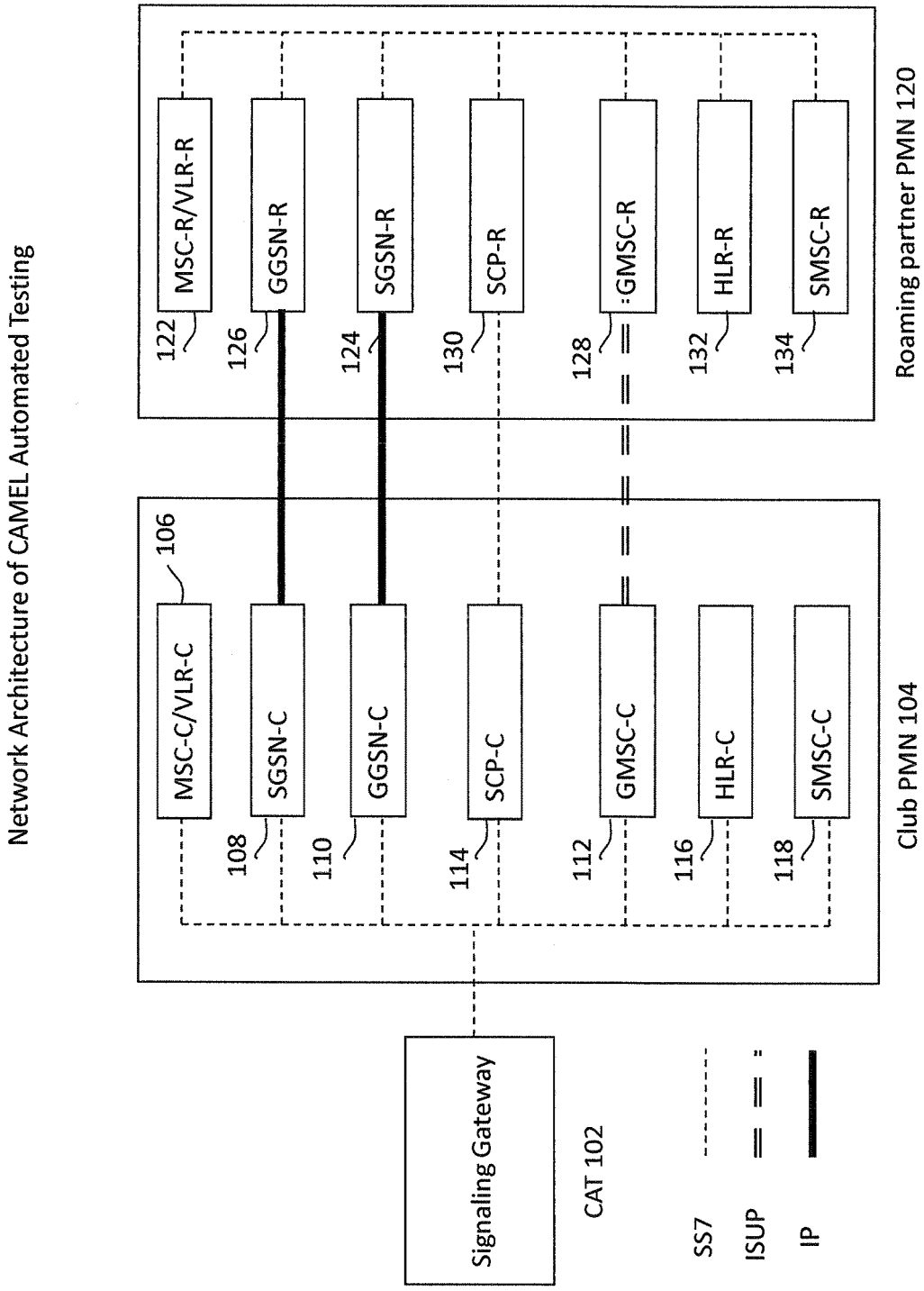

Network Architecture of CAMEL Automated Testing
Roaming partner PMN 120
MSC-R/VLR-R
GGSN-R
SGSN-R
SCP-R
:GMSC-R
HLR-R
SMSC-R
122
126
124
130
128
132
134
Club PMN 104
106
MSC-C/VLR-C
SGSN-C
GGSN-C
SCP-C
GMSC-C
HLR-C
SMSC-C
108
110
114
112
116
118
Signaling Gateway
CAT 102
SS7
ISUP
IP

FIG 1

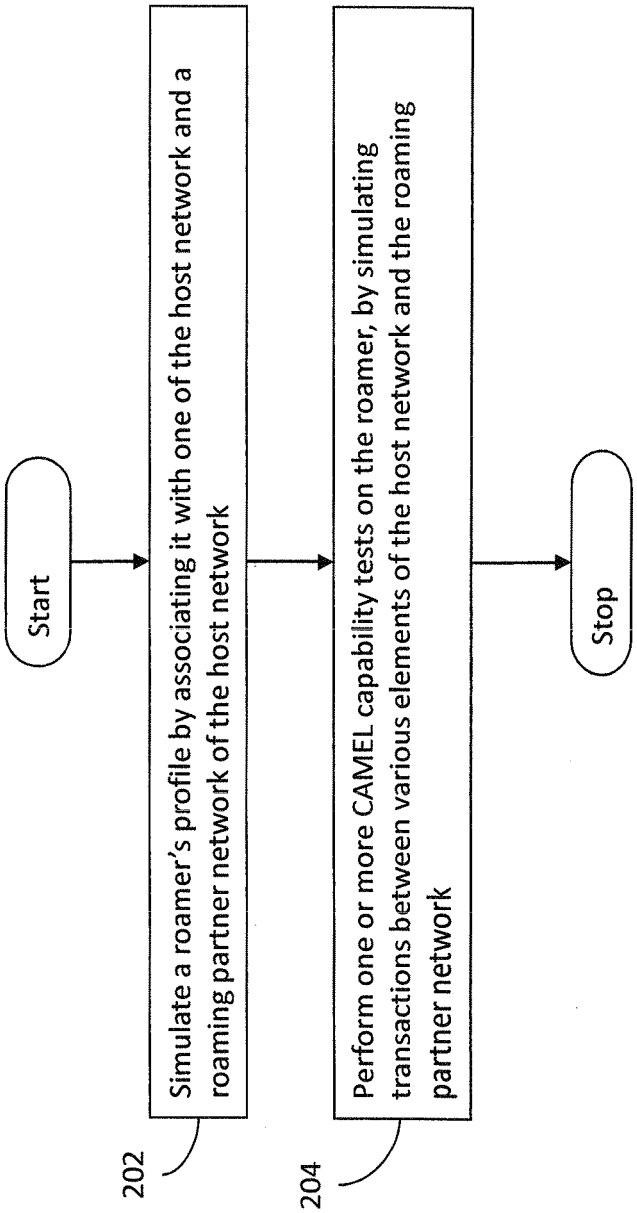

Start
Simulate a roamer's profile by associating it with one of the host network and a roaming partner network of the host network
202
Perform one or more CAMEL capability tests on the roamer, by simulating transactions between various elements of the host network and the roaming partner network
204
Stop

FIG. 2

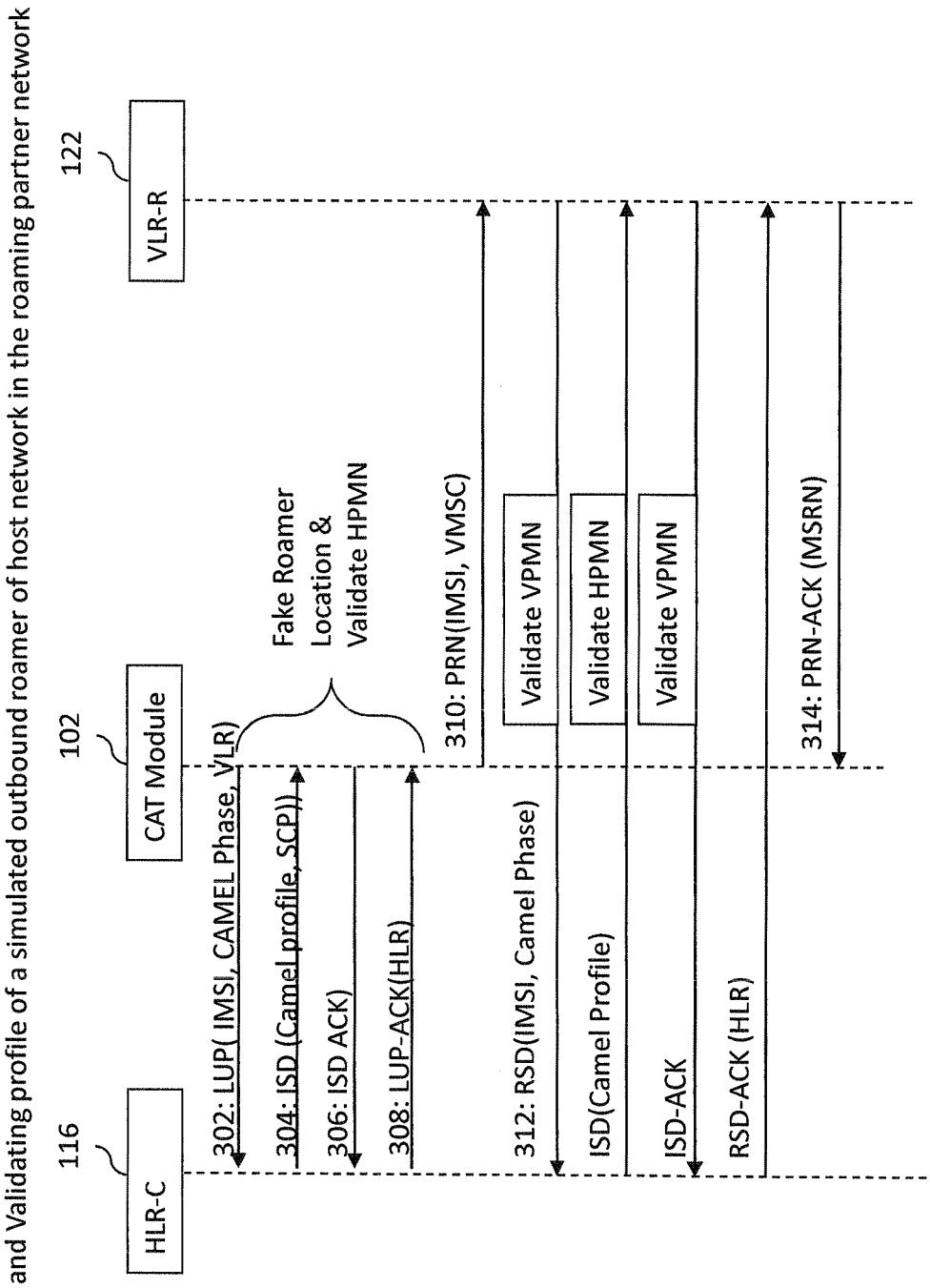

Creating and Validating profile of a simulated outbound roamer of host network in the roaming partner network
116
HLR-C
102
CAT Module
122
VLR-R
302: LUP(IMSI, CAMEL Phase, VLR)
304: ISD (Camel profile, SCP))
306: ISD ACK)
308: LUP-ACK(HLR)
Fake Roamer Location & Validate HPMN
310: PRN(IMSI, VMSC)
Validate VPMN
312: RSD(IMSI, Camel Phase)
Validate HPMN
ISD(Camel Profile)
Validate VPMN
ISD-ACK
RSD-ACK (HLR)
314: PRN-ACK (MSRN)

FIG. 3

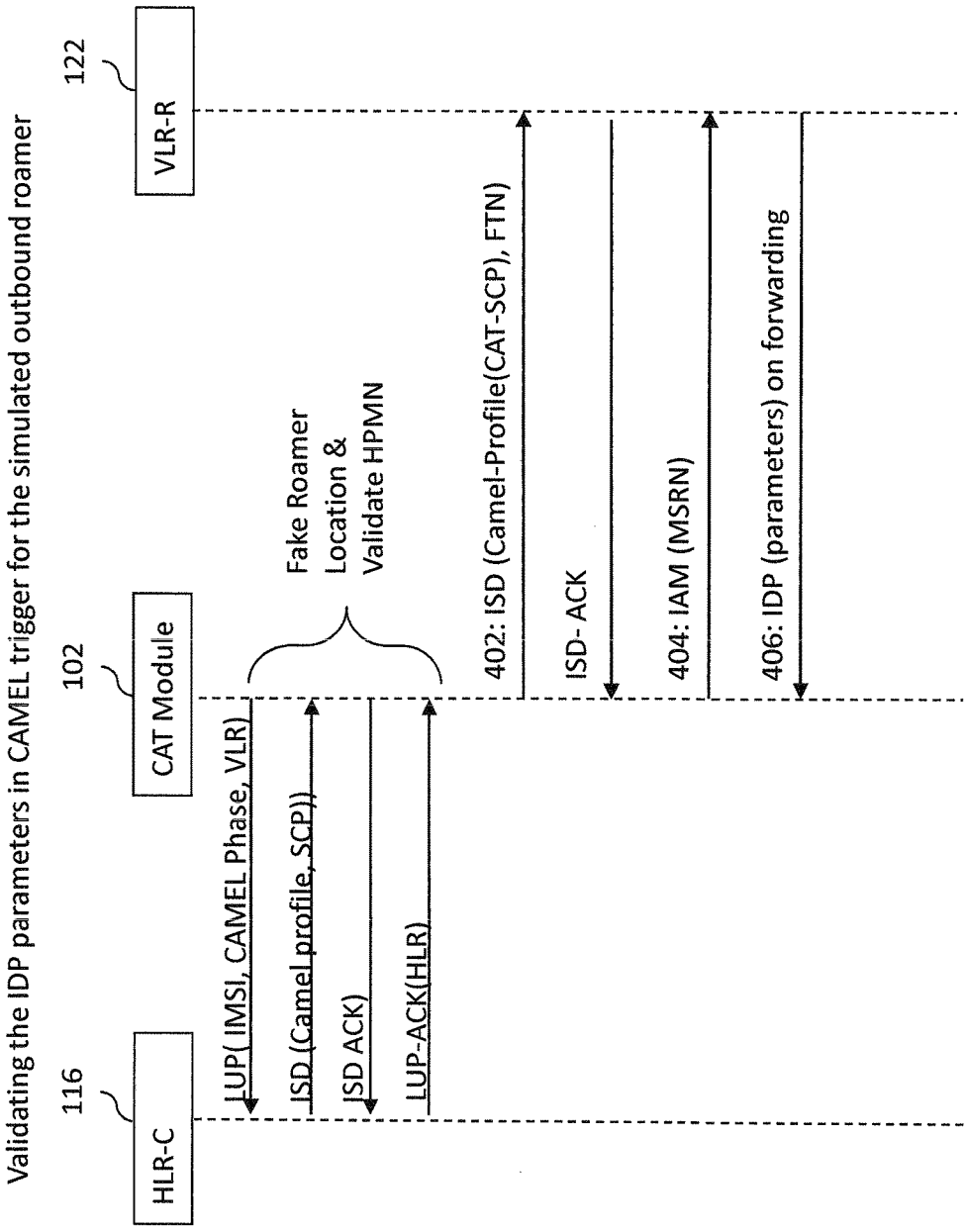

Validating the IDP parameters in CAMEL trigger for the simulated outbound roamer
HLR-C
116
CAT Module
102
VLR-R
122
LUP(IMSI, CAMEL Phase, VLR)
ISD (Camel profile, SCP))
ISD ACK)
LUP-ACK(HLR)
Fake Roamer
Location &
Validate HPMN
402: ISD (Camel-Profile(CAT-SCP), FTN)
ISD- ACK
404: IAM (MSRN)
406: IDP (parameters) on forwarding

FIG. 4

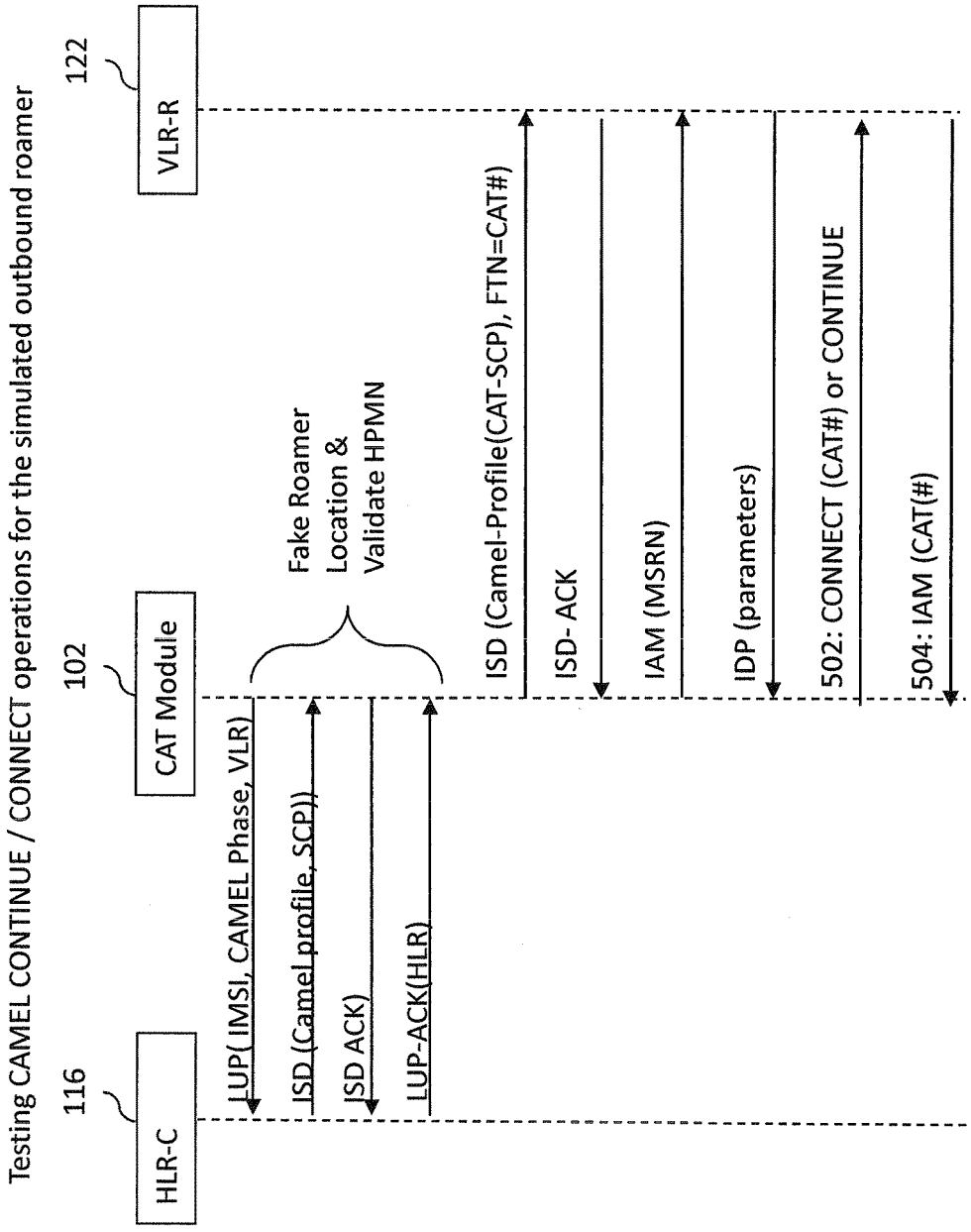

Testing CAMEL CONTINUE / CONNECT operations for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
LUP(IMSI, CAMEL Phase, VLR)
ISD (Camel profile, SCP))
ISD ACK)
LUP-ACK(HLR)
Fake Roamer
Location &
Validate HPMN
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
502: CONNECT (CAT#) or CONTINUE
504: IAM (CAT(#)

FIG. 5

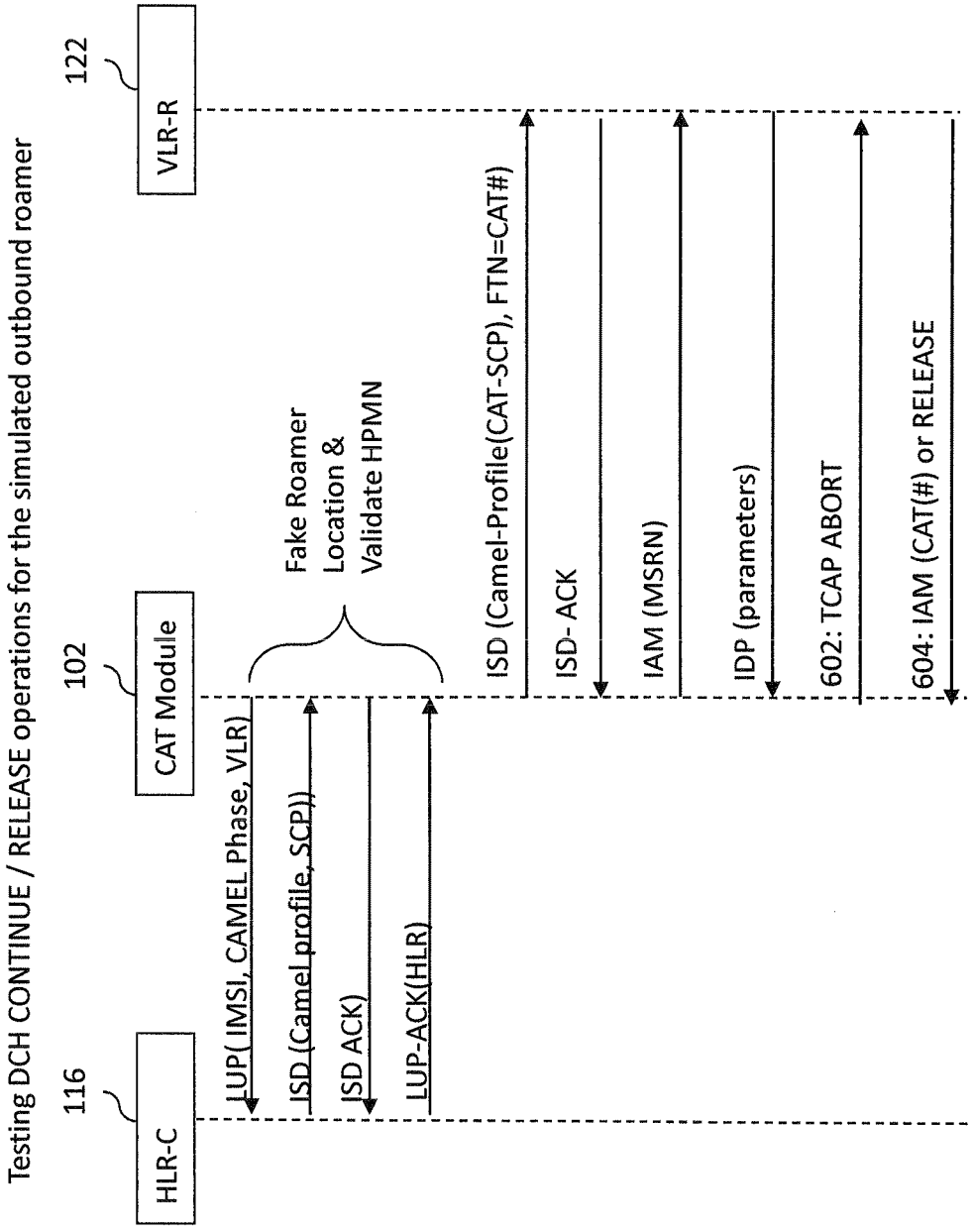

Testing DCH CONTINUE / RELEASE operations for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
LUP(IMSI, CAMEL Phase, VLR)
ISD (Camel profile, SCP))
ISD ACK)
LUP-ACK(HLR)
Fake Roamer
Location &
Validate HPMN
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
602: TCAP ABORT
604: IAM (CAT(#) or RELEASE

FIG. 6

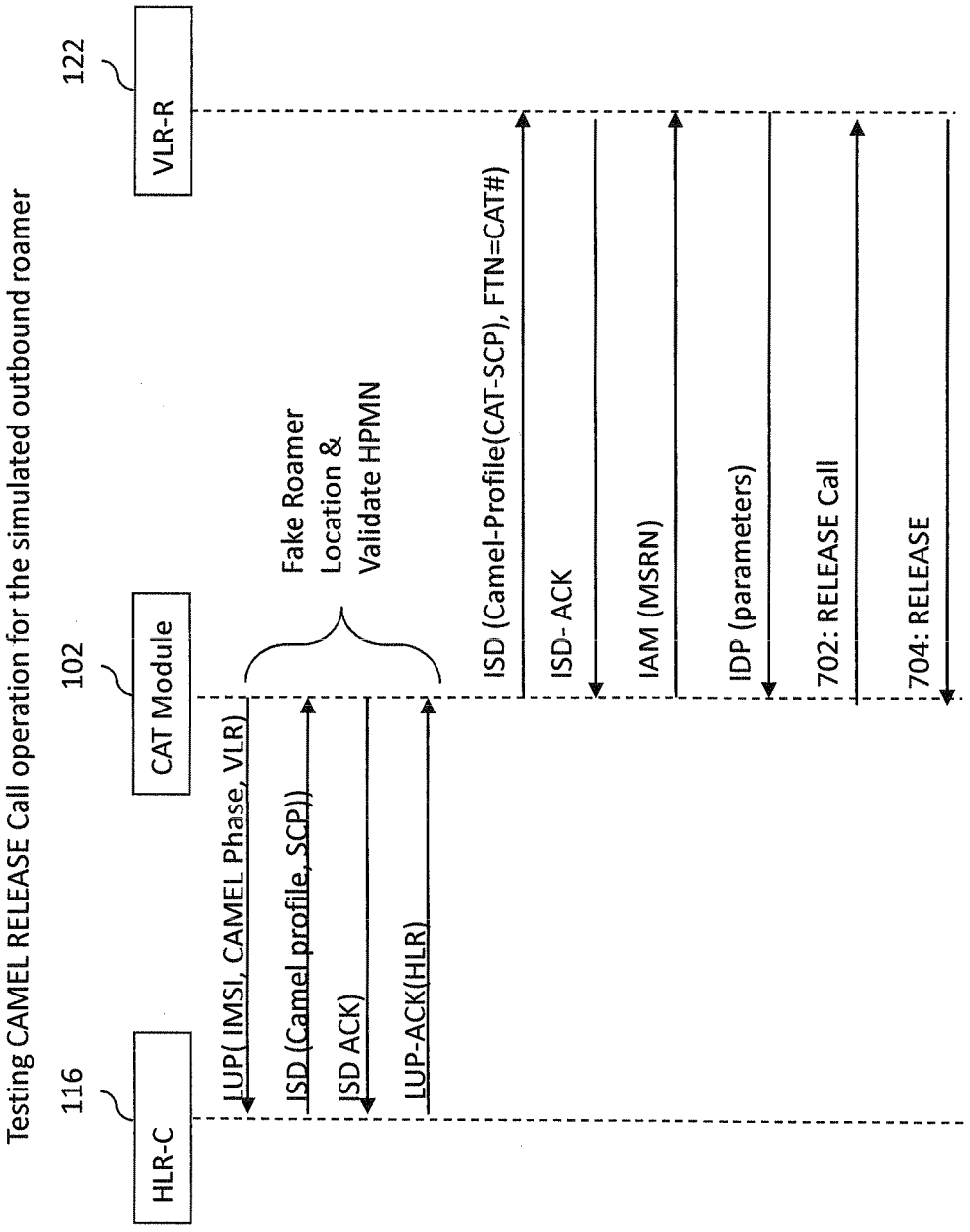

Testing CAMEL RELEASE Call operation for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
LUP(IMSI, CAMEL Phase, VLR)
ISD (Camel profile, SCP))
ISD ACK)
LUP-ACK(HLR)
Fake Roamer Location & Validate HPMN
ISD (CamelI-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
702: RELEASE Call
704: RELEASE

FIG. 7

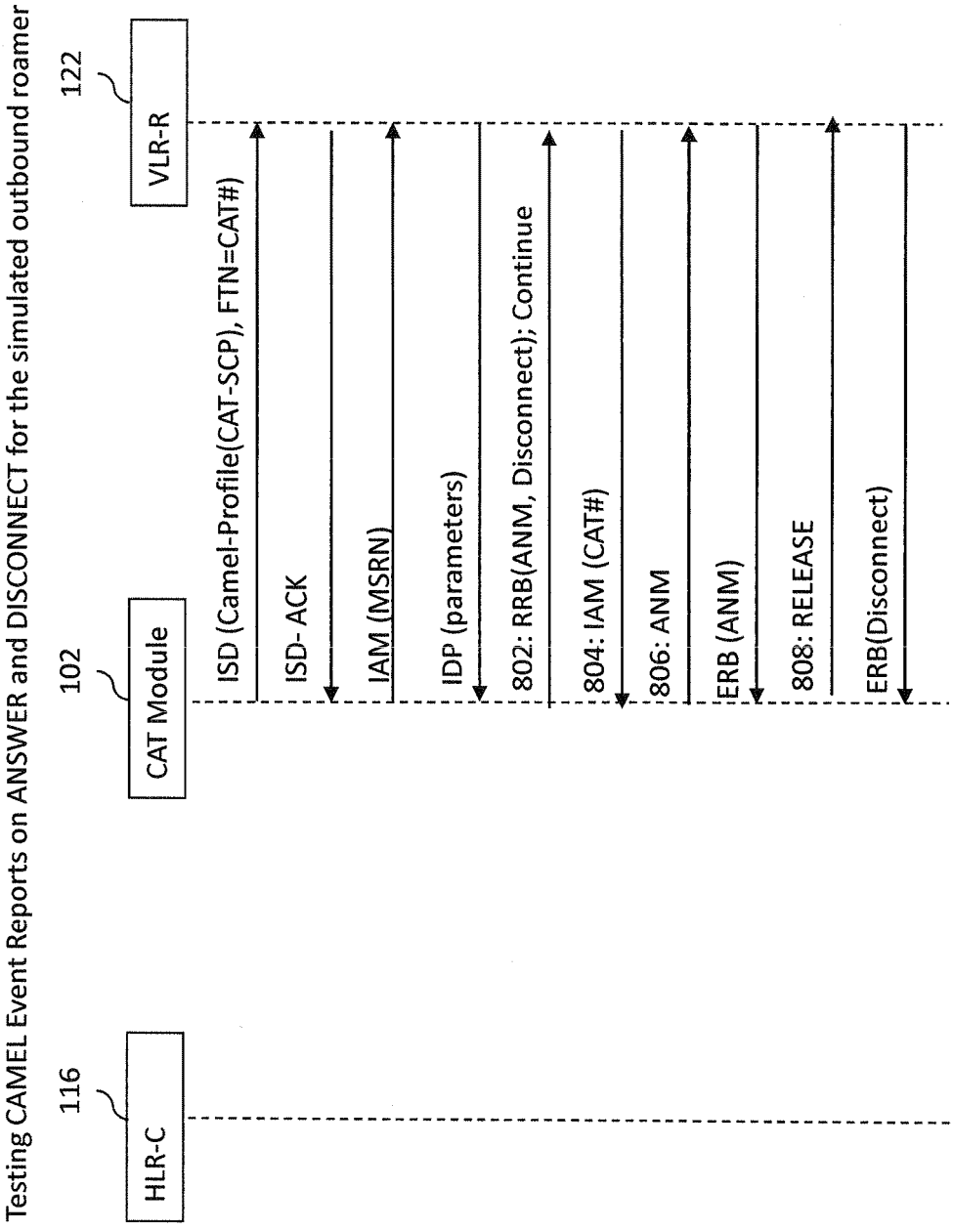

Testing CAMEL Event Reports on ANSWER and DISCONNECT for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
802: RRB(ANM, Disconnect); Continue
804: IAM (CAT#)
806: ANM
ERB (ANM)
808: RELEASE
ERB(Disconnect)

FIG. 8

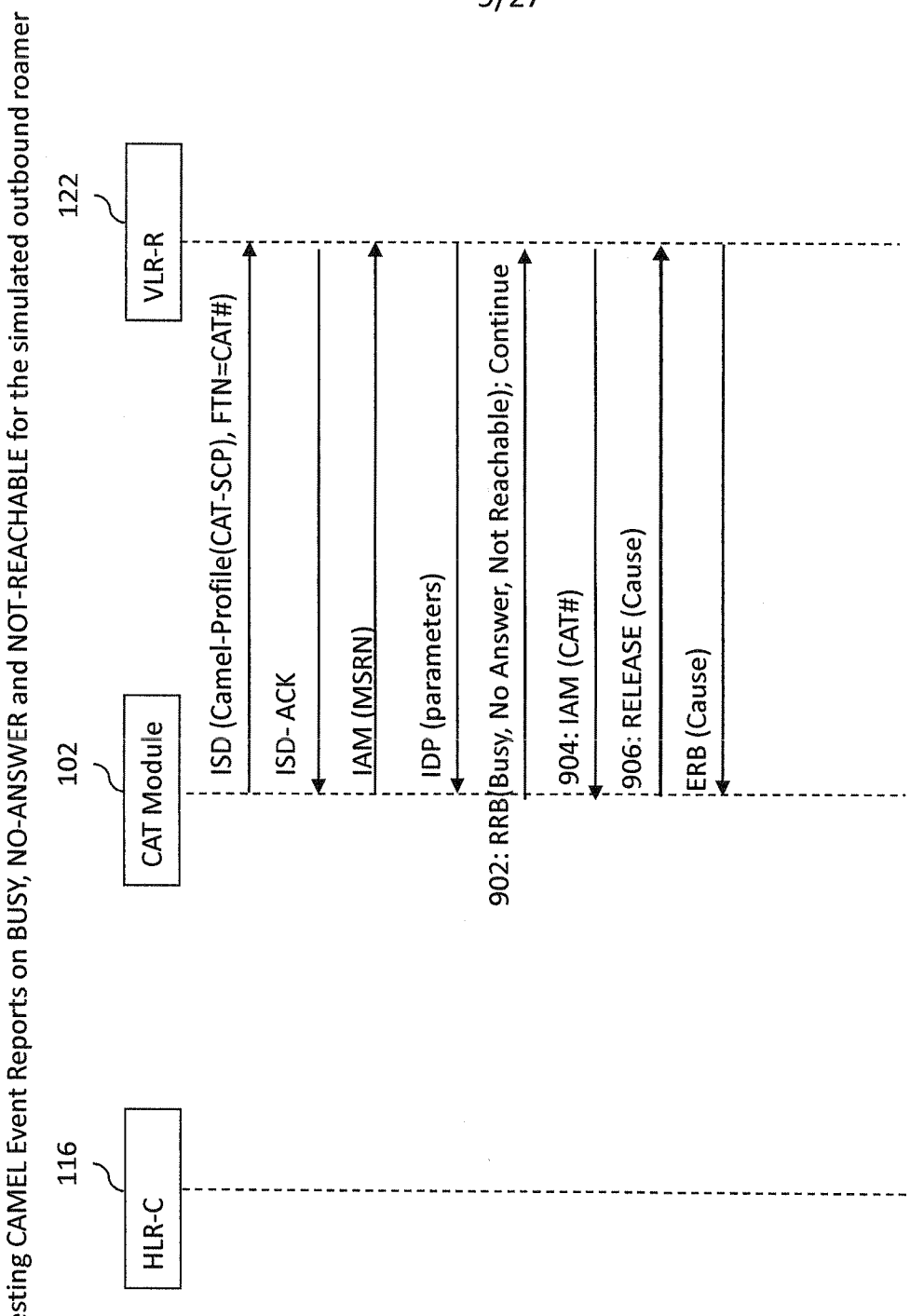

Testing CAMEL Event Reports on BUSY, NO-ANSWER and NOT-REACHABLE for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
ISD (CamelProfile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
902: RRB(Busy, No Answer, Not Reachable); Continue
904: IAM (CAT#)
906: RELEASE (Cause)
ERB (Cause)

FIG. 9

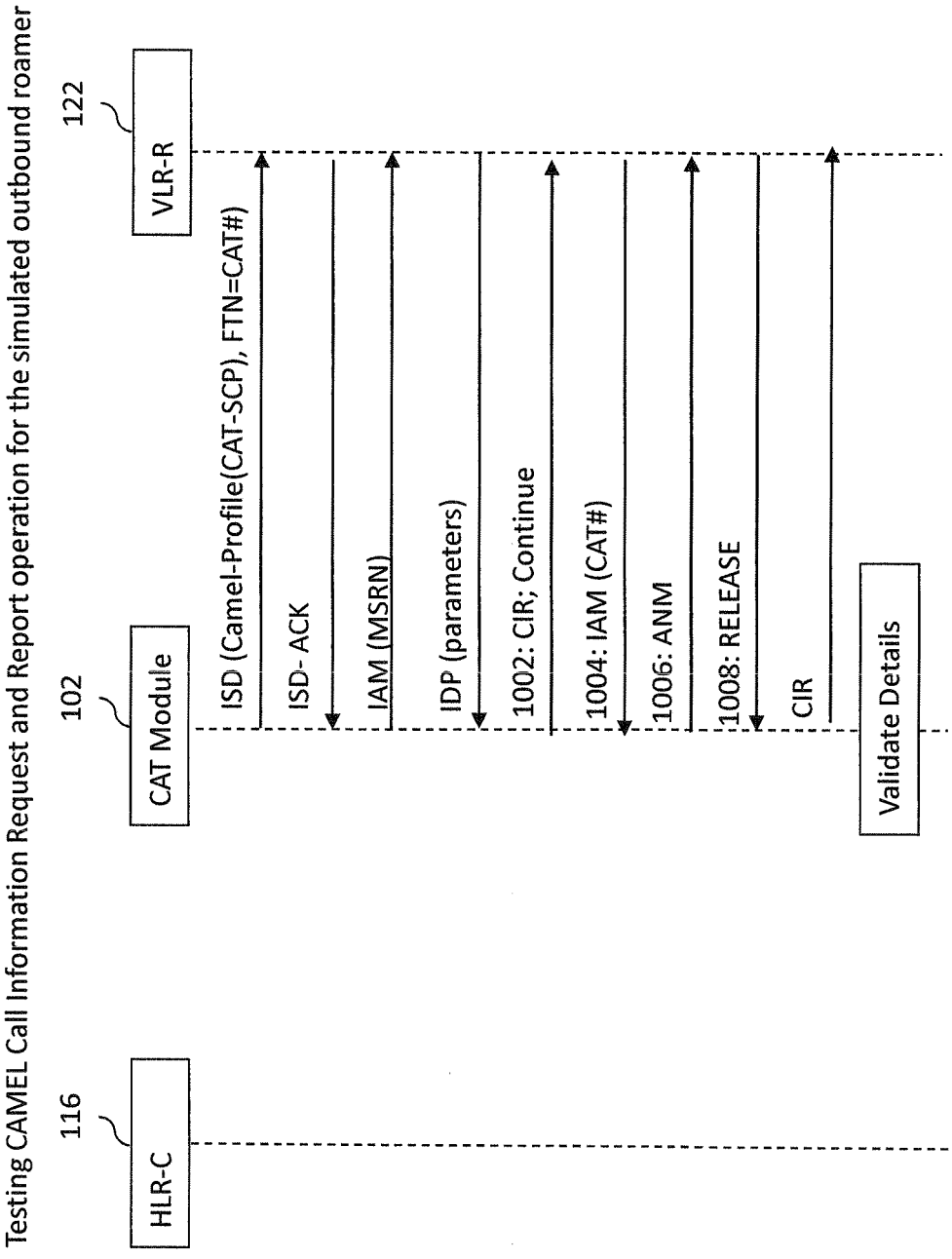

Testing CAMEL Call Information Request and Report operation for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
1002: CIR; Continue
1004: IAM (CAT#)
1006: ANM
1008: RELEASE
CIR
Validate Details

FIG. 10

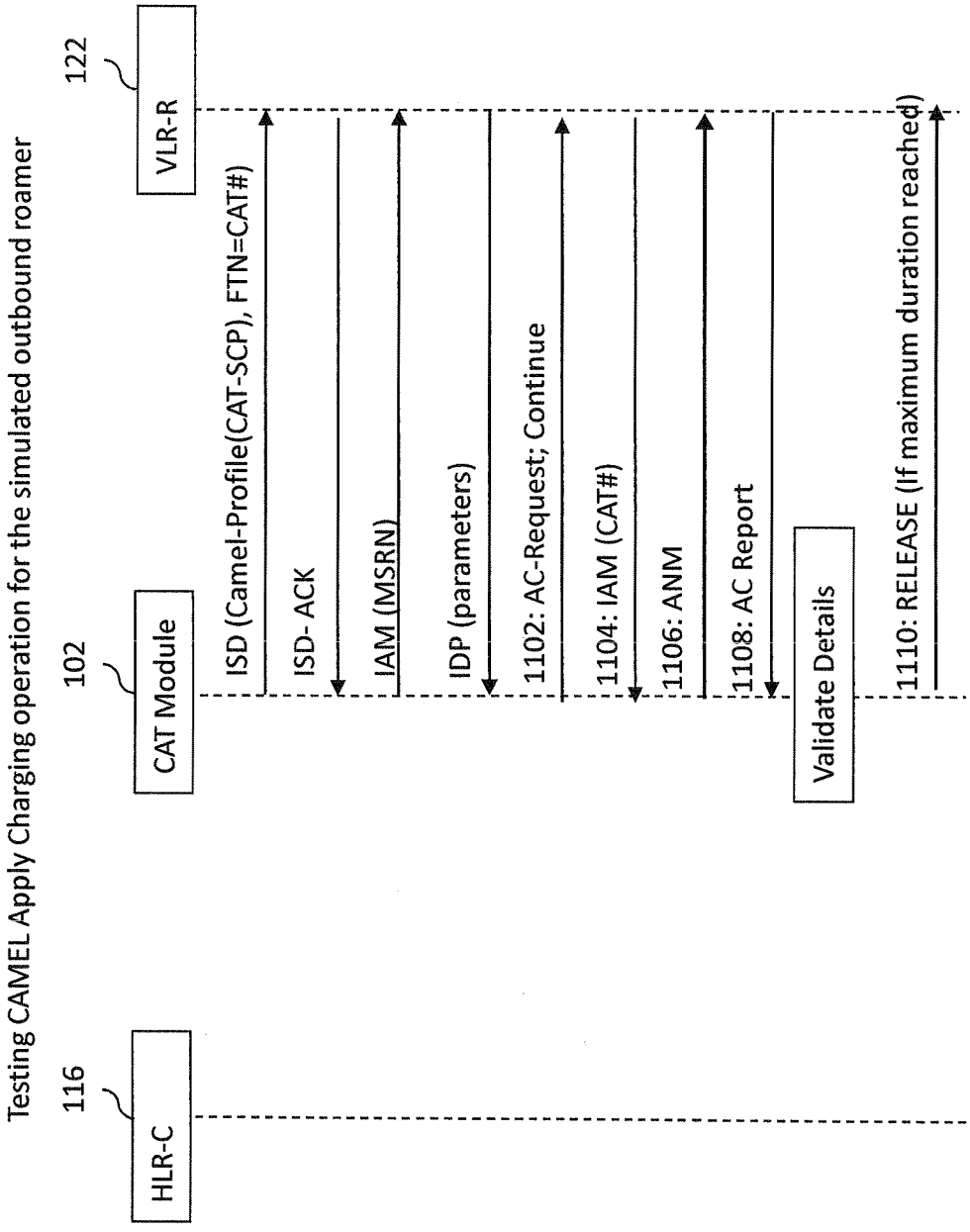

Testing CAMEL Apply Charging operation for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
1102: AC-Request; Continue
1104: IAM (CAT#)
1106: ANM
1108: AC Report
Validate Details
1110: RELEASE (If maximum duration reached)

FIG. 11

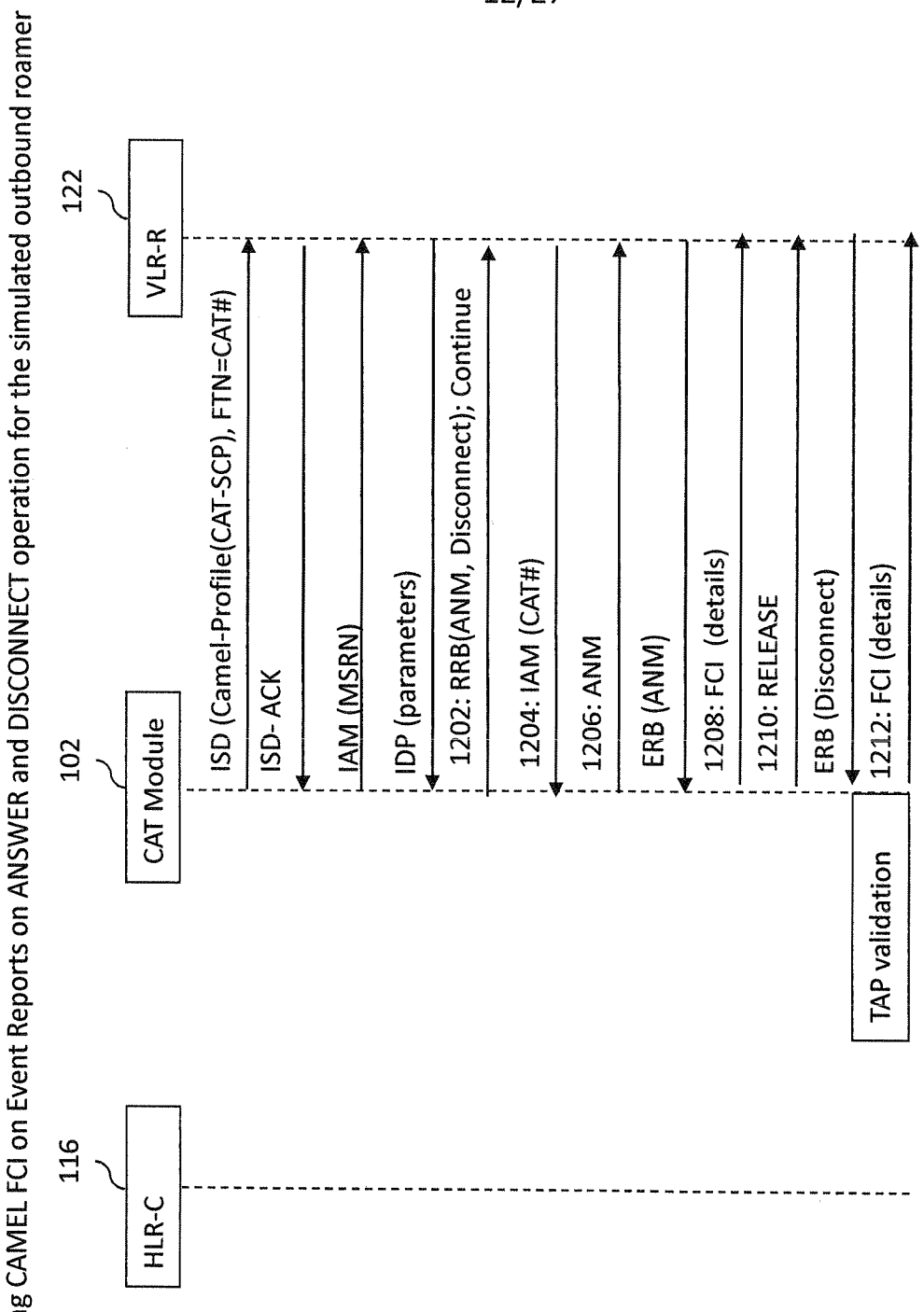

Testing CAMEL FCI on Event Reports on ANSWER and DISCONNECT operation for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
1202: RRB(ANM, Disconnect); Continue
1204: IAM (CAT#)
1206: ANM
ERB (ANM)
1208: FCI (details)
1210: RELEASE
ERB (Disconnect)
1212: FCI (details)
TAP validation

FIG. 12


Testing interaction of MAP PSI location and subscriber state with CAMEL operation for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
ISD (Camel-Profile(CAT-SCP), FTN=CAT#)
ISD- ACK
IAM (MSRN)
IDP (parameters)
1302: PSI (IMSI, Info Required)
1304: PSI (ACK, Info)
1306: CONTINUE
1308: IAM (CAT#)
1310: RELEASE Call
1312: RELEASE
If VLR correct
If not-reachable
Else

FIG. 13

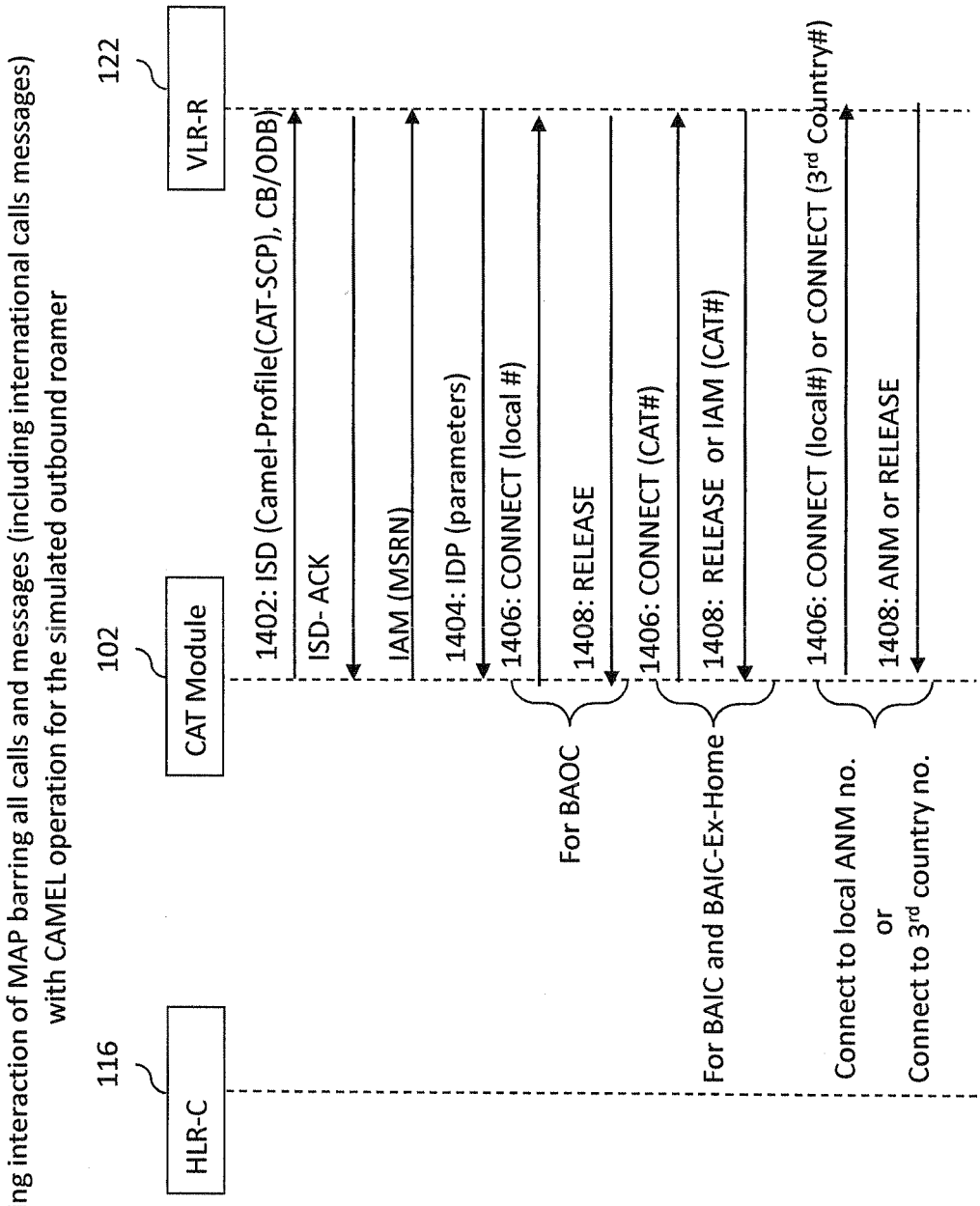

Testing interaction of MAP barring all calls and messages (including international calls messages) with CAMEL operation for the simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
1402: ISD (Camel-Profile(CAT-SCP), CB/ODB)
ISD- ACK
IAM (MSRN)
1404: IDP (parameters)
1406: CONNECT (local #)
1408: RELEASE
For BAOC
1406: CONNECT (CAT#)
1408: RELEASE or IAM (CAT#)
For BAIC and BAIC-Ex-Home
1406: CONNECT (local#) or CONNECT (3rd Country#)
1408: ANM or RELEASE
Connect to local ANM no.
or
Connect to 3rd country no.

FIG. 14

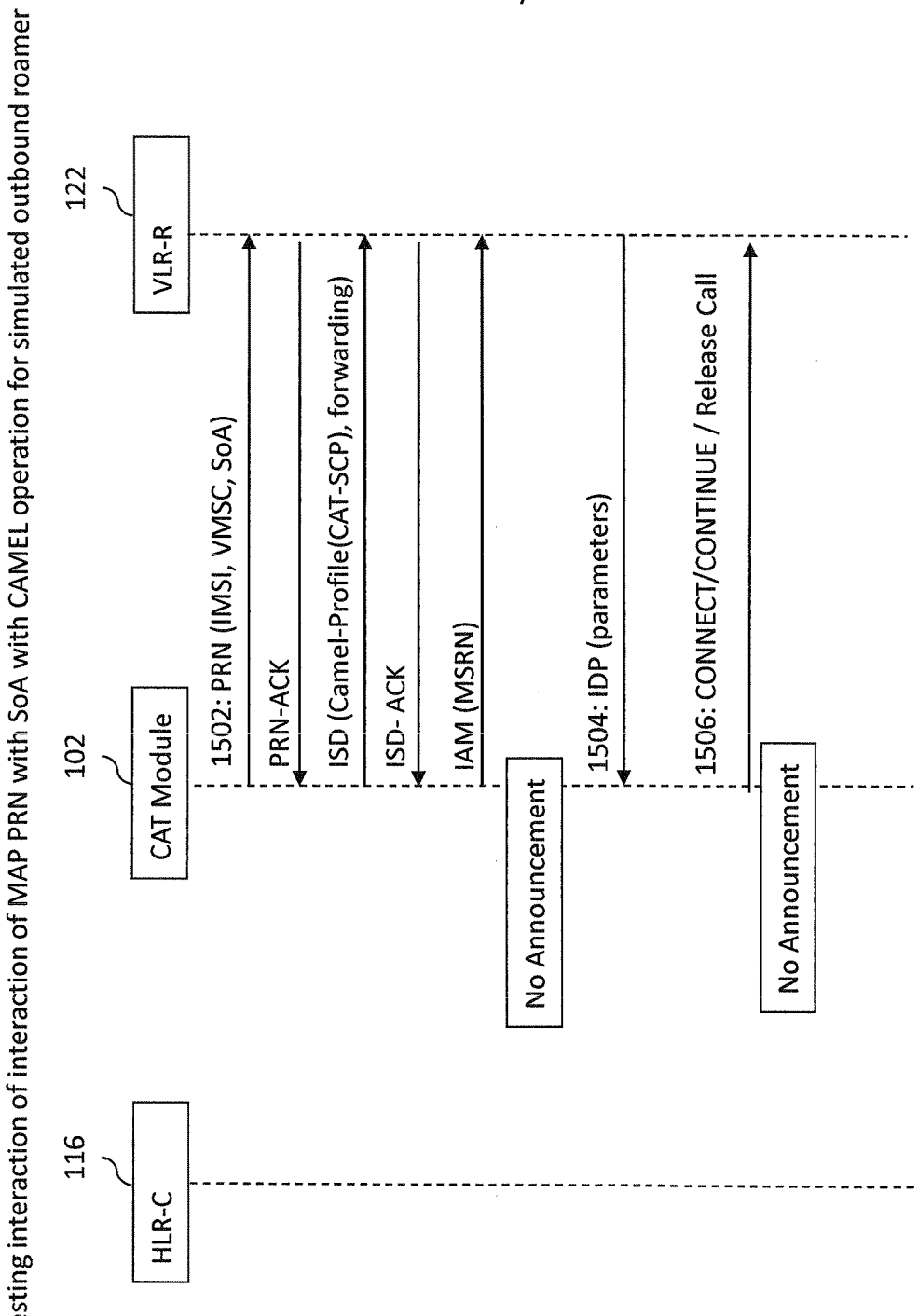

Testing interaction of MAP PRN with SoA with CAMEL operation for simulated outbound roamer
116
HLR-C
102
CAT Module
122
VLR-R
1502: PRN (IMSI, VMSC, SoA)
PRN-ACK
ISD (Camel-Profile(CAT-SCP), forwarding)
ISD- ACK
IAM (MSRN)
No Announcement
1504: IDP (parameters)
1506: CONNECT/CONTINUE / Release Call
No Announcement

FIG. 15

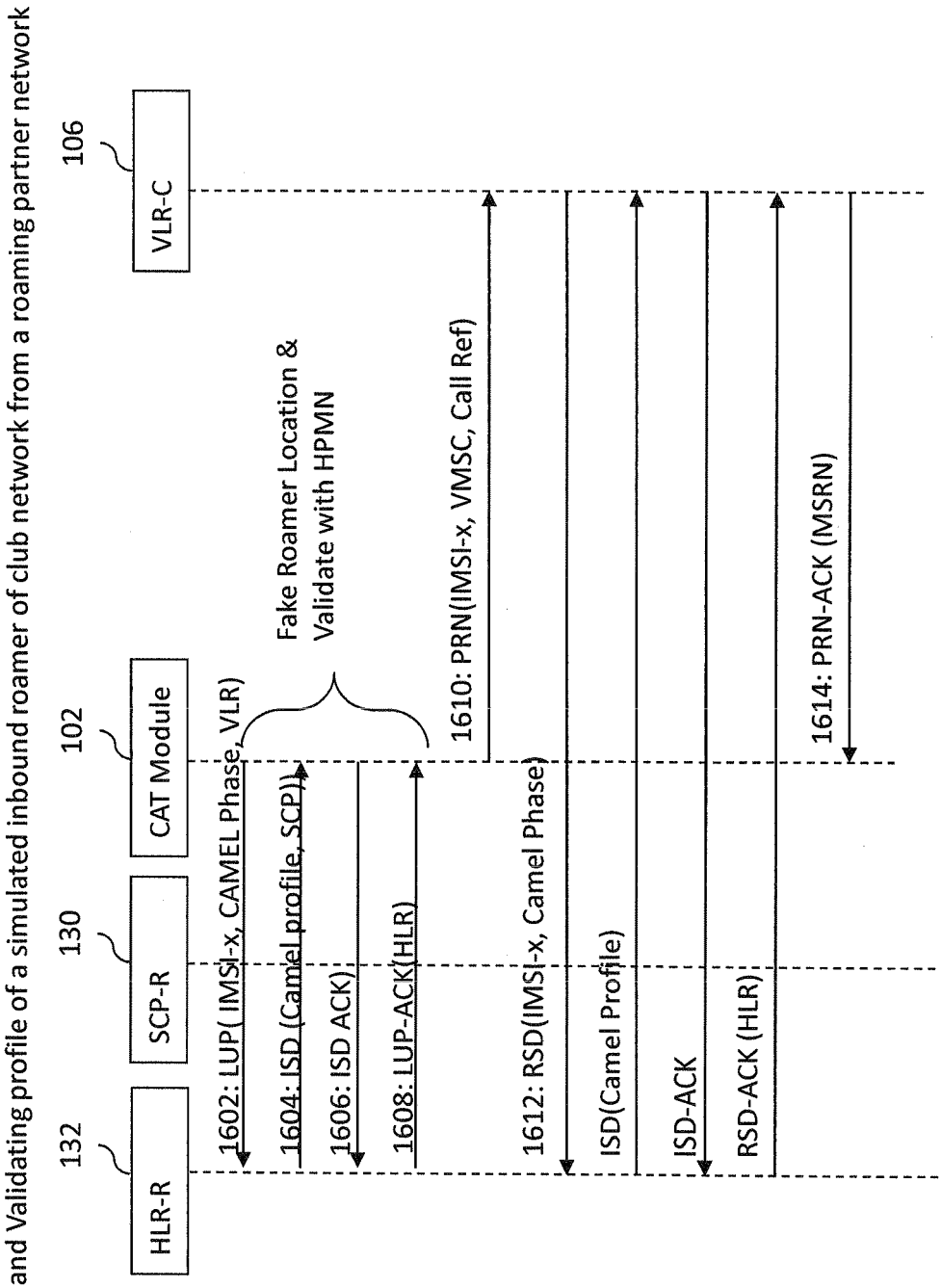

Creating and Validating profile of a simulated inbound roamer of club network from a roaming partner network
132
HLR-R
130
SCP-R
102
CAT Module
106
VLR-C
1602: LUP(IMSI-x, CAMEL Phase, VLR)
1604: ISD (Camel profile, SCP))
1606: ISD ACK)
1608: LUP-ACK(HLR)
Fake Roamer Location & Validate with HPMN
1610: PRN(IMSI-x, VMSC, Call Ref)
1612: RSD(IMSI-x, Camel Phase)
ISD(Camel Profile)
ISD-ACK
RSD-ACK (HLR)
1614: PRN-ACK (MSRN)

FIG. 16

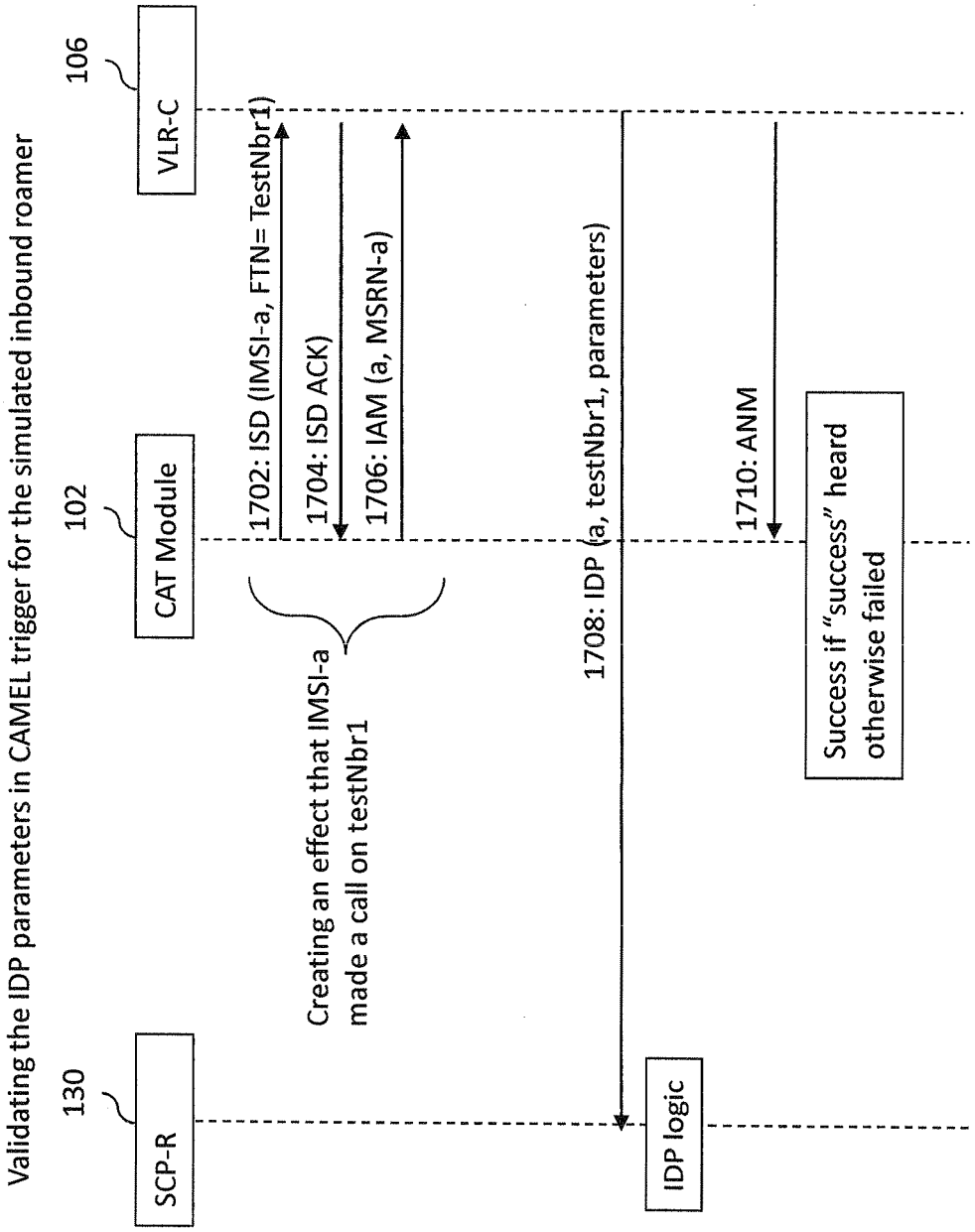

Validating the IDP parameters in CAMEL trigger for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
IDP logic
1702: ISD (IMSI-a, FTN= TestNbr1)
1704: ISD ACK)
1706: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on testNbr1
1708: IDP (a, testNbr1, parameters)
1710: ANM
Success if "success" heard otherwise failed

FIG. 17

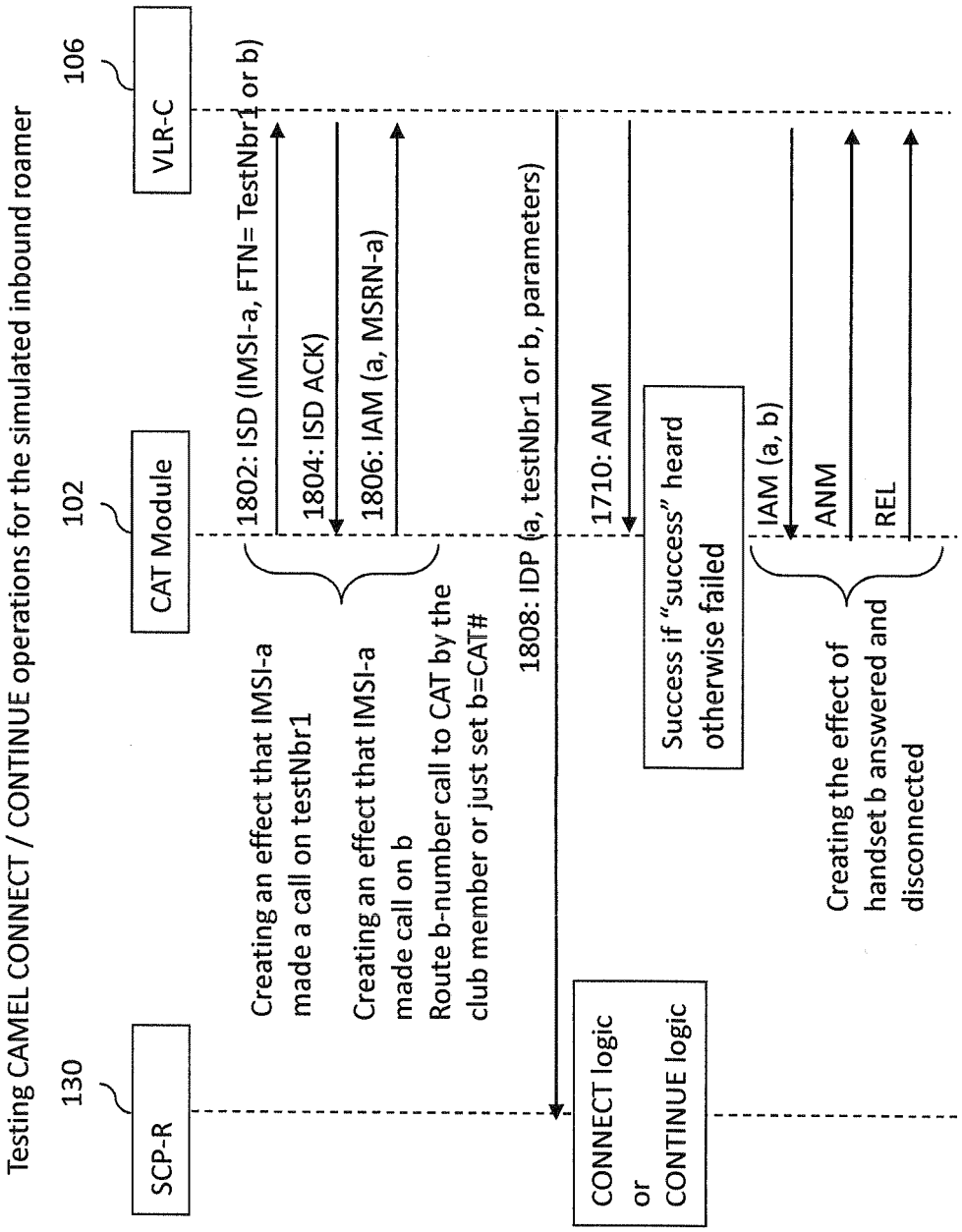

Testing CAMEL CONNECT / CONTINUE operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
1802: ISD (IMSI-a, FTN= TestNbr1 or b)
1804: ISD ACK)
1806: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on testNbr1
Creating an effect that IMSI-a made call on b
Route b-number call to CAT by the club member or just set b=CAT#
1808: IDP (a, testNbr1 or b, parameters)
1710: ANM
CONNECT logic or CONTINUE logic
Success if "success" heard otherwise failed
IAM (a, b)
ANM
REL
Creating the effect of handset b answered and disconnected

FIG. 18

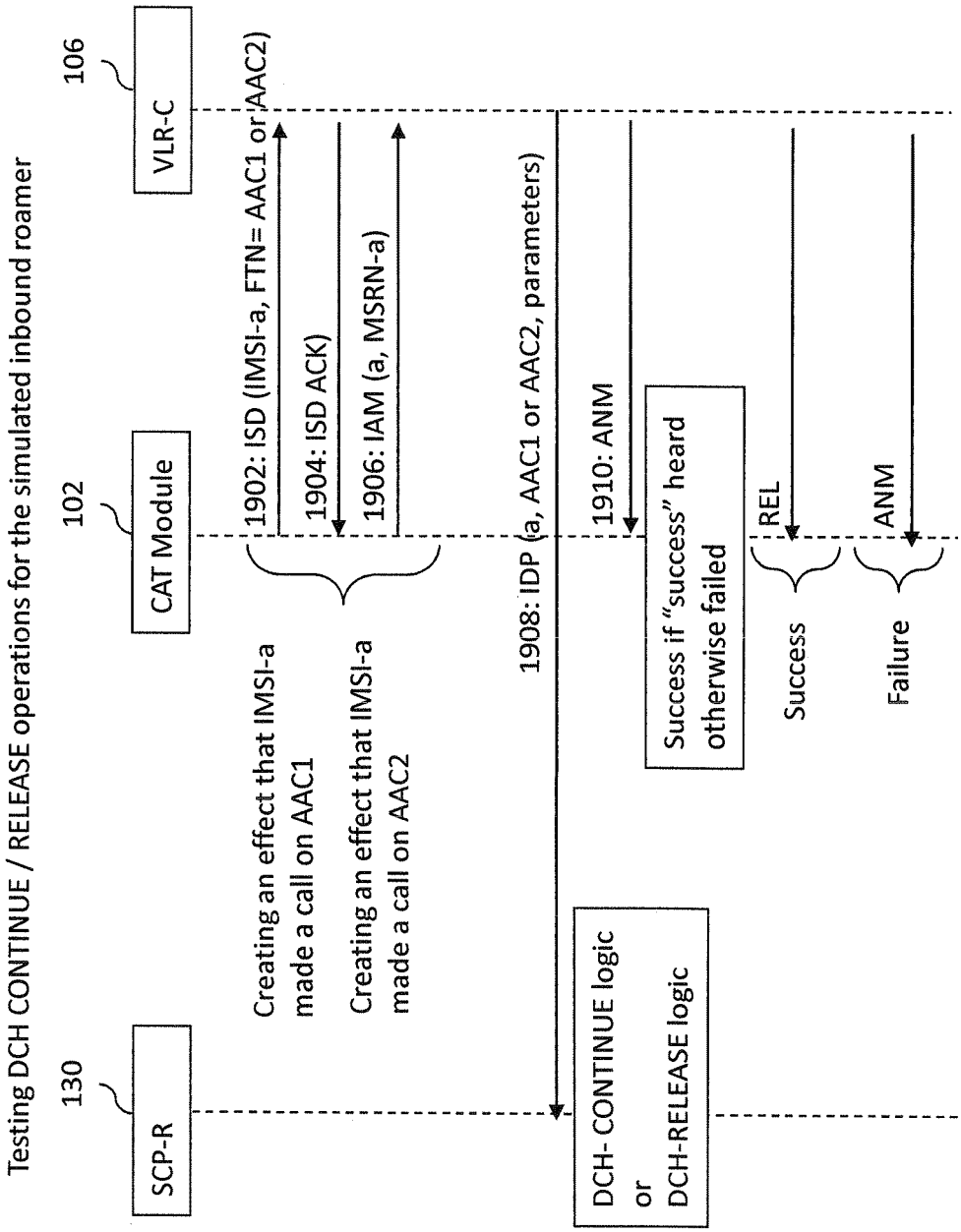

Testing DCH CONTINUE / RELEASE operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
1902: ISD (IMSI-a, FTN= AAC1 or AAC2)
1904: ISD ACK)
1906: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on AAC1
Creating an effect that IMSI-a made a call on AAC2
1908: IDP (a, AAC1 or AAC2, parameters)
1910: ANM
DCH- CONTINUE logic or DCH-RELEASE logic
Success if "success" heard otherwise failed
REL
ANM
Success
Failure

FIG. 19

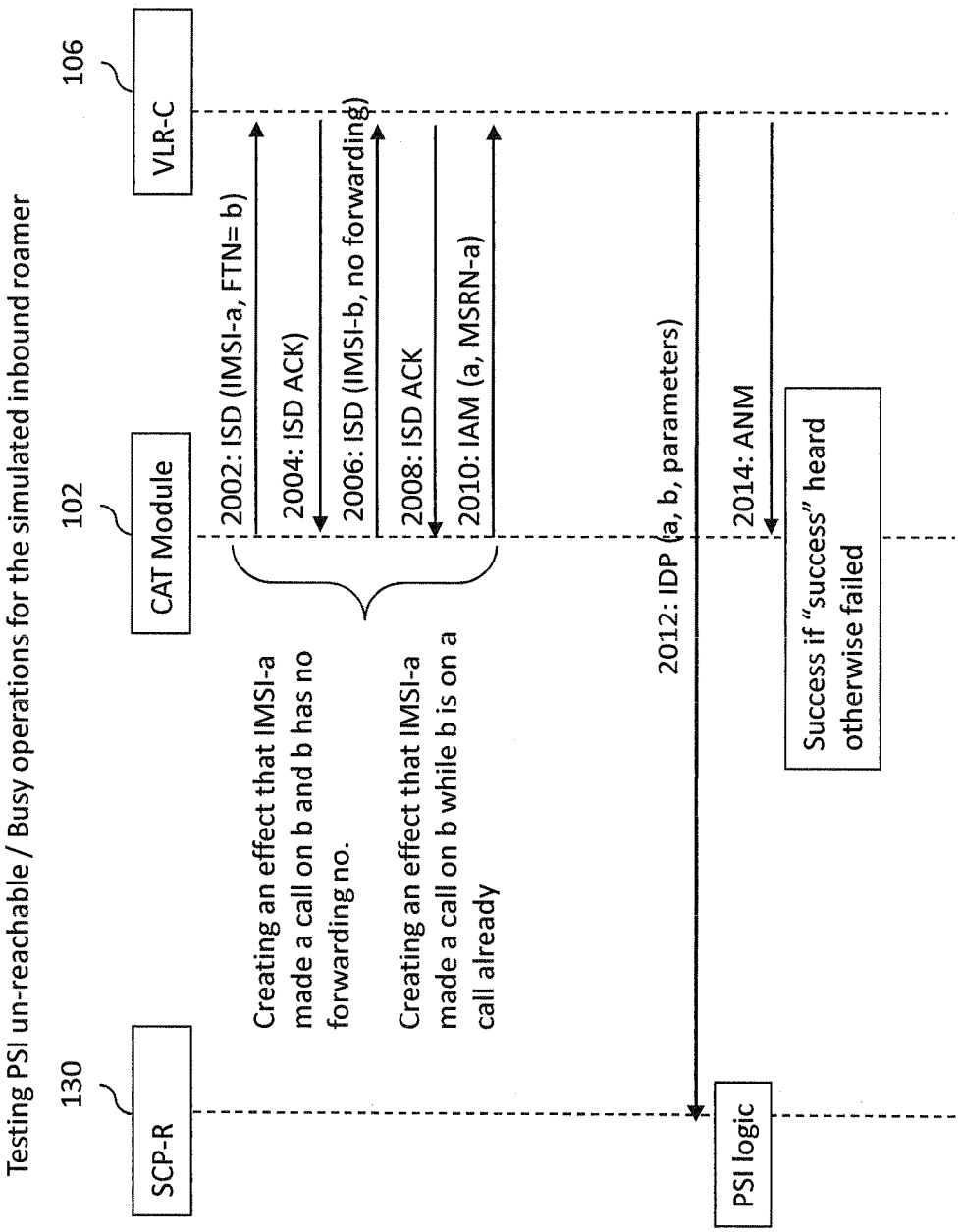

Testing PSI un-reachable / Busy operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
PSI logic
2002: ISD (IMSI-a, FTN= b)
2004: ISD ACK)
2006: ISD (IMSI-b, no forwarding)
2008: ISD ACK
2010: IAM (a, MSRN-a)
2012: IDP (a, b, parameters)
2014: ANM
Creating an effect that IMSI-a made a call on b and b has no forwarding no.
Creating an effect that IMSI-a made a call on b while b is on a call already
Success if "success" heard otherwise failed

FIG. 20

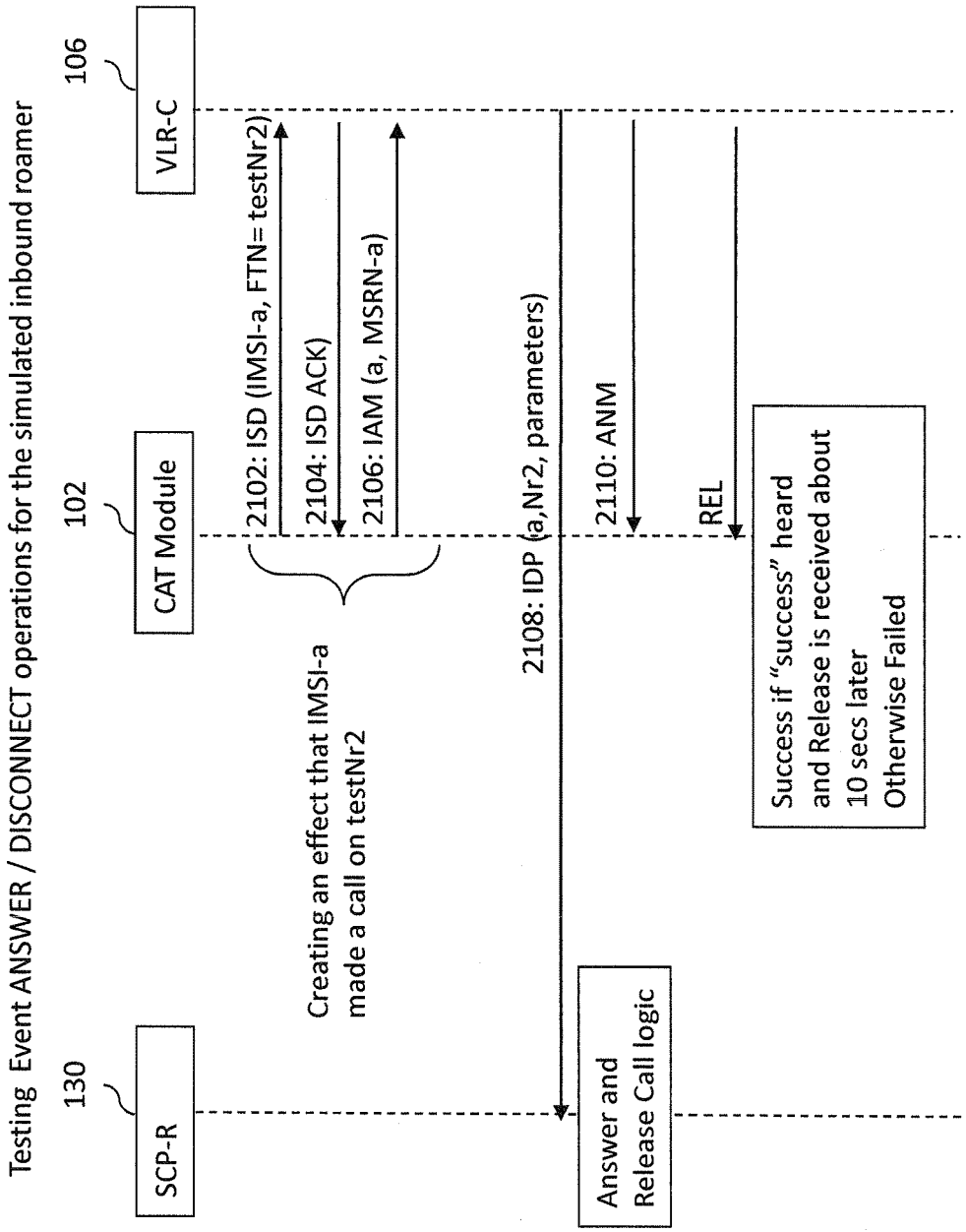

Testing Event ANSWER / DISCONNECT operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2102: ISD (IMSI-a, FTN= testNr2)
2104: ISD ACK)
2106: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on testNr2
2108: IDP (a,Nr2, parameters)
2110: ANM
REL
Answer and Release Call logic
Success if "success" heard and Release is received about 10 secs later Otherwise Failed

FIG. 21

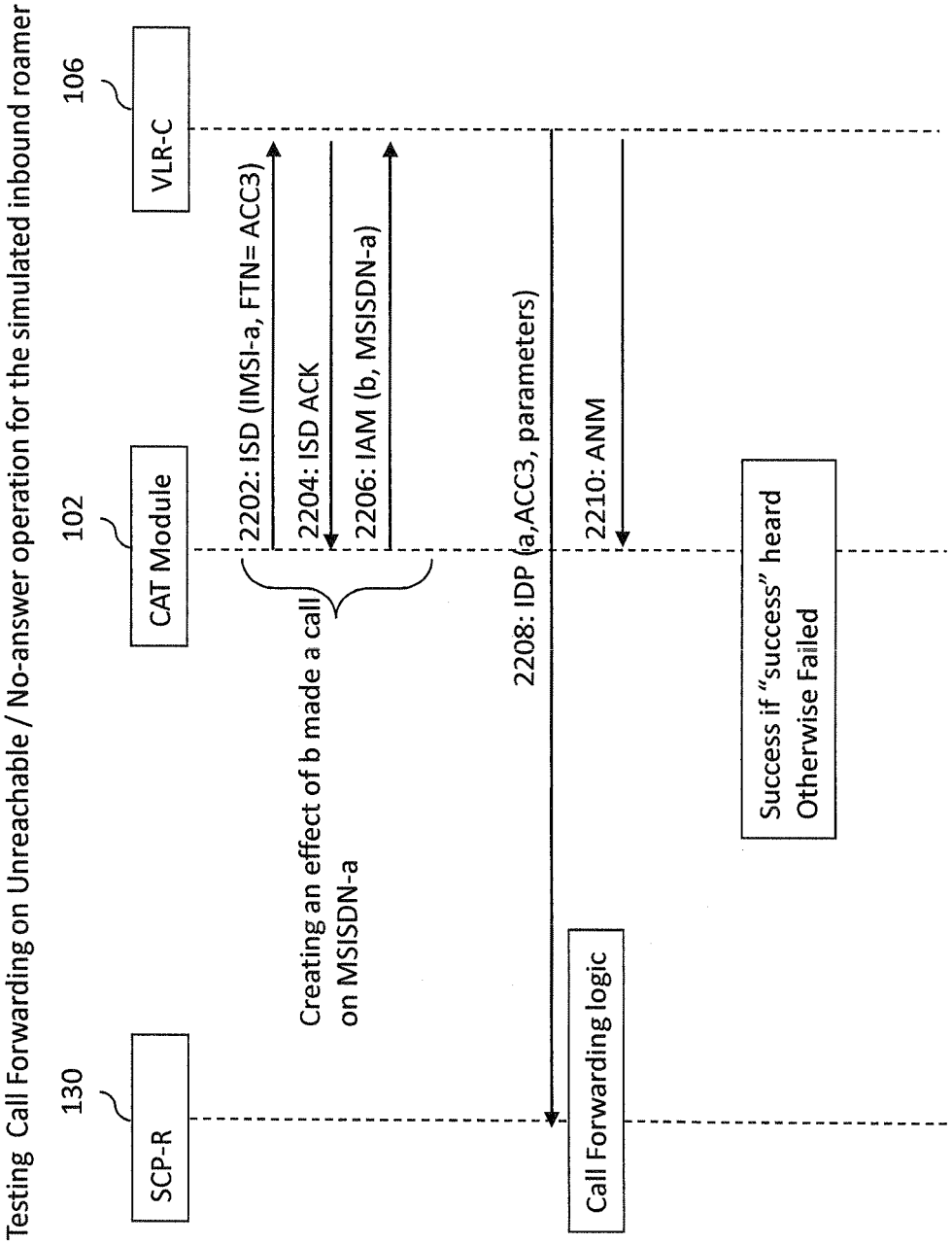

Testing Call Forwarding on Unreachable / No-answer operation for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2202: ISD (IMSI-a, FTN= ACC3)
2204: ISD ACK
2206: IAM (b, MSISDN-a)
Creating an effect of b made a call on MSISDN-a
2208: IDP (a,ACC3, parameters)
2210: ANM
Call Forwarding logic
Success if "success" heard
Otherwise Failed

FIG. 22

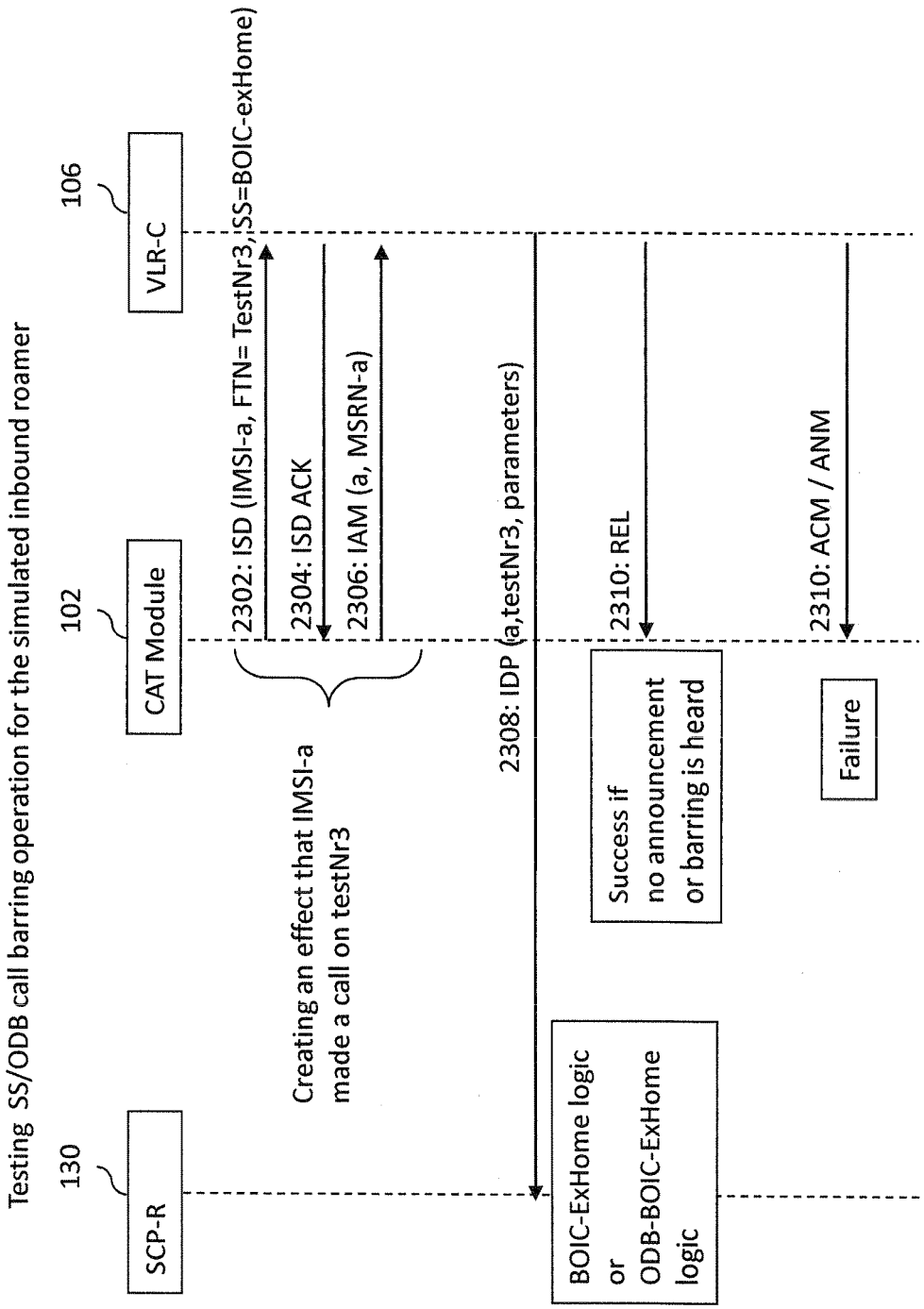

Testing SS/ODB call barring operation for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2302: ISD (IMSI-a, FTN= TestNr3, SS=BOIC-exHome)
2304: ISD ACK
2306: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on testNr3
2308: IDP (a,testNr3, parameters)
BOIC-ExHome logic or ODB-BOIC-ExHome logic
2310: REL
Success if no announcement or barring is heard
2310: ACM / ANM
Failure

FIG. 23

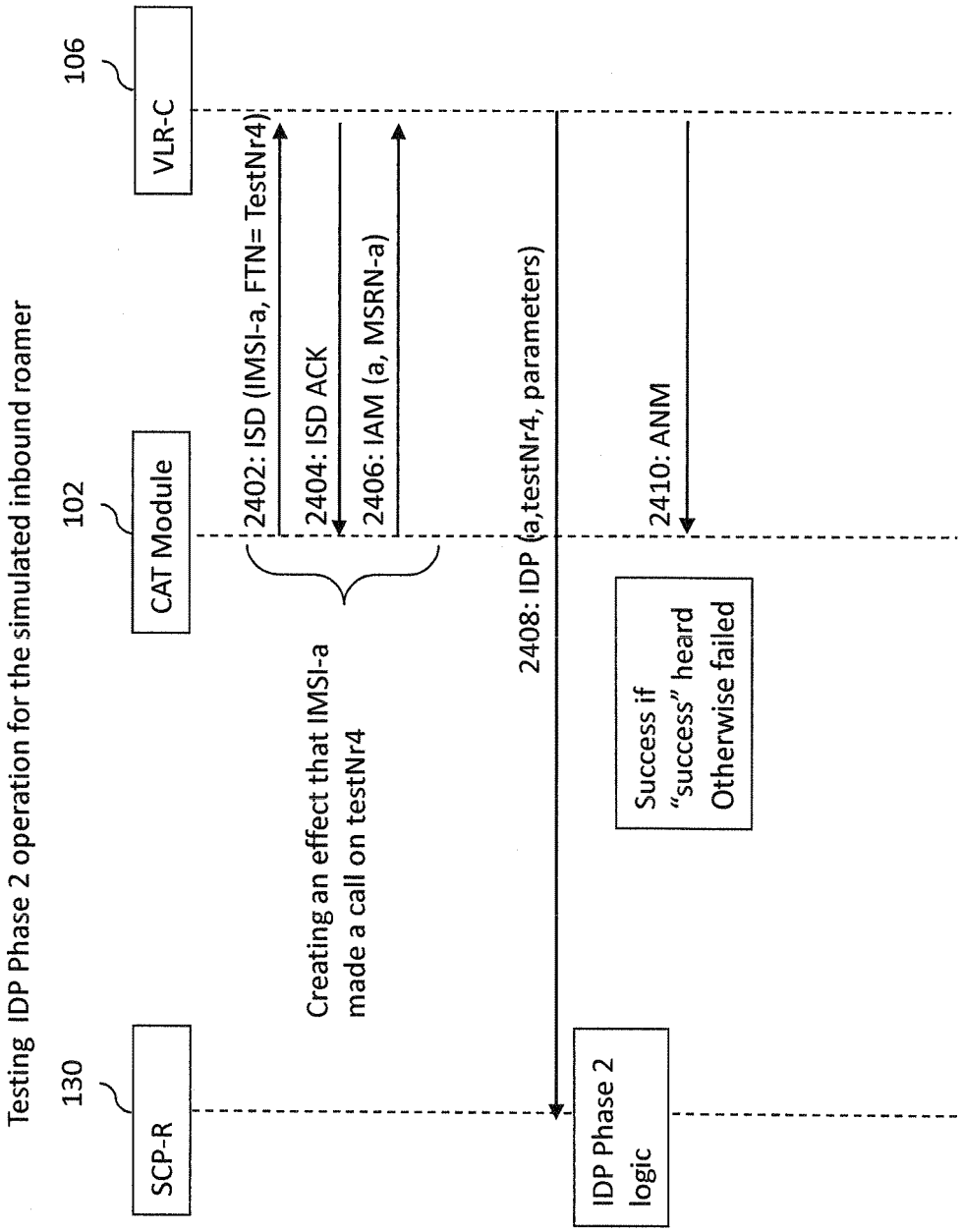

Testing IDP Phase 2 operation for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2402: ISD (IMSI-a, FTN= TestNr4)
2404: ISD ACK
2406: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on testNr4
2408: IDP (a,testNr4, parameters)
2410: ANM
IDP Phase 2 logic
Success if "success" heard Otherwise failed

FIG. 24

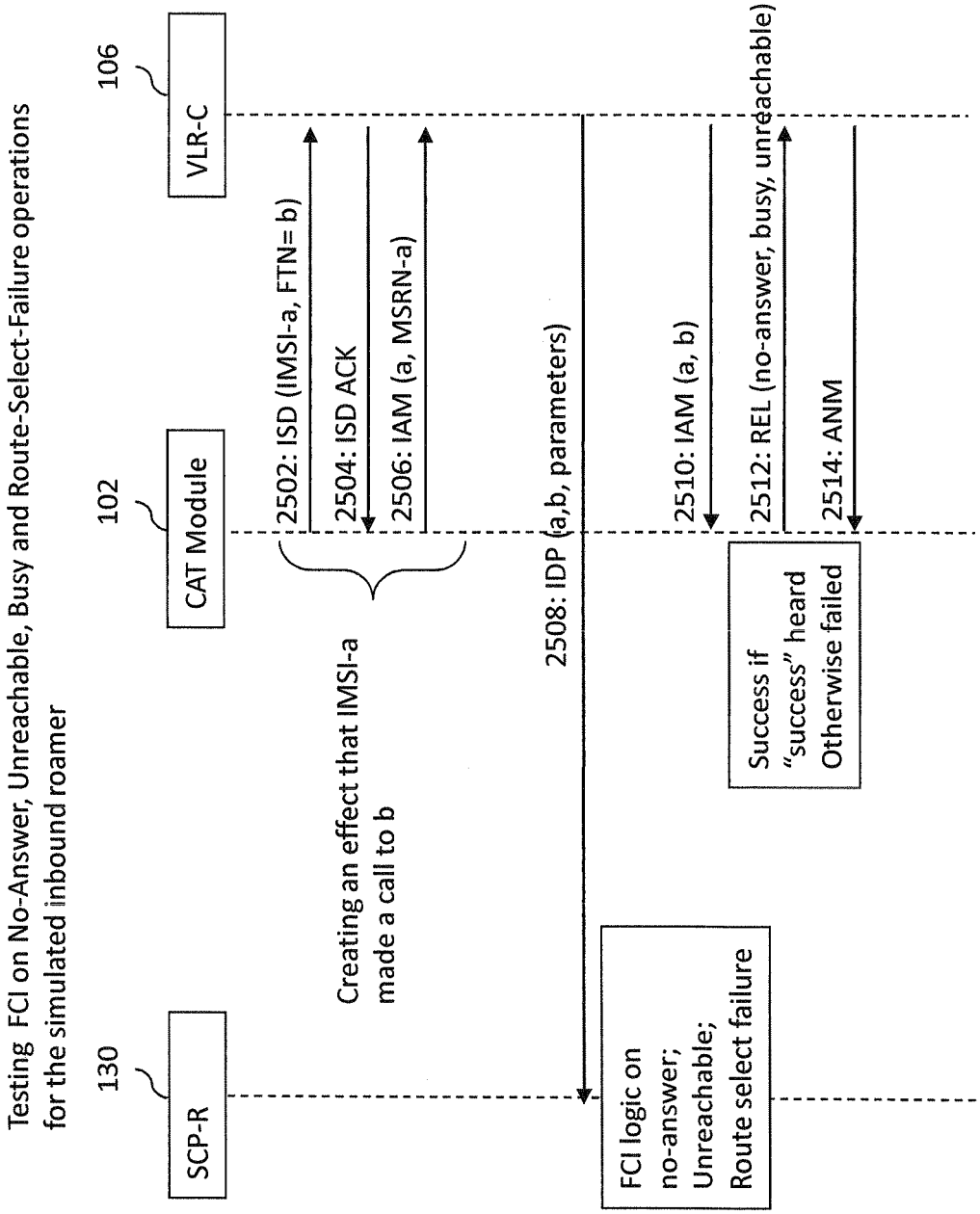

Testing FCI on No-Answer, Unreachable, Busy and Route-Select-Failure operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2502: ISD (IMSI-a, FTN= b)
2504: ISD ACK
2506: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call to b
2508: IDP (a,b, parameters)
2510: IAM (a, b)
2512: REL (no-answer, busy, unreachable)
2514: ANM
FCI logic on no-answer; Unreachable; Route select failure
Success if "success" heard Otherwise failed

FIG. 25

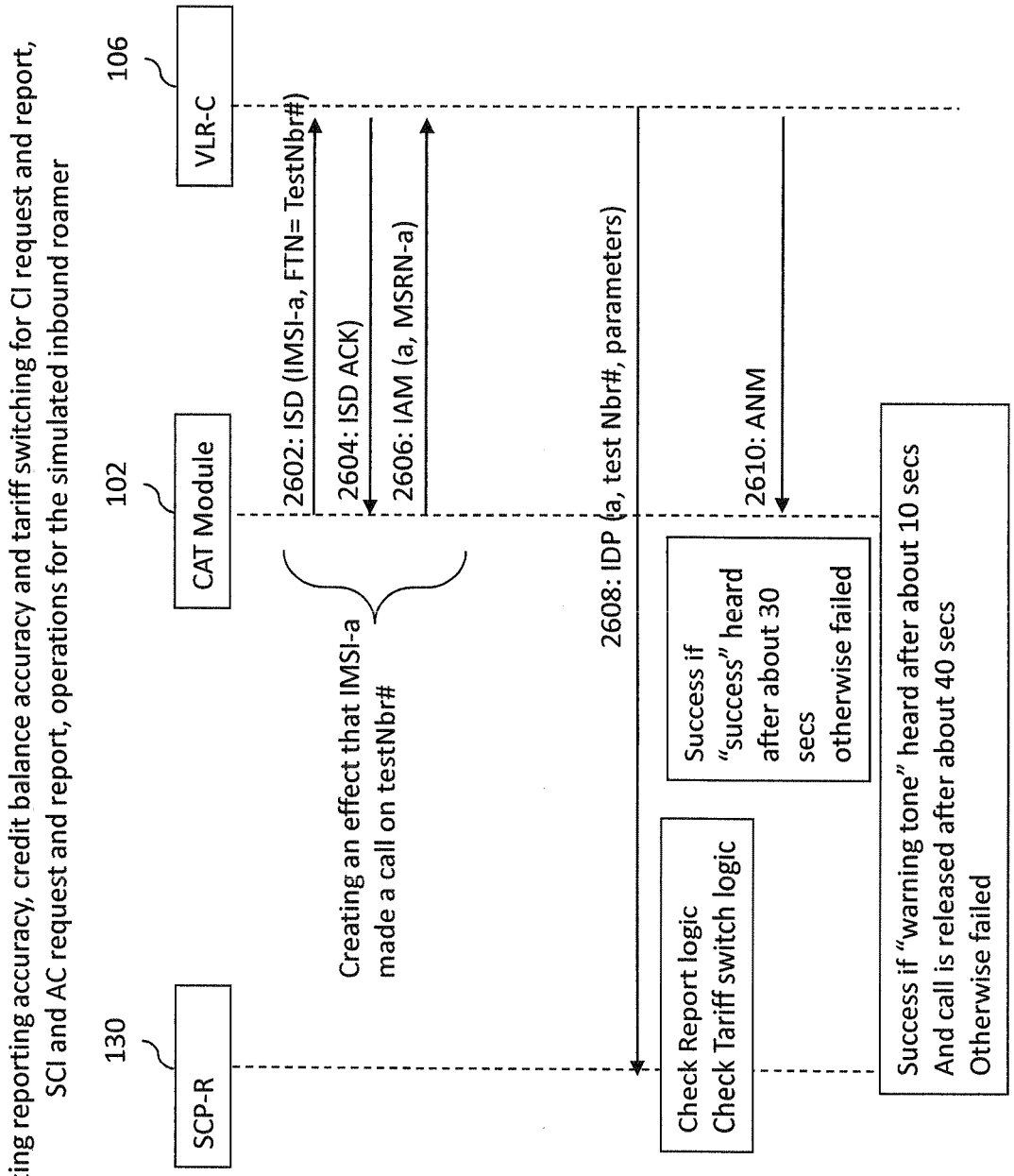

Testing reporting accuracy, credit balance accuracy and tariff switching for CI request and report,
SCI and AC request and report, operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2602: ISD (IMSI-a, FTN= TestNbr#)
2604: ISD ACK)
2606: IAM (a, MSRN-a)
Creating an effect that IMSI-a
made a call on testNbr#
2608: IDP (a, test Nbr#, parameters)
2610: ANM
Check Report logic
Check Tariff switch logic
Success if
"success" heard
after about 30
secs
otherwise failed
Success if "warning tone" heard after about 10 secs
And call is released after about 40 secs
Otherwise failed

FIG. 26

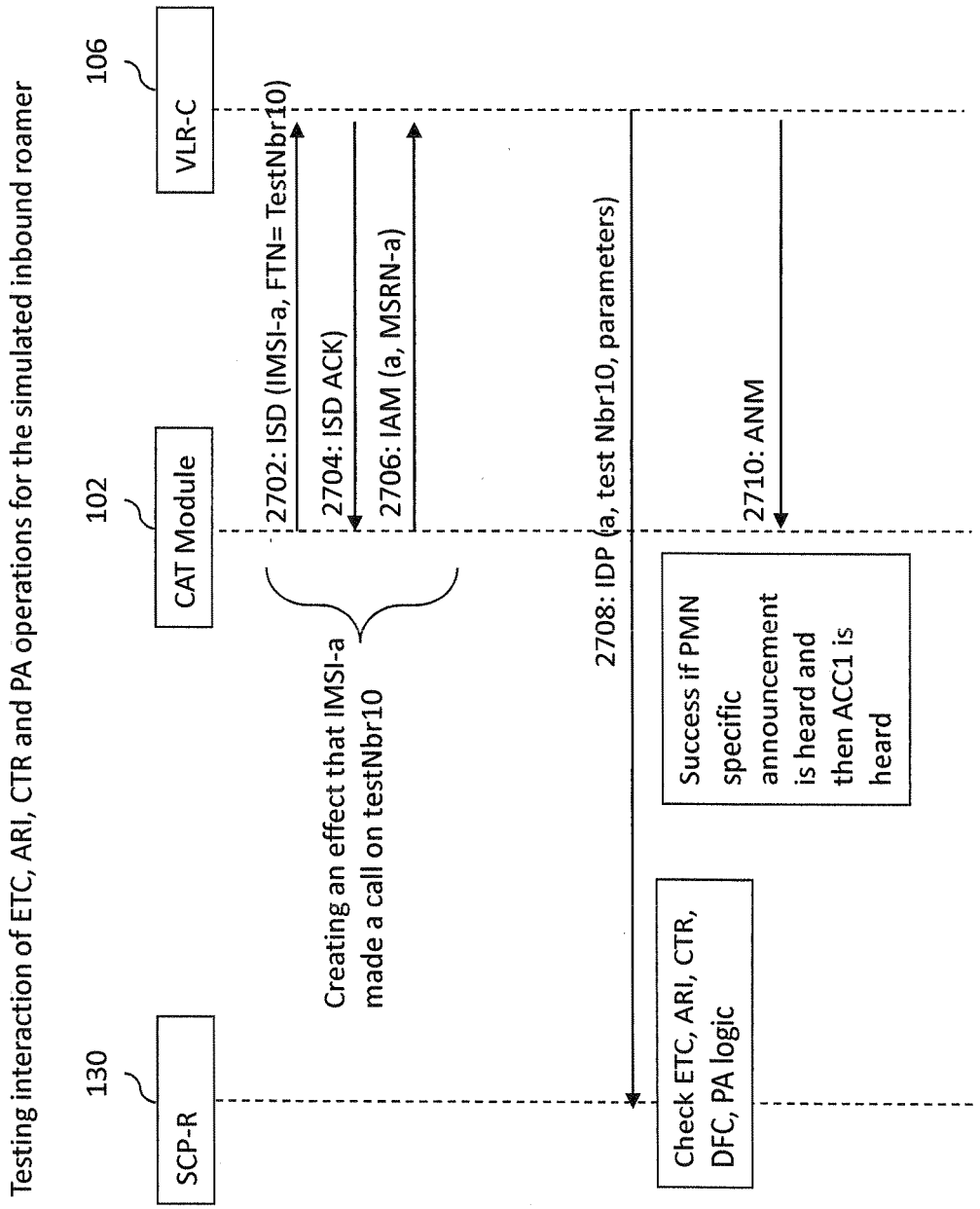

Testing interaction of ETC, ARI, CTR and PA operations for the simulated inbound roamer
130
SCP-R
102
CAT Module
106
VLR-C
2702: ISD (IMSI-a, FTN= TestNbr10)
2704: ISD ACK)
2706: IAM (a, MSRN-a)
Creating an effect that IMSI-a made a call on testNbr10
2708: IDP (a, test Nbr10, parameters)
2710: ANM
Check ETC, ARI, CTR, DFC, PA logic
Success if PMN specific announcement is heard and then ACC1 is heard

FIG. 27