ETSI TECHNICAL REPORT

ETR 150

September 1994

Source: ETSI TC-SPS

Reference: DTR/SPS-03036

ICS: 33.080

Key words: V5 interface, PSTN

Signalling Protocols and Switching (SPS); V5 interface Public Switched Telephone Network (PSTN) mappings

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

Blank page

Foreword

This ETSI Technical Report (ETR) was produced by the Signalling Protocols and Switching (SPS) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

This ETR is a re-issue of SPS-TR 002 (1993) to make its contents publicly available.

Blank page

1 Scope

This ETSI Technical Report (ETR) provides examples of how national protocols may be mapped onto the common PSTN protocol in the V5 interface as specified in ETS 300 324-1 [1]. These examples are intended for information only and do not create specification requirements for any equipment. It is up to national governing bodies and/or network operators to create official mappings for each of their national analogue protocols onto the PSTN V5 protocol. Without such required mappings, integration among manufacturers will be difficult or impossible in that country.

NOTE: Network operators contributing to the definition of this ETR reserve the right to change procedures in their PSTN protocols without giving notification to the users of this ETR.

For the examples given, not all possible call scenarios or error conditions will be discussed. These have to be specified in the official mappings created by national governing bodies and/or network operators.

Where particular countries or national protocols are mentioned in this ETR, the example given is only one potential mapping; other mappings are also possible. This ETR is not to be considered to constitute requirements for any country or national protocol.

According to the V5 interface specification, a large number of parameters (e.g., timers, cadences, voltages, frequencies, etc.) have to be pre-defined. Default values may also be pre-defined for some provisionable parameters. These may be discussed in this ETR, but it is the responsibility of national governing bodies and/or network operators to specify these values fully. All values discussed in this text are only examples and do not constitute requirements.

2 References

For the purposes of this ETR, the following references apply:

[1] ETS 300 324-1 (1994): "Signalling Protocols and Switching (SPS); V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".

3 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

AN	Access Network
DDI	Direct Dialling-In
DTMF	Dual Tone Multi-Frequency
FE	Function Element
LE	Local Exchange
PABX	Private Automatic Branch eXchange
PBX	Private Branch eXchange
PSTN	Public Switched Telephone Network

4 General information on the mappings layout

In the following flow diagrams, time is shown running from top to bottom, with no scale. The vertical bars represent the following entity:

user port	=	national PSTN interface between subscriber equipment and Access Network;
V5 AN side	=	V5 AN PSTN protocol entity;
V5 LE side	=	V5 LE PSTN protocol entity;
national PSTN protocol	=	national PSTN protocol implementation in the LE.

Line conditions detected or forwarded on the user line and primitives originated by the National Protocol in the LE have been mapped onto Function Elements (FE) according to tables 1 and 2 of the V5.1 interface specification, ETS 300 324-1 [1].

A brief description of the physical conditions detected or generated on the PSTN line is shown in brackets below the function element, for example:

```
                user port                V5.1 AN side
digit 1            |      FE-line_signal      |
                   |------------------------->|
                   |    (line state sign.)    |
                   |                          |
```

Figure 1

The diagrams do not give information about the timers involved in the V5 PSTN protocol message exchange (refer to table 28 of ETS 300 324-1 [1]).

States of the PSTN protocol are shown on the right side of the vertical bars only when a state transition occurs (for further information refer to tables 29 to 31 of ETS 300 324-1 [1]).

The message types visible on the V5 interface are represented in capital letters and are given along with an indication of their direction in the centre portion of the diagrams. Below the message, a further explanation of the structure of the message itself is given (i.e. information element and line signal). For editorial reasons, some abbreviations have been adopted to represent the information elements. The following rules apply:

Pulse-notification	=	Pn
Autonomous-signalling-sequence	=	Asis
Sequence-response	=	Sr
Cadenced-ringing	=	Cr
Pulsed-signal	=	Ps
Steady-signal	=	Ss
Digit-signal	=	Ds
Resource unavailable	=	Ru

An example is given in figure 2 of how an ESTABLISH message carrying an off hook indication (Steady signal) can be represented.

```
V5 AN side               V5 LE side
   |      ESTABLISH         |
   |----------------------->|
   |    Ss = off hook       |
   |                        |
```

Figure 2

The SIGNAL ACK messages, used to acknowledge SIGNAL messages, may occur at any time during the PATH ACTIVE state and their position within the protocol is arbitrary.

The occurrence of the SIGNAL ACK message is independent from the mappings and is therefore not shown in the following drawings.

5 Mappings

This Clause contains mappings supplied by European national governing bodies and/or network operators. The mappings have been grouped according to the nation which has supplied them.

5.1 V5 PSTN signal flows for a BT network

Notes on case A: A direct exchange line

Subscriber A calling and subscriber A clearing.

NOTE 1: It has been assumed that only one dialled digit is sent for this example.

NOTE 2: The exchange release signal is a 100 ms reduction in line current to less than 1 mA, and has been mapped onto a reduced battery information element. This should be allocated to a pulse type and should be designed as uninterruptable. As shown in the example, the acknowledgement-request option has been used.

NOTE 3: For the example shown, it was decided that the AN should acknowledge the end of exchange release signal and that the LE should not send the DISCONNECT message until that acknowledgement had been received. This makes sure that the 100 ms pulse is correctly transported to the customer's equipment.

Notes on case B: A direct exchange line

Subscriber B called and subsequently cleared.

NOTE 1: It is assumed that the cadenced-ring information element would point to a pre-provisioned type of ringing which reverses the polarity of the line whilst ringing takes place.

NOTE 2: It is assumed that the ringing is stopped by the telephone being taken off hook and that no specific message is required from the exchange.

NOTE 3: The end of call signal shown is a 100 ms reduction in line current to less than 1 mA. This should be allocated to a pulse type and should be designated uninterruptable. As shown in the example, the acknowledgement-request option has been used.

NOTE 4: The exchange release signal is a 100 ms reduction in line current to less than 1 mA, and has been mapped onto a reduced battery information element. This should be allocated to a pulse type and should be designated uninterruptable. As shown in the example, the acknowledgement-request option has been used.

Notes on case C: An earth-calling PBX

Subscriber A calling and subscriber A clearing.

NOTE 1: It has been assumed that only one digit is sent for this example.

NOTE 2: The seize acknowledgement is handled autonomously as there is not enough time for the acknowledgement to be sent from the exchange.

NOTE 3: The exchange release acknowledgement signal is a timed disconnection of both a- and b-wires and has been mapped onto a pulsed no-battery information element. This should be an uninterruptable pulse and the signal sent after it (normal battery) should be the state to which the line defaults after the pulse has been sent.

Notes on case D: An earth-calling PBX

Subscriber B called and subsequently cleared.

NOTE 1: It is assumed that the cadenced-ring information element would point to a pre-provisioned type of ringing which reverses the polarity whilst ringing takes place. The line should remain at reverse polarity in-between the bursts.

NOTE 2: It is assumed that the ringing is stopped by the telephone being taken off hook and that no specific message is required from the exchange.

NOTE 3: The exchange release acknowledgement message is a timed disconnection of both a- and b-wires and has been mapped onto a pulsed no-battery information element. This should be an uninterruptable pulse and the signal sent after it (normal battery) should be the state to which the line defaults after the pulse has been sent.

5.1.1 Case A: Subscriber A calling and subscriber A clearing

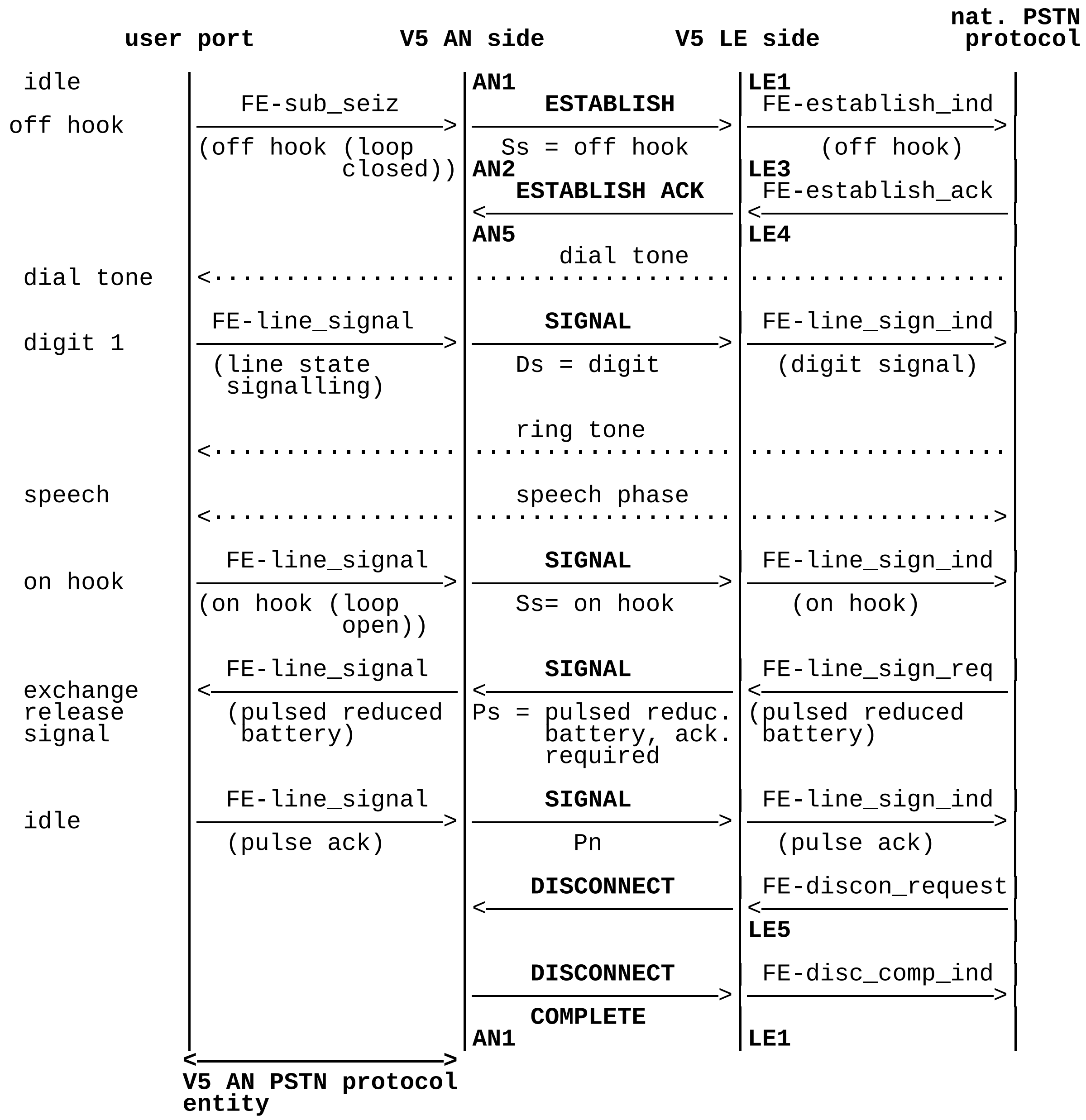

Figure 3

5.1.2 Case B: Subscriber B called and subsequently cleared

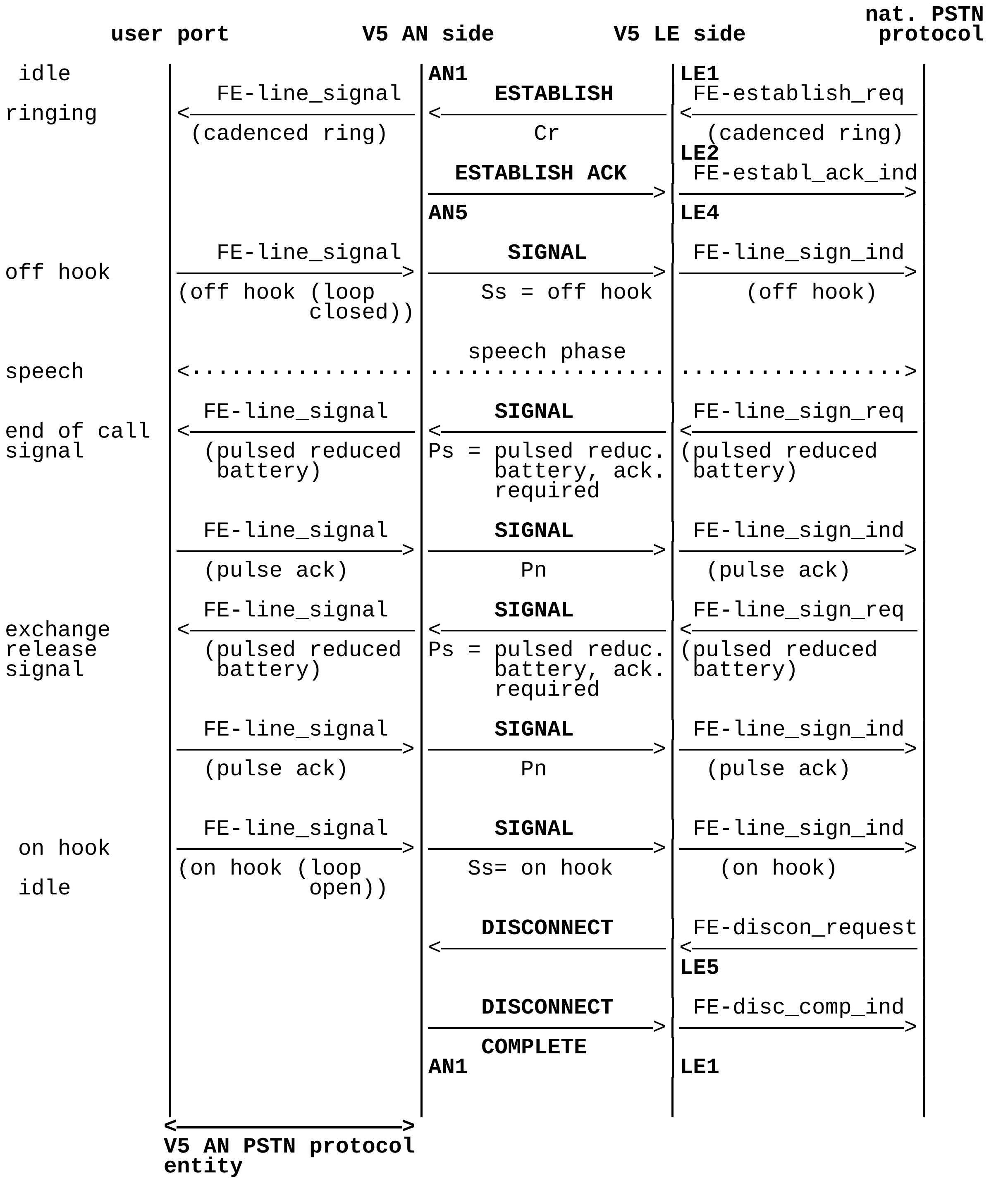

Figure 4

5.1.3 Case C: Subscriber A calling and subscriber A clearing for an earth-calling PBX

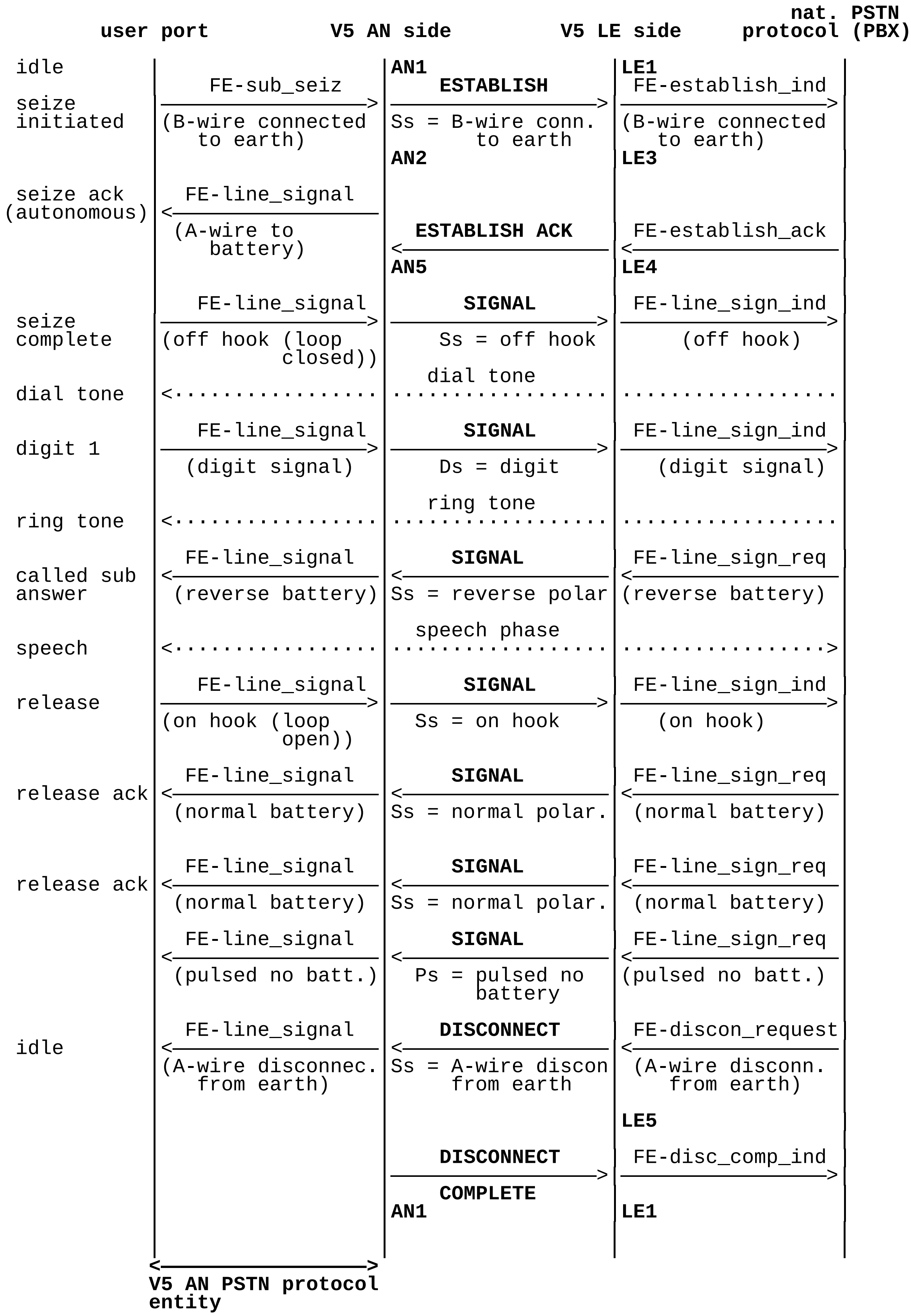

Figure 5

5.1.4 Case D: Subscriber B called and subsequently cleared for an earth-calling PBX

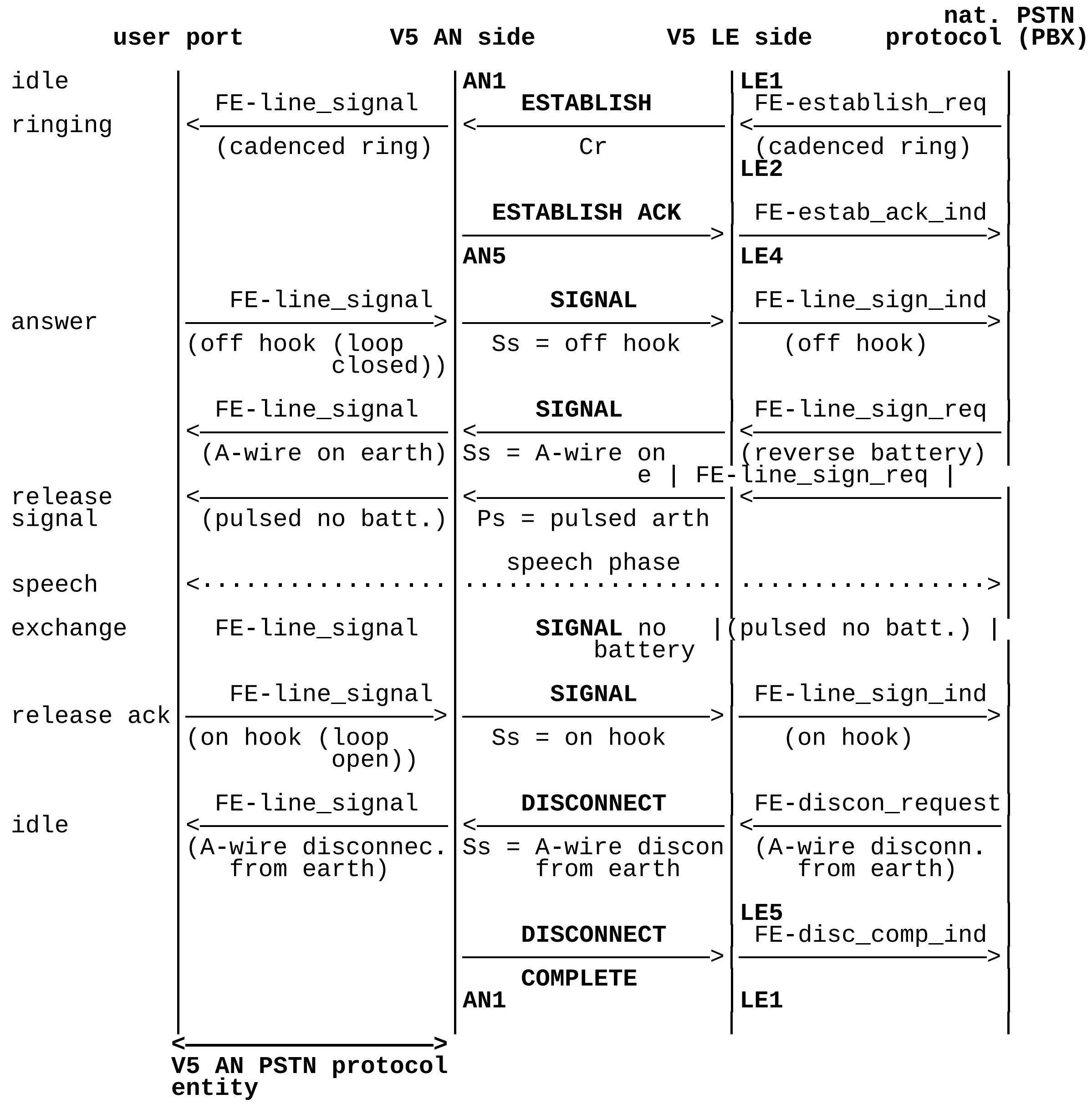

Figure 6

5.2 V5 PSTN signal flows for an Italian network

Notes on case A: A direct exchange line

Subscriber A calling and subscriber A clearing.

NOTE 1: It has been assumed that only one dialled digit is sent for this example.

NOTE 2: The meter pulses shown in this drawing have been mapped onto a meter pulse information element, and the acknowledgement request option has been used. It has been assumed that the meter pulse information element would point to a pre-provisioned type of pulse.

Notes on case B: A direct exchange line

Subscriber B called and subsequently cleared. Subscriber B is enabled to the identification of the incoming calls.

NOTE 1: The initial ring message is used to generate a single ring and to activate the speech path between the subscriber telephone equipment and the user port in order to allow the transmission, by the LE, of the calling party identification data. The cadenced-ring information is used to start normal ringing.

NOTE 2: It has been assumed that the cadenced-ring information element would point to a pre-provisioned type of ringing.

NOTE 3: The busy tone generated by the exchange to subscriber B is an information that the conversation with the calling party has been terminated. In case the exchange does not receive any on hook signal by the called party, after a period it will start the procedures to park that line.

Notes on case C: A DDI PABX with line state signalling

An example of a passive call is herein reported. For the Italian DDI PABX no active call is shown because no particular protocol is necessary and case A (direct exchange line) can be considered as a valid example exception made for the meter pulses which in Italy are never sent to a PABX DDI.

Subscriber B called and subscriber B clearing.

NOTE 1: Signalling from the DDI PABX to the line card at the AN is performed via line impedance and voltages falls variations. Signalling from the AN to the PABX consists in polarity reversals and line voltage interruptions.

NOTE 2: It has been assumed that only one dialled digit is sent to the DDI PABX for this example.

NOTE 3: The Low Impedance state is that state into which the line defaults after the call has been cleared. The Clear Forward is a condition of normal polarity of the line which causes it to become idle. Normal polarity state is also called Availability Forward and is kept till the next seizure.

Notes on case D: A direct exchange line

Subscriber A in conversation with B uses call hold supplementary service to call subscriber C and to start a three party conference.

NOTE 1: It has been assumed that only one digit has been dialled to address subscriber C.

NOTE 2: The register recall signal has been mapped onto a Pulsed Signal type information element.

NOTE 3: The procedure to start a three party conference consists in digit 3 sent to the local exchange by the supplementary service bearer while having both the conference subscribers in a hold state.

5.2.1 Case A: Subscriber A calling and subscriber A clearing

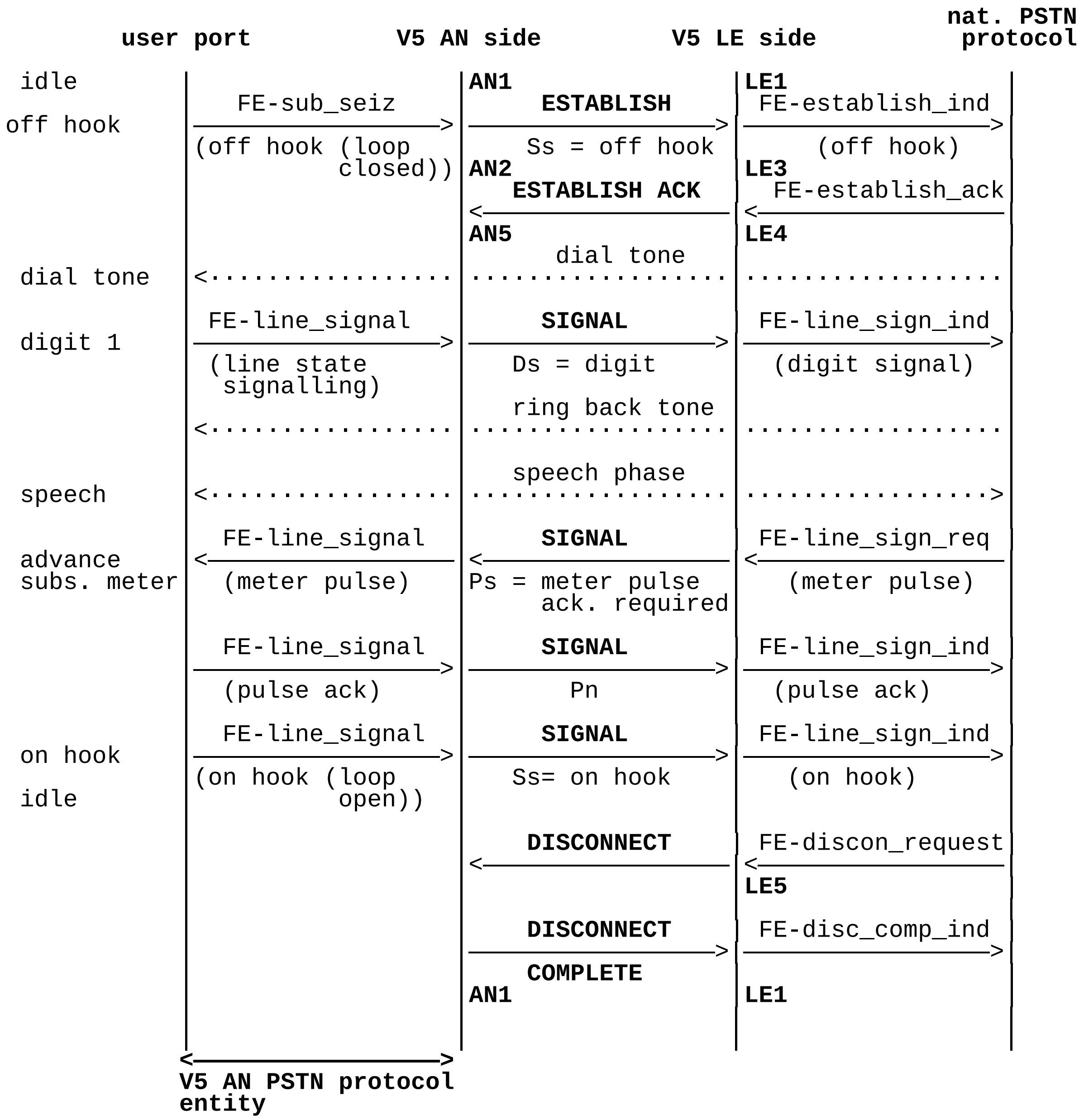

Figure 7

5.2.2 Case B: Subscriber B, with identification of calling party service active, called and subsequently cleared

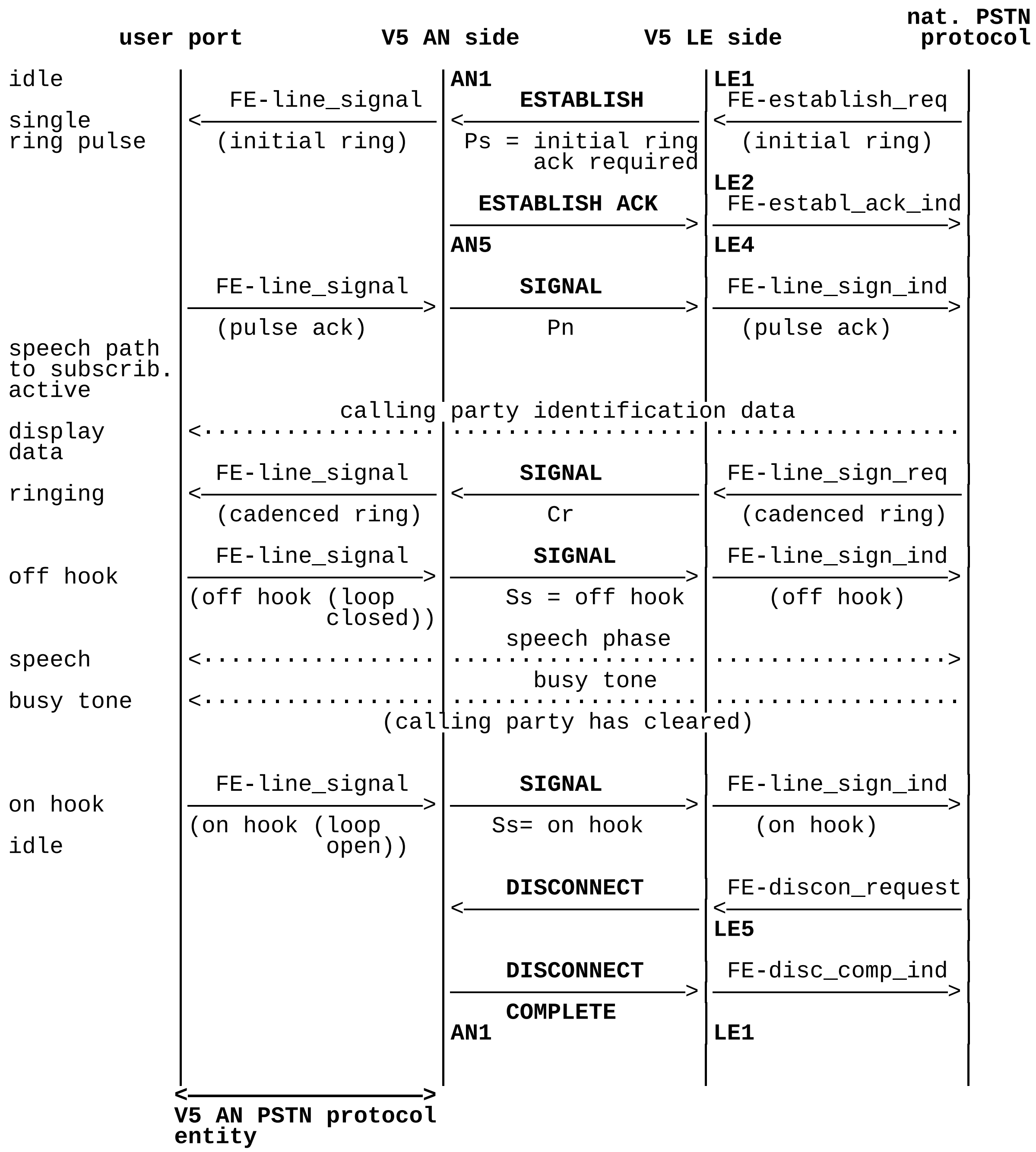

Figure 8

5.2.3 Case C: Subscriber A called and subscriber A clearing for an Italian DDI PABX

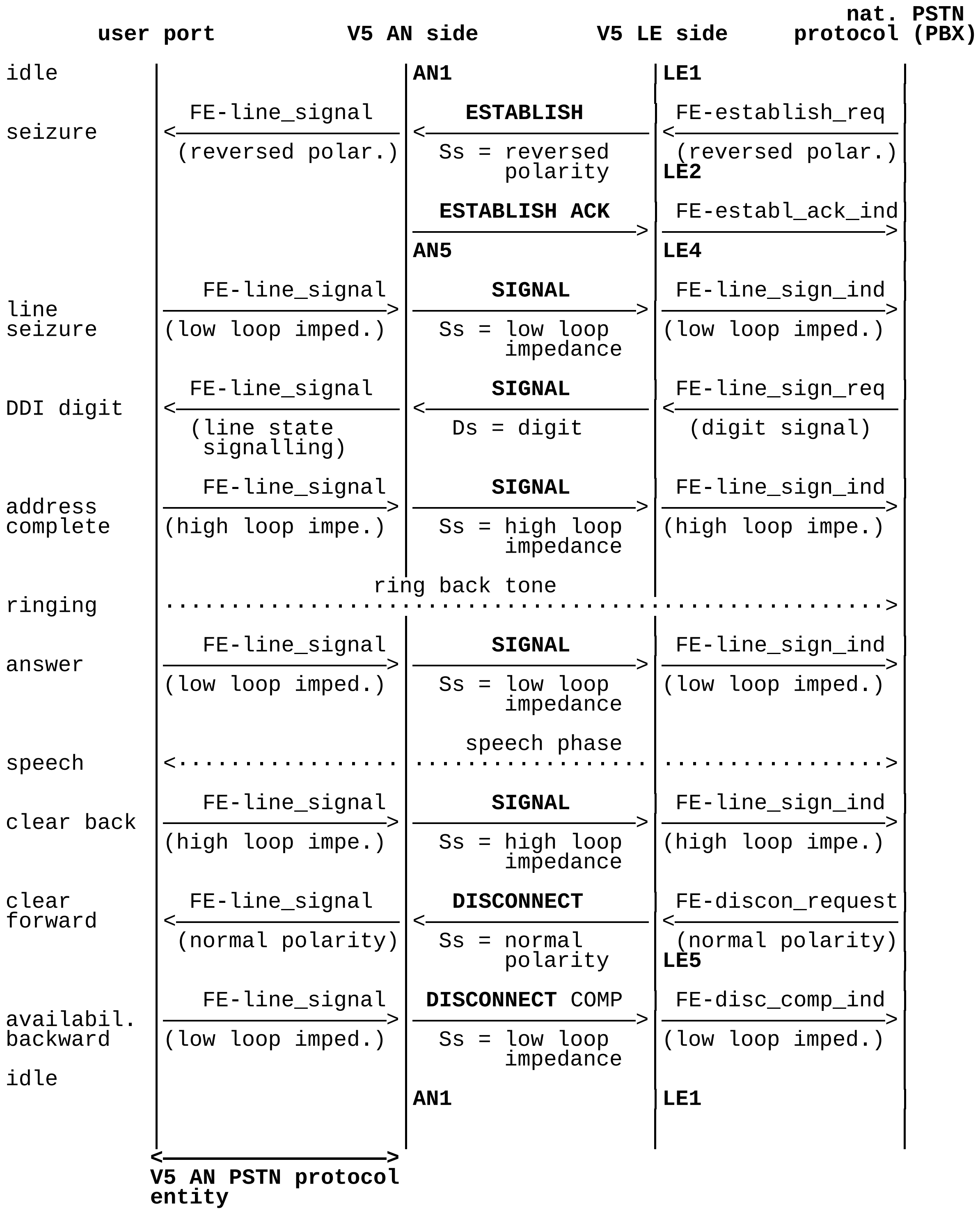

Figure 9

5.2.4 Case D: Subscriber A in conversation with B uses call hold supplementary service to call subscriber C and to start a three party conference

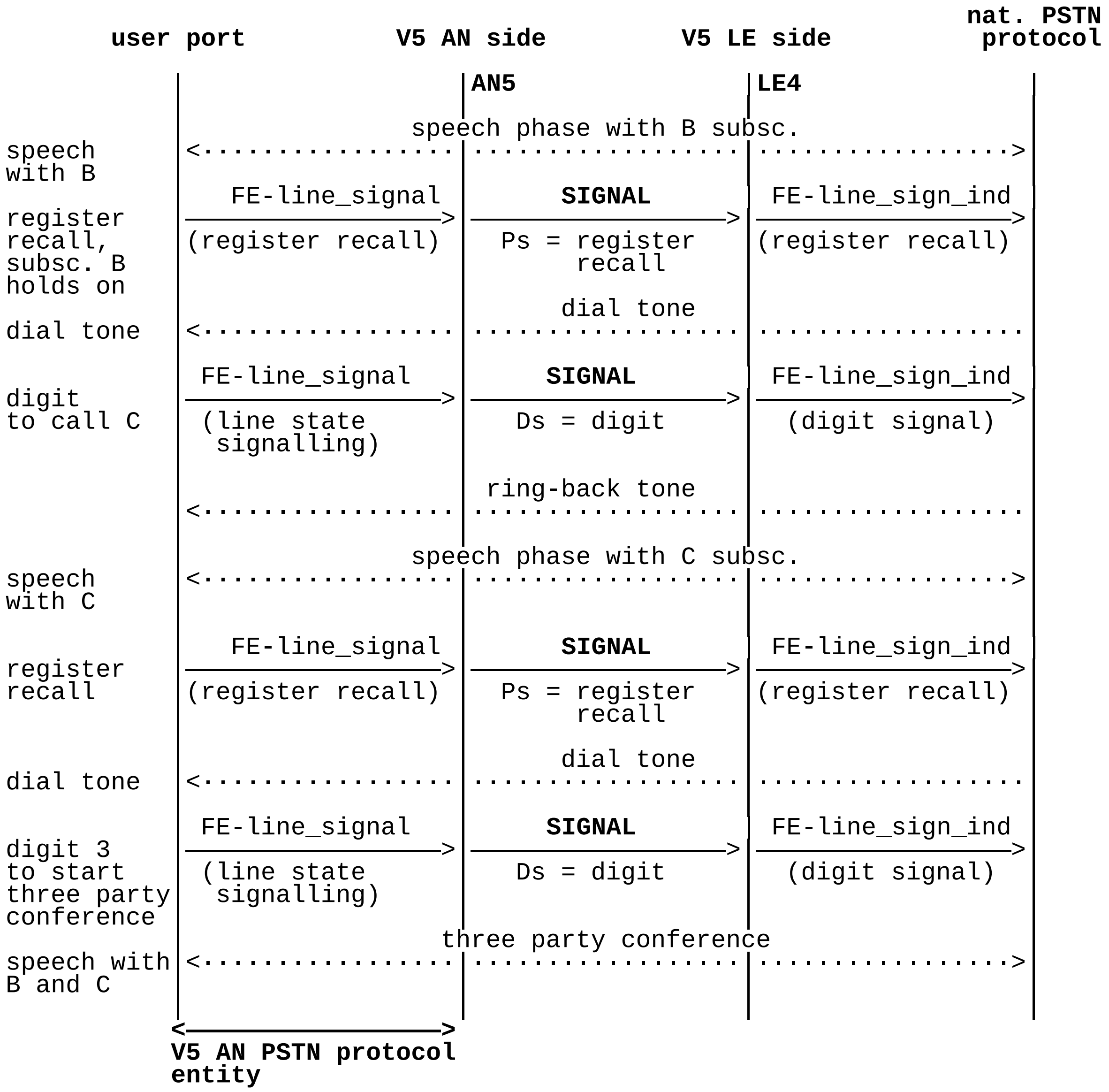

Figure 10

5.3 V5 PSTN signal flows for an Austrian network

The Austrian PSTN uses different subscriber access equipment. From the protocol point of view, the different access equipment can be classified into the following three PSTN access types:

- Main Station;
- PABX with DC-based DDI;
- PABX with pilot-frequency based DDI.

In case of an active call (A-side), one common PSTN protocol exists for the three access types, but in case of a passive call (B-side), different PSTN protocols are used. In the following five cases, examples for possible call scenarios in the Austrian network are given. They show how the different PSTN protocols of the Austrian network can be mapped onto the common PSTN protocol of the V5 interface.

Case A: Active call, valid for all access types;
Case B: Passive call, access type = main Station;
Case C: Passive call, access type = PABX with DC-based DDI;
Case D: Passive call, access type = PABX with pilot-frequency-based DDI;
Case E: Force Release sequence, valid for all access types.

Notes on case A: A simple active call (valid for all access types)

Three examples are given:

- a simple active call, with subscriber A clearing (Case A.1);
- meter pulse transmission to the subscriber (Case A.2);
- malicious call handling (Case A.3).

Additional notes to the signal flows:

NOTE 1: The dial procedure is bilingual. That implies, that even if the subscriber uses a DTMF-station, the LE and the AN shall be able to receive dial-pulses by default. With the first transmitted digit, the dialling system (DTMF or pulse dialling) is selected for a call and it has to be kept until the end of the call. For the case of pulse dialling, only one digit is shown in Case A.1.

NOTE 2: The LE uses a short interruption (250 ms) of the battery voltage ("Pulsed no battery") to put the station back into the idle condition. After the "no battery" pulse, the LE uses a short guard time interval (650 ms) to prevent an immediate succeeding passive call and to enable an active call to prevail. To ensure this guard time interval, it is necessary to report the end of the "no battery" pulse back to the LE.

In case of call hold for malicious call handling, the "pulsed no battery" signal is delayed accordingly (see Case A.3).

NOTE 3: The number of meter pulses on a meter pulse counter at the subscriber station shall never be less than the number of meter pulses at the LE. This can be assured by requesting the AN to report the end of the meter pulse(s) back to the LE. The pulsed signal should be marked as uninterruptible. To reduce the number of these SIGNAL messages in case of higher pulse rates, more than one meter pulse can be carried in one SIGNAL message.

Notes on case B: A simple passive call (access type = main station)

Only one example is given for this case:

- a simple passive call to a main station subscriber, with subscriber B clearing (Case B).

Additional notes to the signal flow:

NOTE 1: It is assumed that the ringing is stopped by the off hook signal and that no specific message is required from the LE for that.

NOTE 2: The LE uses a short interruption (250 ms) of the battery voltage ("Pulsed no battery") to put the station back into the idle condition. After the "no battery" pulse, the LE uses a short guard time interval (650 ms) to prevent an immediate succeeding passive call and to enable an active call to prevail. To ensure this guard time interval, it is necessary to report the end of the "no battery" pulse back to the LE.

Notes on case C: A simple passive call (access type = PABX with DC-based DDI)

Only one example is given for this case:

- a simple passive call with subscriber B clearing (Case C).

Additional notes to the signal flow:

NOTE 1: Negative DC-voltage pulses on b-wire are used to transmit DDI-pulses into the PABX. IF DDI pulses are to be transmitted during the active phase of the ringing cadence, the ringing current on a-wire has to be interrupted.

This DDI-mechanism has to be predefined in the AN, so the LE has only to transmit SIGNAL-messages containing the DDI-digits. Only one DDI-digit is shown in Case C.

NOTE 2: It is assumed that the ringing is stopped by the off hook signal and that no specific message is required from the LE for that.

NOTE 3: The LE uses a short interruption (250 ms) of the battery voltage ("Pulsed no battery") to put the station back into the idle condition. After the "no battery" pulse, the LE uses a short guard time interval (650 ms) to prevent an immediate succeeding passive call and to enable an active call to prevail. To ensure this guard time interval, it is necessary to report the end of the "no battery" pulse back to the LE.

Notes on case D: A simple passive call (access type = PABX with pilot-frequency-based DDI)

Only one example is given for this case:

- a simple passive call with subscriber B clearing (Case D).

Additional notes to the signal flow:

NOTE 1: A pilot-frequency signal (12 kHz) from the LE is used to seize the PABX, and the PABX responds with an off/on hook signal within a compelled sequence. This seizing signalling-sequence is shown in figure 11. Two transitions have to be supervised by the LE during the seizing sequence:

Transition 1: The PABX shall go off hook within 160 ms after the end of the pilot-frequency signal has been detected. If it does not, emergency mode of the PABX is assumed.

Transition 2: The PABX shall go on hook again within 160 ms after the end of the pilot-frequency signal has been detected. If it does not, a failure situation of the PABX is assumed.

Following the successful seizing sequence, the pilot-frequency is switched on again to be prepared for the dialling phase. Due to the variable signalling delay in the AN and the tight supervision times of the LE, the whole seizing cycle (between the dotted lines of figure 11) should be done autonomously within the AN using an autonomous-signalling-sequence. Three different sequence-response types from the AN are possible in this case:

- normal seizure (both transitions occurred in time);
- emergency mode (the first transition did not occur in time);
- seizing failure (the second transition did not occur in time).

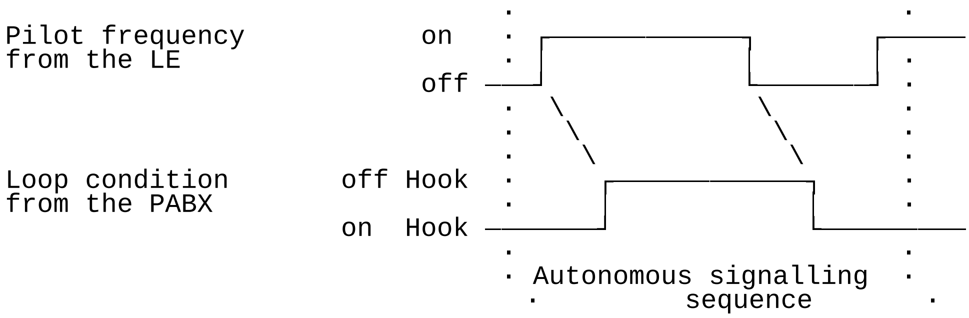

Figure 11: Seizing procedure of a PABX with pilot-frequency-based DDI

NOTE 2: Short interruptions of the pilot-frequency (pulses) are used to transmit DDI-pulses into the PABX. This dialling-in mechanism has to be predefined in the AN, so the LE has only to transmit SIGNAL-messages containing the DDI-digits. Only one DDI-digit is shown in Case D.

NOTE 3: The PABX transmits an "end of dialling" condition to the LE by using a pulsed off hook signal.

NOTE 4: The pilot-frequency signal has to be removed when the subscriber goes off hook (answer). It is assumed that no specific message is required from the LE for that.

NOTE 5: The LE uses a short interruption (250 ms) of the battery voltage ("Pulsed no battery") to put the station back into the idle condition. After the "no battery" pulse, the LE uses a short guard time interval (650 ms) to prevent an immediate succeeding passive call and to enable an active call to prevail. To ensure this guard time interval, it is necessary to report the end of the "no battery" pulse back to the LE.

Notes on case E: Force release situation (valid for all access types)

Two examples are given:

- force release, normal sequence (Case E.1);
- force release, failure situation (Case E.2).

Additional note to the signal flow:

NOTE: After the end of a call (when the A or the B-side has terminated), the subscriber on the partner side of the call normally goes on hook within a specified time (10 sec). If it does not, and irrespective if it was an active or a passive call, the subscriber is forced released by the LE using the short interruption of the battery voltage ("pulsed no battery"). In case of an automatic answering equipment, the equipment will immediately respond by going on hook. To distinguish the normal behaviour of an automatic answering equipment from a failure situation of the subscriber equipment, this reaction has to be supervised by a short timer (550 ms). The signalling-sequence of force release is shown in figure 12.

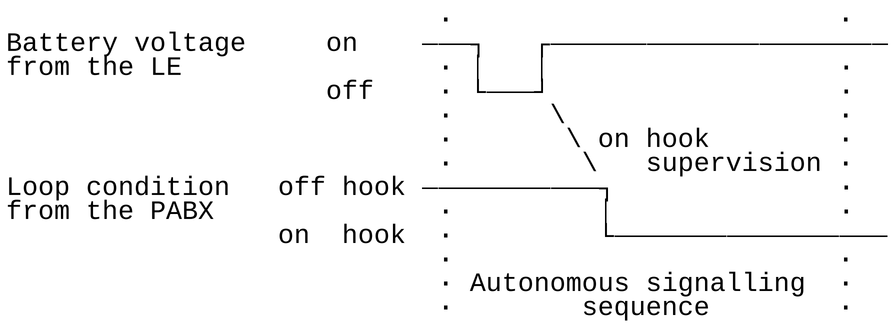

Figure 12: Force release signalling sequence

Due to the variable signalling delay of the AN, the sequence between the dotted line should be done autonomously by the AN using an autonomous signalling-sequence. The force release sequence has to be started by a predefined signalling-sequence. According to the result of the supervision two different sequence response types are possible:

- on hook condition detected within the time limit (normal sequence);
- on hook condition missing within the time limit (failure situation).

Both cases are shown in figures 19 and 20, respectively.

5.3.1 Case A.1: Active call, valid for all access types; subscriber A clearing

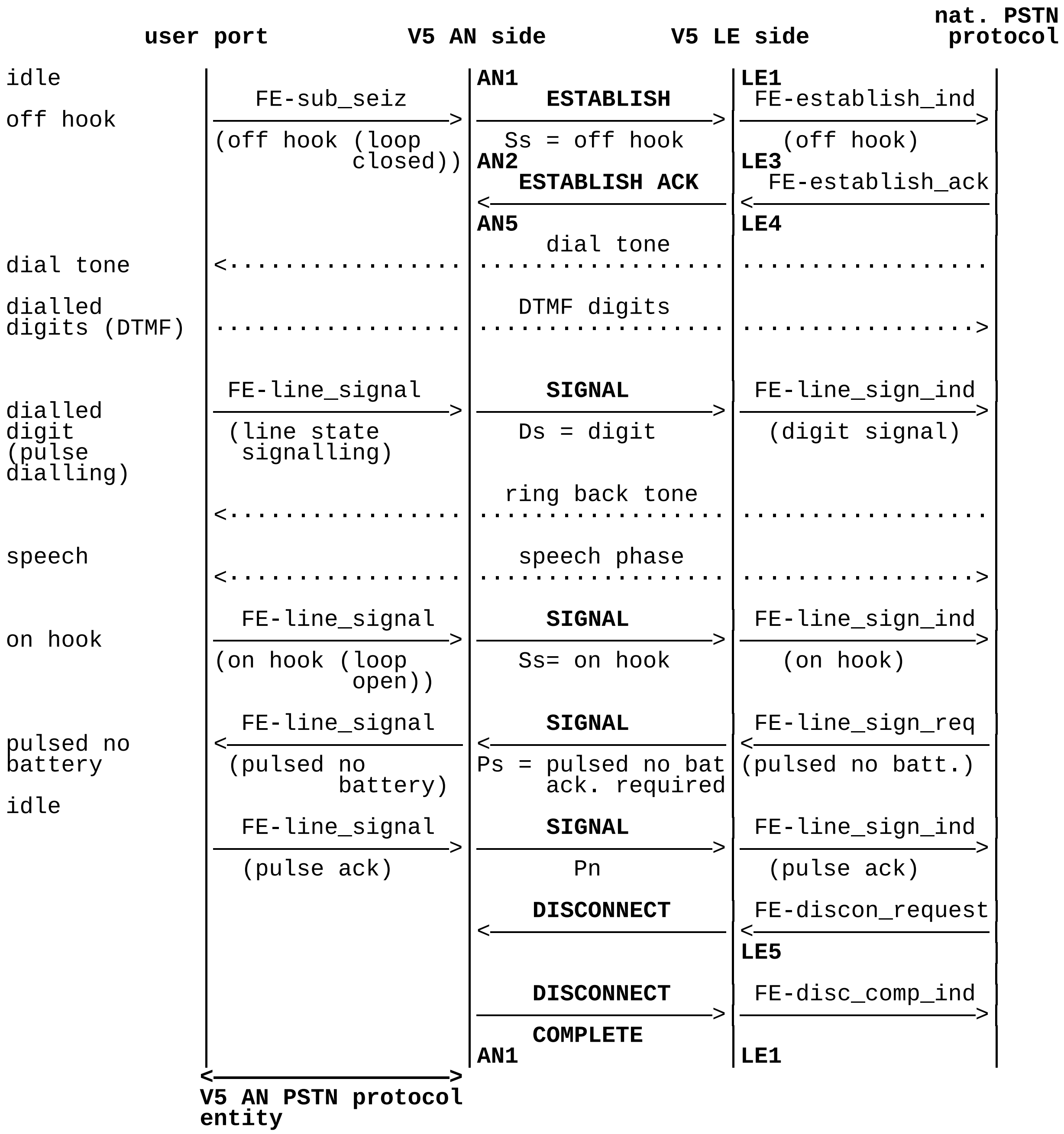

Figure 13

5.3.2 Case A.2: Active call, valid for all access types; meter pulse transmission

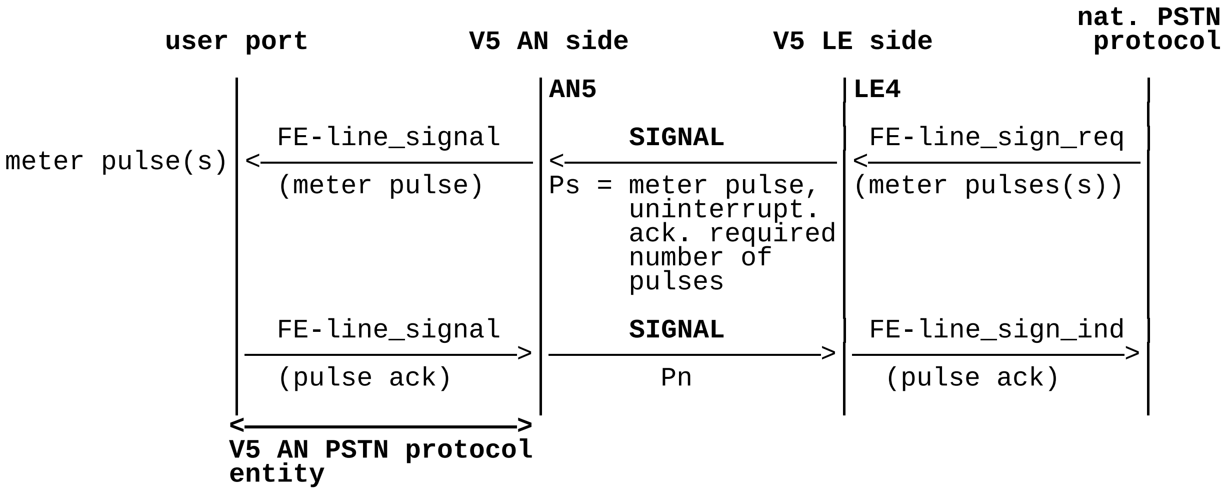

Figure 14

5.3.3 Case A.3: Active call, valid for all access types; call hold

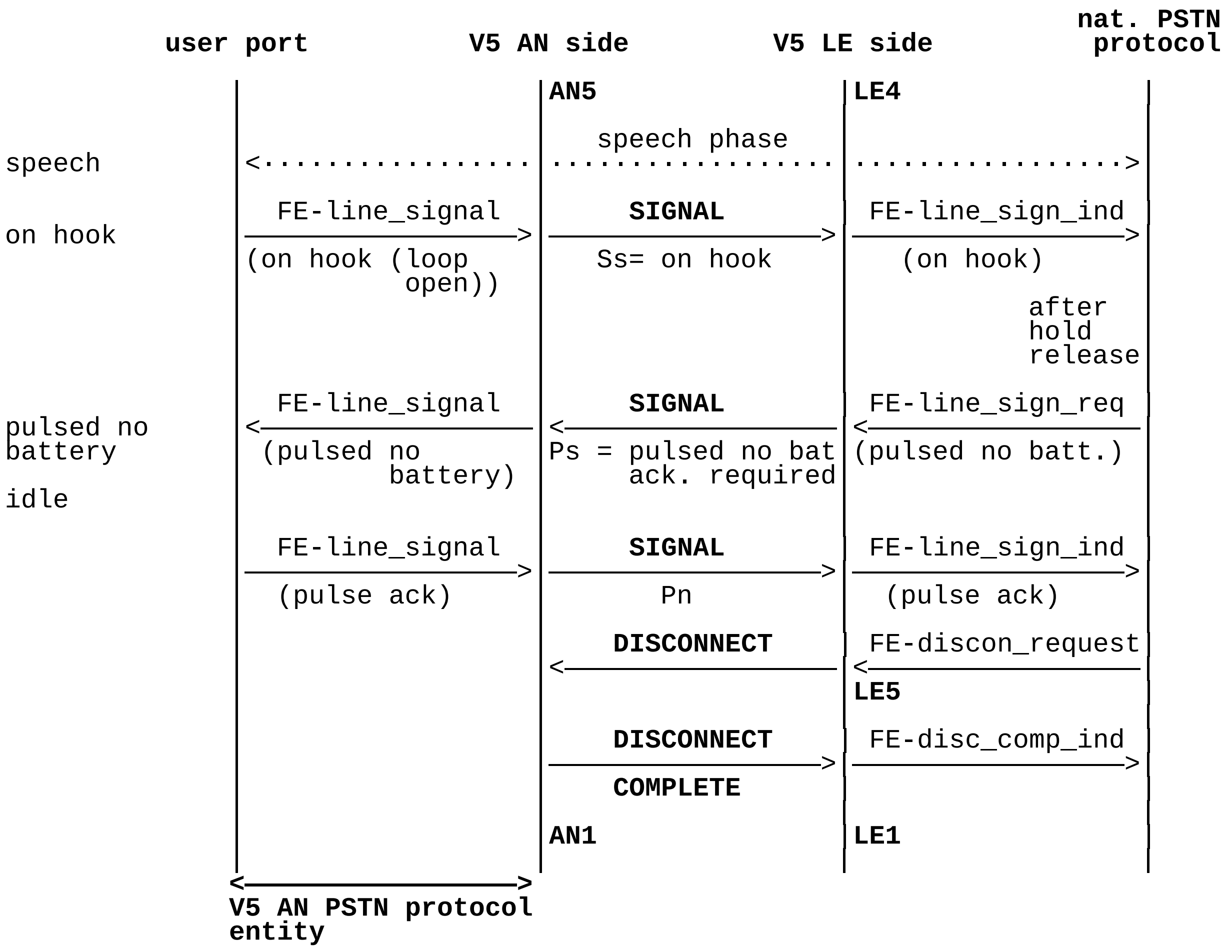

Figure 15

5.3.4 Case B: Passive call, access type = main station; subscriber B is clearing

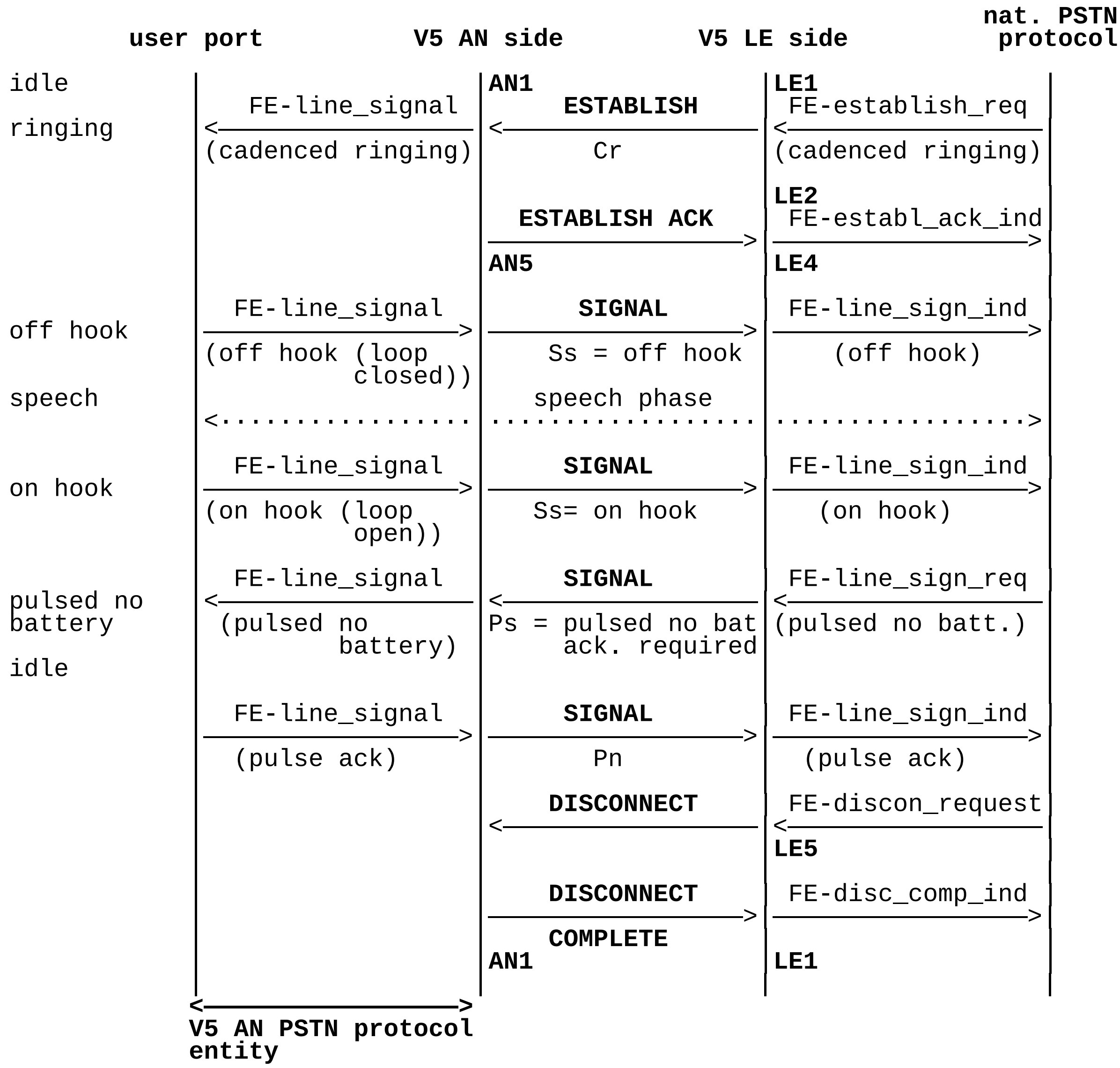

Figure 16

5.3.5 Case C: Passive call, access type = PABX with DC-based DDI; subscriber B is clearing

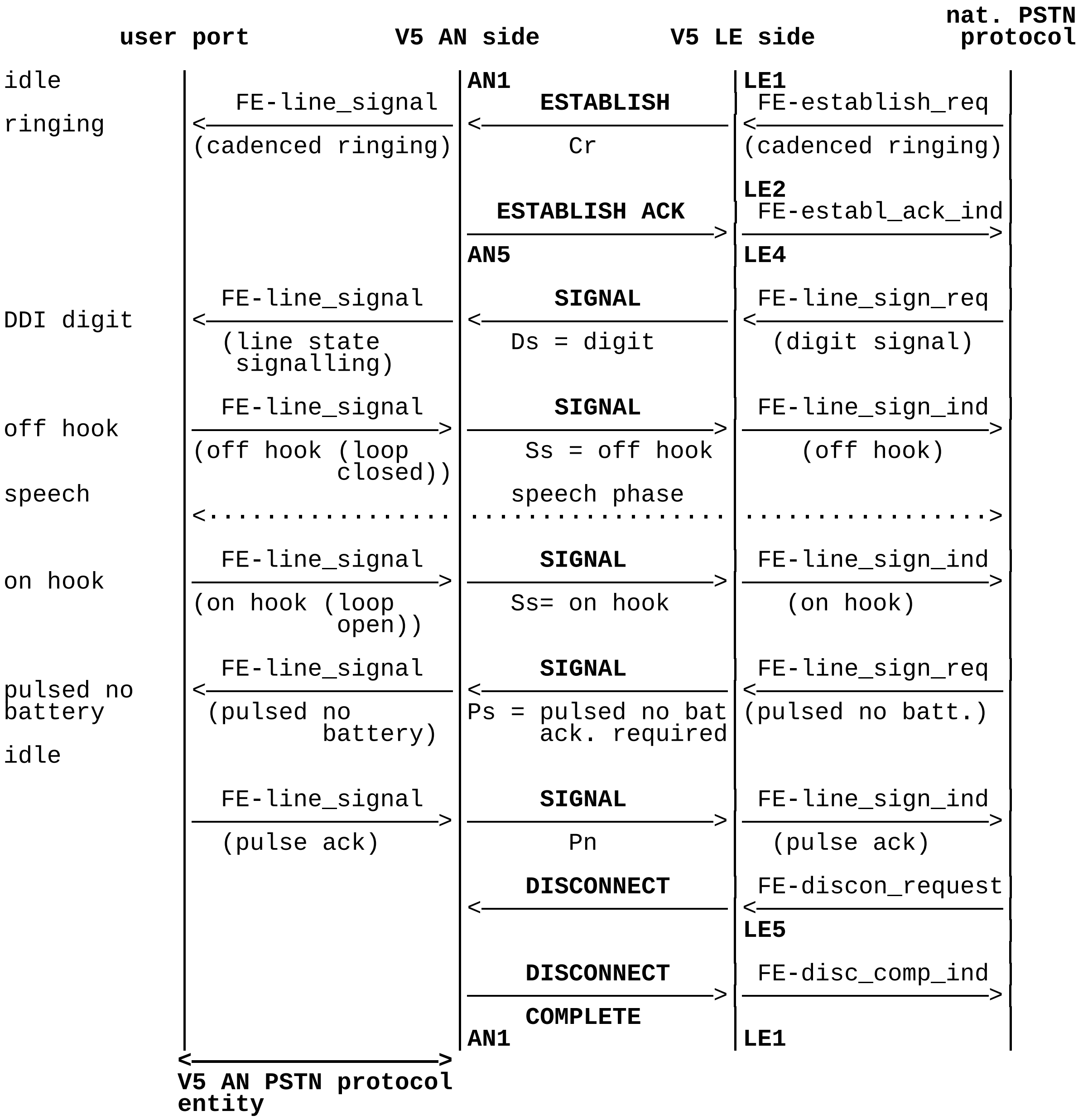

Figure 17

5.3.6 Case D: Passive call, access type = PABX with pilot-frequency-based DDI; subscriber B is clearing

user port		V5 AN side	V5 LE side	nat. PSTN protocol
idle		AN1	LE1	
pilot freq. on	<--- FE-line_signal (Asis request)	<--- ESTABLISH Asis	<--- FE-establish_req (signalling sequ.)	
		ESTABLISH ACK --->	LE2	
off hook		AN5	FE-establ_ack_ind --->	
			LE4	
pilot freq. off				
on hook				
pilot freq. on	FE-line_signal ---> (Asis report)	SIGNAL ---> Sr (normal sequence)	FE-line_signal_ind ---> (sequ. response)	
DDI digit	<--- FE-line_signal (pilot frequency interruptions)	<--- SIGNAL Ds = digit	<--- FE-line_sign_req (digit signal)	
end of dialling	FE-line_signal ---> (pulsed off hook (pulsed loop closed))	SIGNAL ---> Ps = pulsed off hook	FE-line_sign_ind ---> (pulsed off hook)	
off hook	FE-line_signal ---> (off hook (loop closed))	SIGNAL ---> Ss = off hook	FE-line_sign_ind ---> (off hook)	
pilot freq. off				
speech	<.................	speech phase	.................>	
on hook	FE-line_signal ---> (on hook (loop open))	SIGNAL ---> Ss= on hook	FE-line_sign_ind ---> (on hook)	
pulsed no battery	<--- FE-line_signal (pulsed no battery)	<--- SIGNAL Ps = pulsed no bat ack. required	<--- FE-line_sign_req (pulsed no batt.)	
idle				
	FE-line_signal ---> (pulse ack)	SIGNAL ---> Pn	FE-line_sign_ind ---> (pulse ack)	
		<--- DISCONNECT	<--- FE-discon_request	
			LE5	
		DISCONNECT COMPLETE --->	FE-disc_comp_ind --->	
		AN1	LE1	

<---> V5 AN PSTN protocol entity

Figure 18

5.3.7 Case E.1: Release initiated by partner, force release (normal sequence)

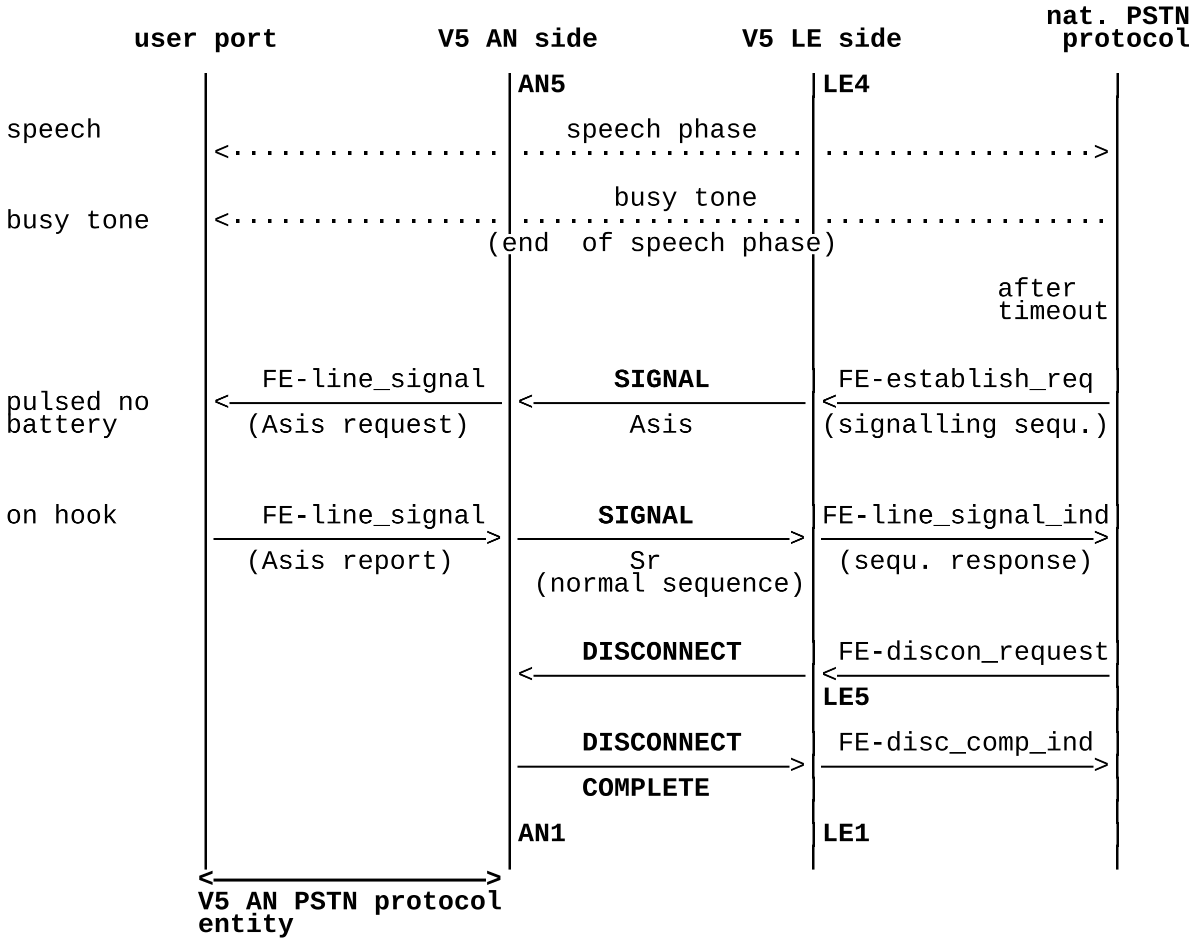

Figure 19

5.3.8 Case E.2: Release initiated by partner, force release (failure situation)

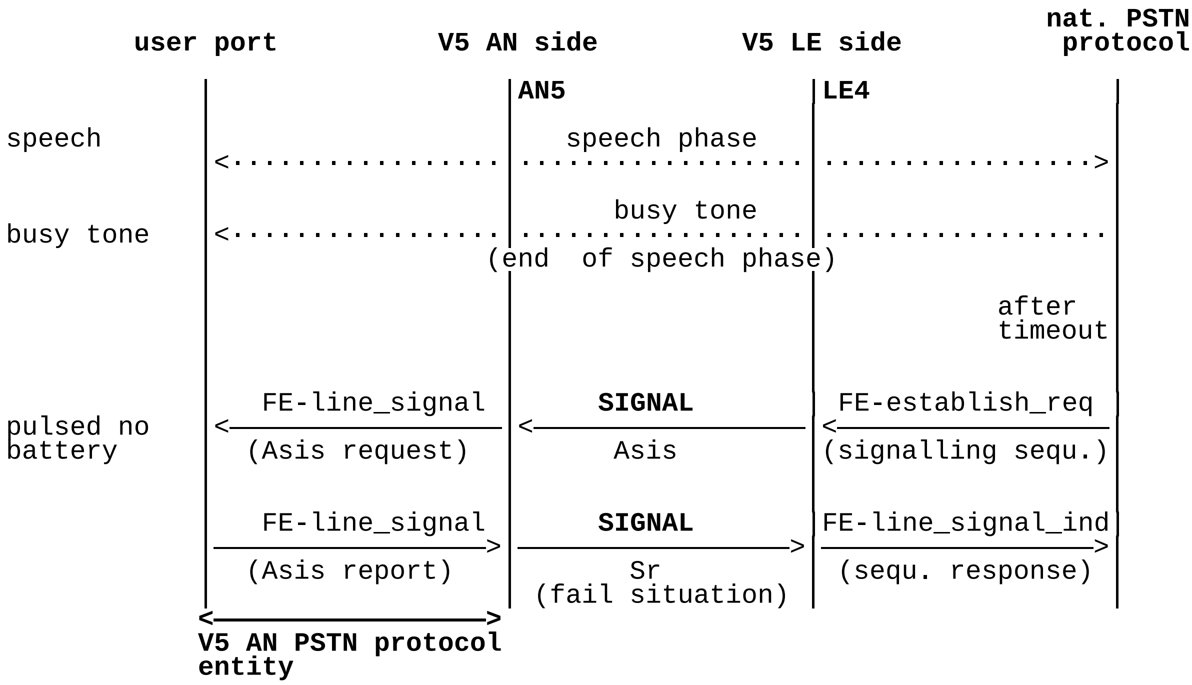

Figure 20

5.4 V5 PSTN signal flows for a German Telekom network

Note on case B: A direct exchange line

Subscriber A calling and subscriber A clearing (meter pulse receiving).

NOTE: It has been assumed that the meter pulse information element would point to a pre-provisioned type of pulse. No acknowledgement request option has been used.

Notes on case C: A direct exchange line

Subscriber B called and subsequently cleared.

NOTE 1: It is assumed that the cadenced ringing information element would point to a pre-provisioned type of ringing which consists of the initial ringing followed by the normal (cadenced) ringing.

NOTE 2: It is assumed that the ringing is stopped by the telephone taken off hook and that no specific message is required from the exchange.

Notes on case D: A PBX with line state signalling

Subscriber A calling and subscriber A clearing (meter pulse receiving).

NOTE 1: Supervision of the idle state is done by both, the PBX and the AN (battery on b-wire from the PBX, battery on a-wire from the AN).

NOTE 2: The PBX seizes the AN by connecting a-wire to earth. The PBX changes into a low loop impedance when the AN leaves the idle state after having recognized the seizure from the PBX.

NOTE 3: It has been assumed that the meter pulse information element would point to a pre-provisioned type of pulse and no acknowledgement request option has been used.

NOTE 4: The battery on a-wire information element, which has been sent from LE to AN, causes the AN to connect the a-wire to battery and to activate the supervision of the b-wire.

Notes on case E: A PBX with line state signalling

Subscriber B called and clearing.

NOTE 1: Supervision of the idle state is done by both, the PBX and the AN (battery on b-wire from the PBX, battery on a-wire from the AN).

NOTE 2: The AN seizes the PBX by connecting b-wire to earth. The AN changes into a high loop impedance when the PBX acknowledges the seizure by disconnecting battery from the b-wire and connecting battery to a-wire.

NOTE 3: The FE-line_signal "digit" is defined as earth pulses on the a-wire and battery on the b-wire during the first pulse and pause of every dialling series.

NOTE 4: The AN uses a short 50-Hz-pulse followed by the idle condition to put the PBX back into the idle state. In order to achieve an immediate change to the idle condition after having terminated the 50-Hz-pulse, the whole release cycle is done autonomously within the AN using an autonomous signalling sequence.

5.4.1 Case A: Subscriber A calling and subscriber A clearing

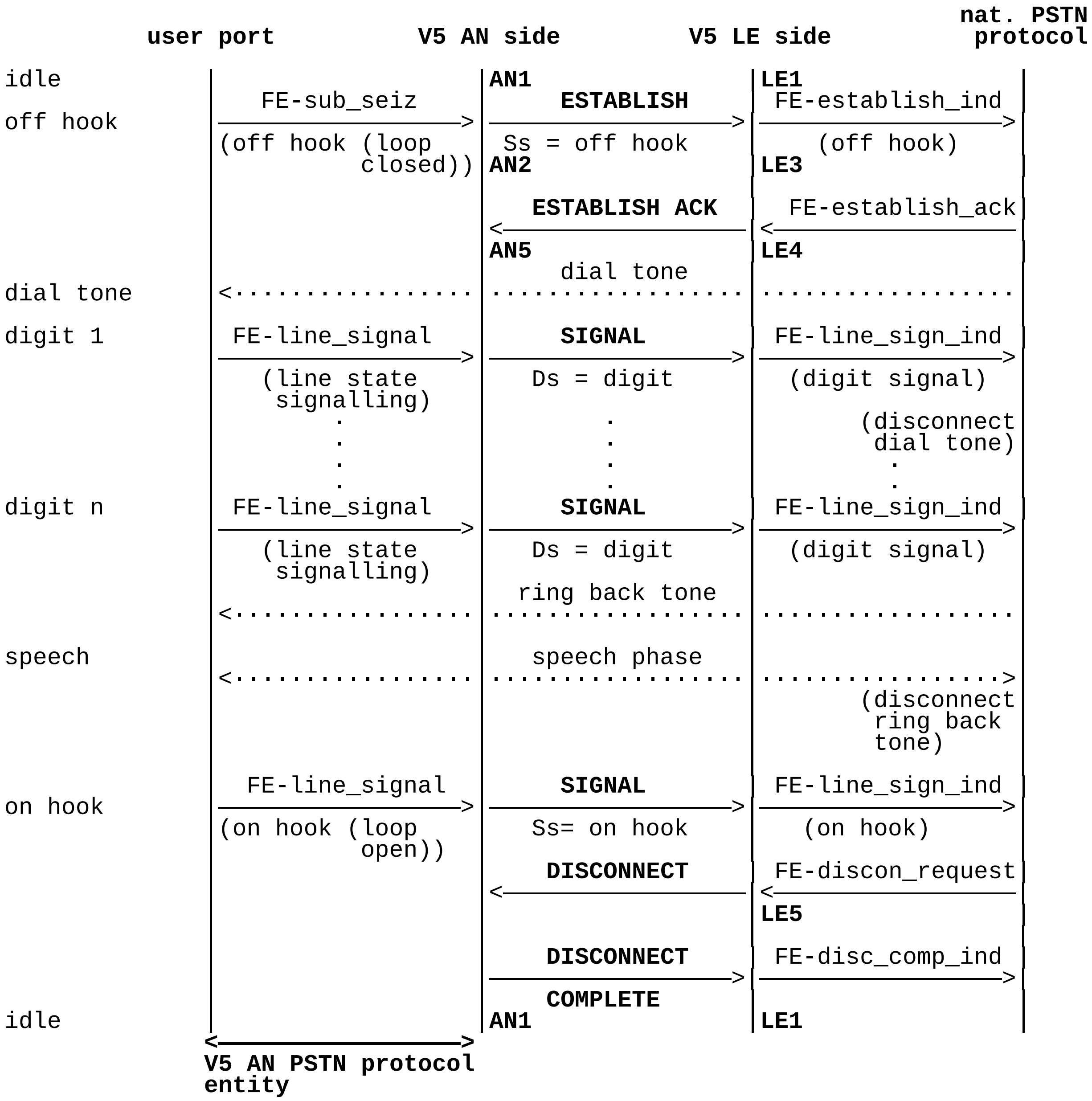

Figure 21

5.4.2 Case B: Subscriber A calling and subscriber A clearing (meter pulses receiving)

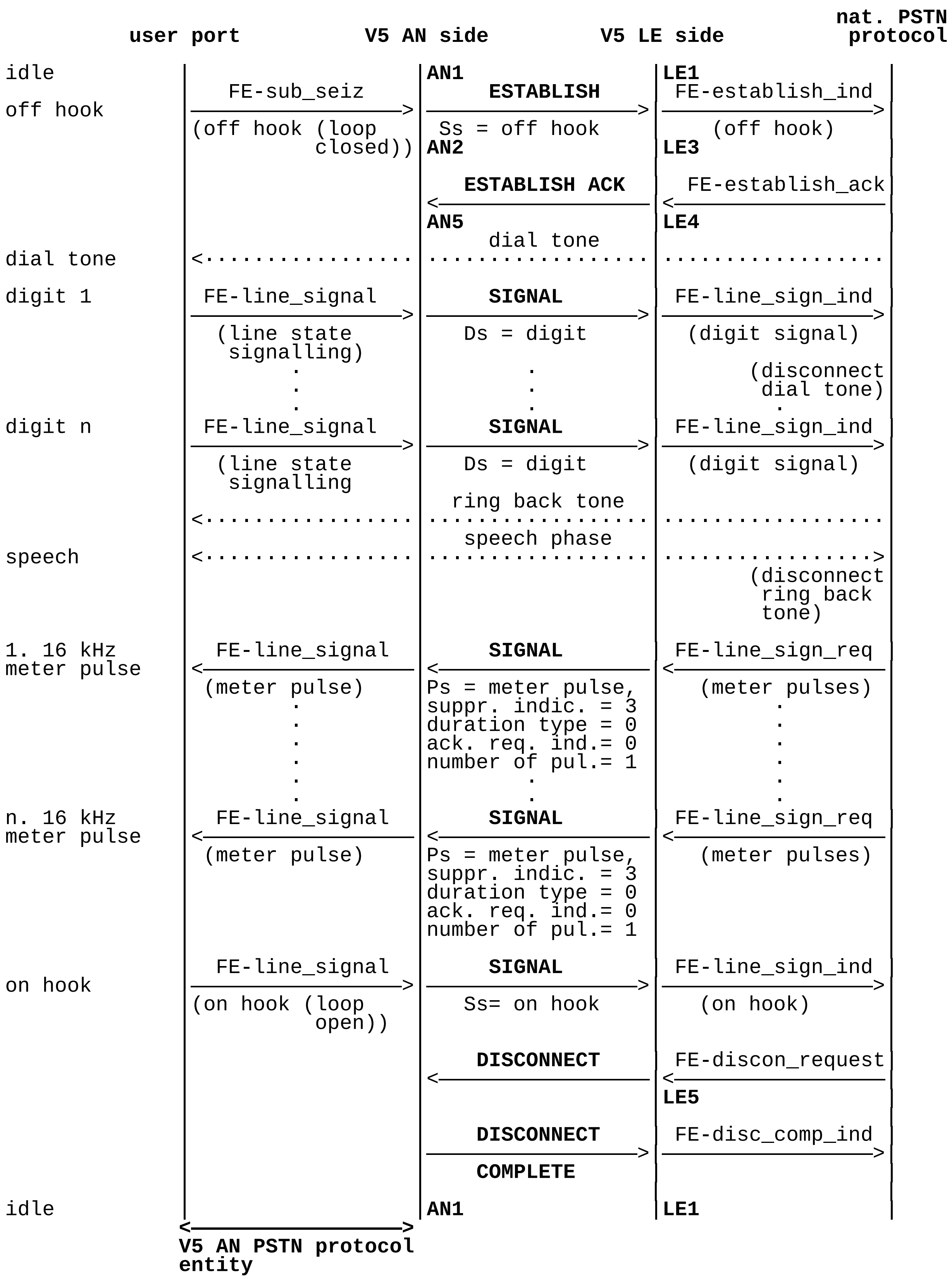

Figure 22

5.4.3 Case C: Subscriber B called and subscriber B clearing

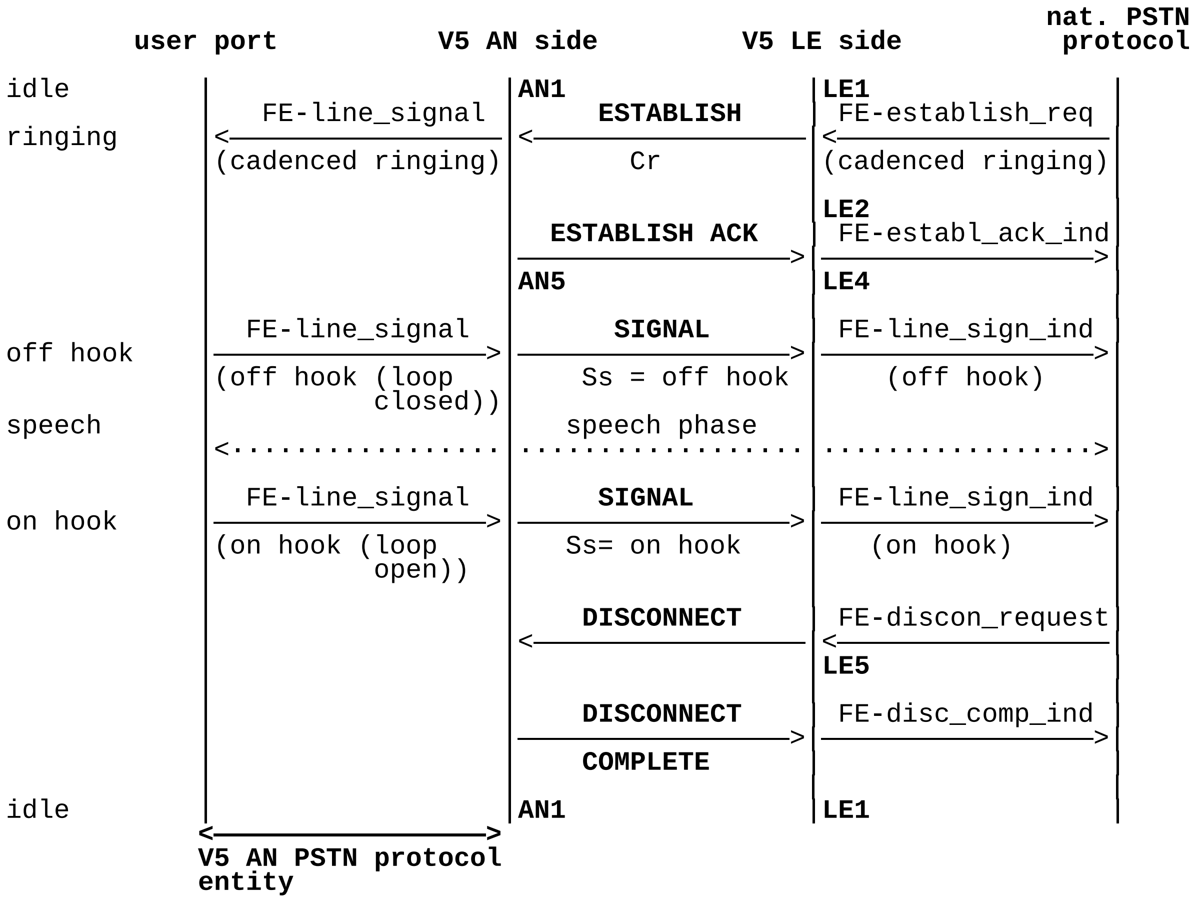

Figure 23

5.4.4 Case D: Subscriber A calling and subscriber A clearing (meter pulses receiving) for a German PBX with DDI

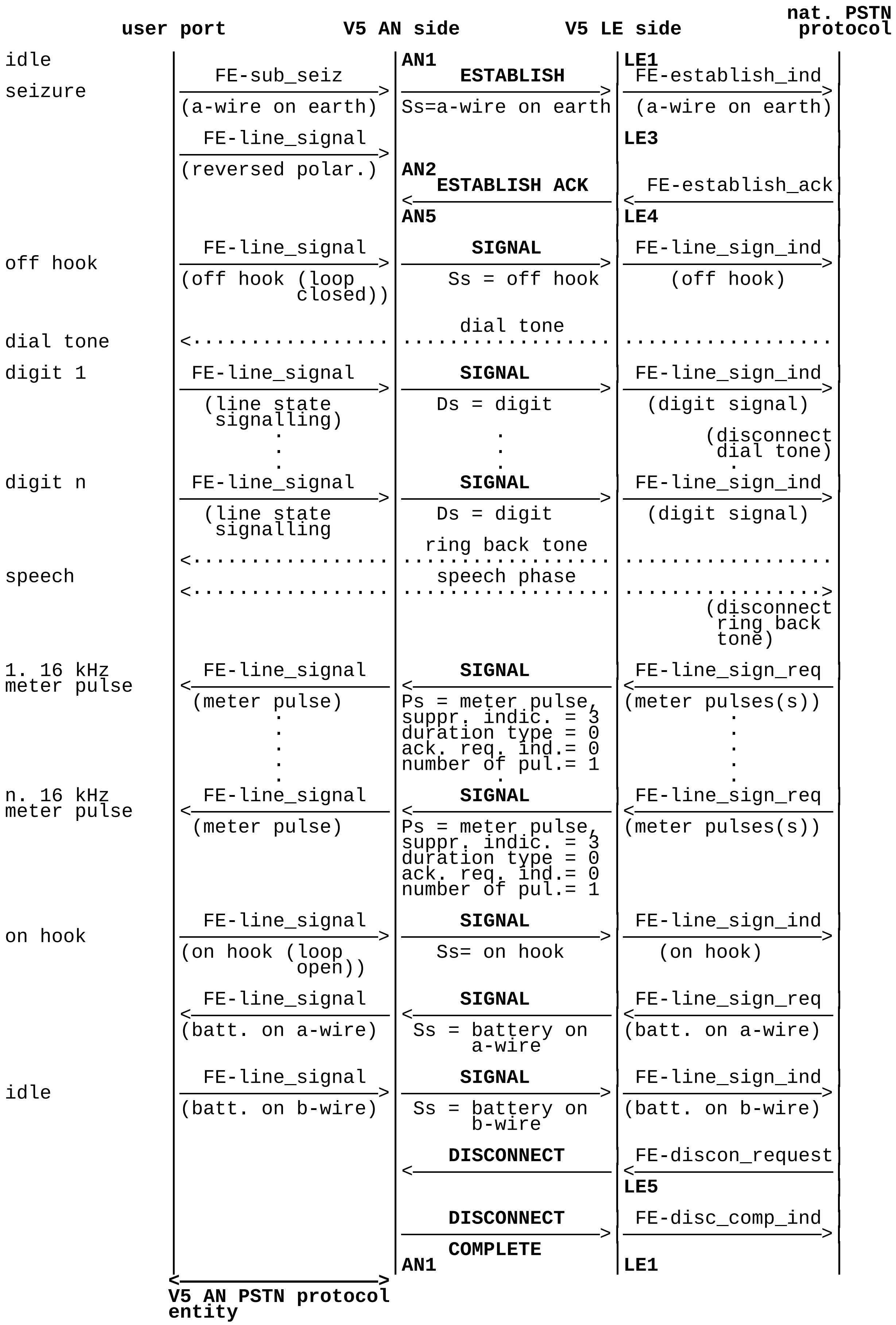

Figure 24

5.4.5 Case E: Subscriber B called and subscriber B clearing for a German PBX with DDI

	user port	V5 AN side	V5 LE side	nat. PSTN protocol
idle		AN1	LE1	
b-wire on earth (from user port)	FE-line_signal <-- (Asis request)	ESTABLISH <-- Asis	FE-establish_req <-- (signalling sequ.)	
battery on a-wire, b-wire disconnected from battery (from PBX)		ESTABLISH ACK -->	LE2 FE-establ_ack_ind -->	
		AN5	LE4	
high loop impedance (from user port)	FE-line_signal --> (Asis report)	**SIGNAL** --> Sr (normal sequence)	FE-line_signal_ind --> (sequ. response)	
digit 1	FE-line_signal <-- (digit)	**SIGNAL** <-- Ds = digit ack required	FE-line_sign_req <-- (digit signal)	
	FE-line_signal --> (pulse ack)	**SIGNAL** --> Pn	FE-line_sign_ind --> (pulse ack)	
digit n	FE-line_signal <-- (digit)	**SIGNAL** <-- Ds = digit ack required	FE-line_sign_req <-- (digit signal)	
	FE-line_signal --> (pulse ack)	**SIGNAL** --> Pn	FE-line_sign_ind --> (pulse ack)	
address compl.	FE-line_signal --> (a-wire on earth and battery on b-wire for 100.. ..200 ms)	**SIGNAL** --> Ps = pulsed rever. polarity pulse durat. type = 0	FE-line_sign_ind --> (pulsed reversed polarity)	
ring back tone	....	ring back tone	.................>	
answer	FE-line_signal --> (a-wire on earth and battery on b-wire for 100.. ..200 ms)	**SIGNAL** --> Ps = pulsed rever. polarity pulse durat. type = 0	FE-line_sign_ind --> (pulsed reversed polarity)	
speech	<.................	speech phase	.................>	
clear back	FE-line_signal -->	**SIGNAL** -->	FE-line_sign_ind -->	
1. pulse (time between 2 pulses = 200..600 ms)	(a-wire on earth and battery on b-wire for 100.. ..200 ms) . .	Ps = pulsed rever. polarity pulse durat. type = 0 . .	(pulsed reversed polarity)	
	FE-line_signal -->	**SIGNAL** -->	FE-line_sign_ind -->	
n. pulse	(a-wire on earth and battery on b-wire for 100.. ..200 ms)	Ps = pulsed rever. polarity pulse durat. type = 0	(pulsed reversed polarity)	

(continued on next page)

	user port	V5 AN side	V5 LE side	nat. PSTN protocol
release (50 Hz-pulse 85...200 ms) (from user port)	<— FE-line_signal (Asis request)	<— **SIGNAL** Asis	<— FE-line_sign_req (signalling sequ.)	
battery on a-wire (from user port)	—> FE-line_signal (Asis report)	—> **SIGNAL** Sr (normal sequence)	—> (sequ. response)	
battery on b-wire (from PBX)	—> FE-line_signal (batt. on b-wire)	—> **SIGNAL** Ss = battery on b-wire	—> FE-line_signal_ind (batt. on b-wire)	
idle		<— **DISCONNECT**	<— FE-discon_request **LE5**	
		—> **DISCONNECT COMPLETE** **AN1**	—> FE-disc_comp_ind **LE1**	

<——> **V5 AN PSTN protocol entity** (spanning user port to V5 AN side)

Figure 25

5.4.6 Case F: Subscriber B called and subscriber B is busy for a German PBX with DDI

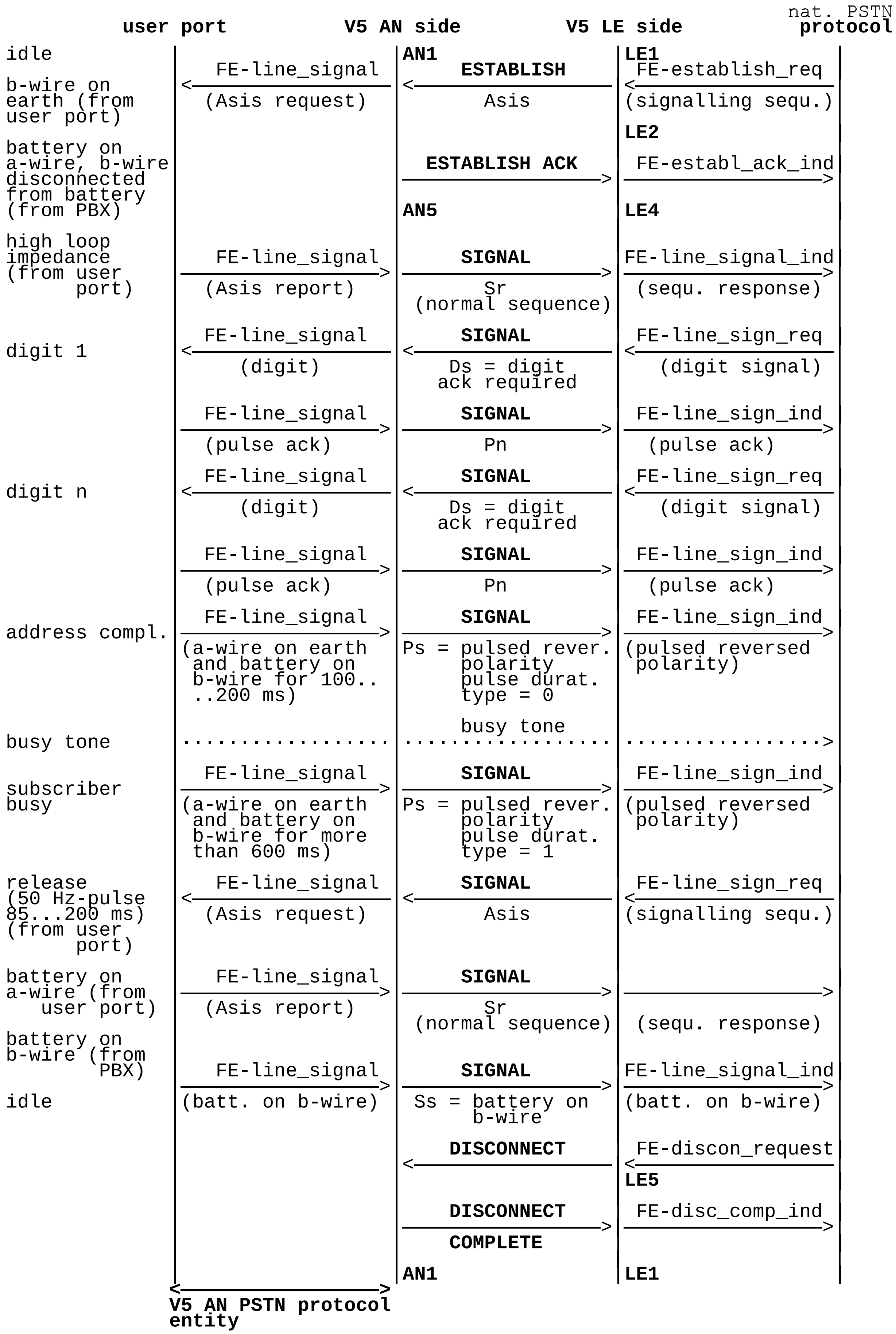

Figure 26

5.4.7 Case G: Subscriber B called and subsequently cleared for a German PBX with DDI

	user port	V5 AN side	V5 LE side / nat. PSTN protocol
idle		**AN1**	**LE1**
b-wire on earth (from user port)	FE-line_signal <--- (Asis request)	**ESTABLISH** <--- Asis	FE-establish_req <--- (signalling sequ.)
battery on a-wire, b-wire disconnected from battery (from user port)		**ESTABLISH ACK** --->	**LE2** FE-establ_ack_ind --->
		AN5	**LE4**
high loop impedance	FE-line_signal ---> (Asis report)	**SIGNAL** ---> Sr (normal sequence)	FE-line_signal_ind ---> (sequ. response)
digit 1	FE-line_signal <--- (digit)	**SIGNAL** <--- Ds = digit ack required	FE-line_sign_req <--- (digit signal)
	FE-line_signal ---> (pulse ack)	**SIGNAL** ---> Pn	FE-line_sign_ind ---> (pulse ack)
digit n	FE-line_signal <--- (digit)	**SIGNAL** <--- Ds = digit ack required	FE-line_sign_req <--- (digit signal)
	FE-line_signal ---> (pulse ack)	**SIGNAL** ---> Pn	FE-line_sign_ind ---> (pulse ack)
address compl.	FE-line_signal ---> (a-wire on earth and battery on b-wire for 100.. ..200 ms)	**SIGNAL** ---> Ps = pulsed rever. polarity pulse durat. type = 0	FE-line_sign_ind ---> (pulsed reversed polarity)
ring back tone	....	ring back tone	..................>
answer	FE-line_signal ---> (a-wire on earth and battery on b-wire for 100.. ..200 ms)	**SIGNAL** ---> Ps = pulsed rever. polarity pulse durat. type = 0	FE-line_sign_ind ---> (pulsed reversed polarity)
speech	<..................	speech phase	..................>
release (50 Hz-pulse 85...200 ms) (from user port)	FE-line_signal <--- (Asis request)	**SIGNAL** <--- Asis	FE-line_sign_req <--- (signalling sequ.)
battery on a-wire (from user port)	FE-line_signal ---> (Asis report)	**SIGNAL** ---> Sr (normal sequence)	---> (sequ. response)

(continued on next page)

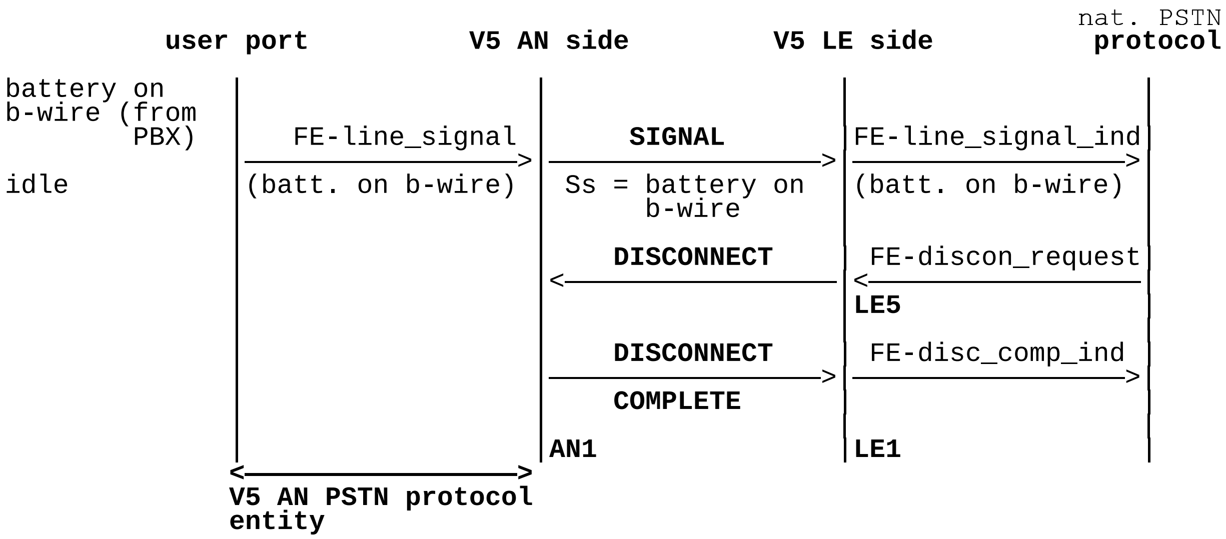
user port
V5 AN side
V5 LE side
nat. PSTN protocol
battery on b-wire (from PBX)
idle
FE-line_signal
(batt. on b-wire)
SIGNAL
Ss = battery on b-wire
FE-line_signal_ind
(batt. on b-wire)
DISCONNECT
FE-discon_request
LE5
DISCONNECT COMPLETE
FE-disc_comp_ind
AN1
LE1
V5 AN PSTN protocol entity

Figure 27

Annex A: List of contributors

The following is a list of the V5 Expert Group delegates or non-delegates who have supplied the information needed for the completion of this ETR for the PTTs of their countries.

For B.T. (U.K.)

Mr. K. A. James (member of V5 SEG)

Tel: +44 473 64 32 86
Fax: +44 473 64 46 07

For SIP (Italy)

Mr. P. Morrone (member of V5 SEG)

Tel: +39 6 3688 5179
Fax: +39 6 3688 5112

For Alcatel Austria A.G. (Austria)

Mr. F. Edler (member of V5 SEG)

Tel: +43 1 797 80
Fax: +43 1 797 80 13

For Deutsche Bundespost Telekom (Germany)

Mr. Lutz Herrmann (not member of V5 SEG)

Tel: +49 30 2845 2284
Fax: +49 30 2831 403

History

Document history	
September 1994	First Edition
February 1996	Converted into Adobe Acrobat Portable Document Format (PDF)