SYSTEM FOR IMPLEMENTING PREPAID ROAMING SOLUTION

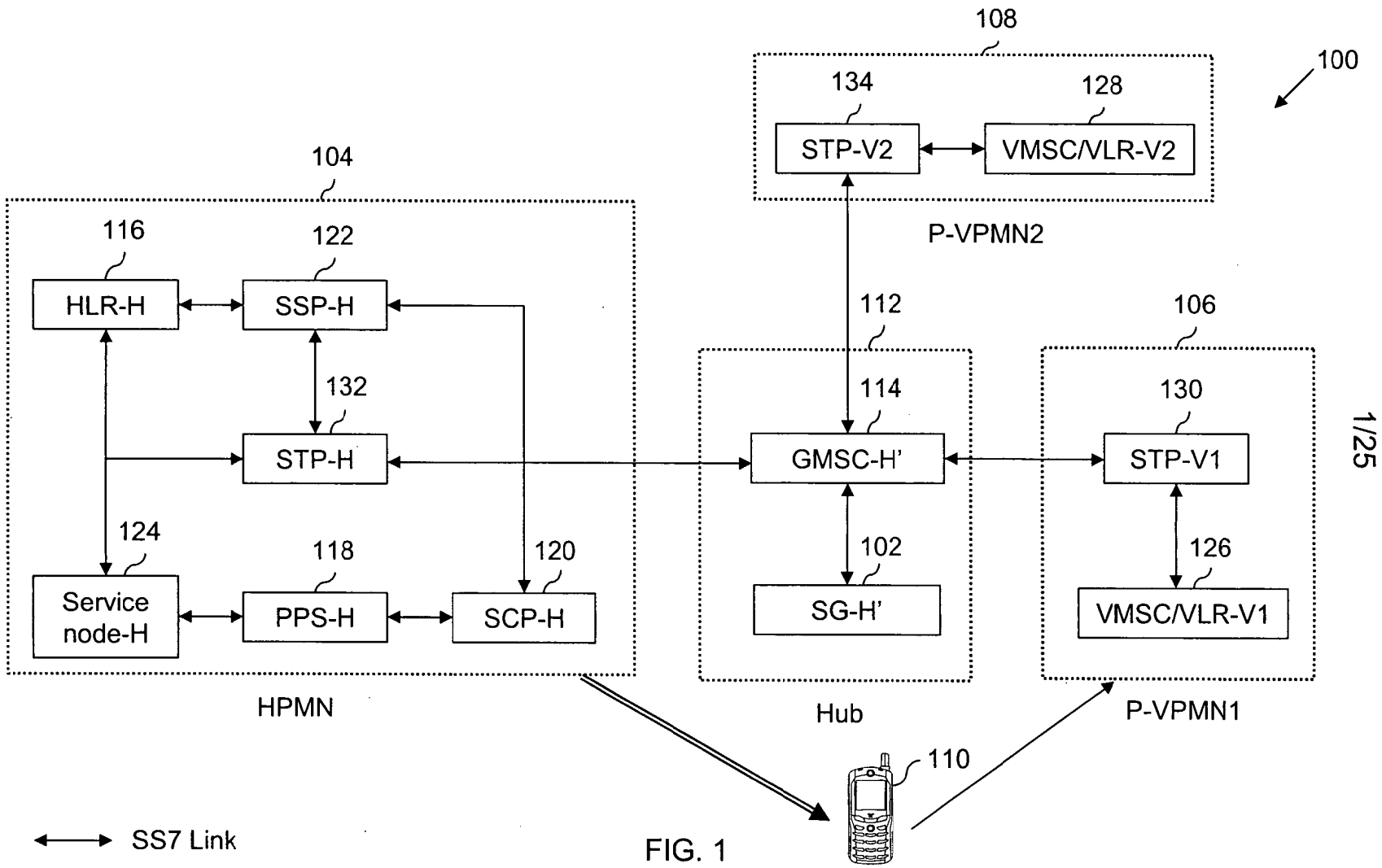


FIG. 1

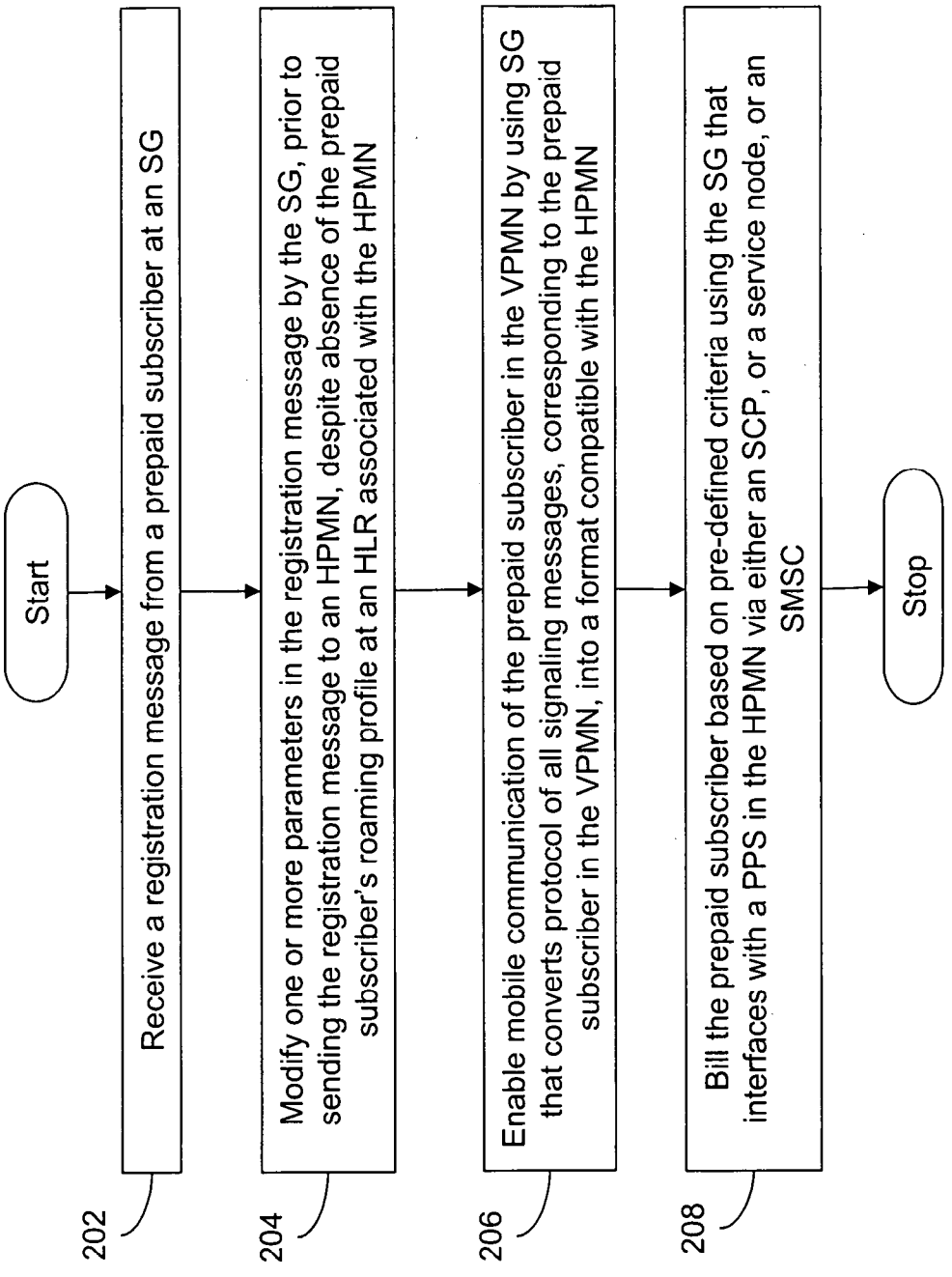

Start
Receive a registration message from a prepaid subscriber at an SG
202
Modify one or more parameters in the registration message by the SG, prior to sending the registration message to an HPMN, despite absence of the prepaid subscriber's roaming profile at an HLR associated with the HPMN
204
Enable mobile communication of the prepaid subscriber in the VPMN by using SG that converts protocol of all signaling messages, corresponding to the prepaid subscriber in the VPMN, into a format compatible with the HPMN
206
Bill the prepaid subscriber based on pre-defined criteria using the SG that interfaces with a PPS in the HPMN via either an SCP, or a service node, or an SMSC
208
Stop

FIG. 2

Registration of a prepaid subscriber of an HPMN at a VPMN

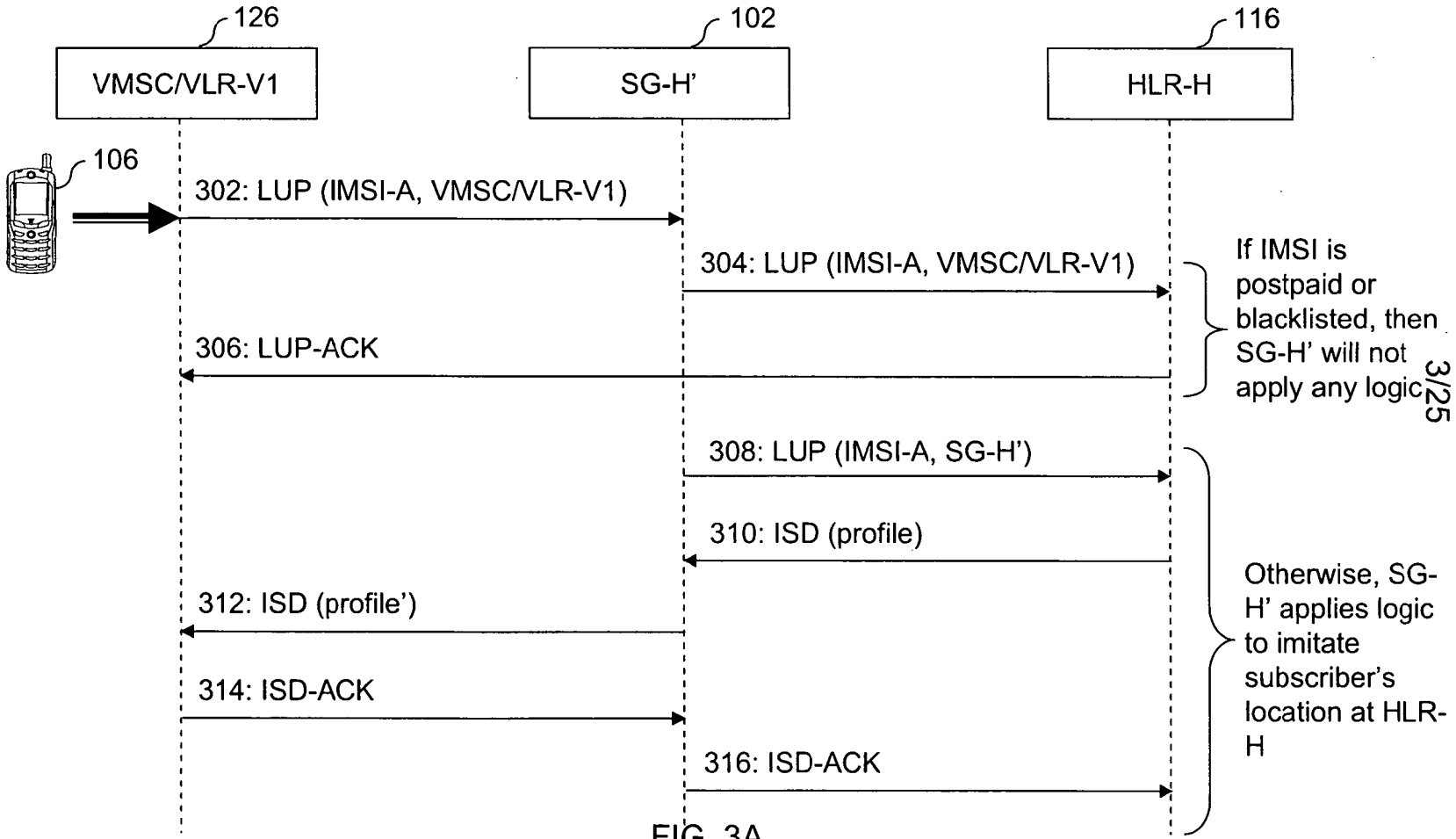


FIG. 3A

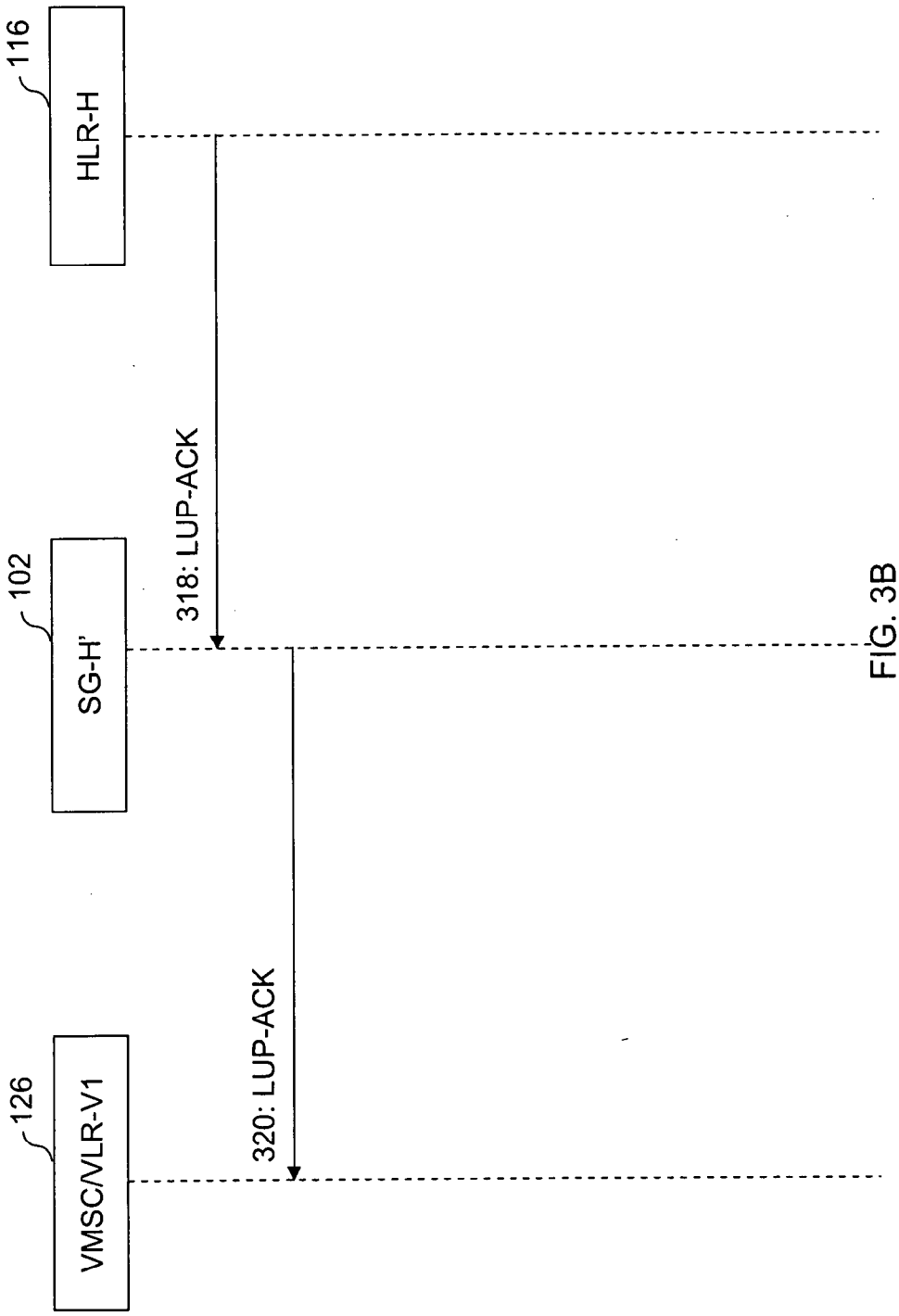


FIG. 3B

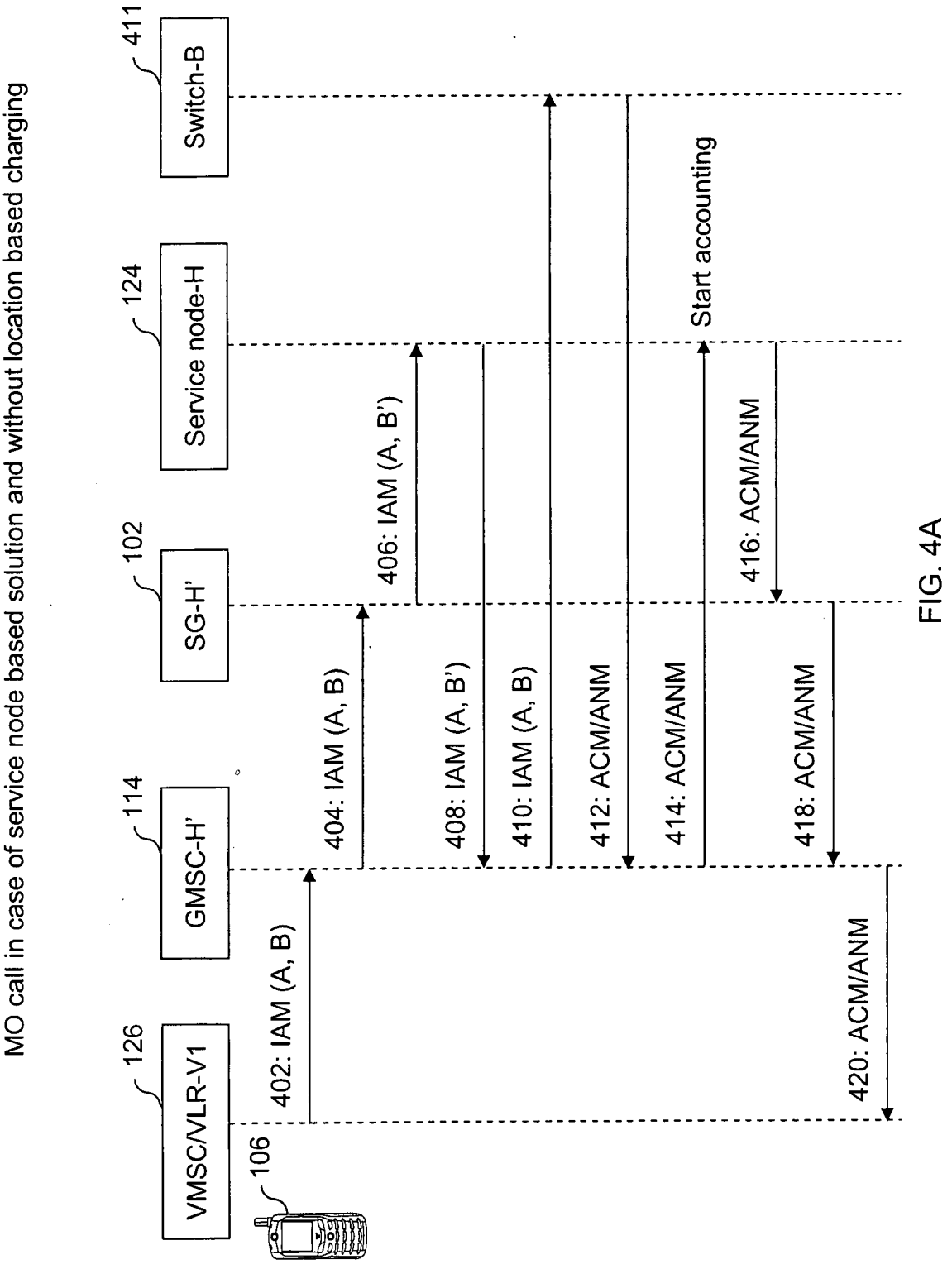

MO call in case of service node based solution and without location based charging
126
VMSC/VLR-V1
106
114
GMSC-H'
102
SG-H'
124
Service node-H
411
Switch-B
402: IAM (A, B)
404: IAM (A, B)
406: IAM (A, B')
408: IAM (A, B')
410: IAM (A, B)
412: ACM/ANM
414: ACM/ANM
Start accounting
416: ACM/ANM
418: ACM/ANM
420: ACM/ANM

FIG. 4A

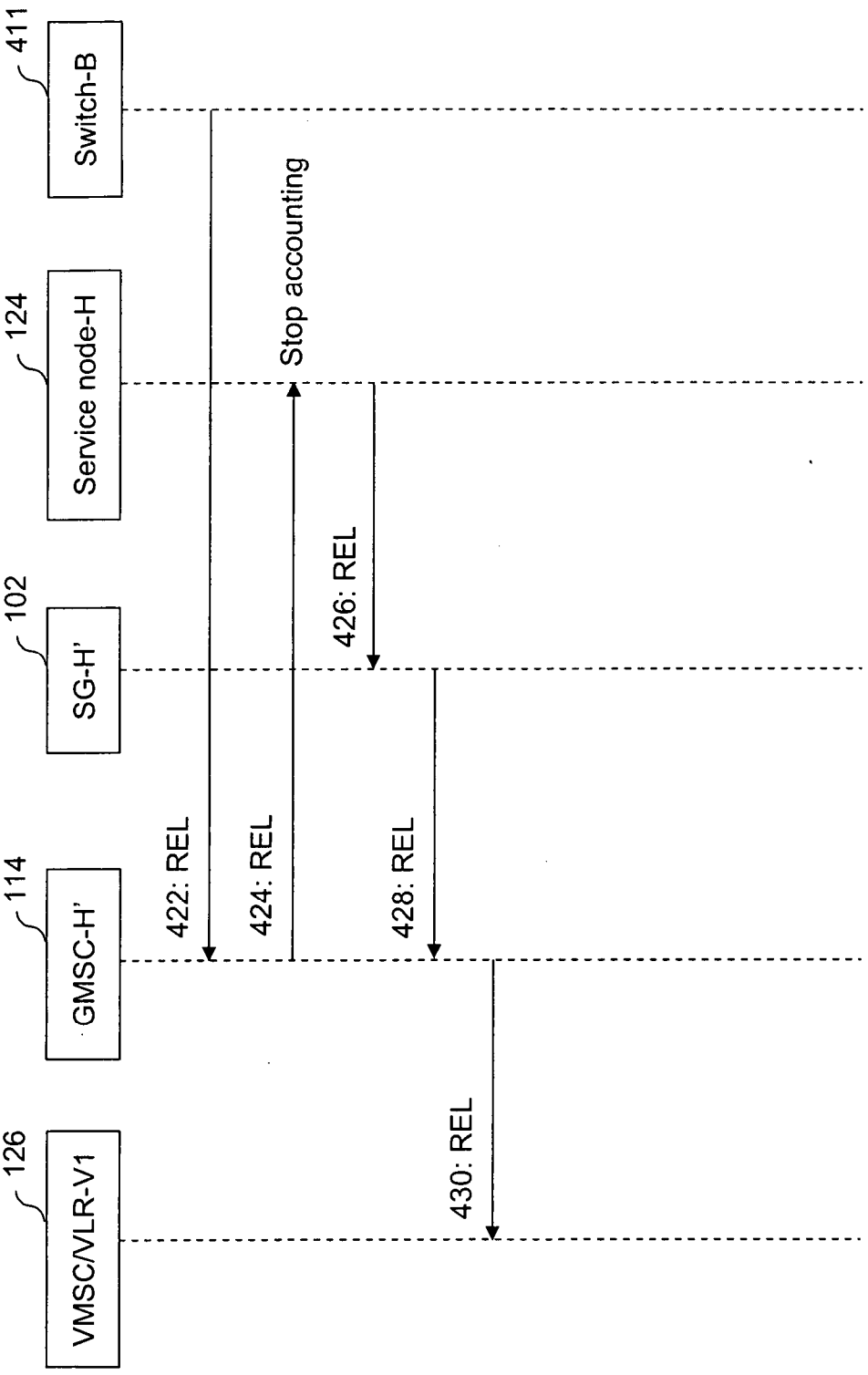

411
Switch-B
124
Service node-H
102
SG-H'
114
GMSC-H'
126
VMSC/VLR-V1
Stop accounting
422: REL
424: REL
426: REL
428: REL
430: REL

FIG. 4B

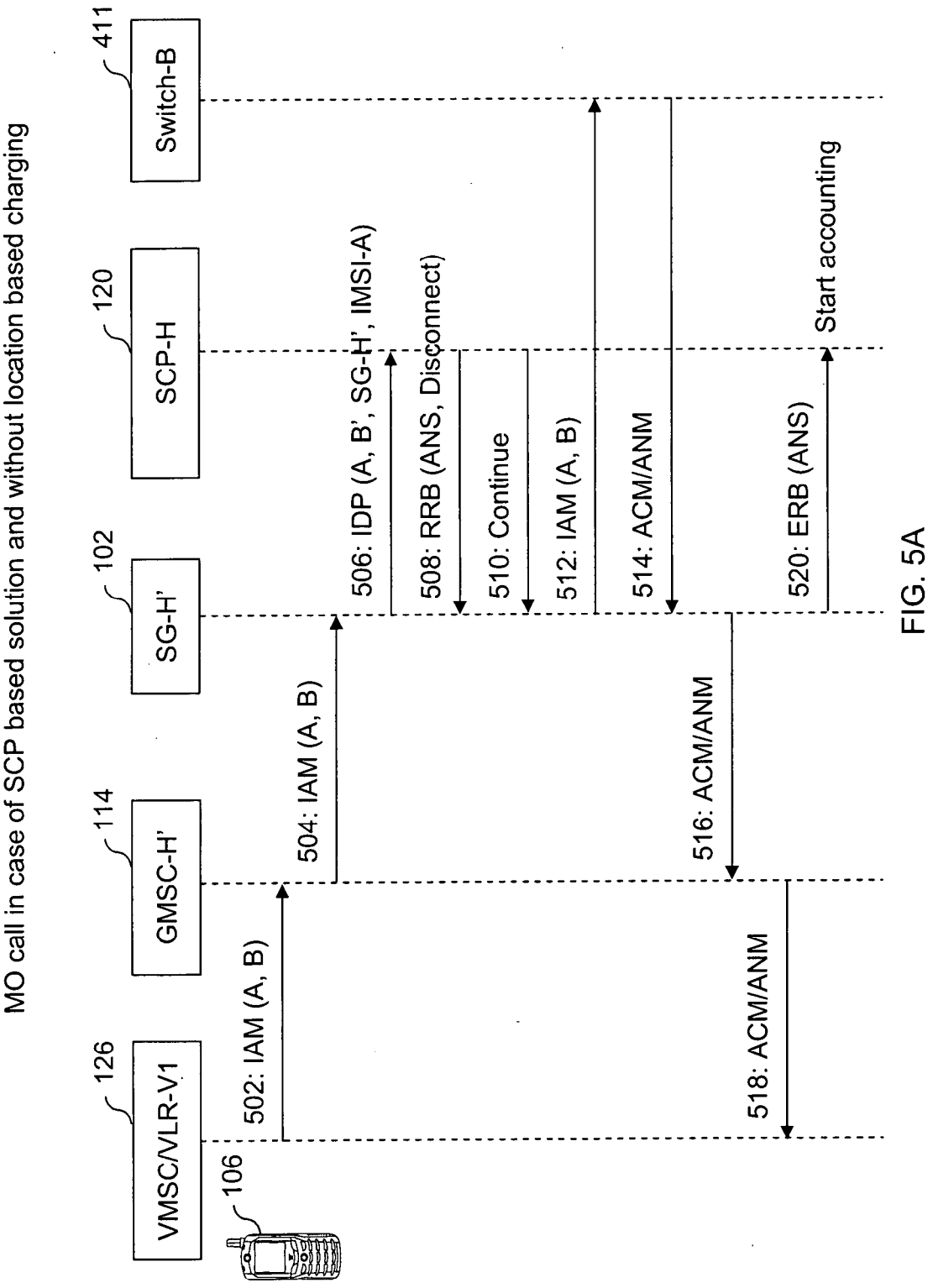

MO call in case of SCP based solution and without location based charging
126
VMSC/VLR-V1
106
114
GMSC-H'
102
SG-H'
120
SCP-H
411
Switch-B
502: IAM (A, B)
504: IAM (A, B)
506: IDP (A, B', SG-H', IMSI-A)
508: RRB (ANS, Disconnect)
510: Continue
512: IAM (A, B)
514: ACM/ANM
516: ACM/ANM
518: ACM/ANM
520: ERB (ANS)
Start accounting

FIG. 5A

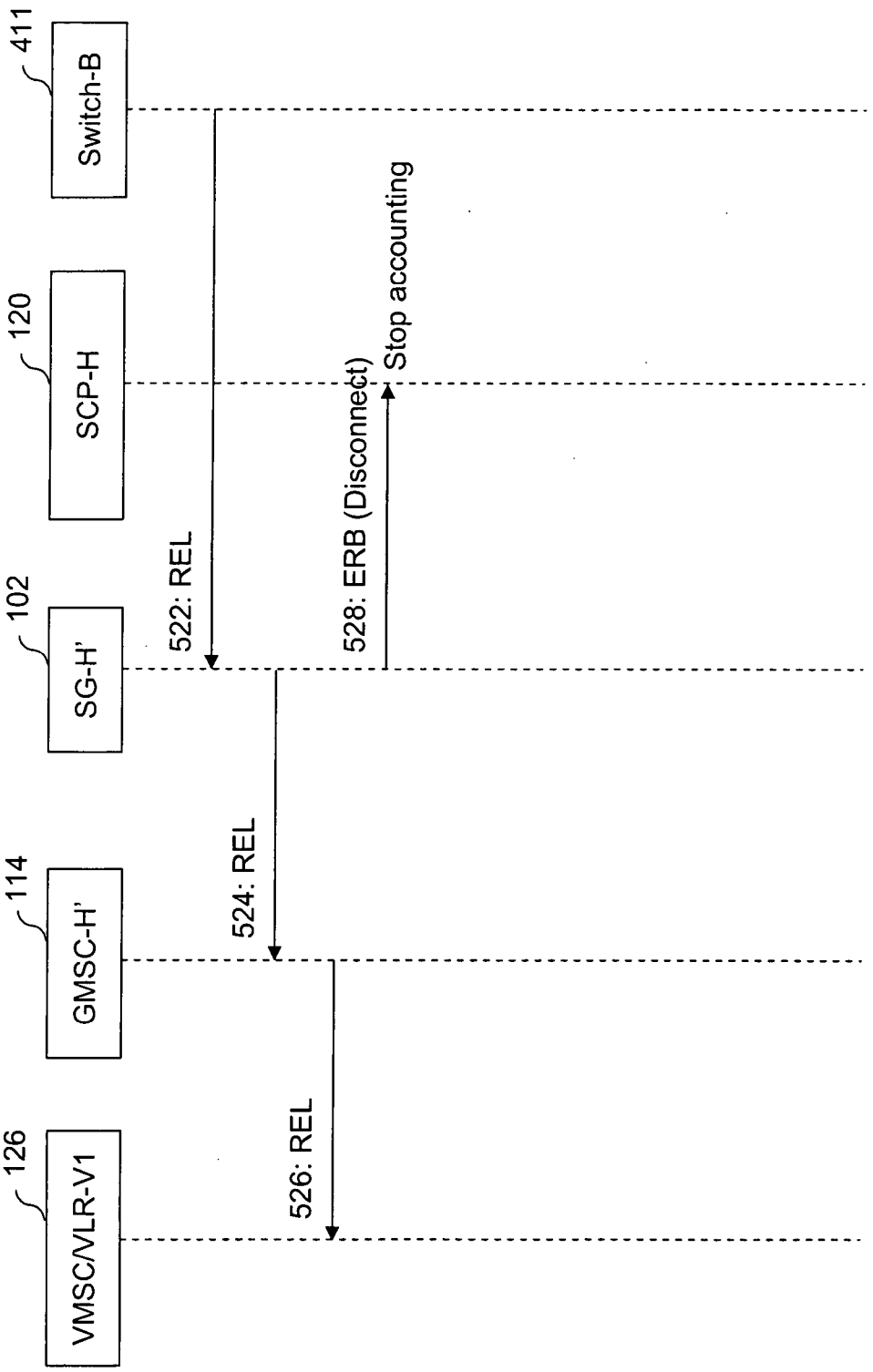

411
Switch-B
120
SCP-H
102
SG-H'
114
GMSC-H'
126
VMSC/VLR-V1
522: REL
524: REL
526: REL
528: ERB (Disconnect)
Stop accounting

FIG. 5B

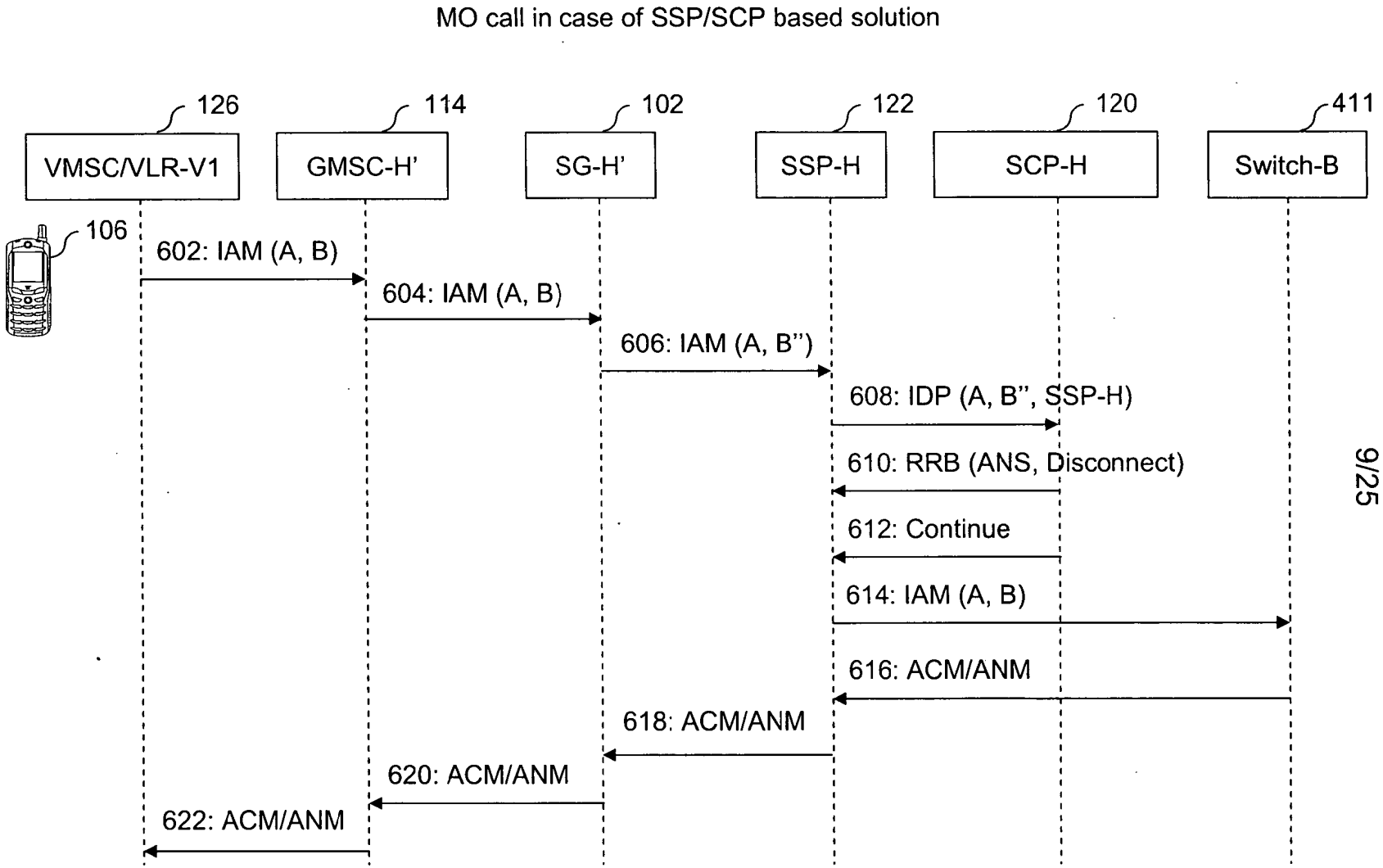

MO call in case of SSP/SCP based solution
126
VMSC/VLR-V1
114
GMSC-H'
102
SG-H'
122
SSP-H
120
SCP-H
411
Switch-B
106
602: IAM (A, B)
604: IAM (A, B)
606: IAM (A, B'')
608: IDP (A, B'', SSP-H)
610: RRB (ANS, Disconnect)
612: Continue
614: IAM (A, B)
616: ACM/ANM
618: ACM/ANM
620: ACM/ANM
622: ACM/ANM

FIG. 6A

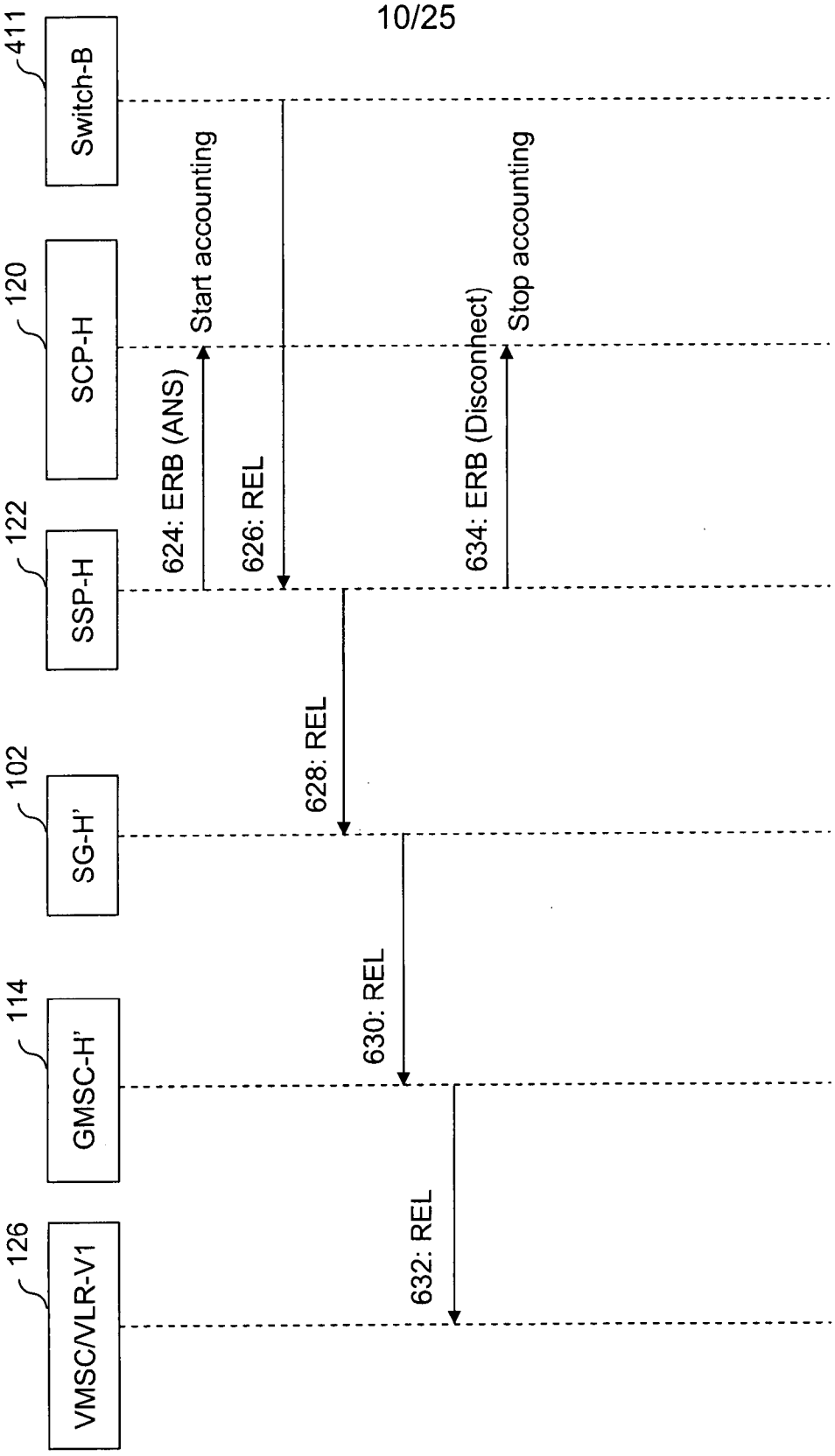

411
Switch-B
120
SCP-H
122
SSP-H
102
SG-H'
114
GMSC-H'
126
VMSC/VLR-V1
624: ERB (ANS)
Start accounting
626: REL
628: REL
630: REL
632: REL
634: ERB (Disconnect)
Stop accounting

FIG. 6B

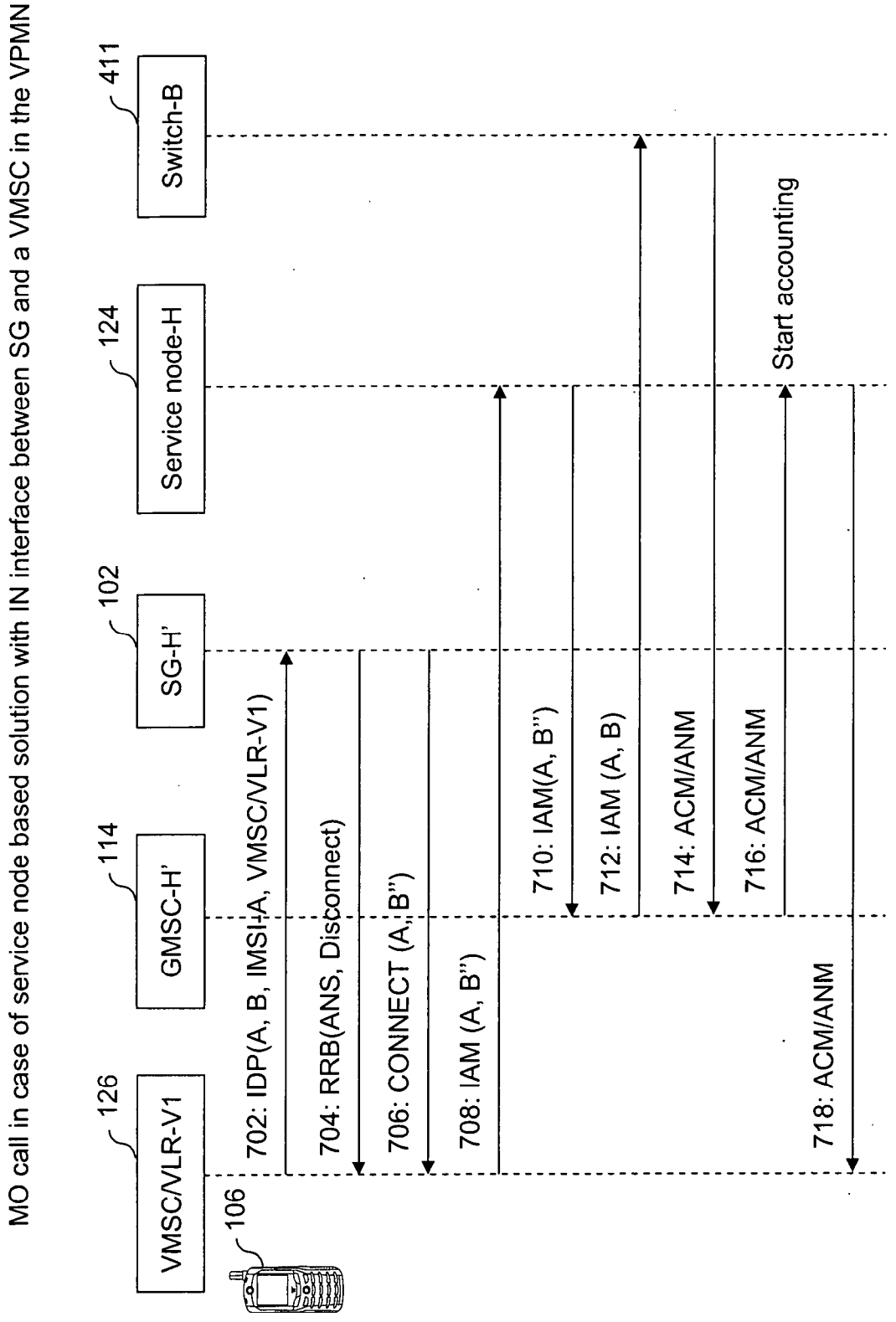

MO call in case of service node based solution with IN interface between SG and a VMSC in the VPMN
VMSC/VLR-V1
126
GMSC-H'
114
SG-H'
102
Service node-H
124
Switch-B
411
106
702: IDP(A, B, IMSI, VMSC/VLR-V1)
704: RRB(ANS, Disconnect)
706: CONNECT (A, B")
708: IAM (A, B")
710: IAM(A, B")
712: IAM (A, B)
714: ACM/ANM
716: ACM/ANM
Start accounting
718: ACM/ANM

FIG. 7A

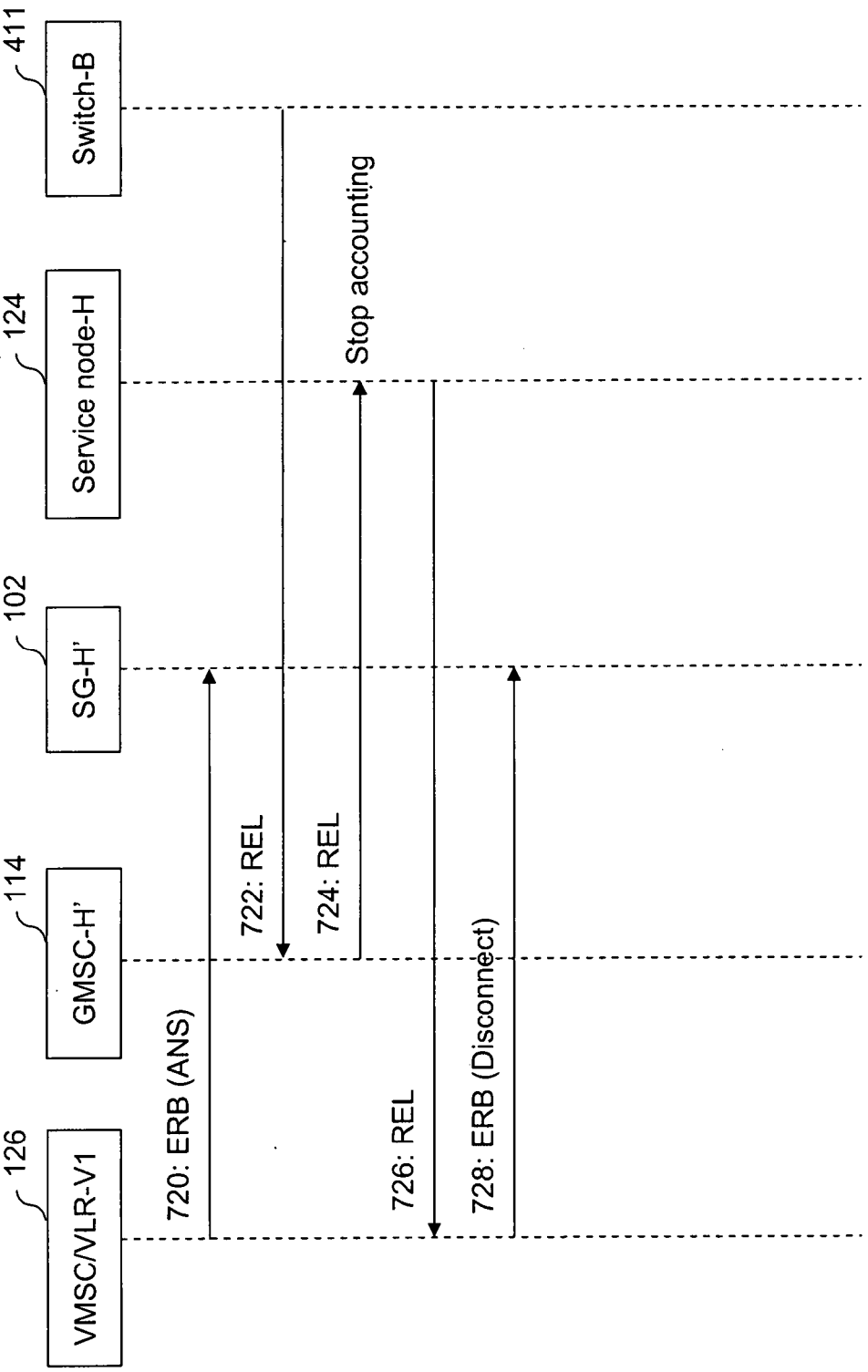

411
Switch-B
124
Service node-H
102
SG-H'
114
GMSC-H'
126
VMSC/VLR-V1
Stop accounting
720: ERB (ANS)
722: REL
724: REL
726: REL
728: ERB (Disconnect)

FIG. 7B

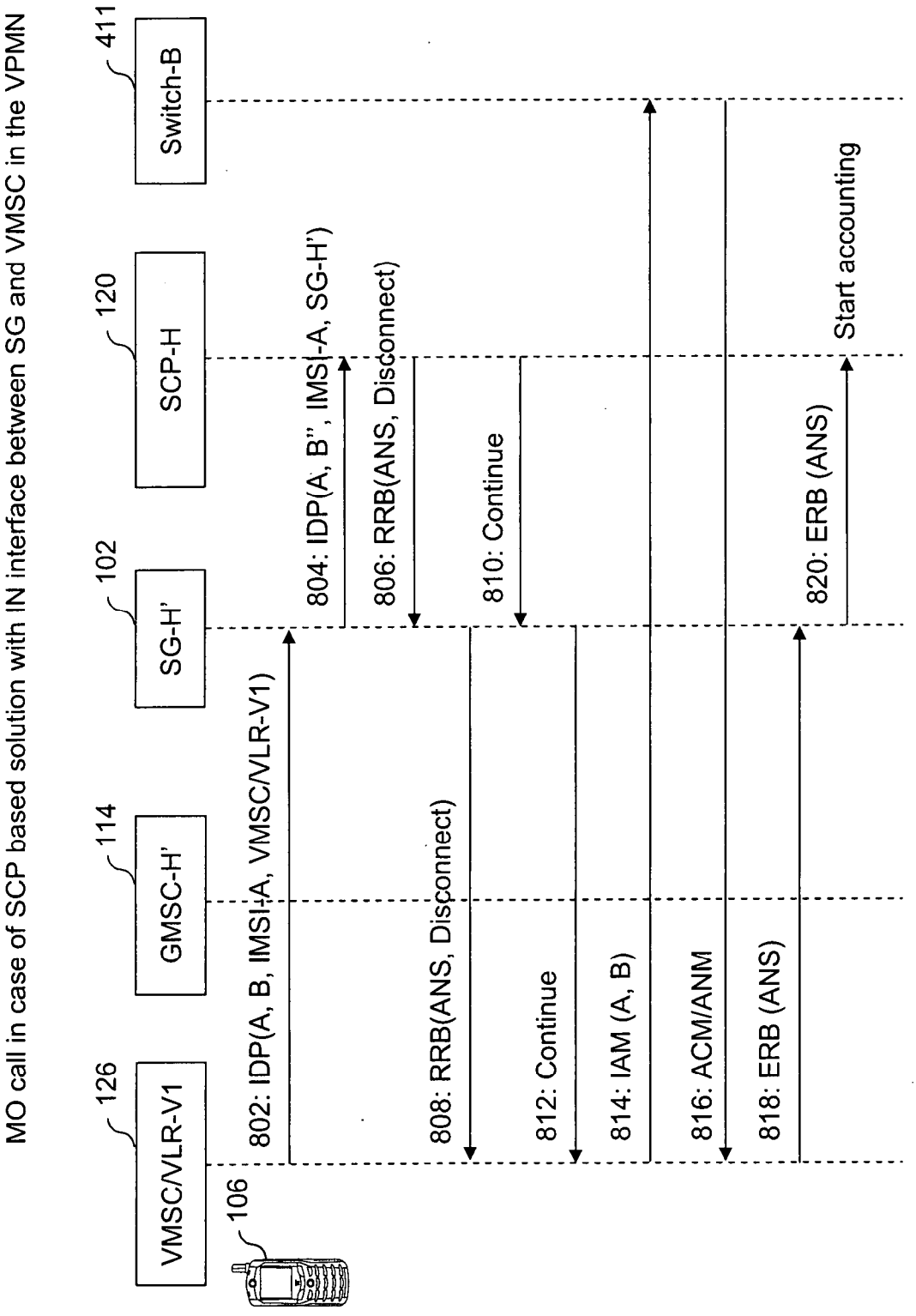

MO call in case of SCP based solution with IN interface between SG and VMSC in the VPMN
126
VMSC/VLR-V1
114
GMSC-H'
102
SG-H'
120
SCP-H
411
Switch-B
106
802: IDP(A, B, IMSI-A, VMSC/VLR-V1)
804: IDP(A, B'', IMSI-A, SG-H')
806: RRB(ANS, Disconnect)
808: RRB(ANS, Disconnect)
810: Continue
812: Continue
814: IAM (A, B)
816: ACM/ANM
818: ERB (ANS)
820: ERB (ANS)
Start accounting

FIG. 8A

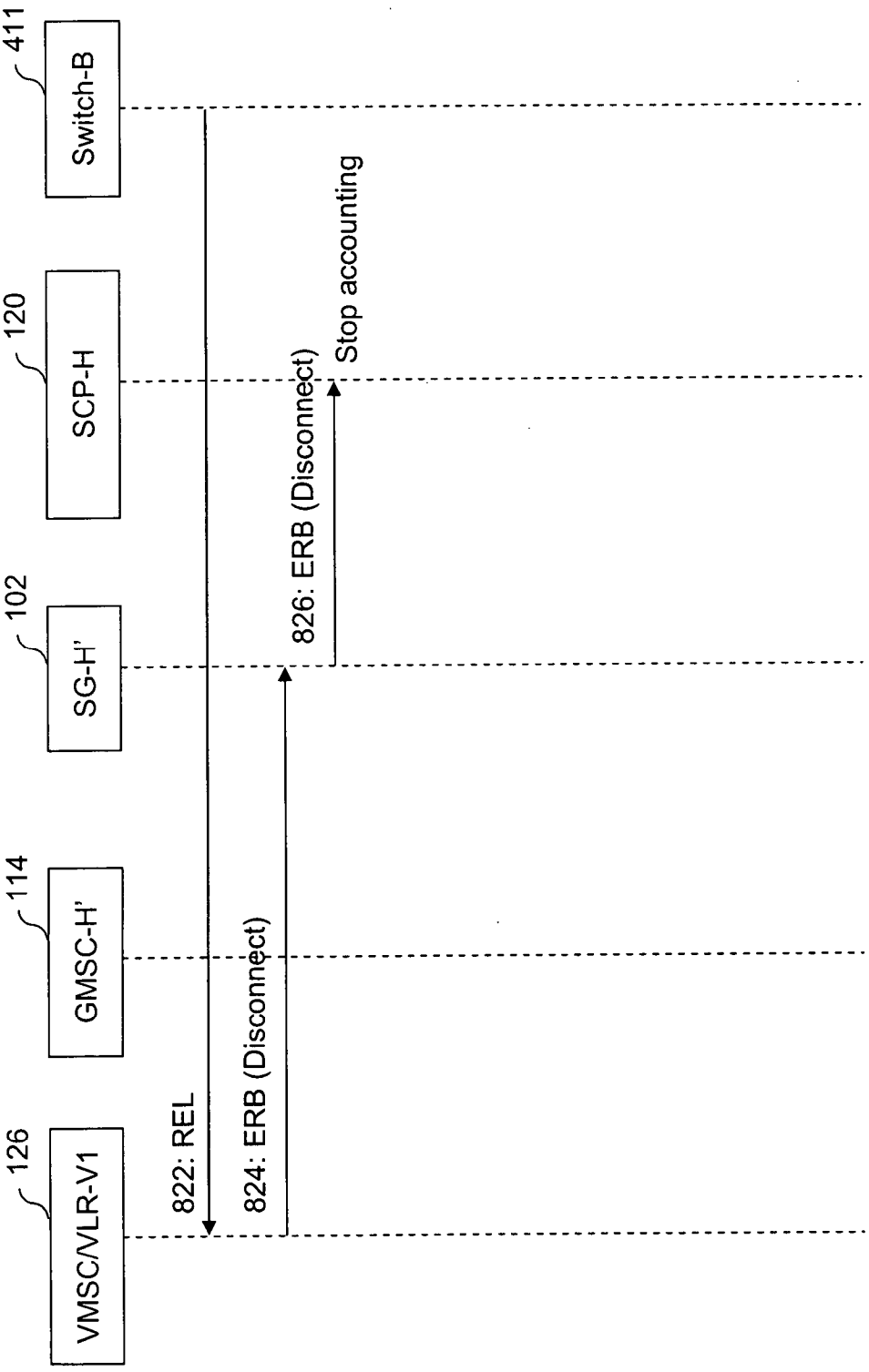

411
Switch-B
120
SCP-H
102
SG-H'
114
GMSC-H'
126
VMSC/VLR-V1
822: REL
824: ERB (Disconnect)
826: ERB (Disconnect)
Stop accounting

FIG. 8B

MT call in case of service node based solution with IN/ISUP interface between SG and a GMSC in the HPMN

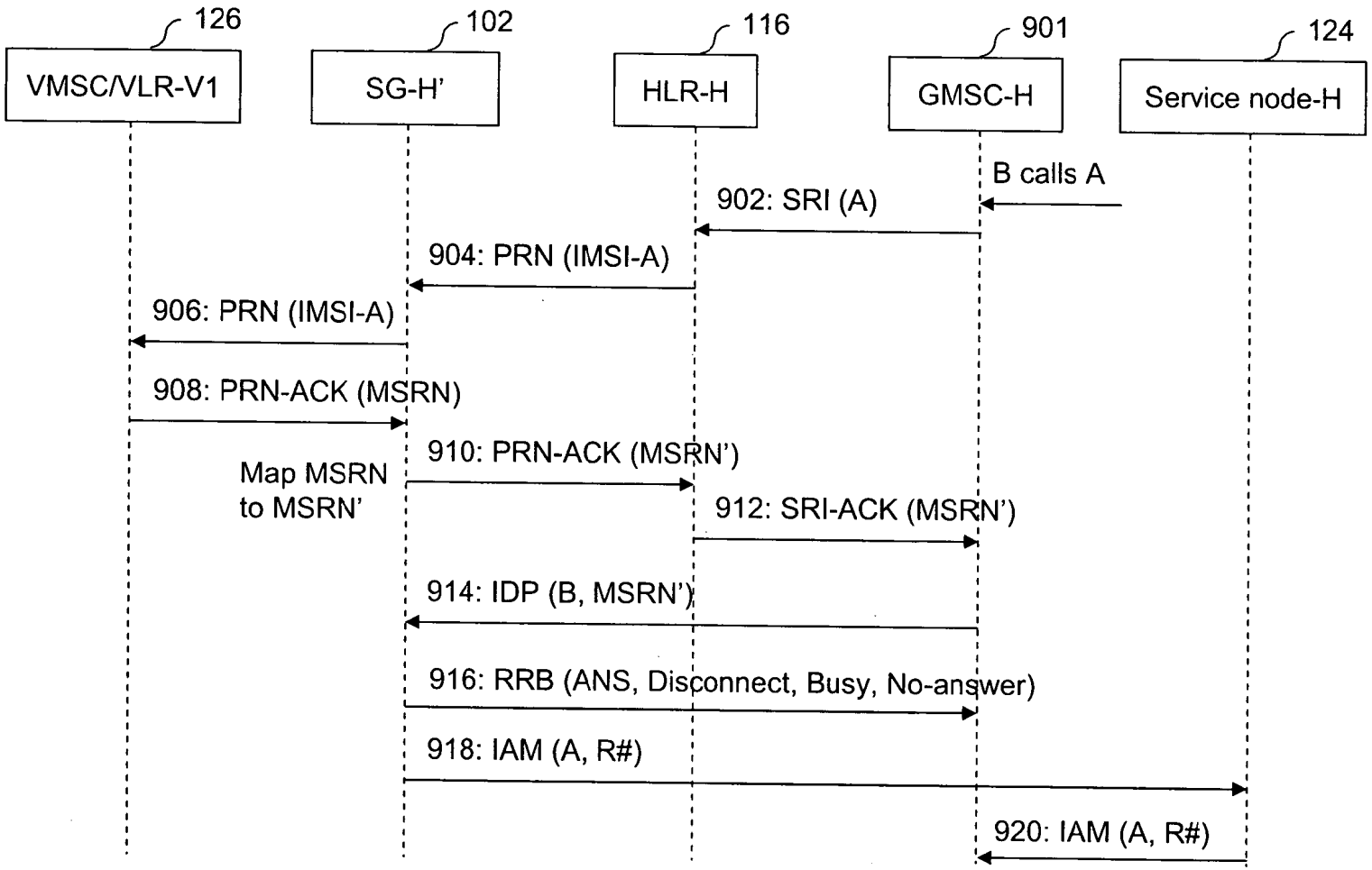


FIG. 9A

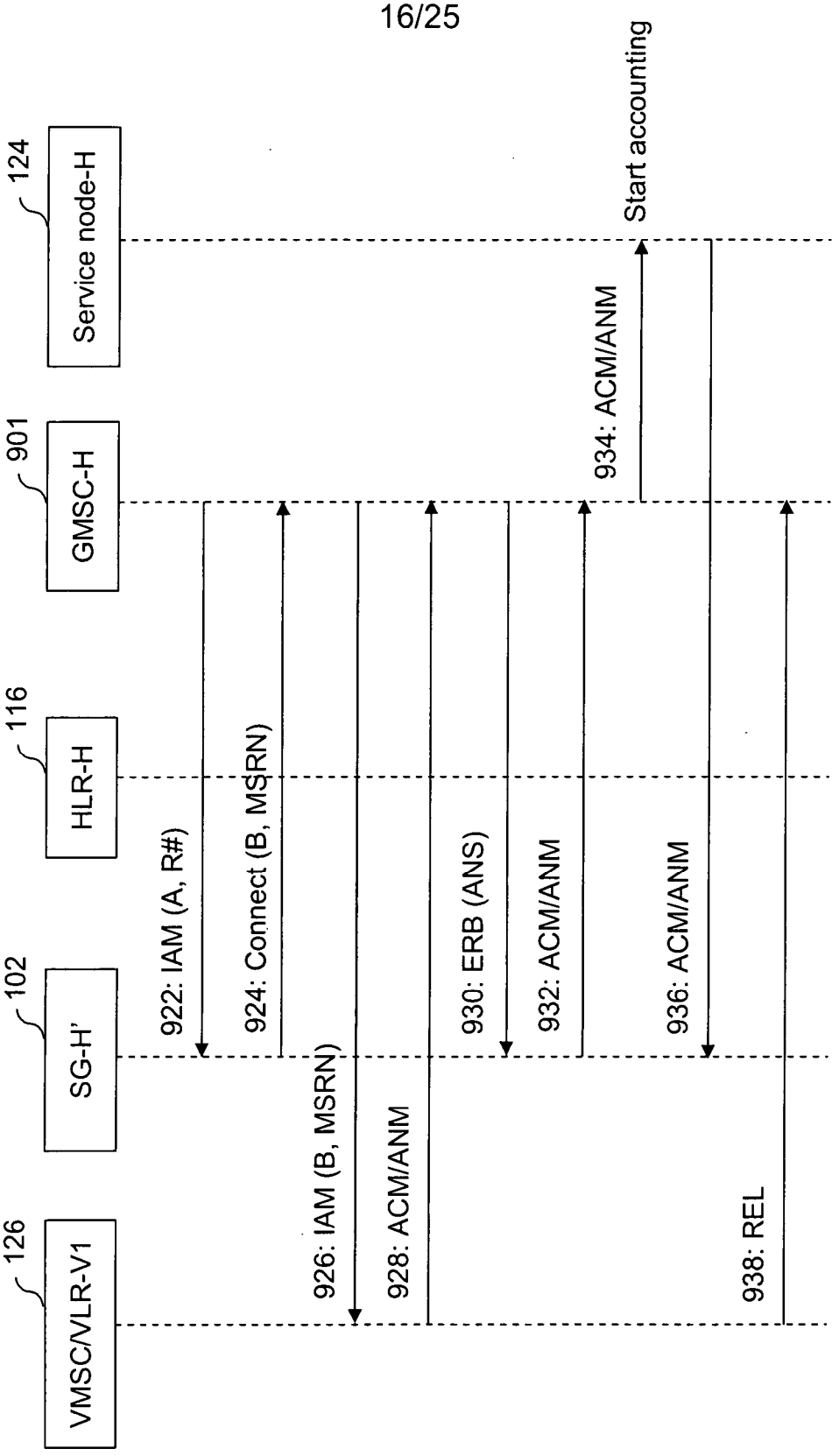

126
VMSC/VLR-V1
102
SG-H'
116
HLR-H
901
GMSC-H
124
Service node-H
922: IAM (A, R#)
924: Connect (B, MSRN)
926: IAM (B, MSRN)
928: ACM/ANM
930: ERB (ANS)
932: ACM/ANM
934: ACM/ANM
Start accounting
936: ACM/ANM
938: REL

FIG. 9B

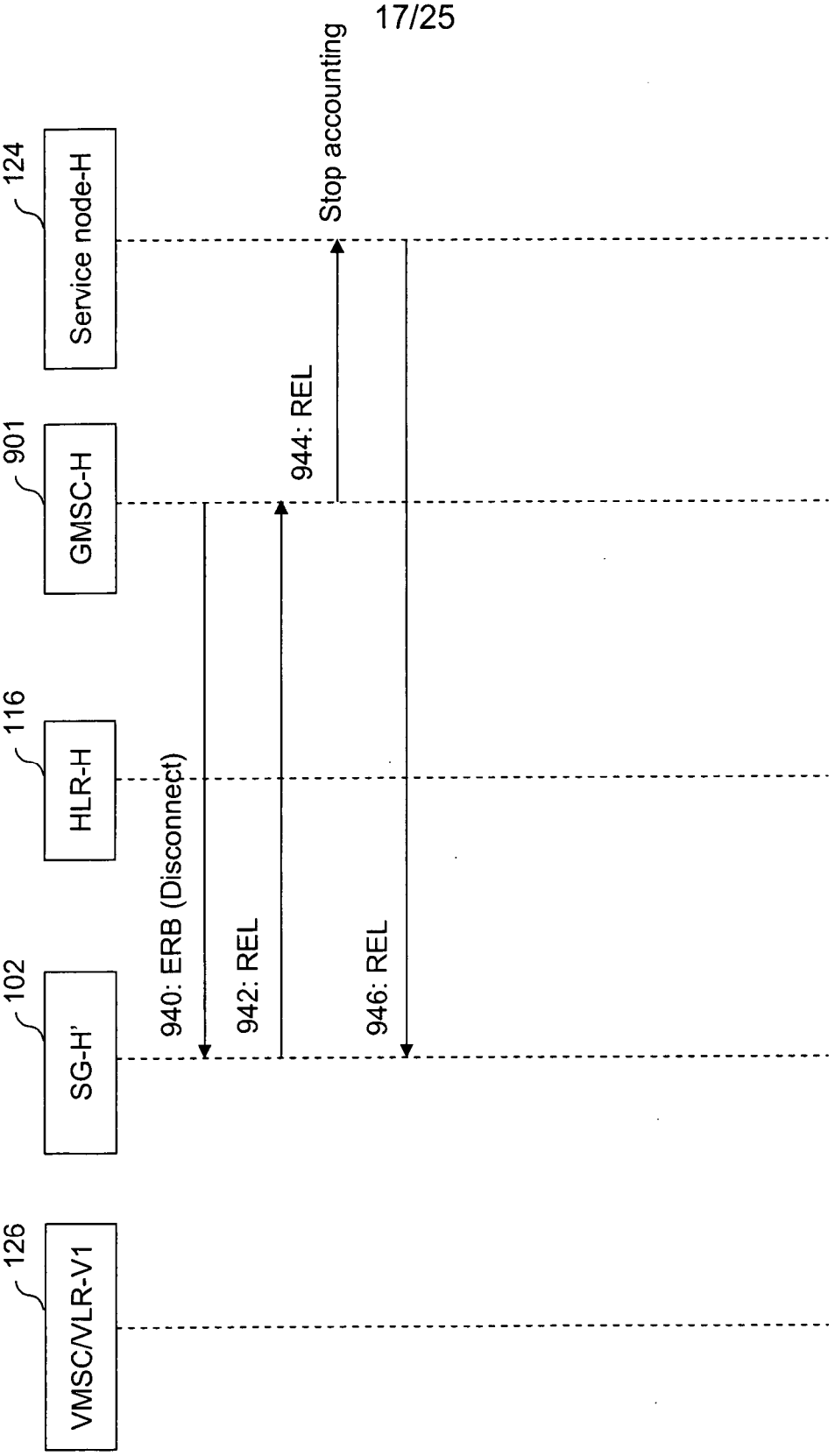

126
VMSC/VLR-V1
102
SG-H'
116
HLR-H
901
GMSC-H
124
Service node-H
940: ERB (Disconnect)
942: REL
944: REL
946: REL
Stop accounting

FIG. 9C

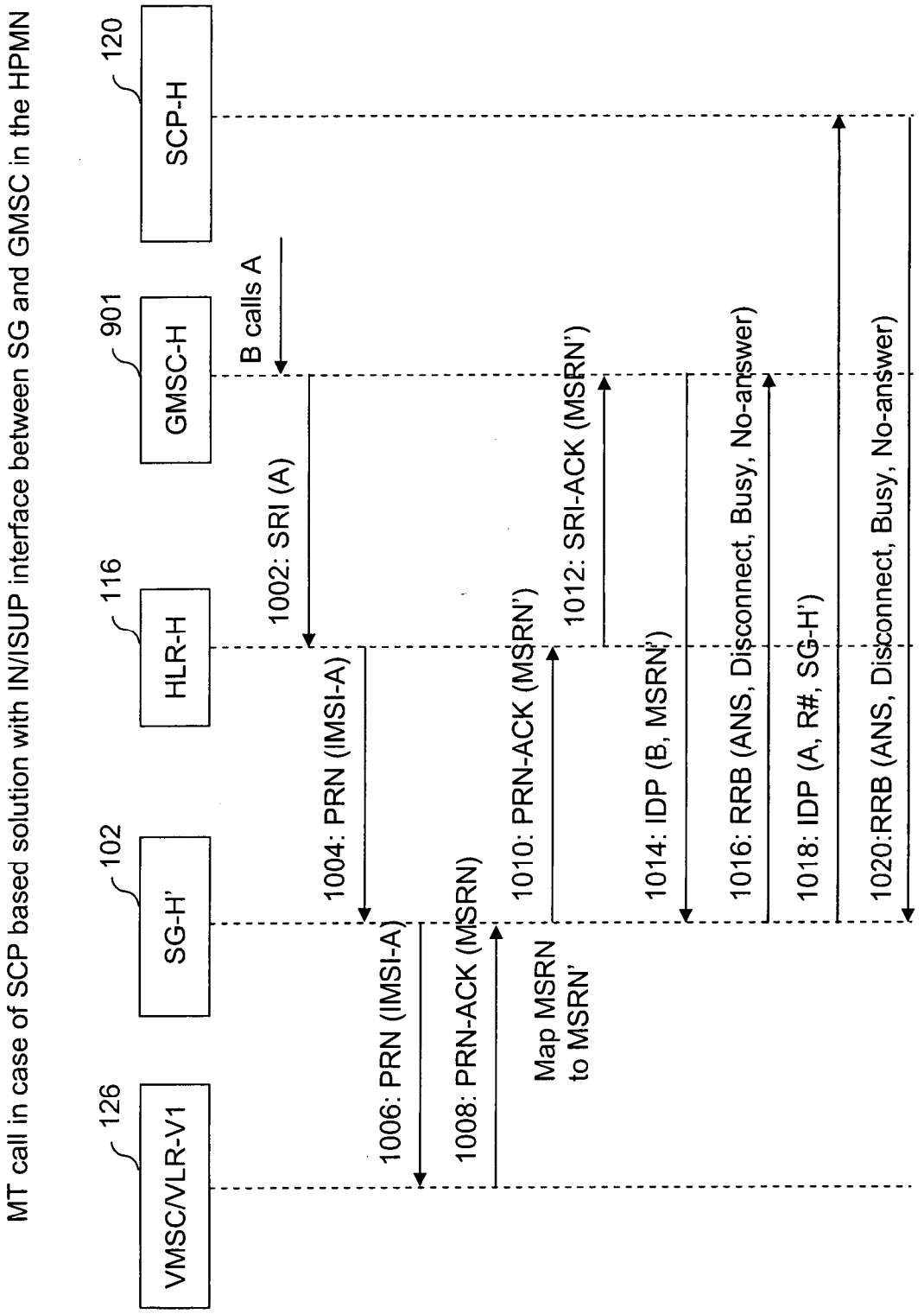

MT call in case of SCP based solution with IN/ISUP interface between SG and GMSC in the HPMN
VMSC/VLR-V1
126
SG-H'
102
HLR-H
116
GMSC-H
901
SCP-H
120
B calls A
1002: SRI (A)
1004: PRN (IMSI-A)
1006: PRN (IMSI-A)
1008: PRN-ACK (MSRN)
Map MSRN to MSRN'
1010: PRN-ACK (MSRN')
1012: SRI-ACK (MSRN')
1014: IDP (B, MSRN')
1016: RRB (ANS, Disconnect, Busy, No-answer)
1018: IDP (A, R#, SG-H')
1020:RRB (ANS, Disconnect, Busy, No-answer)

FIG. 10A

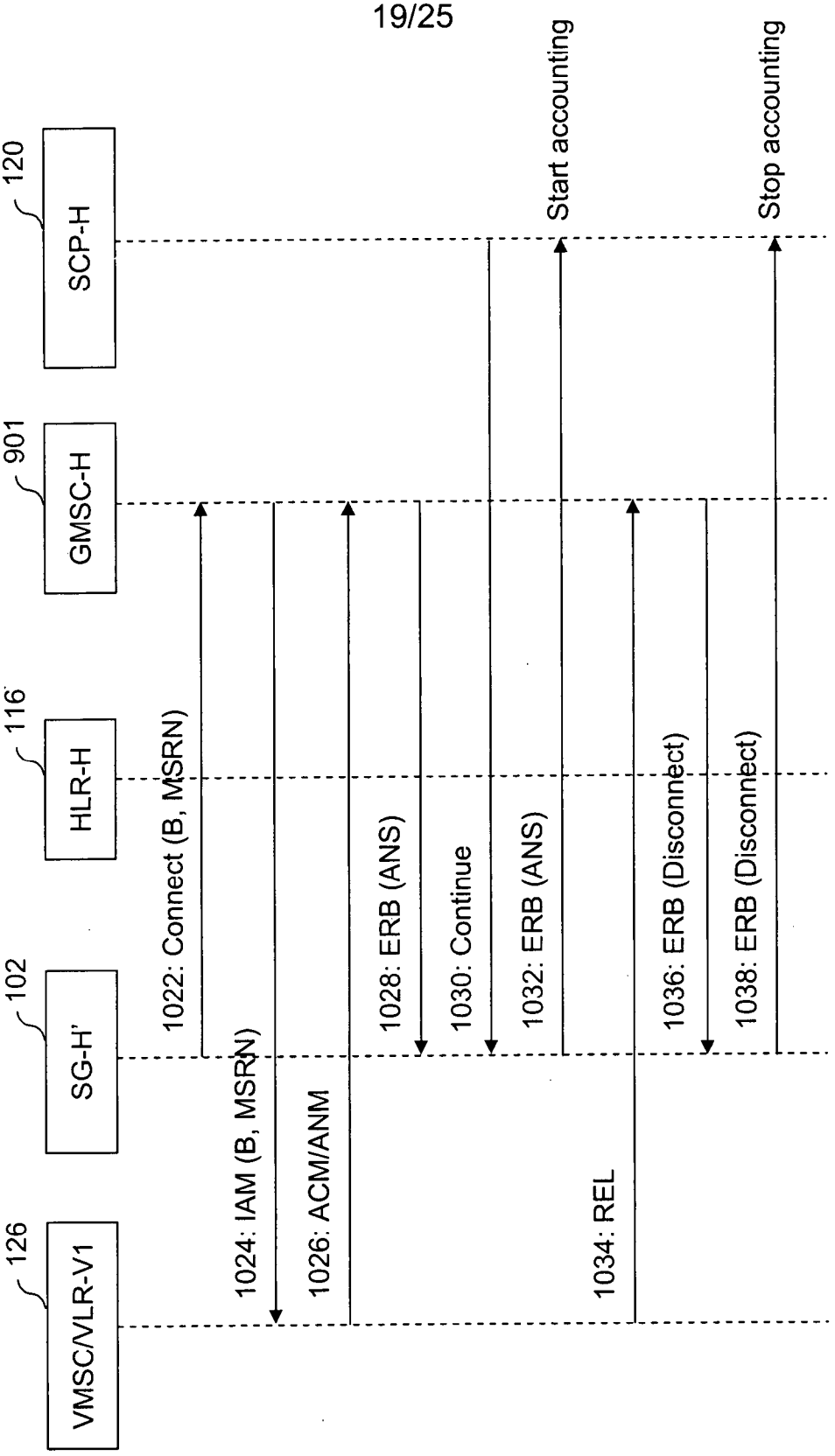

126
VMSC/VLR-V1
102
SG-H'
116
HLR-H
901
GMSC-H
120
SCP-H
1022: Connect (B, MSRN)
1024: IAM (B, MSRN)
1026: ACM/ANM
1028: ERB (ANS)
1030: Continue
1032: ERB (ANS)
1034: REL
1036: ERB (Disconnect)
1038: ERB (Disconnect)
Start accounting
Stop accounting

FIG. 10B

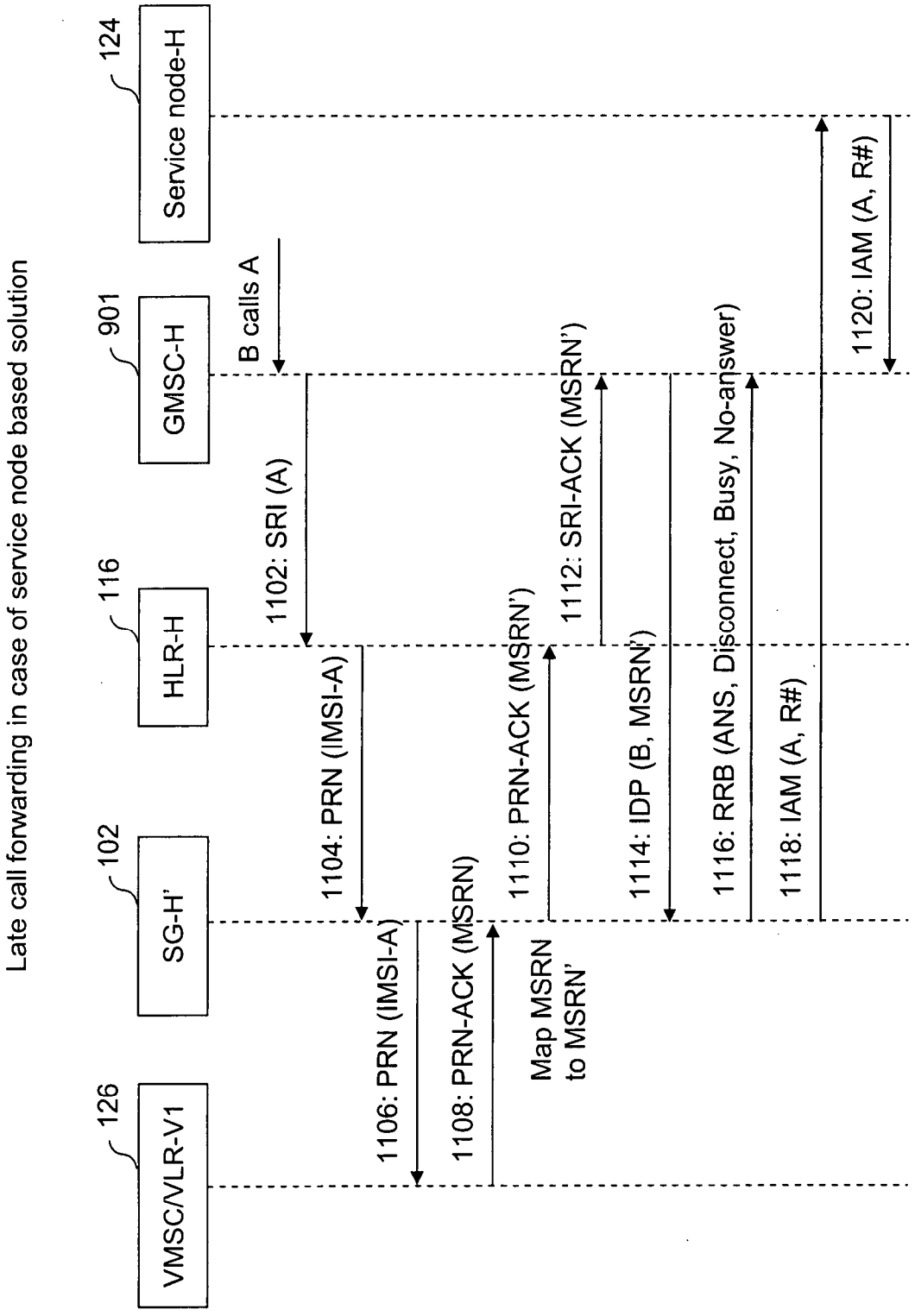

Late call forwarding in case of service node based solution
VMSC/VLR-V1
126
SG-H'
102
HLR-H
116
GMSC-H
901
Service node-H
124
B calls A
1102: SRI (A)
1104: PRN (IMSI-A)
1106: PRN (IMSI-A)
1108: PRN-ACK (MSRN)
Map MSRN to MSRN'
1110: PRN-ACK (MSRN')
1112: SRI-ACK (MSRN')
1114: IDP (B, MSRN')
1116: RRB (ANS, Disconnect, Busy, No-answer)
1118: IAM (A, R#)
1120: IAM (A, R#)

FIG. 11A

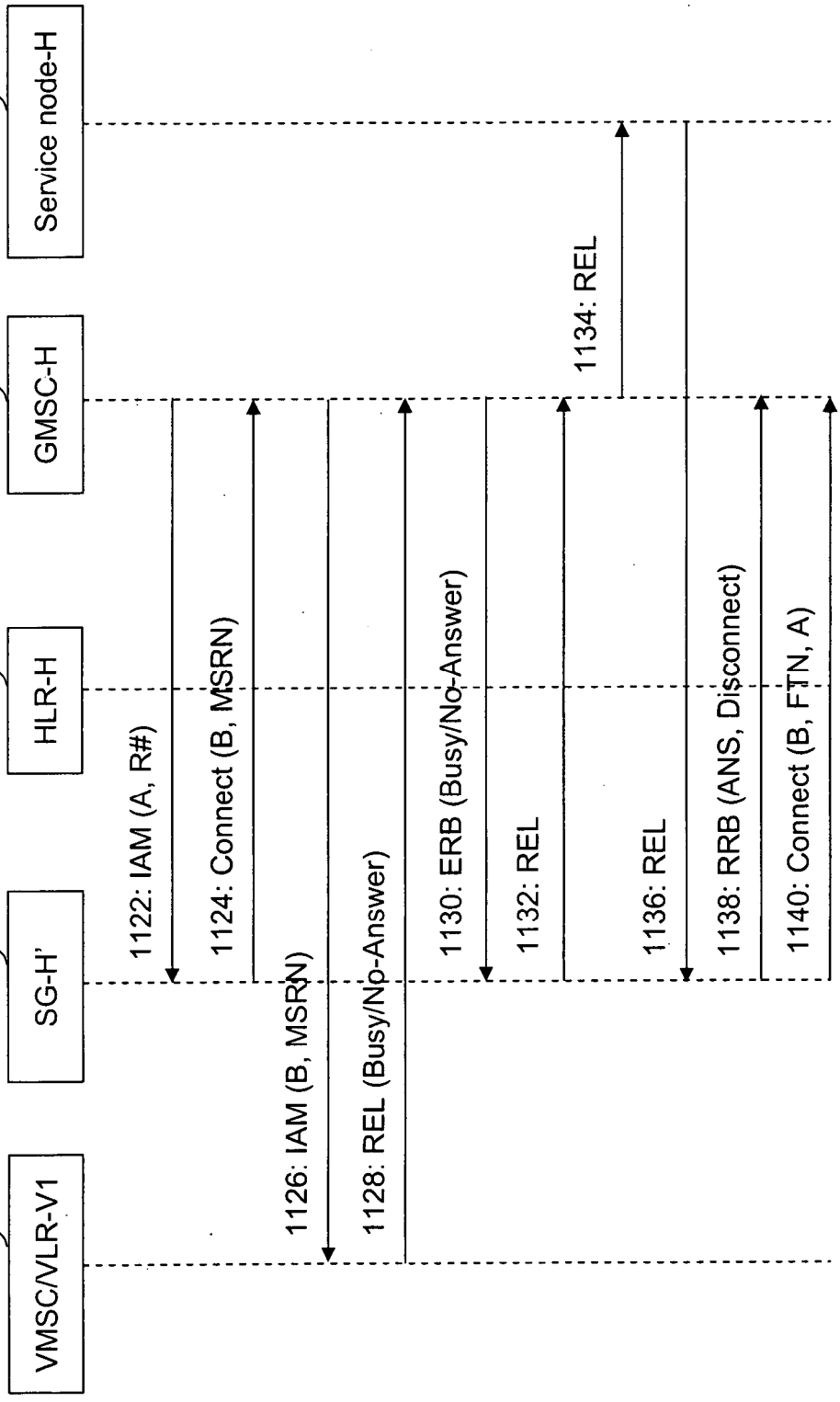

126
VMSC/VLR-V1
102
SG-H'
116
HLR-H
901
GMSC-H
124
Service node-H
1122: IAM (A, R#)
1124: Connect (B, MSRN)
1126: IAM (B, MSRN)
1128: REL (Busy/No-Answer)
1130: ERB (Busy/No-Answer)
1132: REL
1134: REL
1136: REL
1138: RRB (ANS, Disconnect)
1140: Connect (B, FTN, A)

FIG. 11B

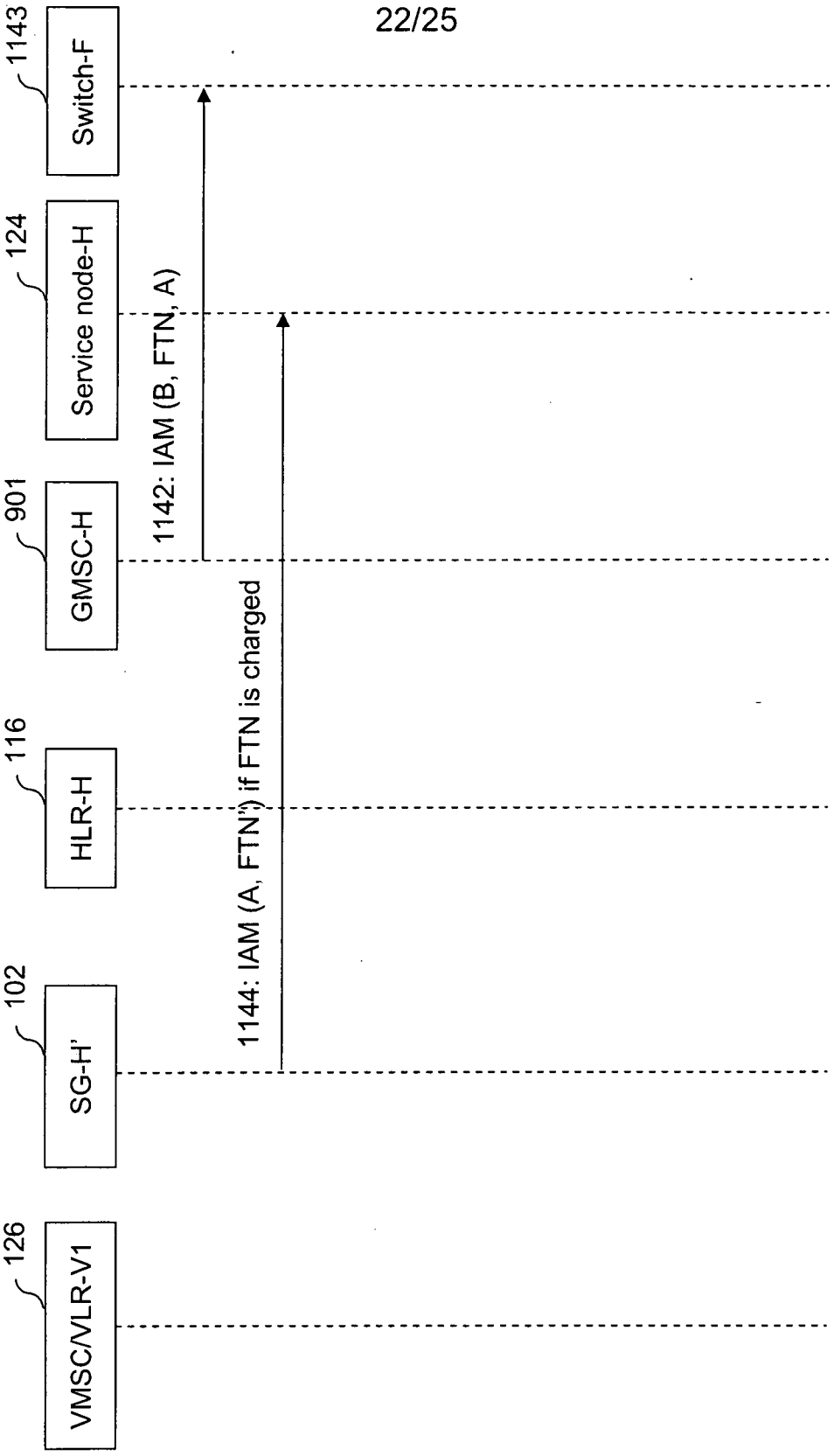

1143
Switch-F
124
Service node-H
901
GMSC-H
116
HLR-H
102
SG-H'
126
VMSC/VLR-V1
1142: IAM (B, FTN, A)
1144: IAM (A, FTN') if FTN is charged

FIG. 11C

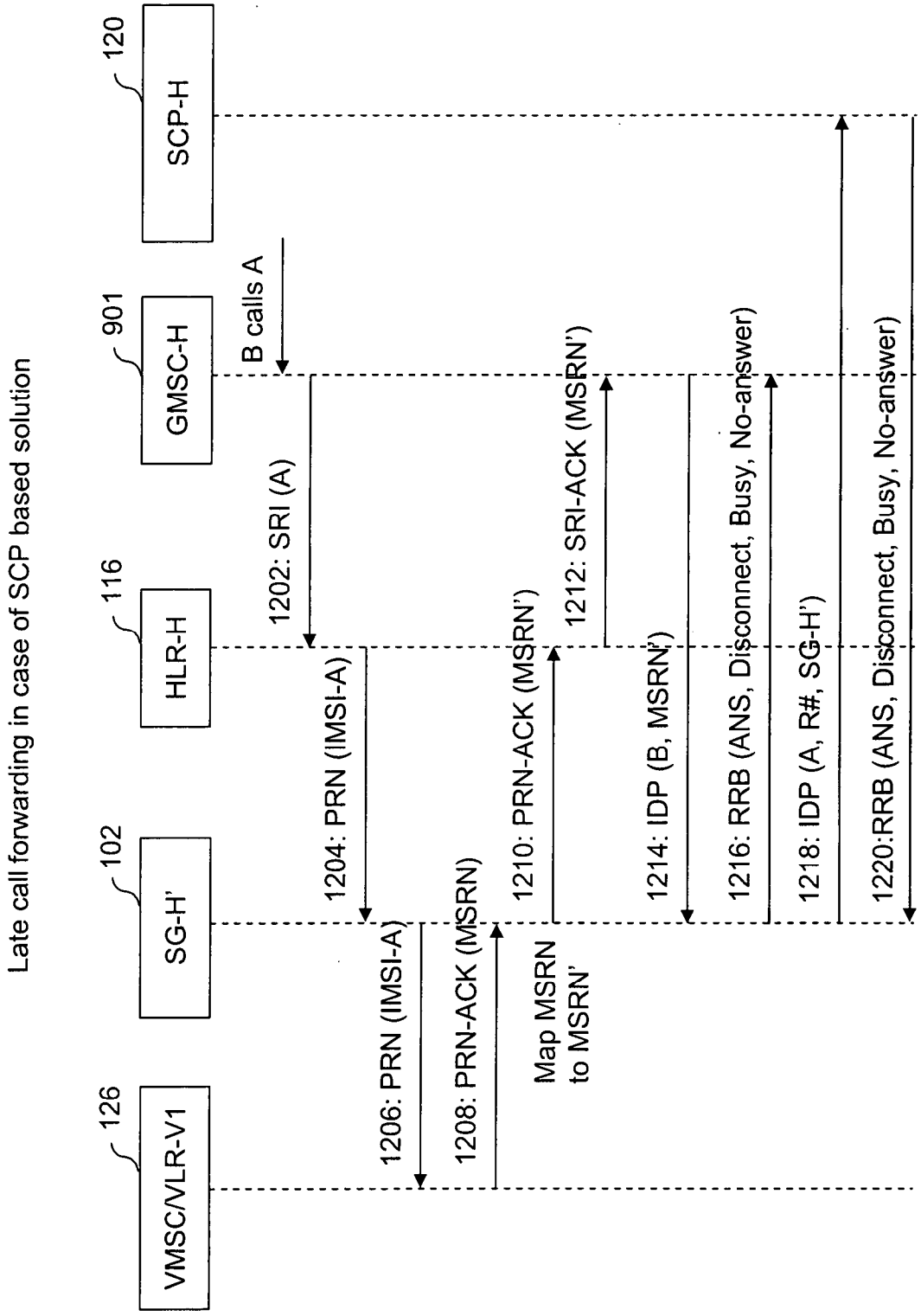

Late call forwarding in case of SCP based solution
VMSC/VLR-V1
126
SG-H'
102
HLR-H
116
GMSC-H
901
SCP-H
120
B calls A
1202: SRI (A)
1204: PRN (IMSI-A)
1206: PRN (IMSI-A)
1208: PRN-ACK (MSRN)
Map MSRN to MSRN'
1210: PRN-ACK (MSRN')
1212: SRI-ACK (MSRN')
1214: IDP (B, MSRN')
1216: RRB (ANS, Disconnect, Busy, No-answer)
1218: IDP (A, R#, SG-H')
1220:RRB (ANS, Disconnect, Busy, No-answer)

FIG. 12A

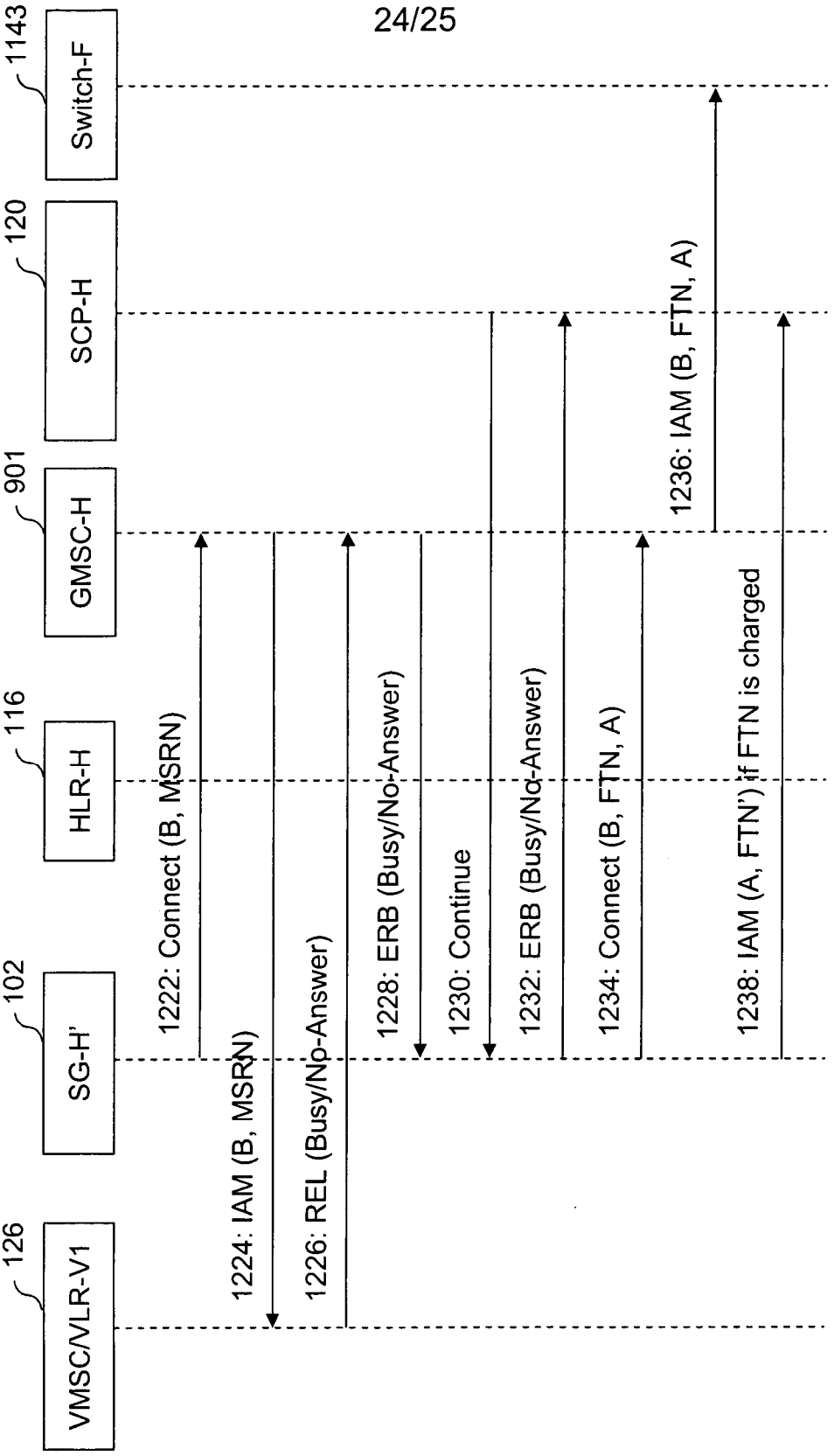

126
VMSC/VLR-V1
102
SG-H'
116
HLR-H
901
GMSC-H
120
SCP-H
1143
Switch-F
1222: Connect (B, MSRN)
1224: IAM (B, MSRN)
1226: REL (Busy/No-Answer)
1228: ERB (Busy/No-Answer)
1230: Continue
1232: ERB (Busy/No-Answer)
1234: Connect (B, FTN, A)
1236: IAM (B, FTN, A)
1238: IAM (A, FTN') if FTN is charged

FIG. 12B

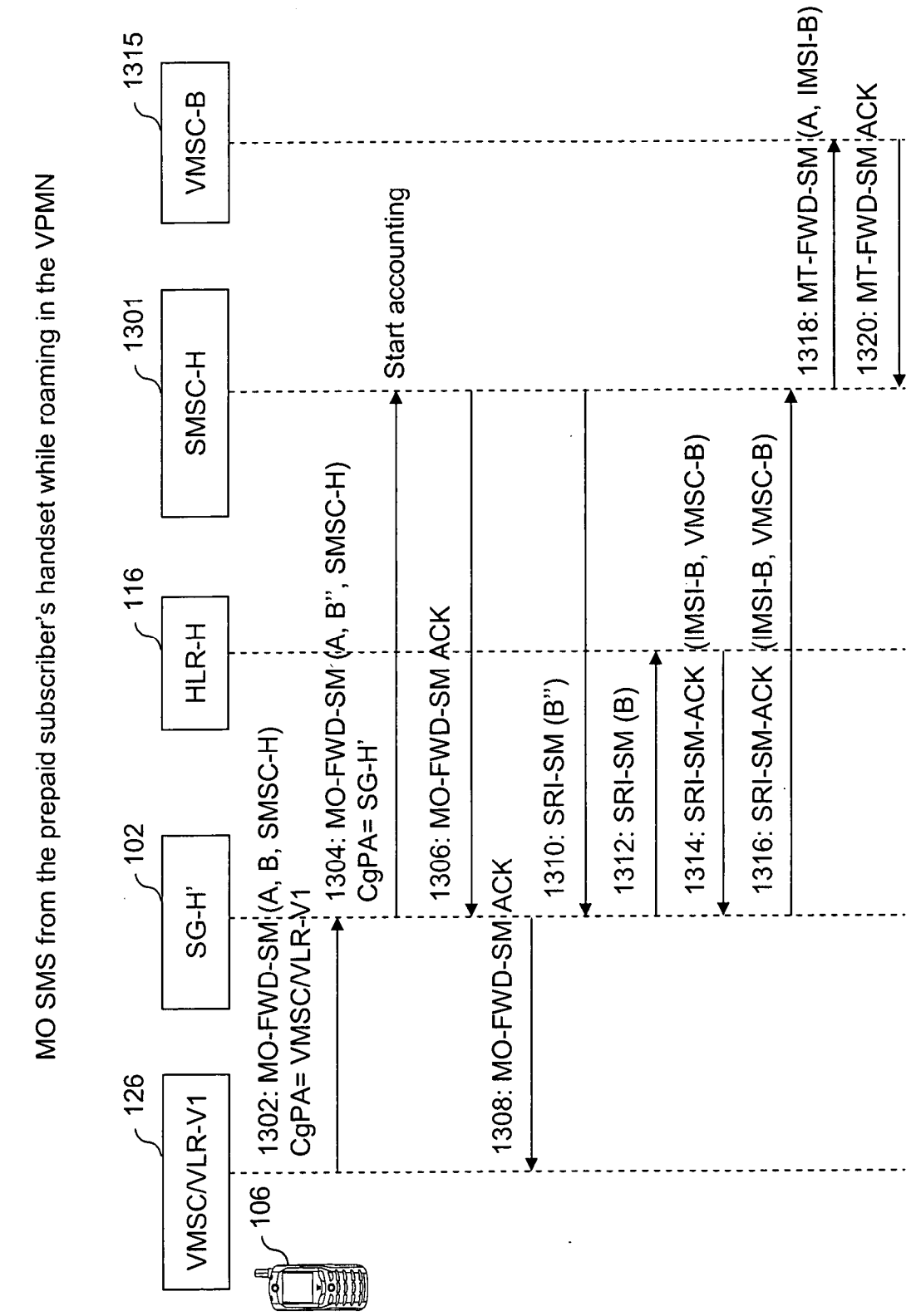

MO SMS from the prepaid subscriber's handset while roaming in the VPMN
VMSC/VLR-V1
126
106
SG-H'
102
HLR-H
116
SMSC-H
1301
VMSC-B
1315
1302: MO-FWD-SM (A, B, SMSC-H)
CgPA= VMSC/VLR-V1
1304: MO-FWD-SM (A, B'', SMSC-H)
CgPA= SG-H'
Start accounting
1306: MO-FWD-SM ACK
1308: MO-FWD-SM ACK
1310: SRI-SM (B'')
1312: SRI-SM (B)
1314: SRI-SM-ACK (IMSI-B, VMSC-B)
1316: SRI-SM-ACK (IMSI-B, VMSC-B)
1318: MT-FWD-SM (A, IMSI-B)
1320: MT-FWD-SM ACK

FIG. 13