically
according to the calling rate
during communication in
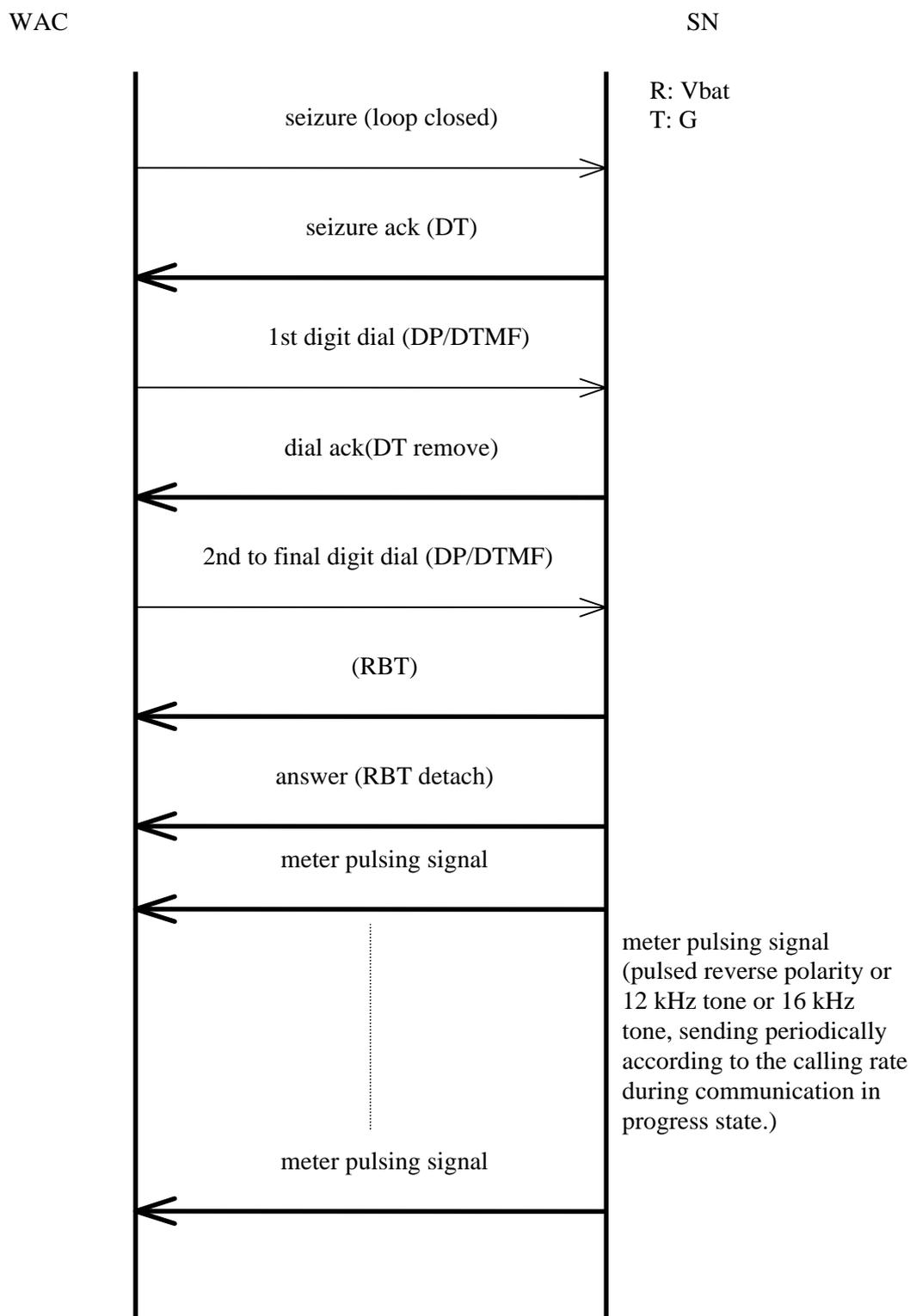progress state.)

← meter pulsing signal

Figure 3-19/C-IF3.01 Meter Pulsing Signal Sending

3.20 Connection to Howler Tone

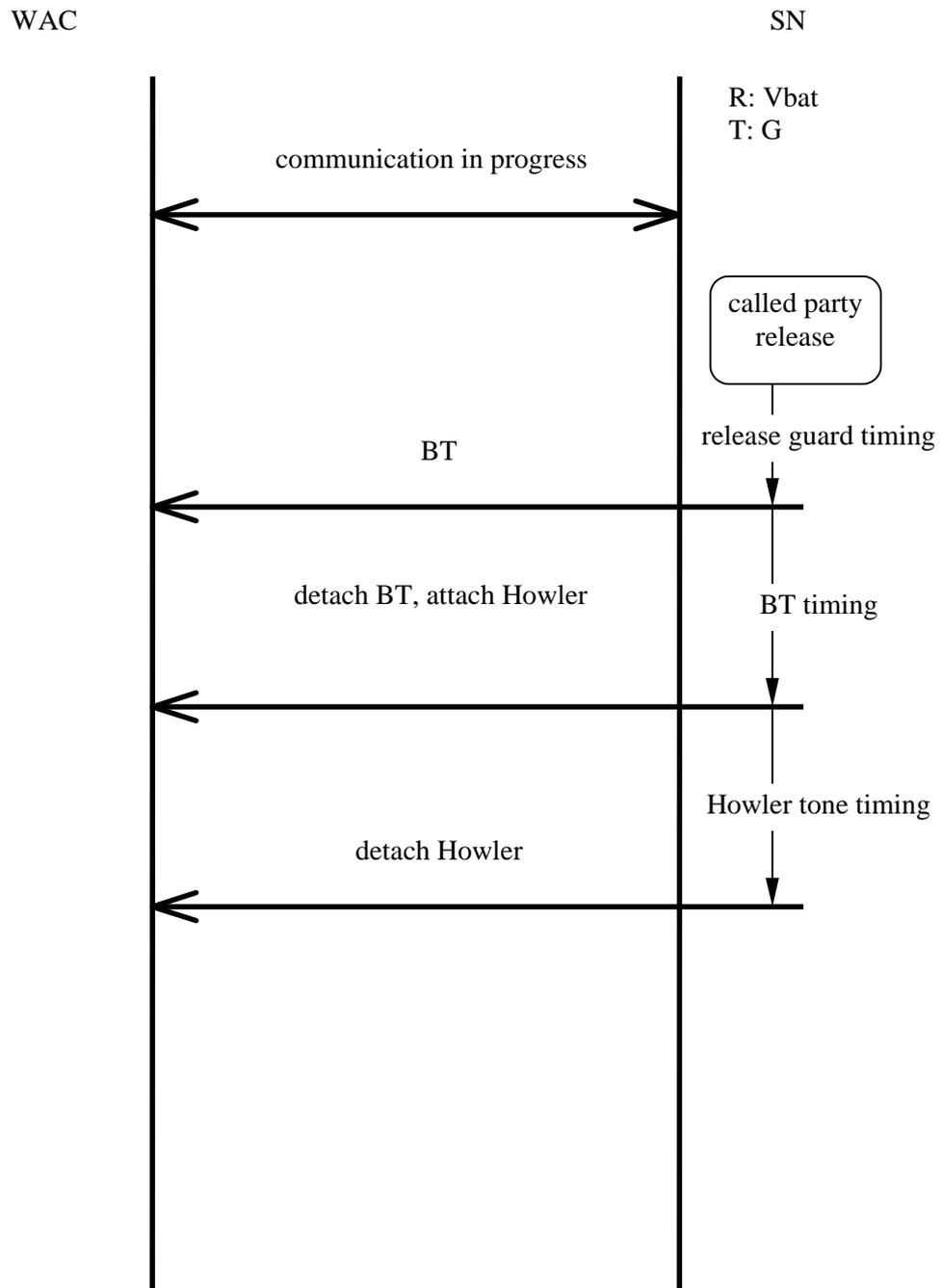Figure 3-20/C-IF3.01 shows a WIF3 sequence of connection to howler tone.

Figure 3-20/C-IF3.01 Connection to Howler Tone