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Technical Specification

Services and Protocol for Advanced Networks (SPAN); Recommended V5 PSTN mapping



Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Services and Protocols for Advanced Networks (SPAN).

Introduction

The V5 interface PSTN signalling protocol standard only provides a "toolbox", a set of messages and information elements that can be used by the regulator or the operator when specifying the national PSTN mapping. The work on the PSTN mapping proposal was initiated by the ETSI Technical Working Group SPAN in order to limit the variants of the national PSTN mapping and make their definition easier.

1 Scope

The present document gives guidance to operators and suppliers in cases where no national PSTN mapping already exists. It describes the translation of signalling from analogue telephone to V5 interface PSTN signalling protocol. In order to meet most national requirements it is designed in a flexible way. In addition, the document attempts to minimize the differences between the various national PSTN mappings. It covers all cases of basic service and presents some examples for special service.

The purpose of the present document is to describe the recommended usage of the various messages provided by the V5 PSTN signalling protocol. Only a subset of the described procedures is needed to define a national PSTN mapping.

The present document does not prohibit the use of other existing variants.

The present document is applicable to access arrangements where the analogue telephone type is supported and an Access Network (AN) is connected to a Local Exchange (LE) via a V5 interface. The analogue telephone type connected to PBXes is not covered in the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI EN 300 324-1 (V2.1.1): "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 the present document, the following abbreviations apply:

| | |
|-------------------------|---|
| a/b | a- (and) b-wire |
| AN | Access Network |
| A-subscriber | calling party (= A-party, A-side, origination side) |
| BA | ISDN Basic Access (2B + D) |
| B-channel | Bearer channel |
| B-subscriber | called party (= B-party, B-side, terminating side) |
| CLIP | Calling Line Identity Presentation |
| DC | Direct Current |
| DDI | Direct Dialing In |
| DTMF | Dual Tone Multi Frequency |
| ETSI | European Telecommunications Standards Institute |
| HW | Hardware |
| LE | Local Exchange |
| ITU-T | International Telecommunication Union, Telecommunication Standardization Sector |
| PSTN | Public Switched Telephone Network |
| T _{dp} | Time control dial pulse |
| T _{hook flash} | Time control hook flash (hook flash = register recall) |
| T _{on hook} | Time control on hook |
| T _{off hook} | Time control off hook |

4 Messages and contents

According to EN 300 324-1 [1], clause 13.5.5, the message "SIGNAL" has to be acknowledged by the message "SIGNAL ACK". In order to improve the readability the "SIGNAL ACK" message is not shown in the present document.

4.1 Seizure

4.1.1 Originating seizure

Situation: idle state, monitoring facility of terminal equipment via AN

Process in terminal equipment: DC loop is closed (off hook)

- Reaction in AN:
 - AN sends ESTABLISH [steady signal: off hook]
 - bearer non-transparent

4.1.2 Seizure acknowledgment for originating seizure

Situation: outgoing seized

- Action in LE:
 - LE sends ESTABLISH ACK
 - LE sends dial tone

Reaction in AN: bearer transparent

NOTE: By awaiting the reception of ESTABLISH ACK in AN before the switching the bearer channel in the AN it is guaranteed that the terminal equipment receives dial tone only when the AN is ready to receive dial signals. If there is an error on layer 2, LE will send dial tone before AN receives ESTABLISH ACK.

4.1.3 Terminating seizure

Situation: idle state, monitoring facility of terminal equipment via AN

LE sends:

- 1) normal case
ESTABLISH [cadenced ringing; ringing type: 0]
- 2) different/distinctive ringing
ESTABLISH [cadenced ringing; ringing type: 1 - 127]

Reaction in AN: AN checks whether ringing signal is possible:

- 1) ringing possible:
AN sends ESTABLISH ACK
- 2) ringing generator in AN is not available:
no ESTABLISH ACK message is sent by AN;
resource unavailable message is not possible as no signalling path is set up

4.1.4 Calling line identification

| | |
|-----------------|--|
| Situation: | idle state, monitoring facility of terminal equipment via AN |
| LE sends: | CLIP after initial ringing ESTABLISH [pulsed signal: initial ringing; suppression indicator: 3; pulse duration type: 0; acknowledge request indicator: 1; number of pulses: 1] |
| Reaction in AN: | AN checks whether ringing signal is possible: <ol style="list-style-type: none"> 1) ringing possible: AN sends ESTABLISH ACK and after sending the initial ringing pulse AN sends SIGNAL[pulse notification] 2) ringing generator in AN is not available: no ESTABLISH ACK message is sent by AN; resource unavailable message is not possible as no signalling path is set up |

as an alternative option:

| | |
|------------|---|
| Situation: | idle state, monitoring facility of terminal equipment via AN |
| LE sends: | CLIP before ringing ESTABLISH [steady signal: reversed polarity] |

4.2 Call Collision

Depending on network requirements either origination or termination call has priority. For a national protocol one option has to be chosen.

4.3 Dialling

4.3.1 Pulse dialling

| | |
|--------------------------------|---|
| Situation: | DC loop at terminal equipment is closed |
| Process in terminal equipment: | dial signal |
| Reaction in AN: | AN sends SIGNAL [digit signal; digit acknowledgment request indicator: 0; digit information: 1 - 15] |

NOTE: The disconnection of bearer channel in AN at the beginning of every dial signal as well as the reconnection of the bearer channel in AN at the end of every dial signal is done independently by AN. The message sent to the LE reflects the number of received pulses (1 to 15) without interpretation of the value. If more than 15 pulses are received, no message is sent to LE. Note that it is not allowed to send the digit information "0000".

4.4 Subscriber answer

| | |
|--------------------------------|---|
| Situation: | DC loop at terminal equipment is open |
| Process in terminal equipment: | DC loop is closed |
| Reaction in AN: | <ul style="list-style-type: none"> • AN sends SIGNAL [steady signal: off hook] • AN terminates ringing signal |

4.5 Subscriber metering

| | |
|-----------------|---|
| Situation: | path active |
| LE sends: | <ol style="list-style-type: none"> 1) SIGNAL [pulsed signal: meter pulse; suppression indicator: 3; pulse duration type: 0; acknowledge request indicator (note 2): 0 or 2; number of pulses: 1 - 31] 2) SIGNAL [pulsed signal: pulsed reversed polarity (note 3); suppression indicator: 3; pulse duration type: 0; acknowledge request indicator: 0 or 2; number of pulses: 1 - 31] |
| Reaction in AN: | AN generates pulses on the a/b-wire |

NOTE 1: During a connection the combination of single pulse and multiple pulses (block tariffing) is allowed.
 With the suppression indicator 3, the line signalling which is allowed to suppress pulses being sent to the terminal is ON HOOK and a DISCONNECT message from the LE.
 However, an already started pulse shall be terminated with the specified length. Subsequent pulses shall be disregarded by the AN. The AN performs the physical pulse generation (12 kHz, 16 kHz).
 For further information about acknowledge request indicator see EN 300 324-1 [1], table 23.

NOTE 2: Acknowledge request indicator: 0 for a single pulse, 2 for multiple pulses.

NOTE 3: This option can be chosen for e.g. coin boxes.

4.6 Automatic metering

4.6.1 LE initiated actions

Situation: path active

- LE sends:
- 1) to start automatic metering on a continuous basis
 SIGNAL[enable-metering: meter pulse;
 rate type: $rt < 0$;
 reporting pulse count: xx;
 repetition indicator: 3;
 suppression indicator: 3;
 pulse duration type: 0]
 - 2) to start automatic metering for a fixed number of pulses
 SIGNAL[enable-metering: meter pulse;
 rate type: $rt < 0$;
 reporting pulse count: xx;
 repetition indicator: 0;
 suppression indicator: 3;
 pulse duration type: 0]
 - 3) to stop automatic metering
 SIGNAL[enable-metering: meter pulse;
 rate type: 0;
 reporting pulse count: xx;
 repetition indicator: xx;
 suppression indicator: xx;
 pulse duration type: xx]
 - 4) to change automatic metering parameters
 SIGNAL[enable-metering: meter pulse;
 rate type: $rt < 0$;
 reporting pulse count: xx;
 repetition indicator: 0 or 3;
 suppression indicator: 3;
 pulse duration type: 0]

(xx: any valid value)

Reaction in AN: AN sends
 SIGNAL [metering report;
 pulse count: number of sent meter pulses
 since last metering report;
 report type: 2]

NOTE: With the suppression indicator 3, the line signalling which is allowed to suppress pulses being sent to the terminal is ON HOOK and a DISCONNECT message from the LE.

4.6.2 AN autonomous responses

| | |
|--------------------------------|--|
| Situation: | AN has received SIGNAL message and generates automatic metering pulses on the a/b-wire |
| Process in terminal equipment: | pulse counts equals the reporting pulse count |
| Action in AN: | <ol style="list-style-type: none"> 1) automatic metering on a continuous basis: AN sends SIGNAL [metering report; pulse count: reporting pulse count; report type: 1] and continues generating metering pulses 2) automatic metering for a fixed number of pulses: AN sends SIGNAL [metering report; pulse count: reporting pulse count; report type: 0] |
| Situation: | AN has received SIGNAL message and generates metering pulses on the a/b-wire. |
| Process in terminal equipment: | port blocks |
| Action in AN: | AN sends SIGNAL [metering report; pulse count: number of sent meter pulses since last metering report; report type: 3; failure reason: 1] |

4.7 Activation and deactivation of hook flash detection using PROTOCOL PARAMETER

The AN is enabled or disabled for hook flash detection by the protocol parameter message from the LE. The default setting is, that the hook flash detection is disabled for both incoming and outgoing calls. The hook flash detection is temporary enabled, i.e. until the end of the connection (DISCONNECT), with the protocol parameter message. The hook flash detection can also be disabled with a protocol parameter message.

The following describes the default adjustment. No minimum pulse length is defined for dial pulses, every pulse recognized by the HW is seen as a valid pulse.

The mapping of a loop interruption onto the respective PSTN message is carried out by means of the duration of the loop interruption, named t . The basic adjustment is that the AN cannot recognize the hook flash signal.

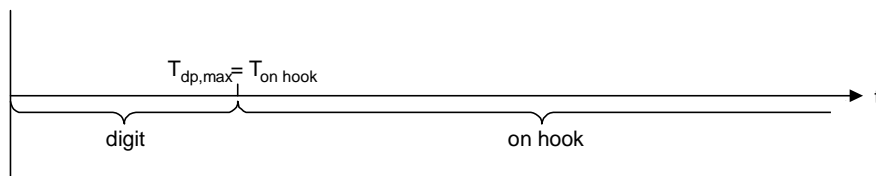


Figure 1

For $t < T_{dp, max}$: a digit signal is recognized.

For $t > T_{on hook}$: On Hook is recognized.

To enable the hook flash, the setting is changed to $T_{dp, max} < T_{on hook}$, which is achieved by changing the On Hook recognition time $T_{on hook}$. For all loop interruptions with the duration $T_{dp, max} < t < T_{on hook}$ a hook flash will be recognized:

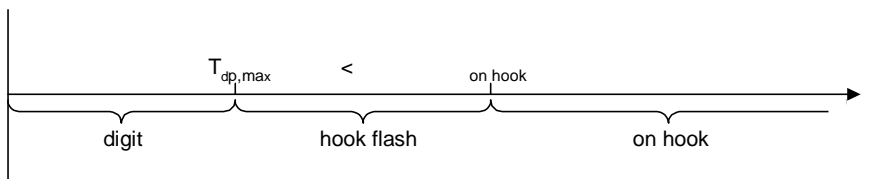


Figure 2

For $t < T_{dp, max}$: a digit signal is recognized.

For $T_{dp, max} < t < T_{on hook}$: Hook Flash is recognized.

For $t > T_{on hook}$: On Hook is recognized.

This mechanism is the same for incoming and outgoing calls.

4.7.1 Activation of hook flash detection

| | |
|-----------------|--|
| Situation: | path active |
| LE sends: | PROTOCOL PARAMETER [recognition time; pulsed signal: register recall; duration type: 1] |
| Reaction in AN: | AN modifies the time control for "on hook" to the time defined for duration type 1 ($T_{on hook} > T_{dp, max}$) |

NOTE: hence, $T_{dp, max} < t < T_{on hook}$

- 1) the loop interruption with the duration $t > T_{dp, max}$ and $t < T_{on hook}$ is recognized as „hook flash" and AN generates SIGNAL [pulsed signal: register recall] message.
- 2) the loop interruption with the duration $t > T_{on hook}$ is valued as "on hook" and AN generates SIGNAL [steady signal: on hook] message.
- 3) if the loop interruption with the duration $t < T_{dp, max}$, AN will generate a SIGNAL [digit signal] message. It is the LE's responsibility to recognize this message as a hook flash signal or as a dial pulse.

4.7.2 Deactivation of hook flash detection

| | |
|-----------------|--|
| Situation: | path active, hook flash detection is activated |
| LE sends: | PROTOCOL PARAMETER[recognition time; pulsed signal: register recall; duration type: 0] |
| Reaction in AN: | The modified time control for "on hook" will be reset based on standard value, i.e. it is set time $T_{on hook} = T_{dp, max}$. |

4.7.3 Hook flash signal/register recall

| | |
|--------------------------------|---|
| Situation: | hook flash recognition enabled |
| Process in terminal equipment: | hook flash signal (short interruption of DC loop) |
| Reaction in AN: | AN sends SIGNAL [pulsed signal: register recall] |

4.8 On hook

| | |
|--------------------------------|---|
| Situation: | DC loop at terminal equipment is closed |
| Process in terminal equipment: | DC loop is interrupted |
| Reaction in AN: | AN sends SIGNAL [steady signal: on hook] |

4.9 Terminating the ringing signal before called party off hook

| | |
|-----------------|---|
| Situation: | DC loop at terminal equipment is open, AN sends ringing signal |
| LE sends: | SIGNAL [steady signal: stop ringing] |
| Reaction in AN: | terminates the ringing signal |

4.10 Start ringing while path active

| | |
|-----------------|---|
| Situation: | DC loop at terminal equipment is open, AN is in path active state, e.g. after initial ring |
| LE sends: | SIGNAL [cadenced ringing type: 0 - 127] |
| Reaction in AN: | AN checks whether ringing signal is possible: <ul style="list-style-type: none"> 1) ringing possible: AN sends ringing signal to the terminal equipment 2) ringing generator in AN is not available: AN sends SIGNAL [resource unavailable] |

4.11 Line reversal

| | |
|-----------------|---|
| Situation: | path active |
| LE sends: | SIGNAL [steady signal: reversed polarity] |
| Reaction in AN: | AN reverses polarity on the subscriber line |

4.12 End of line reversal

| | |
|-----------------|--|
| Situation: | LE has sent SIGNAL [steady signal: reversed polarity], polarity on the line is reversed |
| LE sends: | SIGNAL [steady signal: normal polarity] |
| Reaction in AN: | AN switches polarity on the subscriber line back to normal |

4.13 Line parked

Situation: call is already released by LE
 DC loop in terminal equipment remains closed

LE sends: SIGNAL [steady signal: reduced battery]

Reaction in AN: AN sets a/b- wire to reduced battery

5 Message Flows

The following selection of flow charts reflect characteristic subscriber actions (for normal analogue subscribers without DDI). It does not claim to be complete.

5.1 A-subscriber

5.1.1 A-subscriber off hook until dial tone

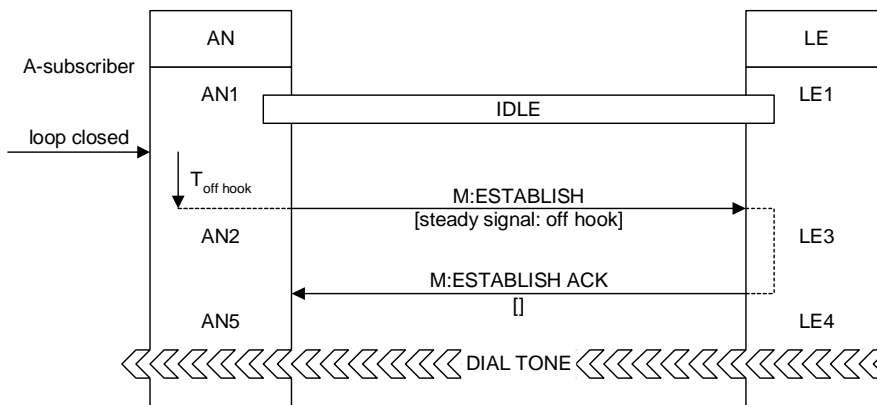


Figure 3

5.1.2 A-subscriber on hook before ESTABLISH ACK

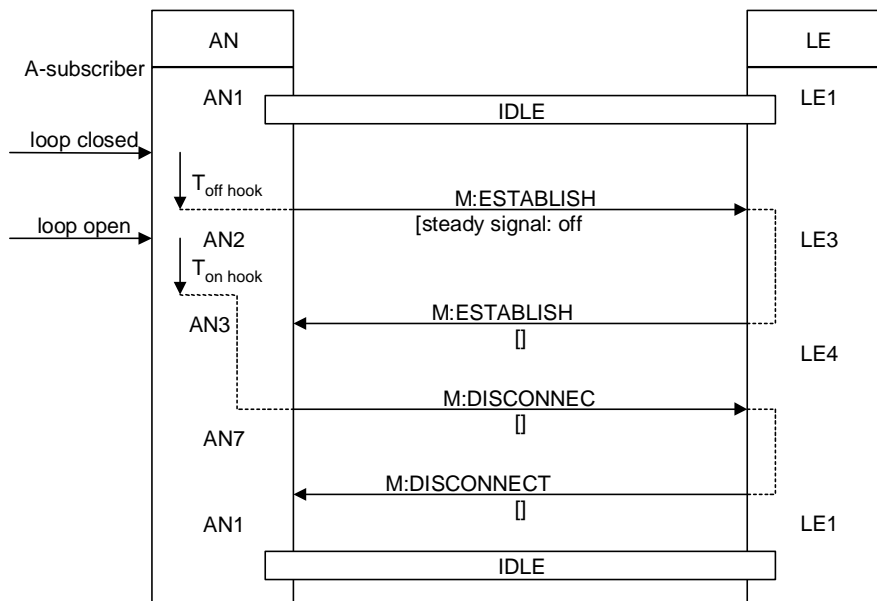


Figure 4

5.1.3 A-subscriber on hook after ESTABLISH ACK

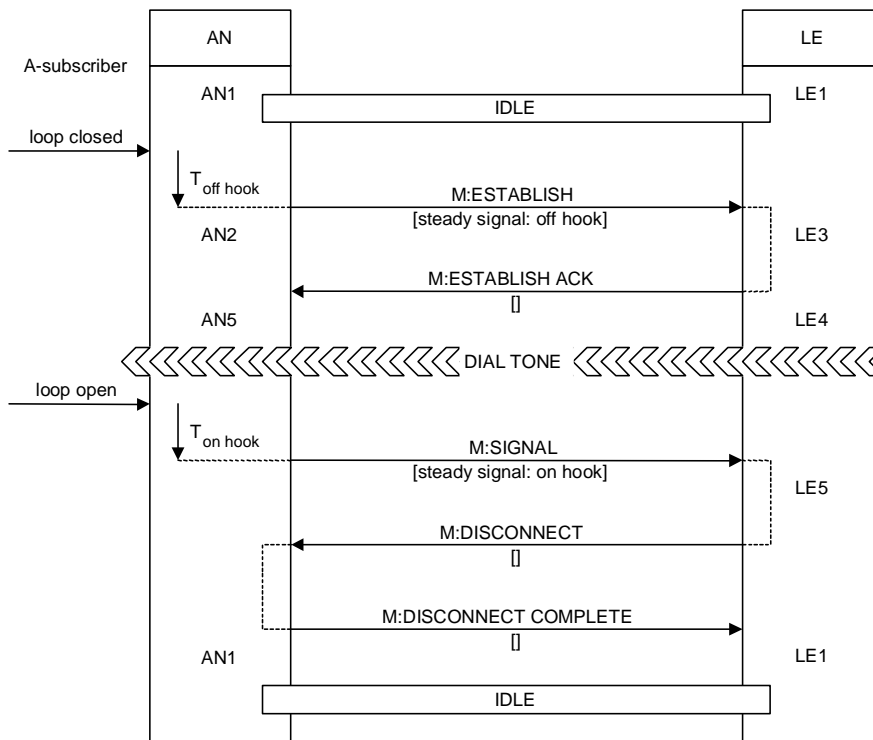


Figure 5

5.1.4 A-subscriber off hook without dialling (expiring of dial tone supervision)

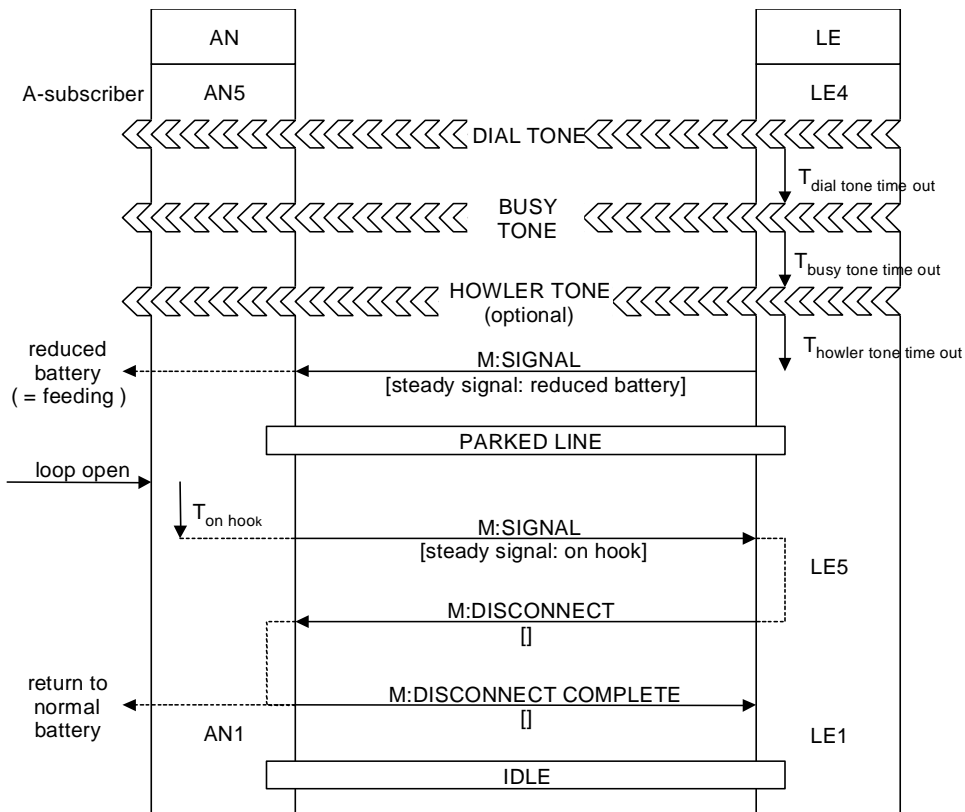


Figure 6

5.1.5 A-subscriber: Pulse dialling

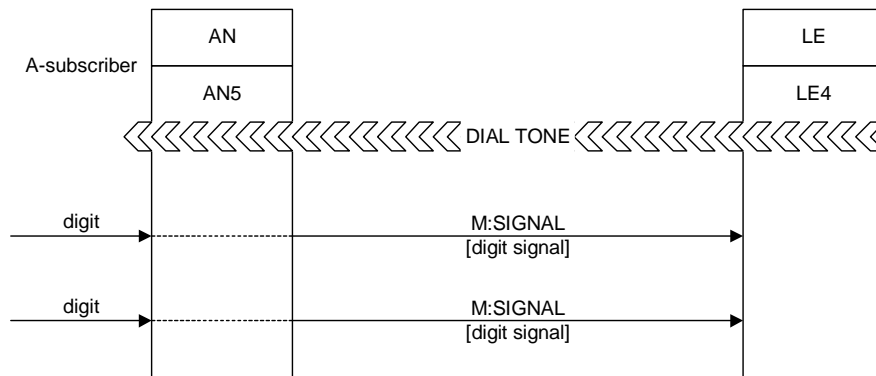


Figure 7

5.1.6 A-subscriber metering after B-subscriber off hook

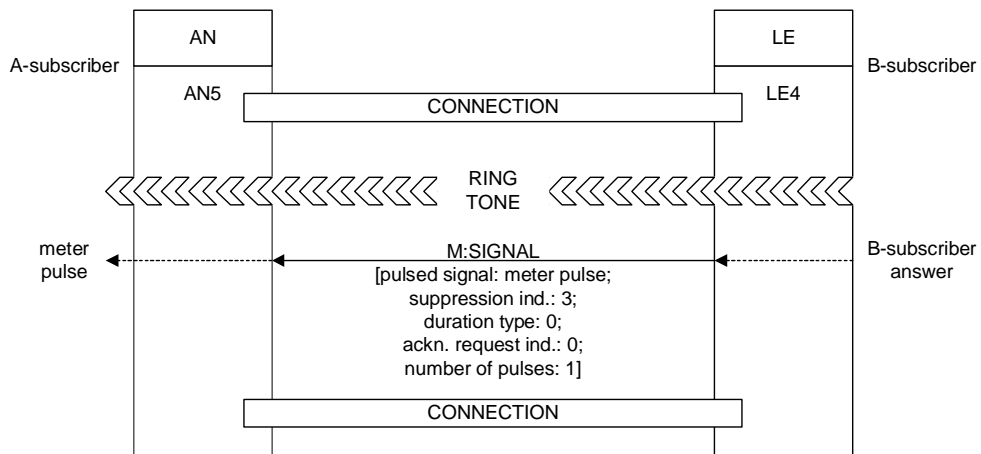


Figure 8

5.1.7 A-subscriber on hook while receiving multiple meter pulses

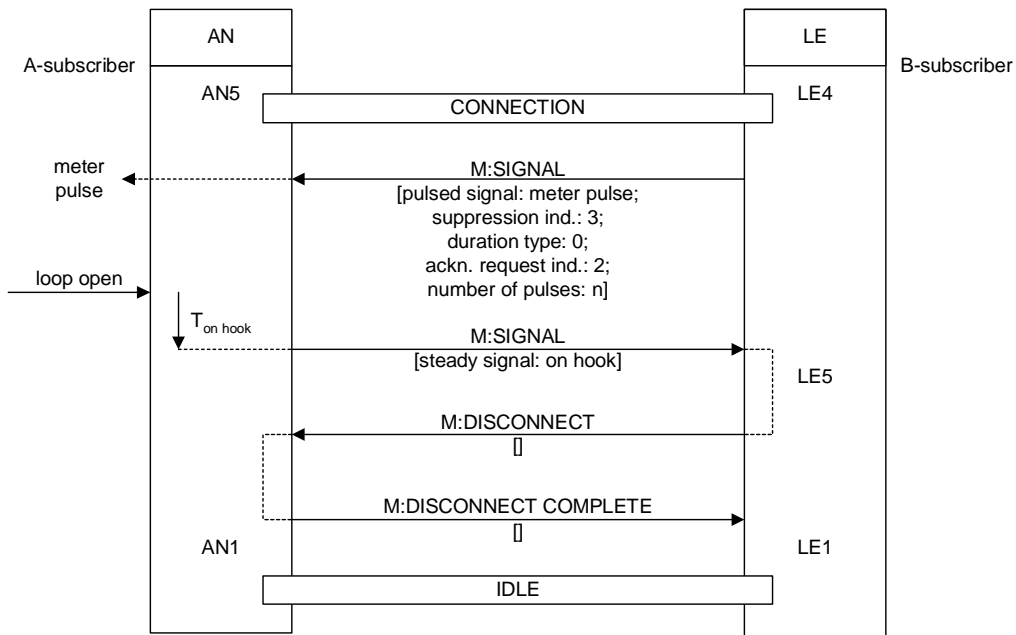


Figure 9

5.1.8 A-subscriber automatic metering

5.1.8.1 Ongoing automatic metering

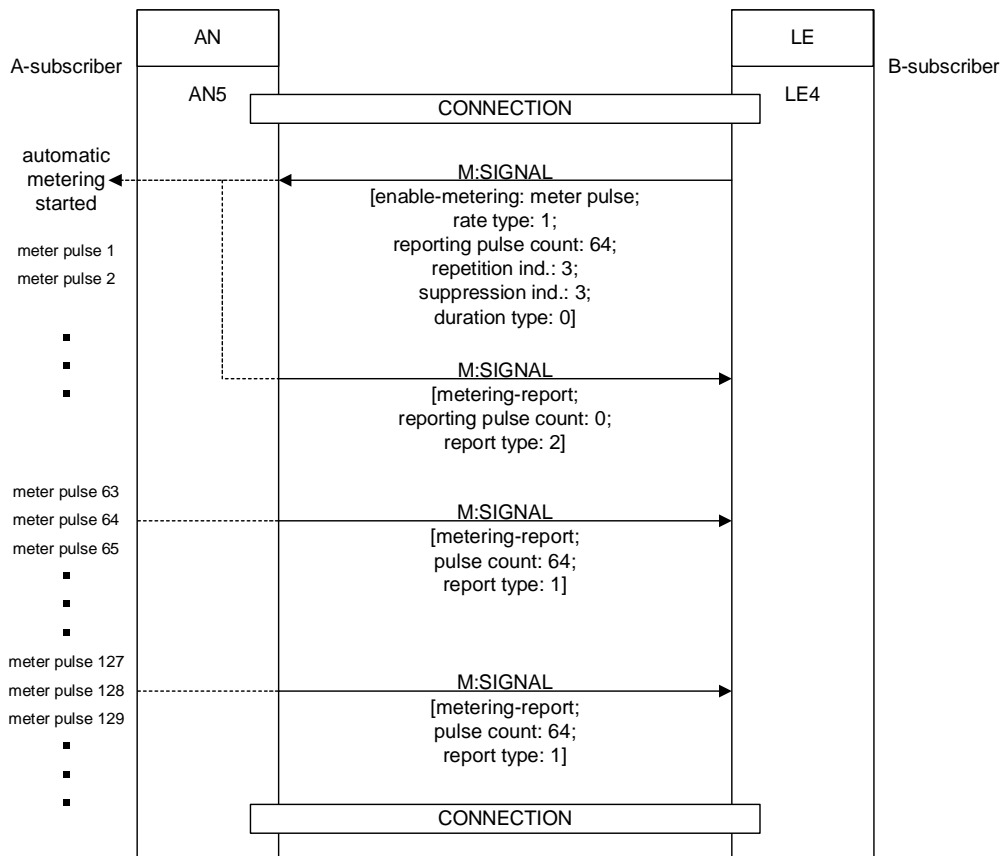


Figure 10

5.1.8.2 Changing the rate during automatic metering

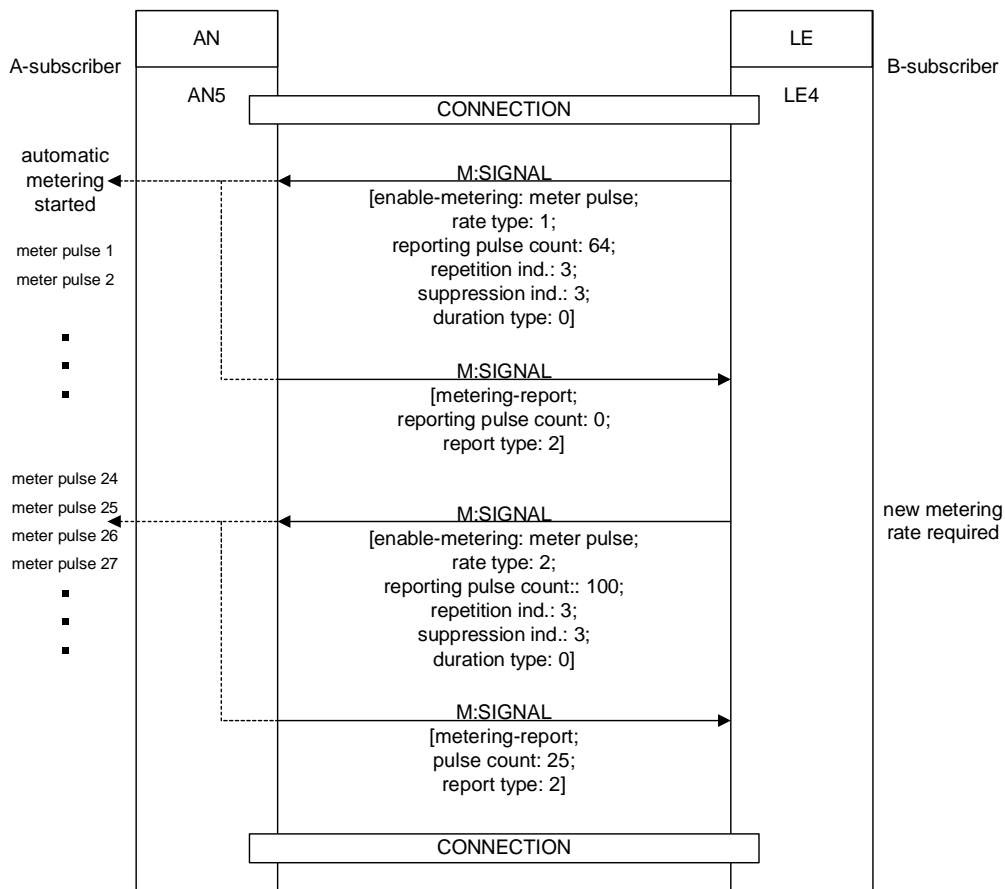
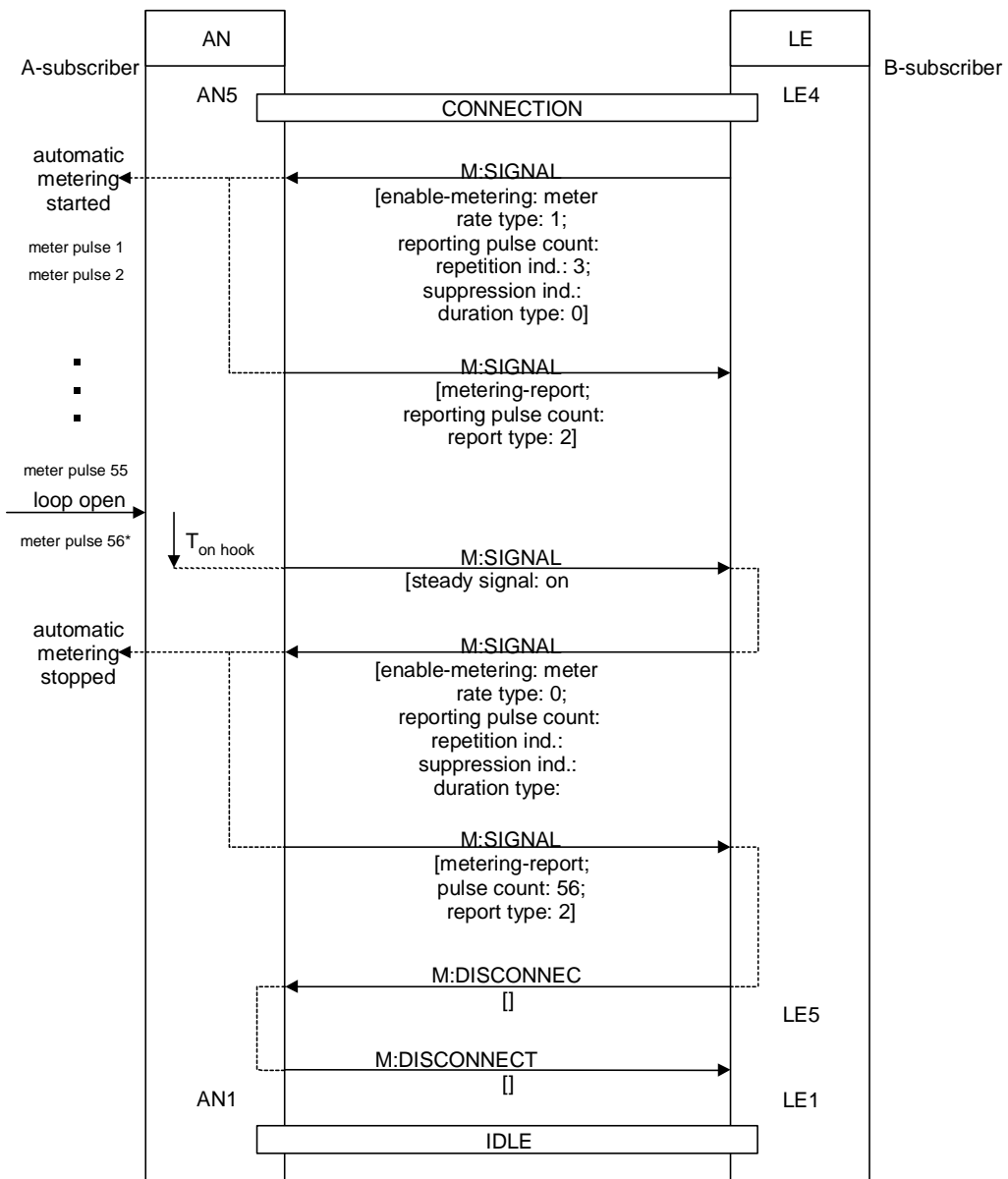


Figure 11

5.1.8.3 A-subscriber call termination during automatic metering



xx - any valid value
 * this metering pulse is suppressed (not sent out)

Figure 12

5.1.8.4 B-subscriber call termination during automatic metering

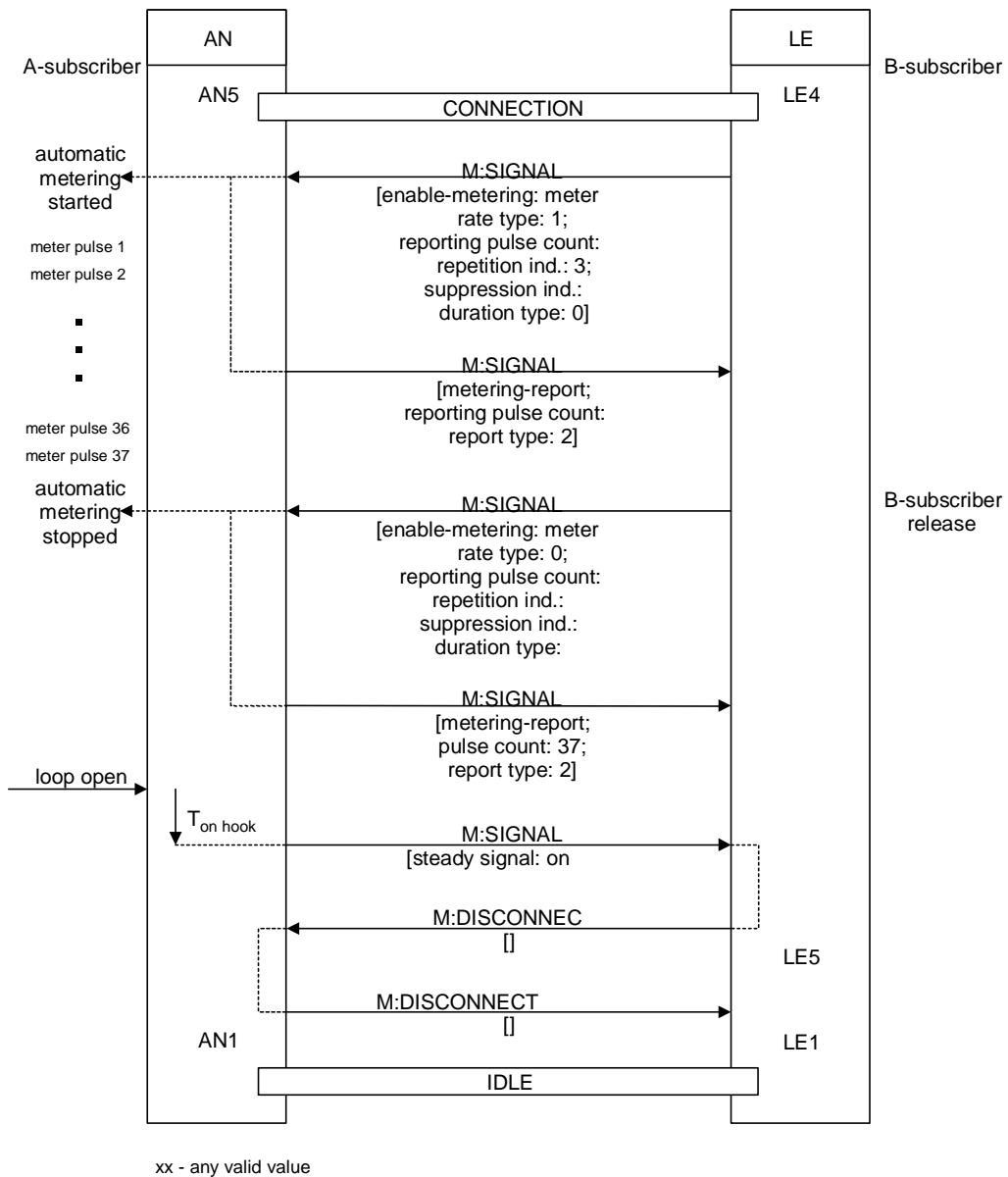


Figure 13

5.1.8.5 Port blocking during automatic metering

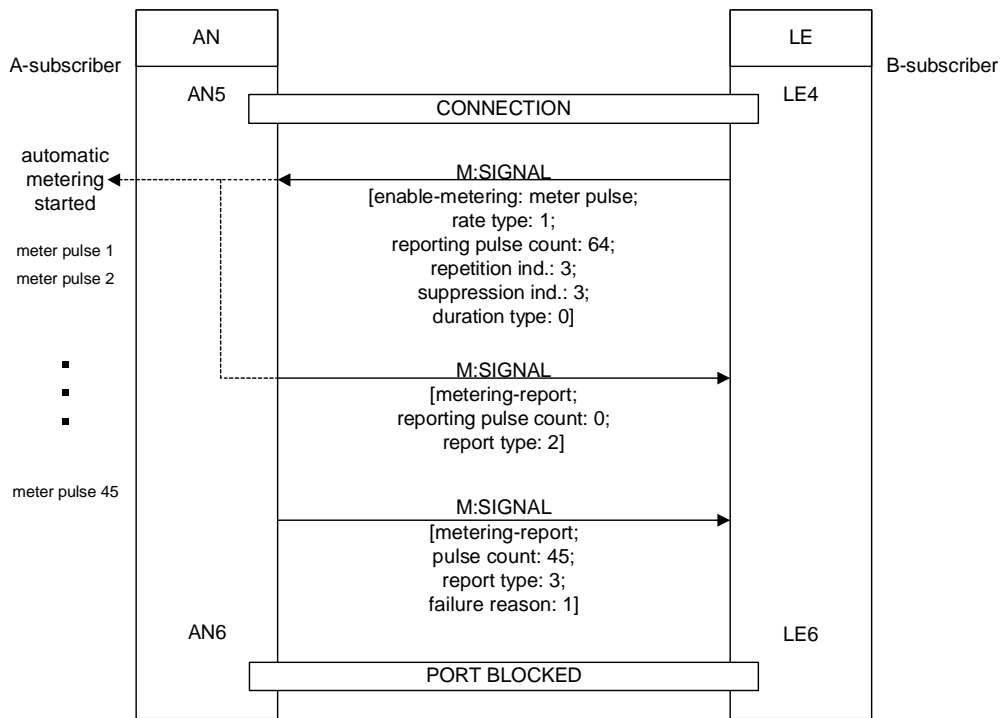


Figure 14

5.1.8.6 Automatic metering for only a fixed number of pulses

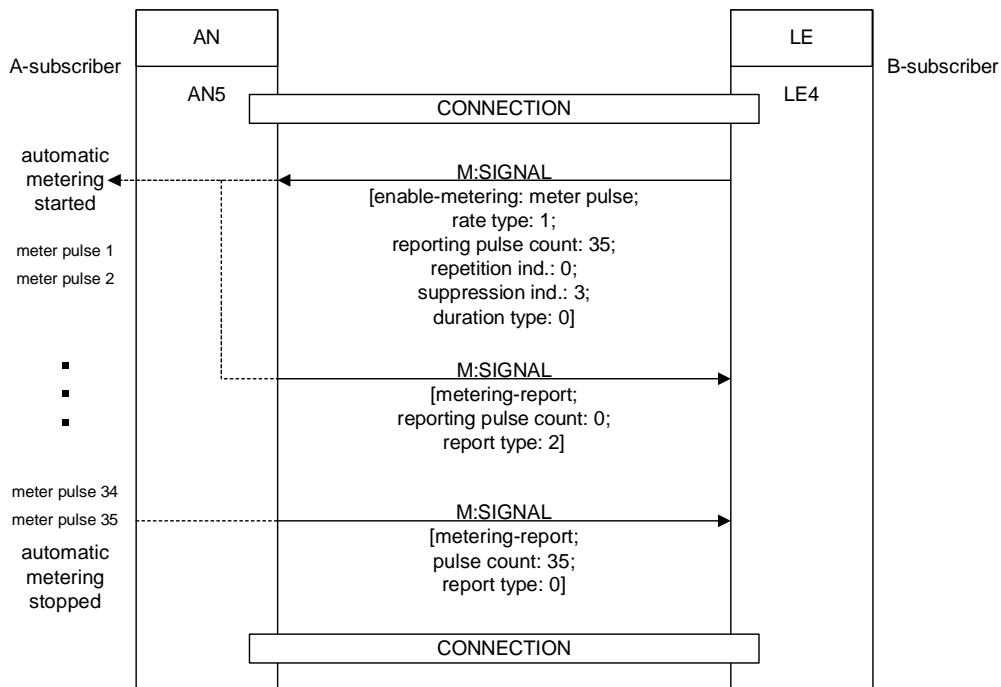


Figure 15

5.1.9 A-subscriber: Expiring of clear back supervision

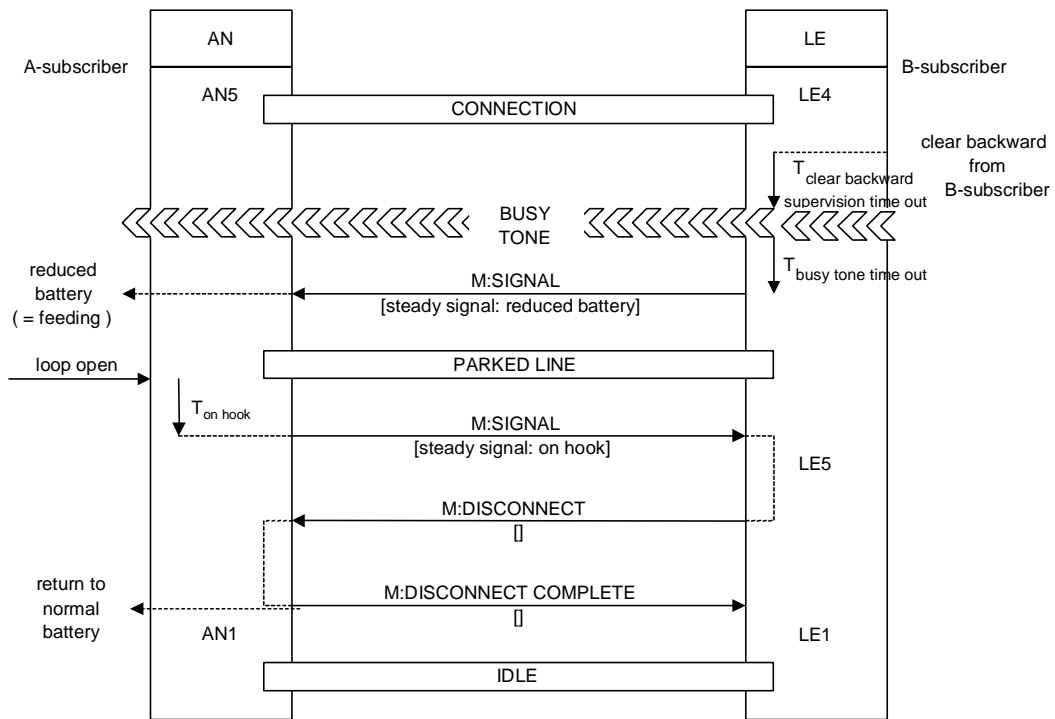


Figure 16

5.1.10 A-subscriber: Line reversal with switch back to normal

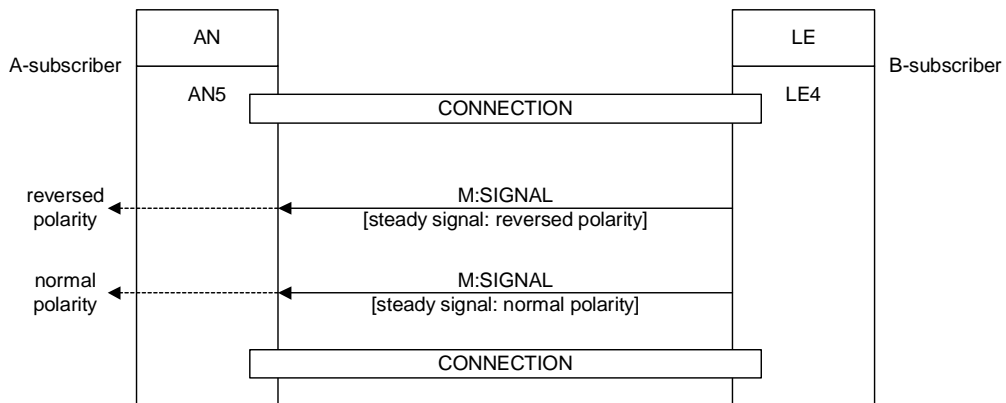


Figure 17

5.2 B-subscriber

5.2.1 B-subscriber: Ringing possible

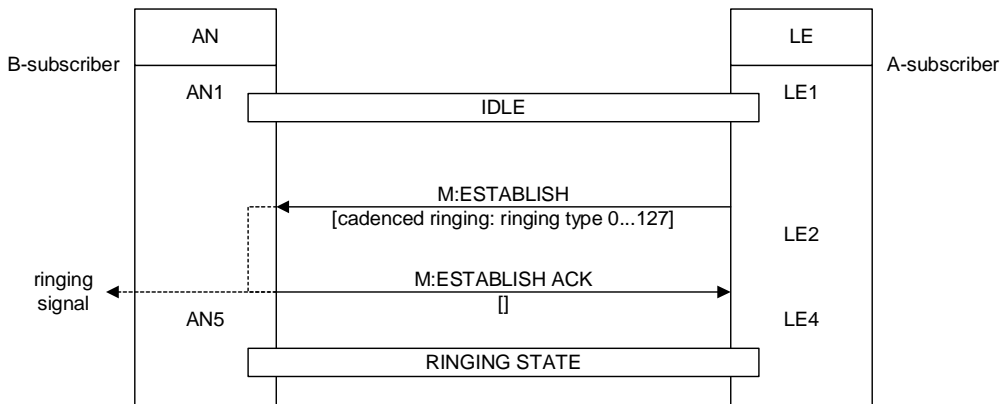


Figure 18

5.2.2 B-subscriber: Ringing not possible

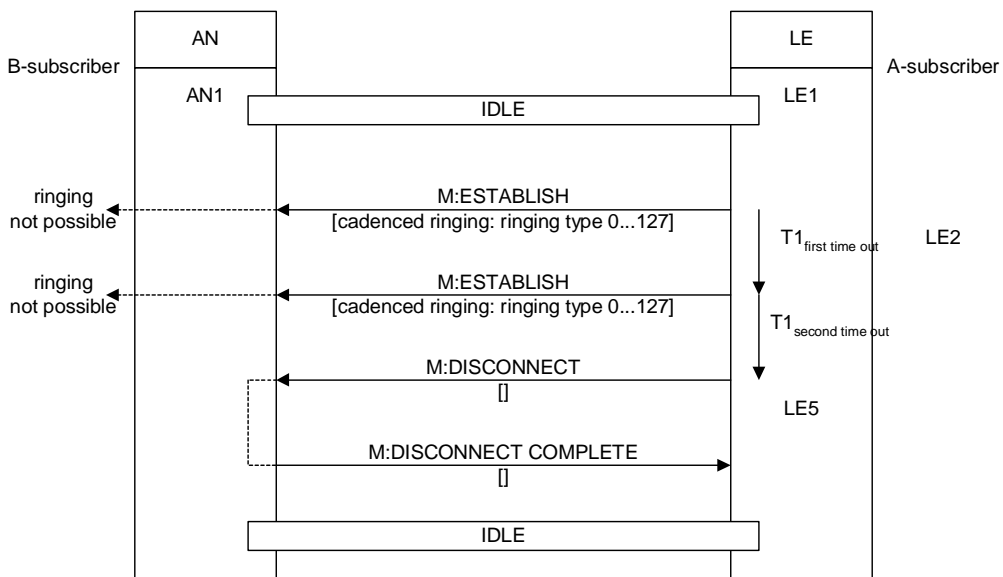


Figure 19

5.2.3 B-subscriber answer

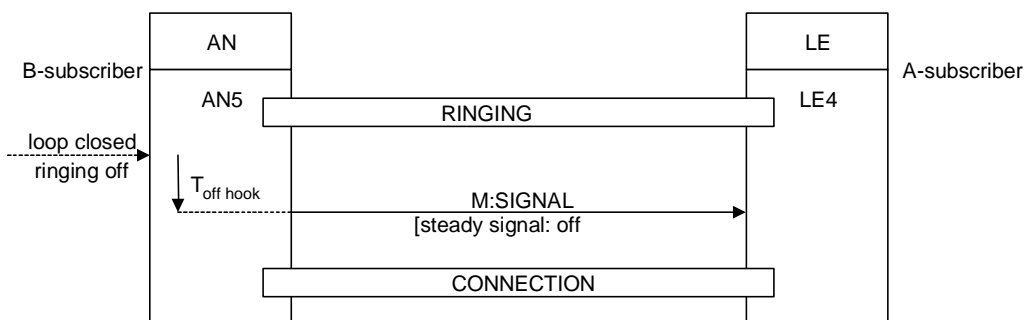


Figure 20

5.2.4 A-subscriber on hook before B-subscriber answer

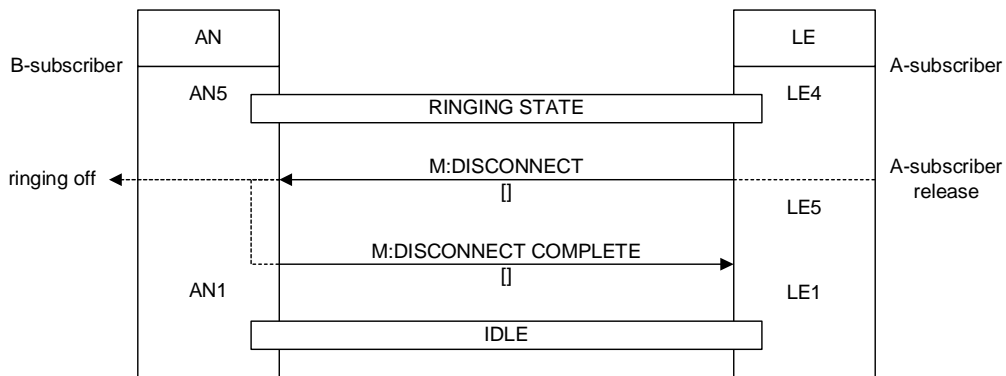


Figure 21

5.2.5 A-subscriber on hook, B-subscriber still off hook until parked line

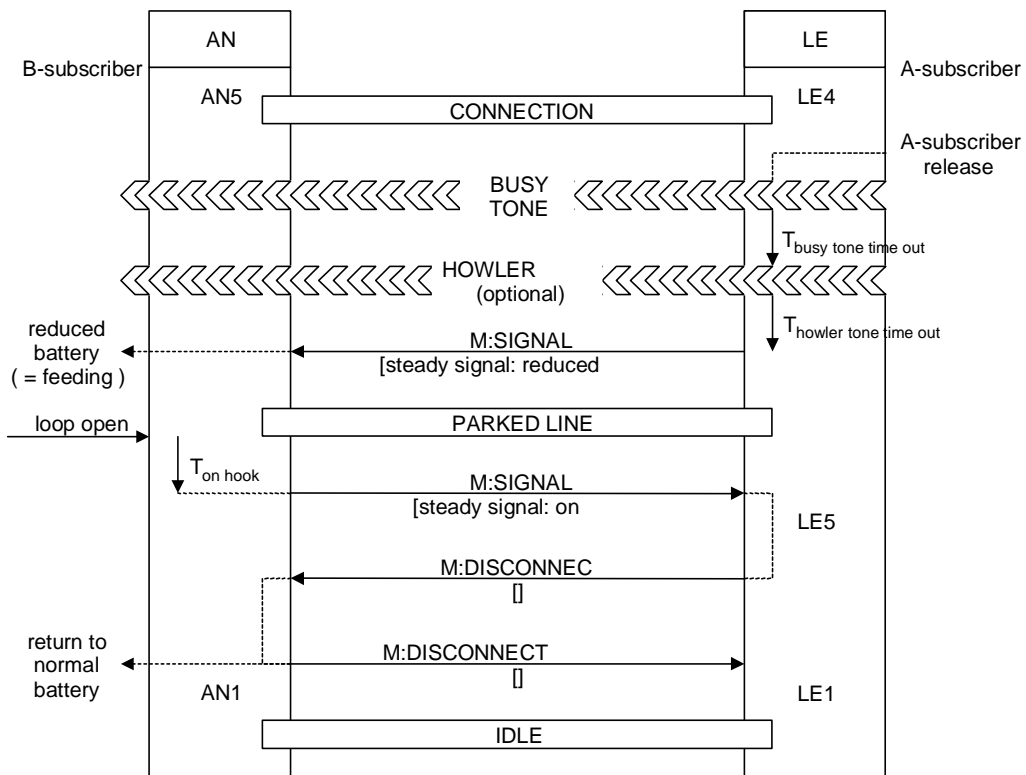


Figure 22

5.2.6 B-subscriber on hook, reanswer while disconnecting the V5 path

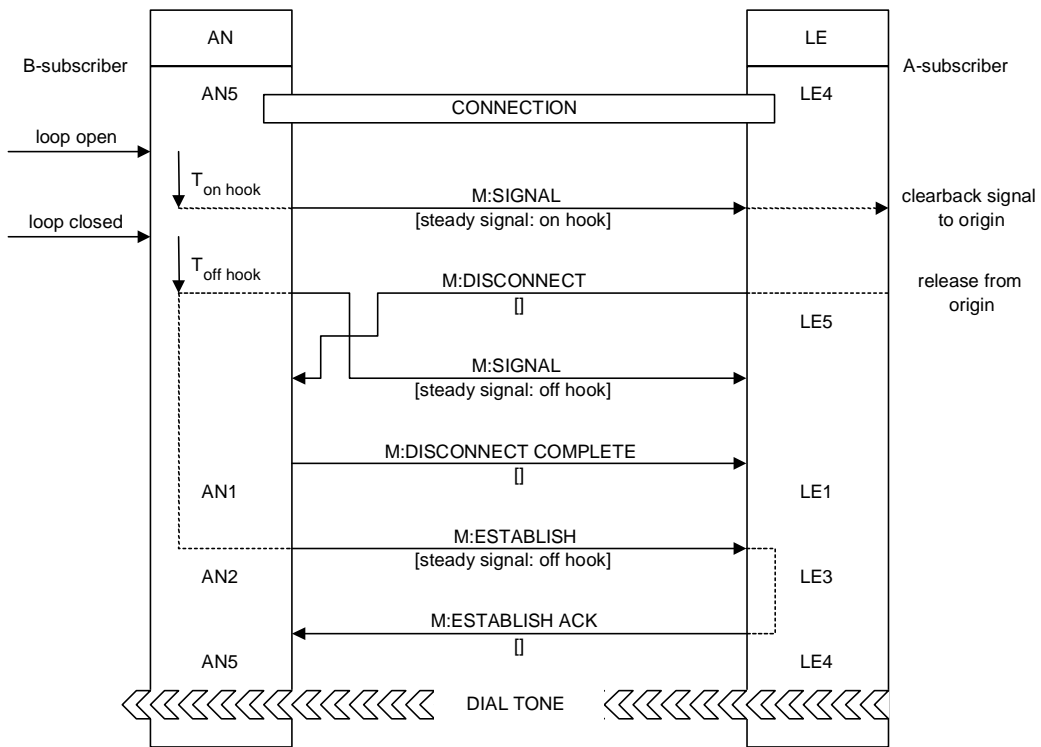


Figure 23

5.2.7 B-subscriber on hook, reanswer before expiration of clear back supervision

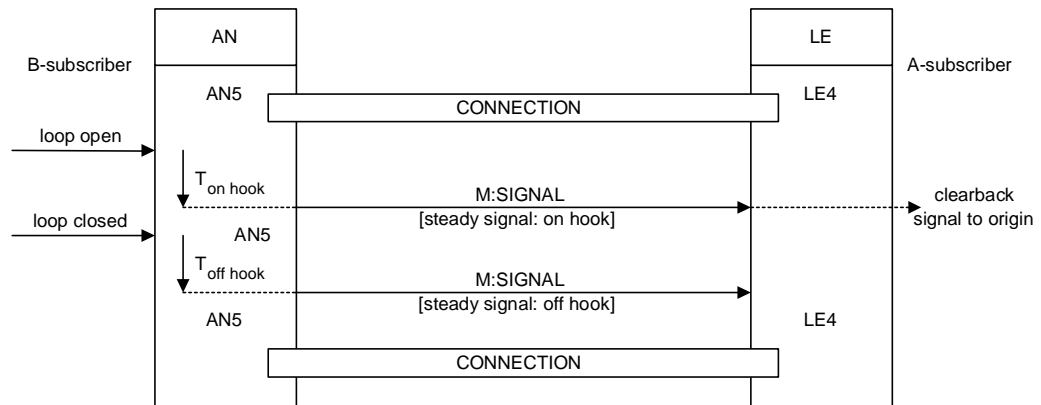


Figure 24

5.2.8 Hook flash signal control (enable hook flash recognition by
 PROTOCOL PARAMETER: $T_{dp} < t < T_{on\ hook}$)

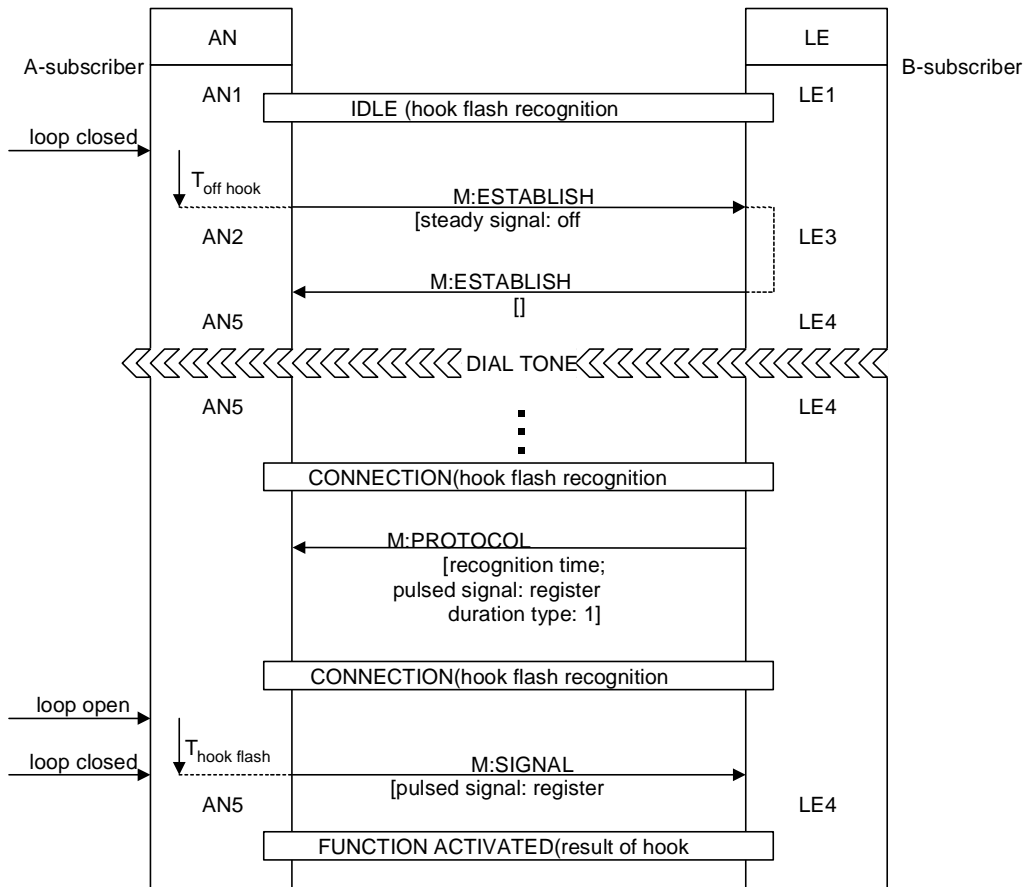


Figure 25

5.2.9 Malicious call trace with hook flash (hook flash recognition enabled:
 $T_{dp} < t < T_{on\ hook}$)

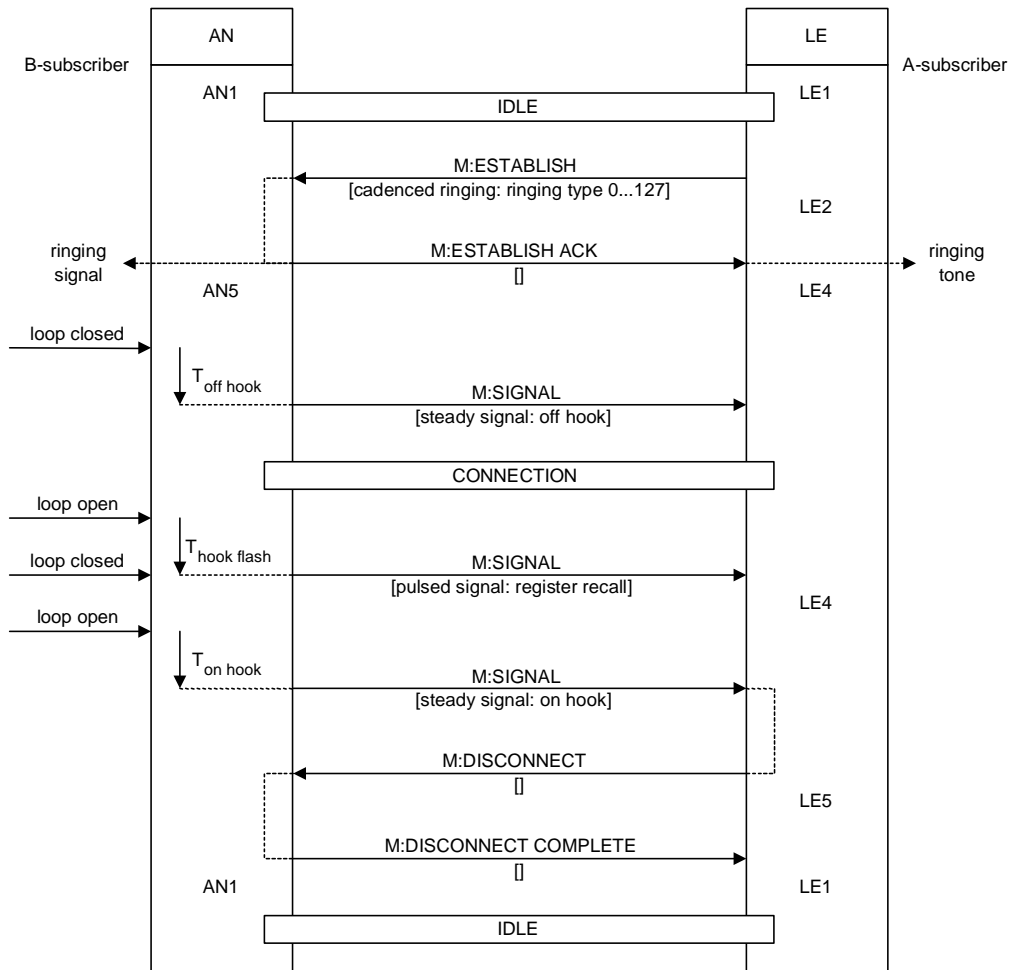


Figure 26

5.2.10 Call waiting with reringing

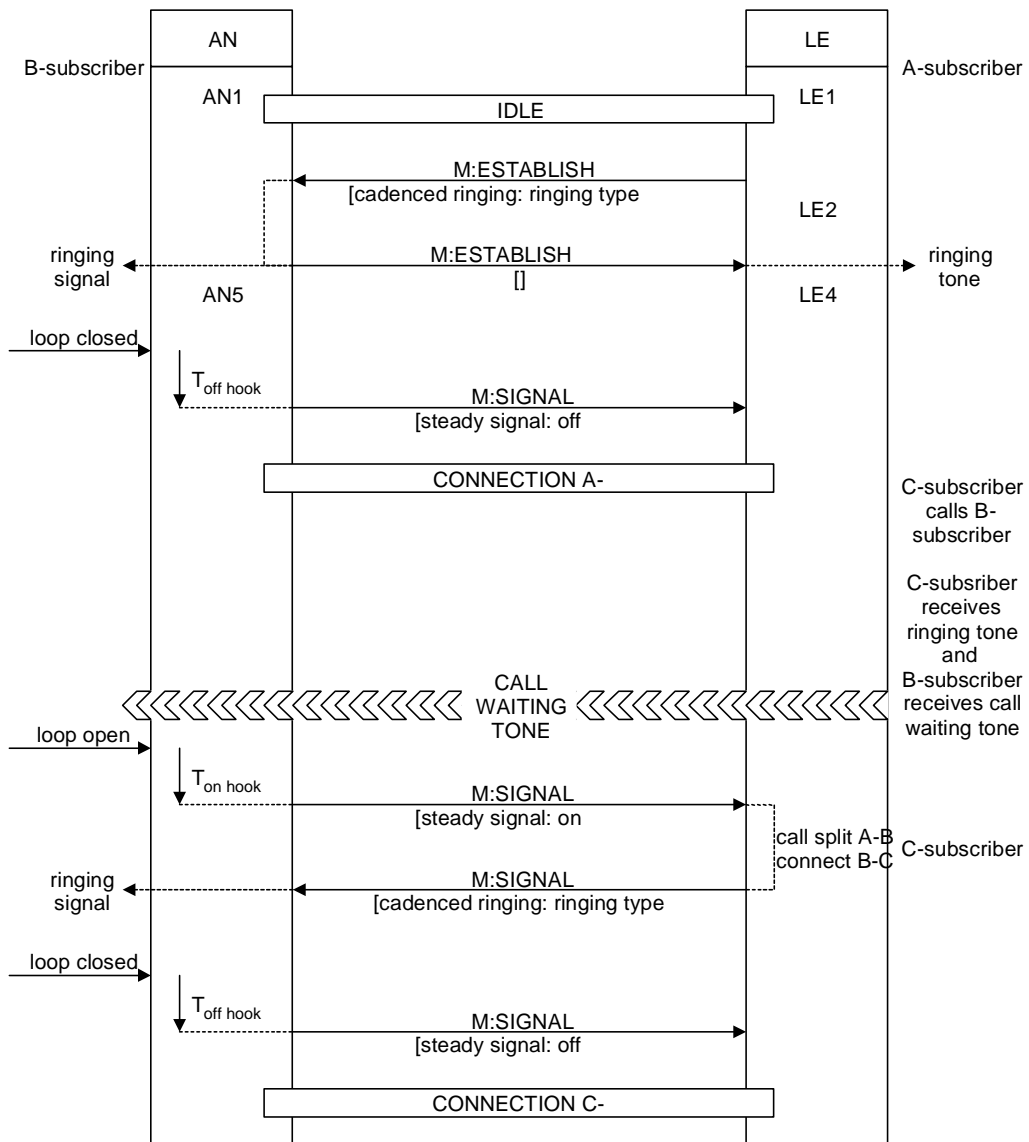


Figure 27

5.2.11 Call waiting, AN can not generate ringing current to B-subscriber for reringing

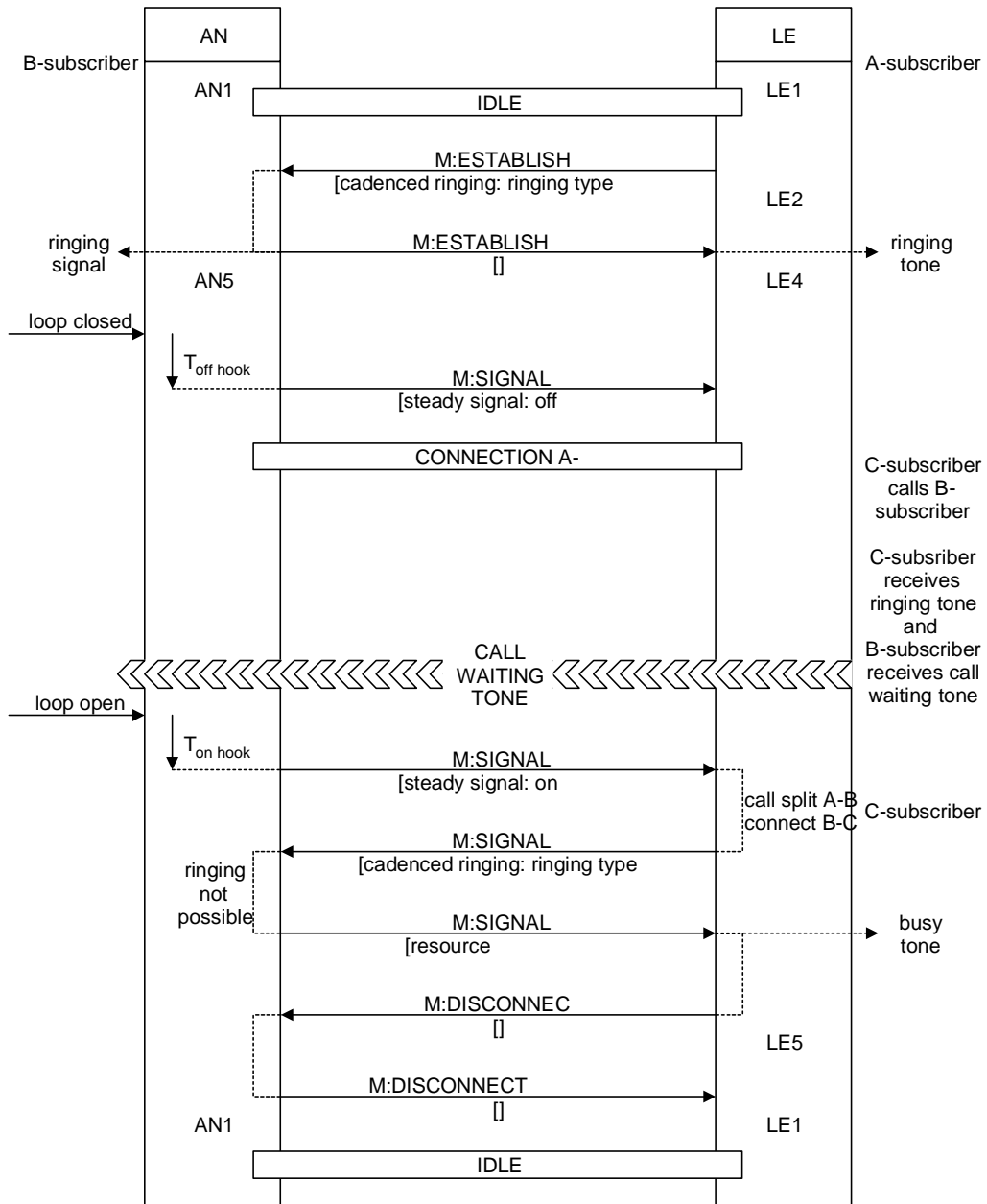


Figure 28

5.2.12 CLIP after initial ringing

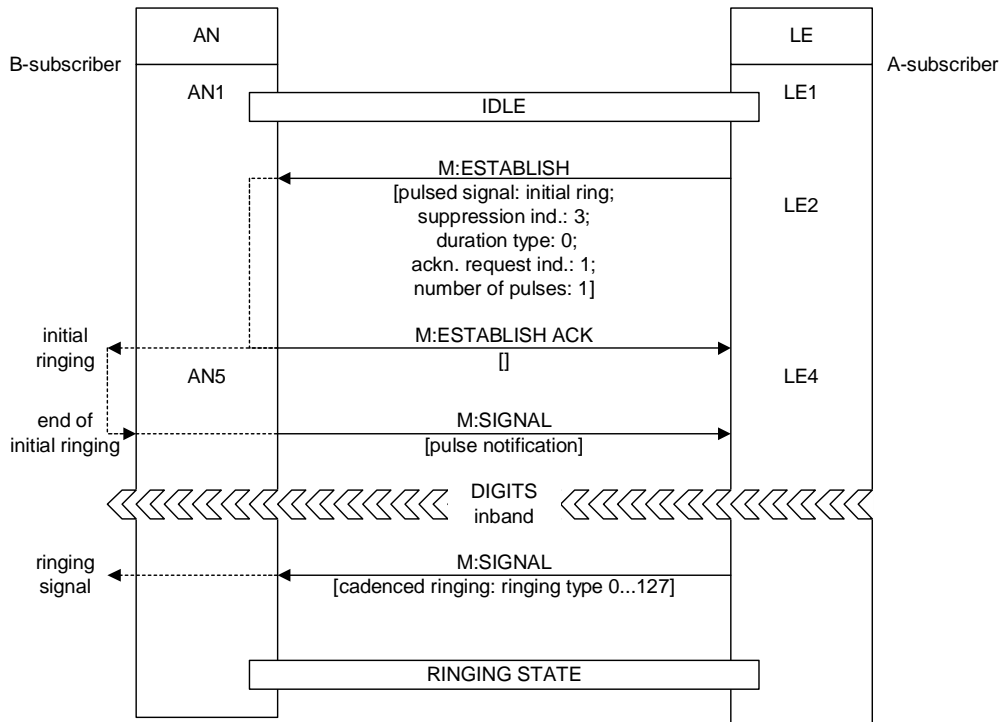


Figure 29

History

| Document history | | |
|-------------------------|---------------|-------------|
| V1.1.1 | November 2000 | Publication |
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