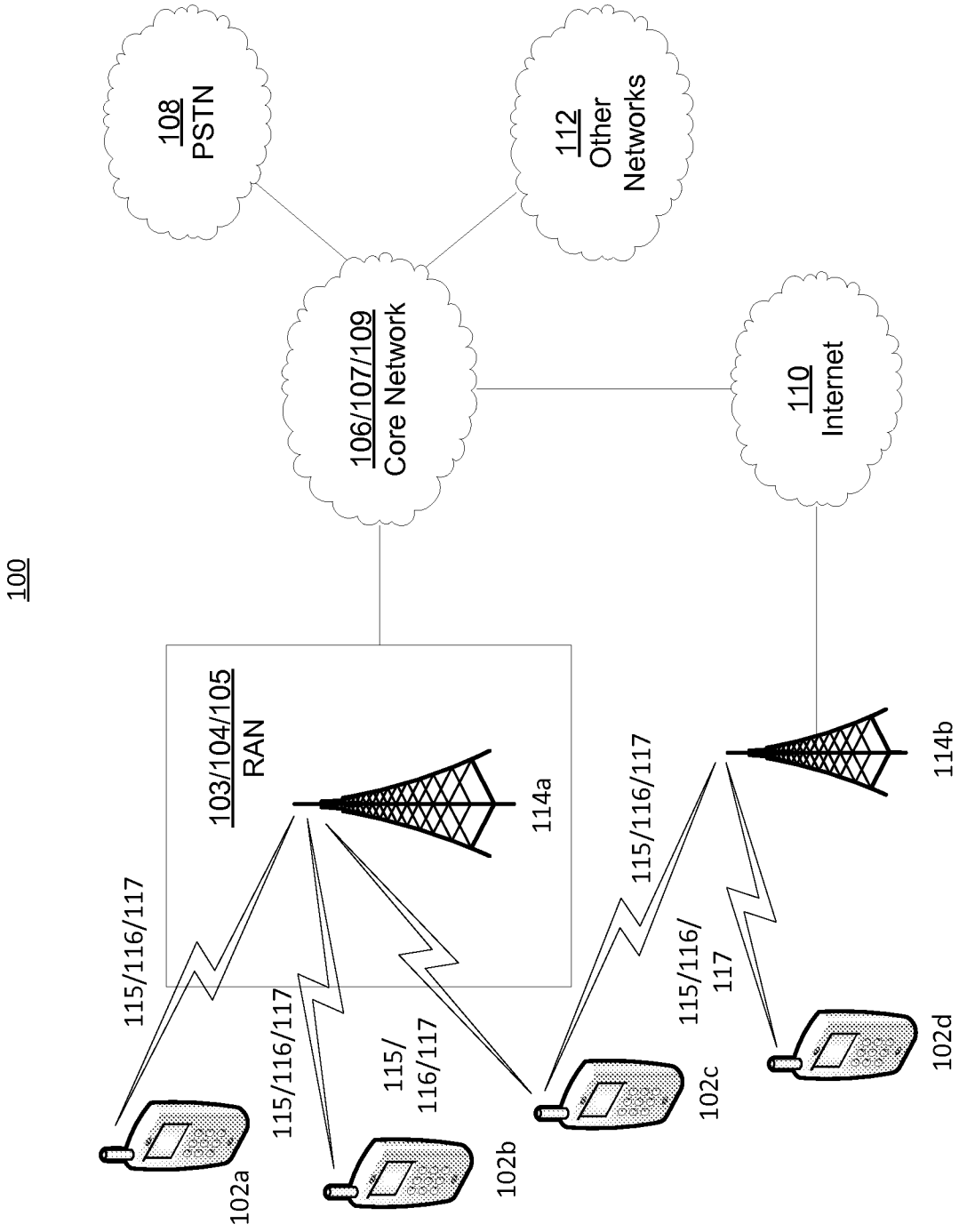
100
108
PSTN
112
Other
Networks
106/107/109
Core Network
110
Internet
103/104/105
RAN
114a
114b
115/116/117
115/116/117
115/
116/117
115/116/117
115/116/
117
102a
102b
102c
102d

FIG. 1A

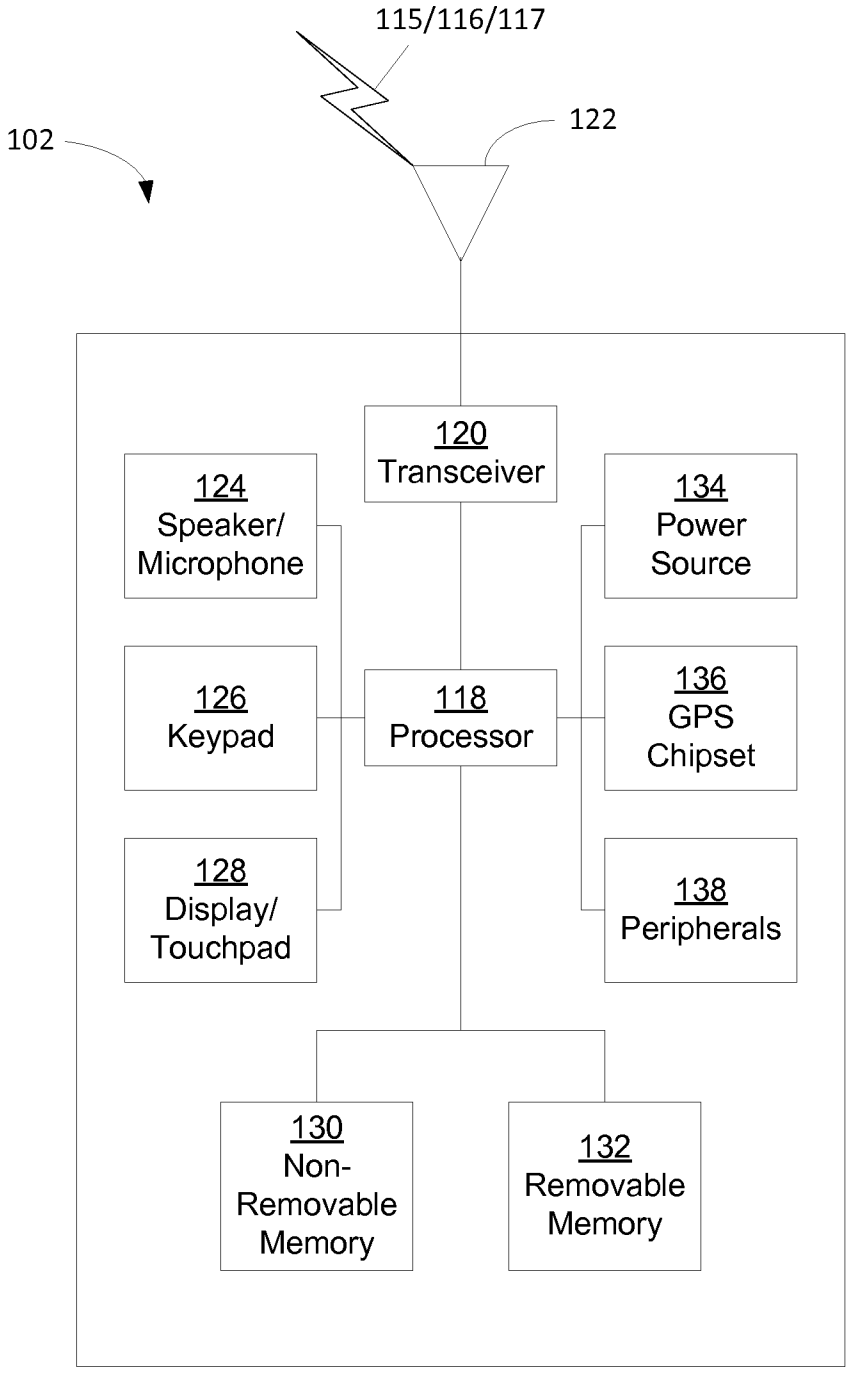
115/116/117
122
102
120
Transceiver
124
Speaker/
Microphone
134
Power
Source
126
Keypad
118
Processor
136
GPS
Chipset
128
Display/
Touchpad
138
Peripherals
130
Non-
Removable
Memory
132
Removable
Memory

FIG. 1B

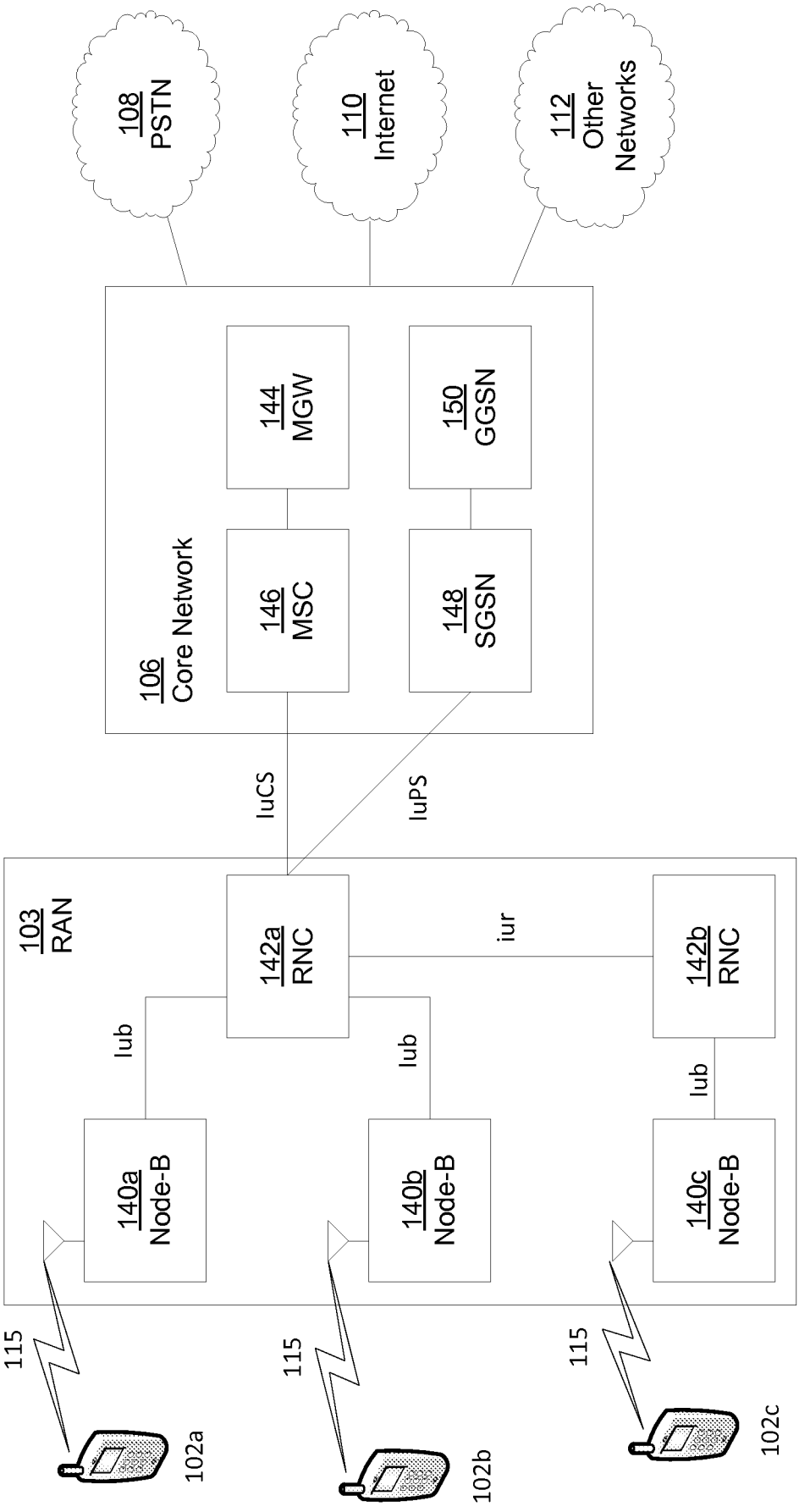
108 PSTN
110 Internet
112 Other Networks
106 Core Network
144 MGW
150 GGSN
146 MSC
148 SGSN
IuCS
IuPS
103 RAN
142a RNC
142b RNC
iur
Iub
Iub
Iub
140a Node-B
140b Node-B
140c Node-B
115
115
115
102a
102b
102c

FIG. 1C

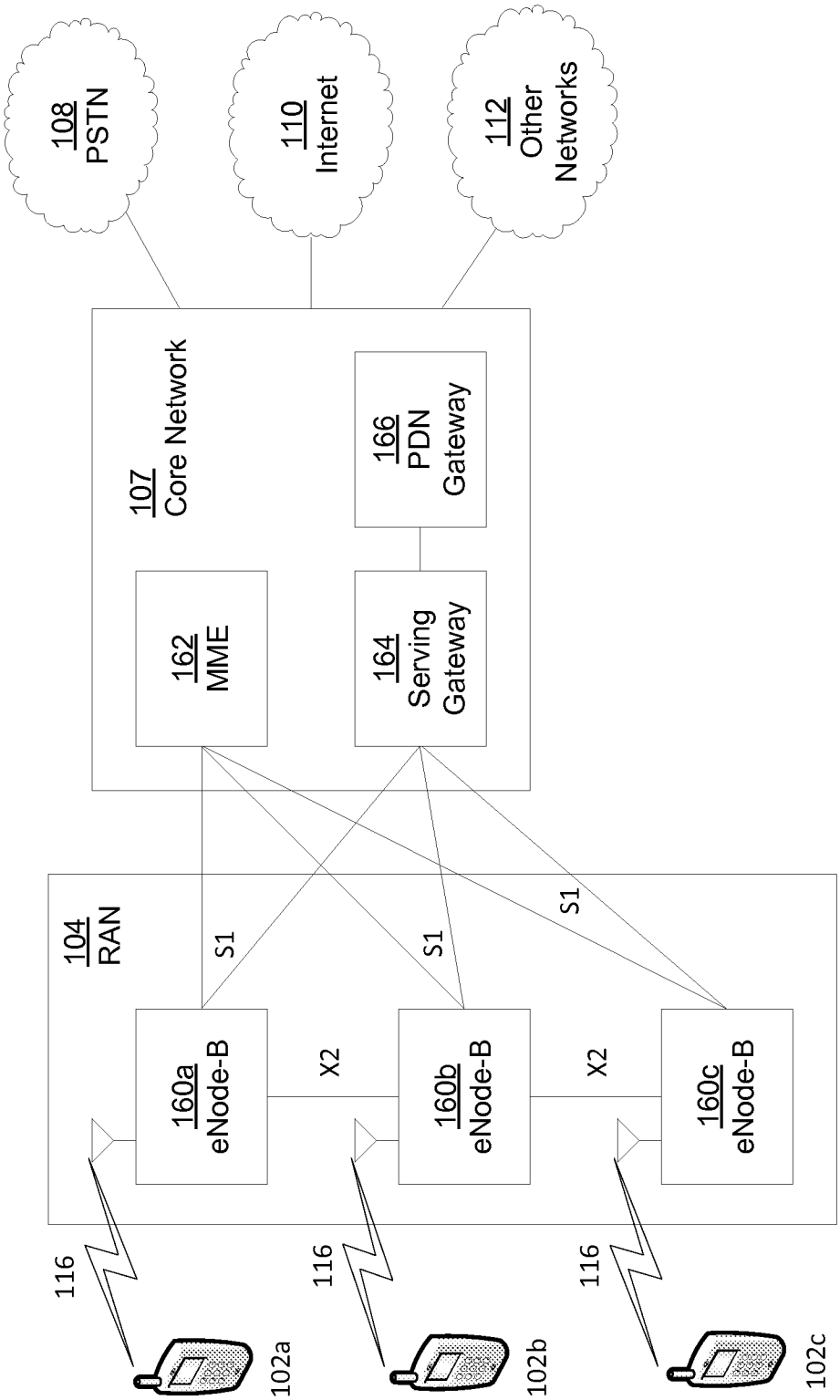
108 PSTN
110 Internet
112 Other Networks
107 Core Network
166 PDN Gateway
162 MME
164 Serving Gateway
104 RAN
S1
S1
S1
160a eNode-B
160b eNode-B
160c eNode-B
X2
X2
116
116
116
102a
102b
102c

FIG. 1D

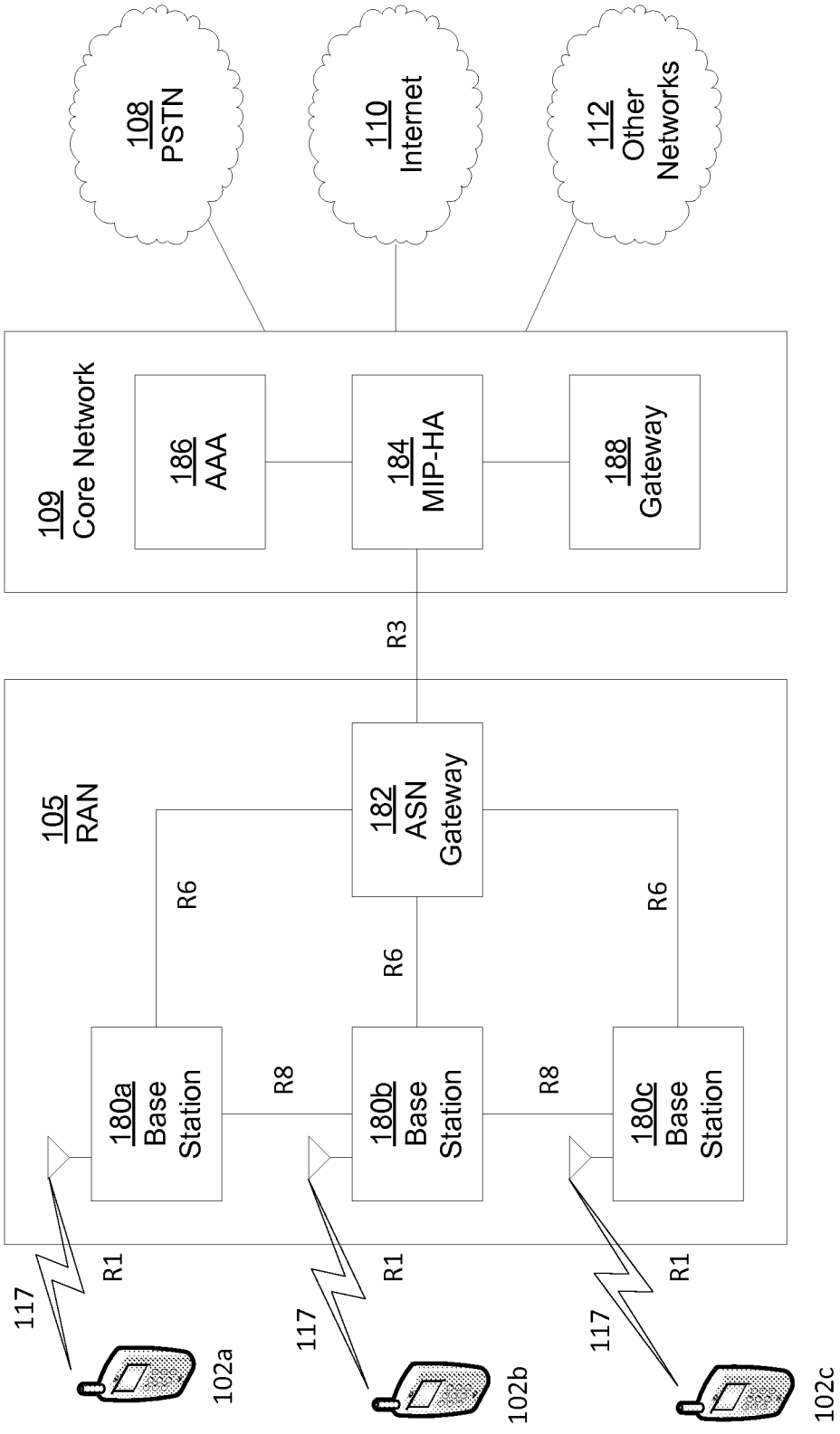
108 PSTN
110 Internet
112 Other Networks
109 Core Network
186 AAA
184 MIP-HA
188 Gateway
R3
105 RAN
182 ASN Gateway
R6
R6
R6
180a Base Station
180b Base Station
180c Base Station
R8
R8
R1
R1
R1
117
117
117
102a
102b
102c

FIG. 1E

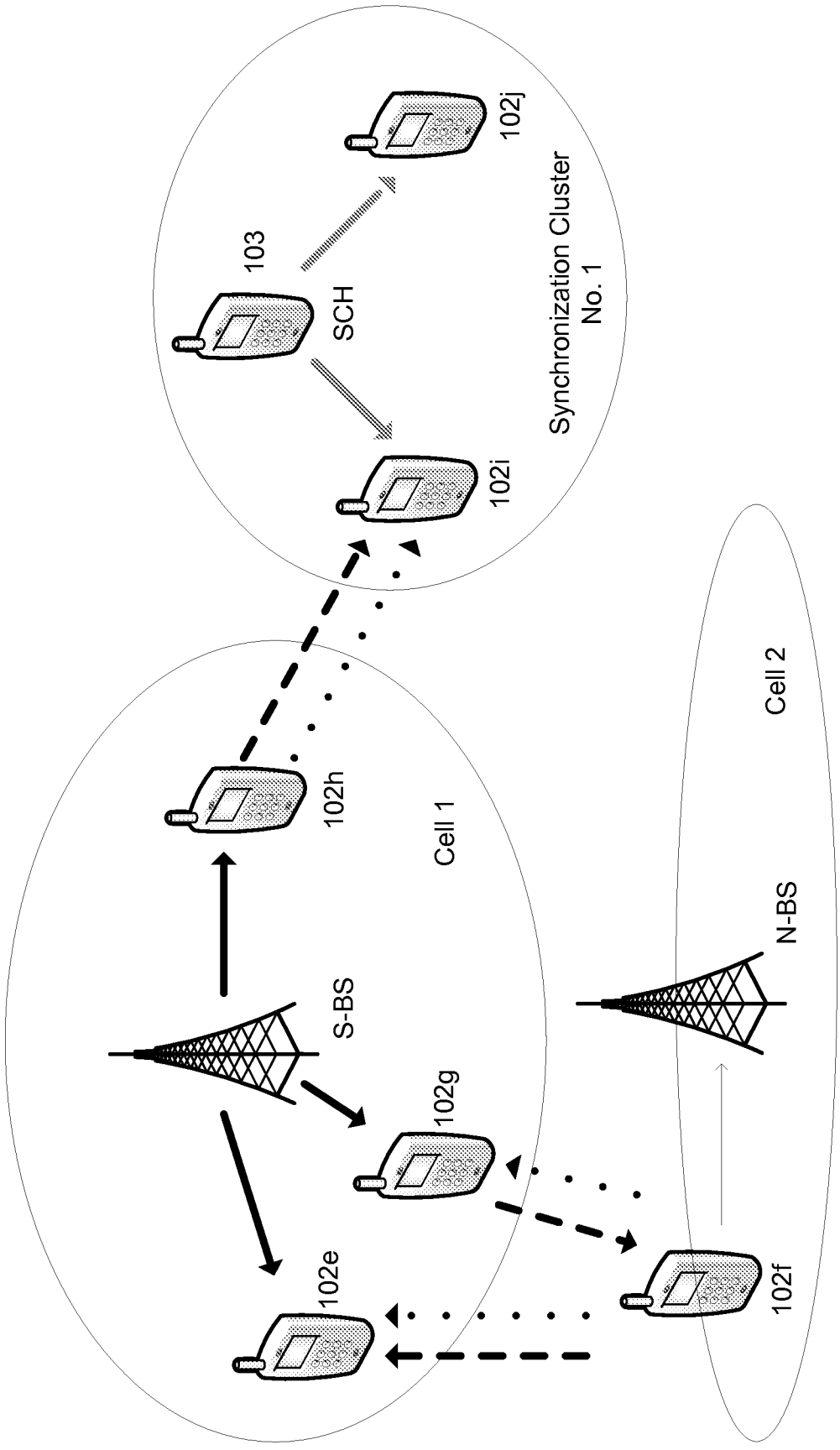
Synchronization Cluster
No. 1
103
SCH
102j
102i
102h
Cell 1
S-BS
102g
102e
Cell 2
N-BS
102f

FIG. 1F

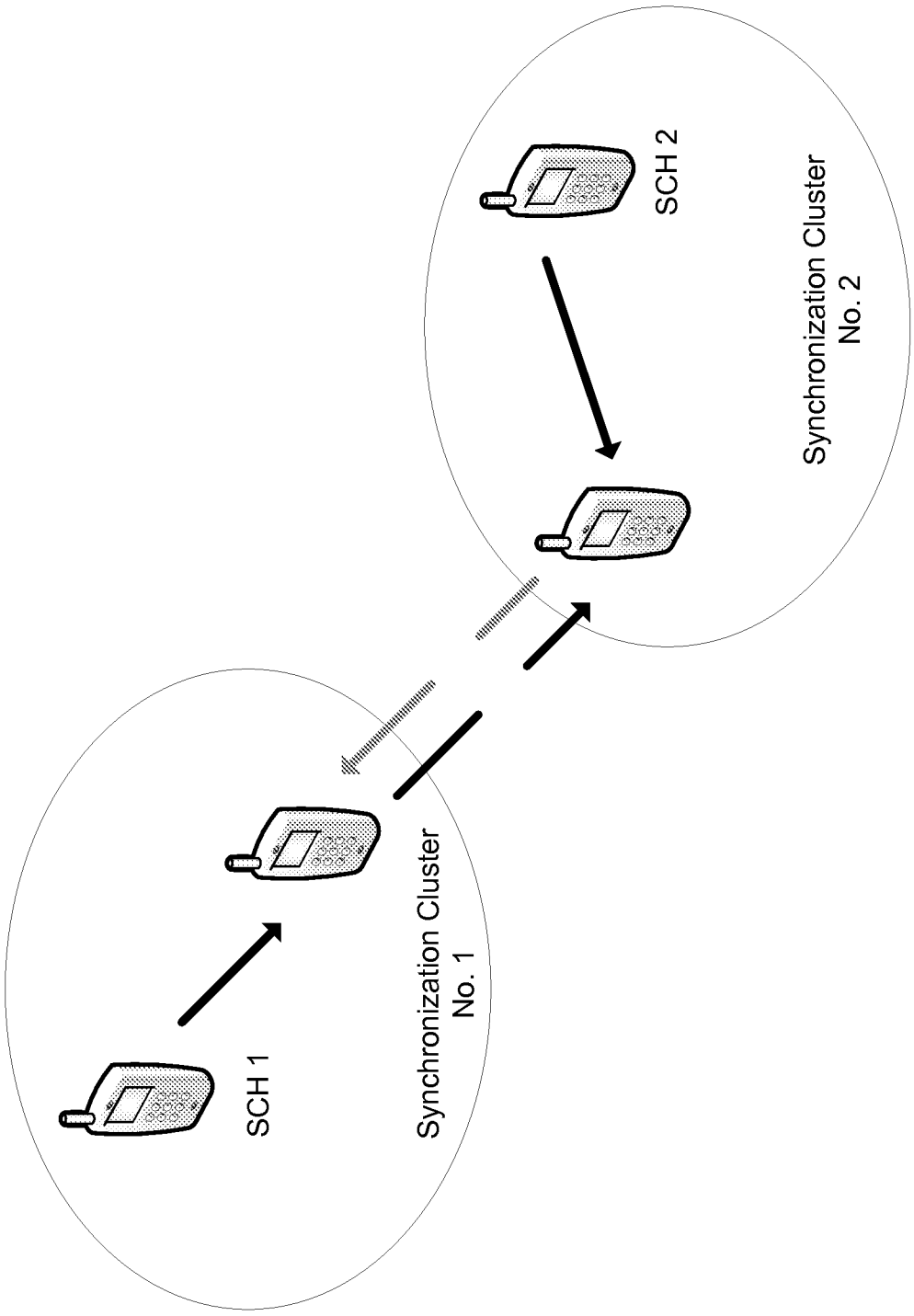
SCH 1
Synchronization Cluster No. 1
SCH 2
Synchronization Cluster No. 2

FIG. 1G

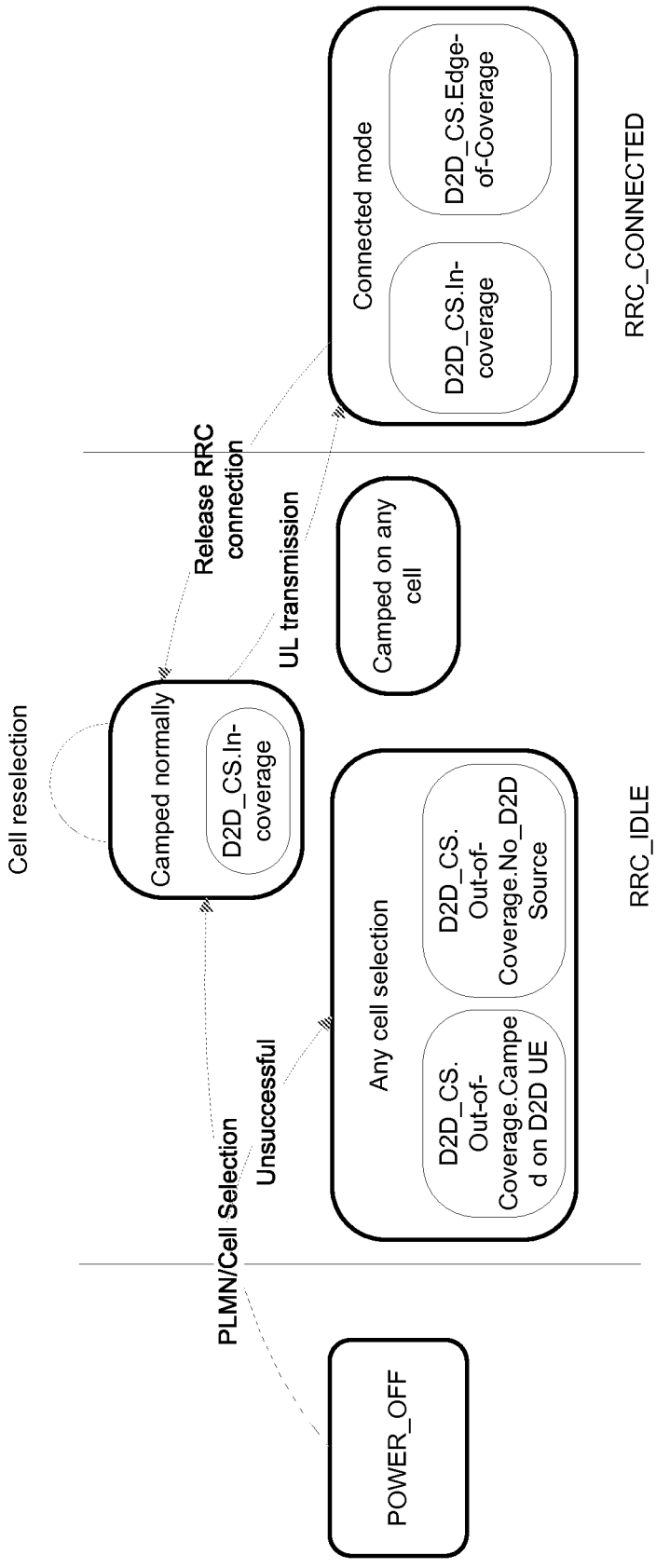
RRC_CONNECTED
RRC_IDLE
Connected mode
D2D_CS.In-coverage
D2D_CS.Edge-of-Coverage
Release RRC connection
UL transmission
Camped on any cell
Camped normally
D2D_CS.In-coverage
Cell reselection
Any cell selection
D2D_CS. Out-of-Coverage.Camped on D2D UE
D2D_CS. Out-of-Coverage.No_D2D Source
Unsuccessful
PLMN/Cell Selection
POWER_OFF

FIG. 2

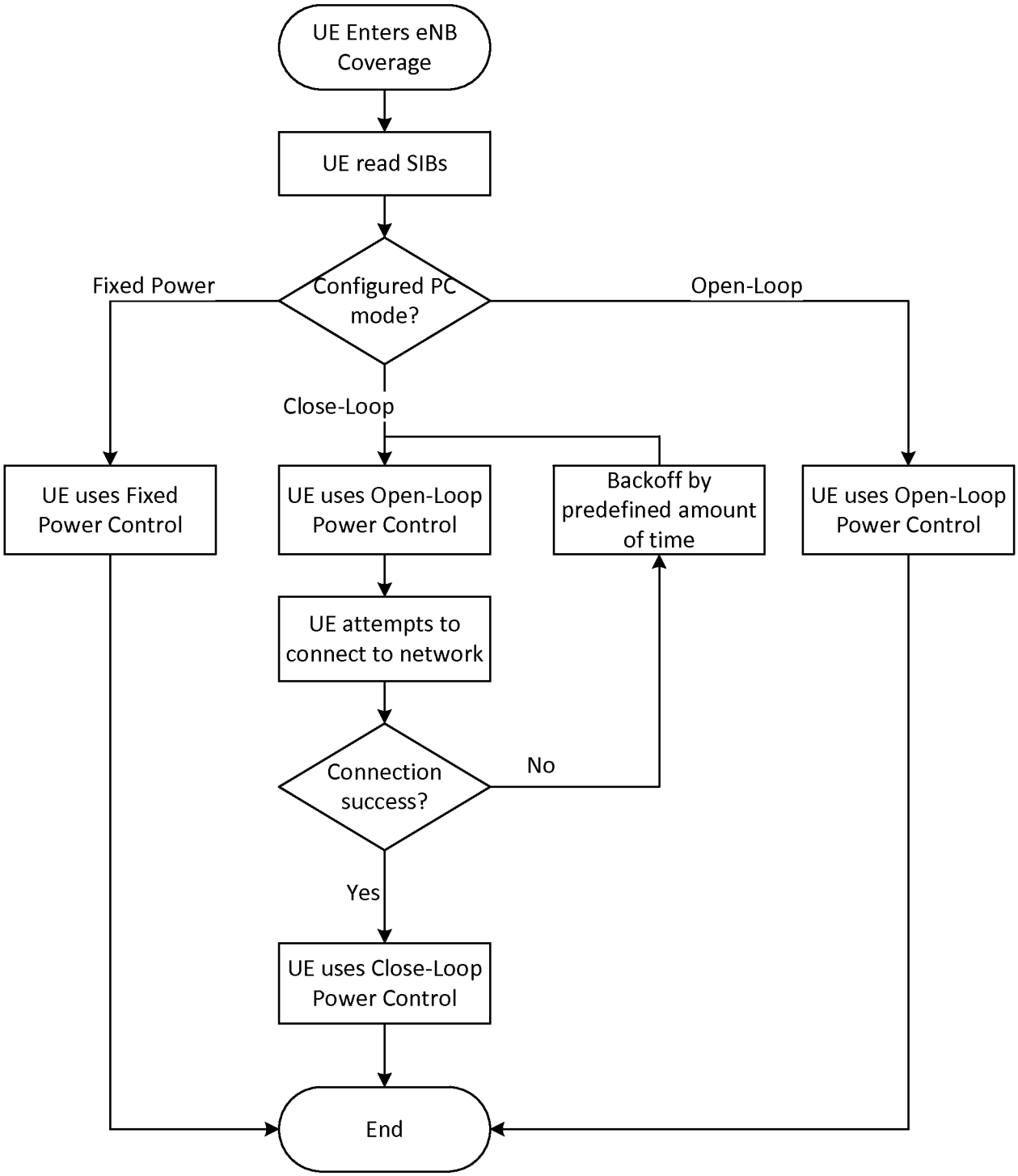
UE Enters eNB Coverage
UE read SIBs
Configured PC mode?
Fixed Power
Open-Loop
Close-Loop
UE uses Fixed Power Control
UE uses Open-Loop Power Control
Backoff by predefined amount of time
UE uses Open-Loop Power Control
UE attempts to connect to network
Connection success?
No
Yes
UE uses Close-Loop Power Control
End

FIG. 3

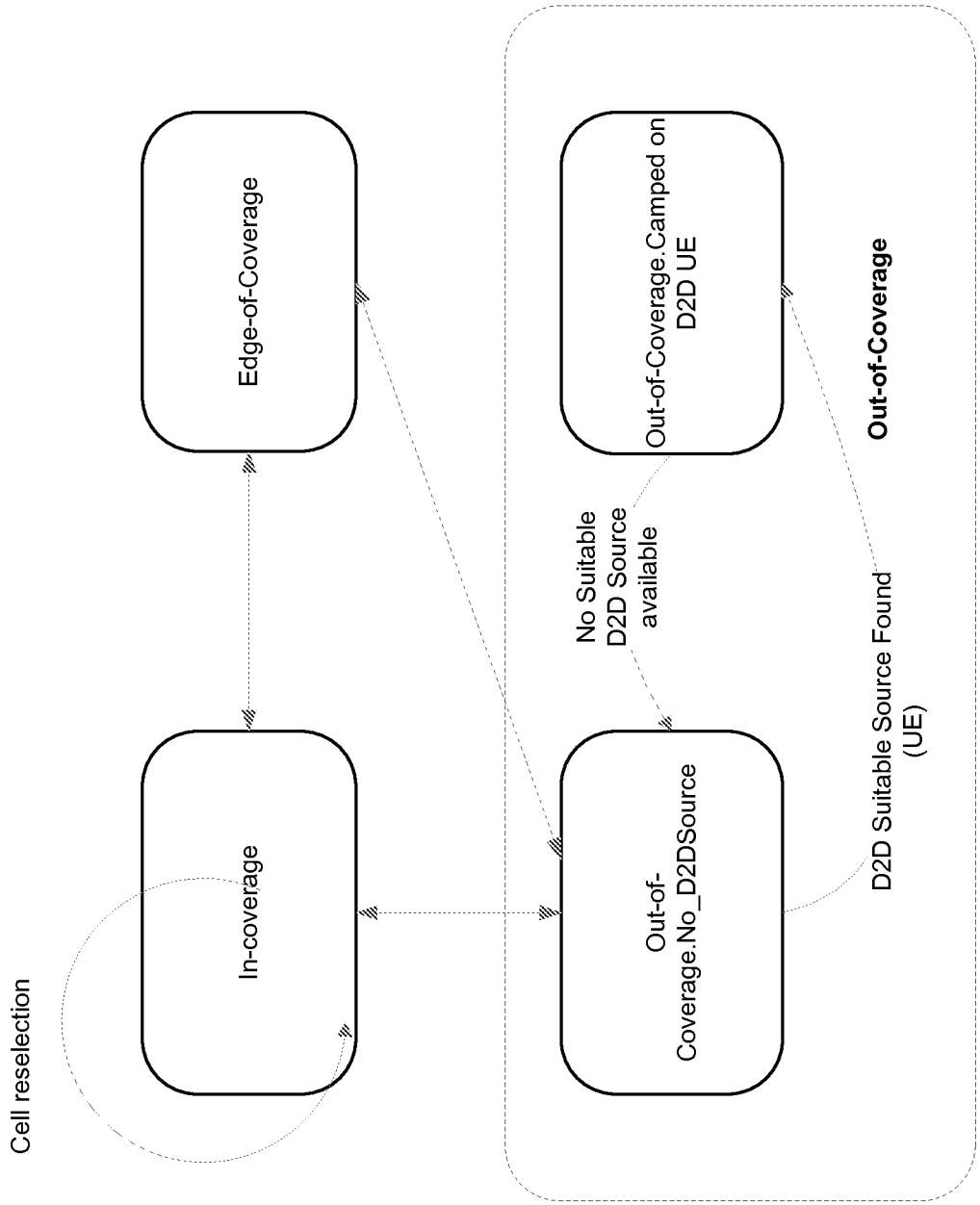
Edge-of-Coverage
In-coverage
Cell reselection
Out-of-Coverage.Camped on D2D UE
Out-of-Coverage.No_D2DSource
No Suitable D2D Source available
D2D Suitable Source Found (UE)
Out-of-Coverage

FIG. 4

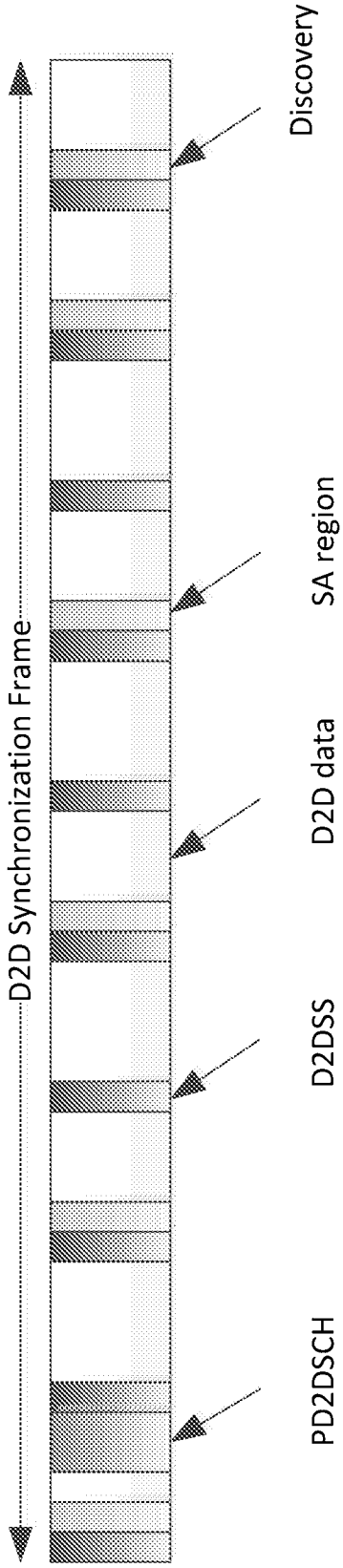
Discovery
SA region
D2D data
D2DSS
PD2DSCH
D2D Synchronization Frame

FIG. 5

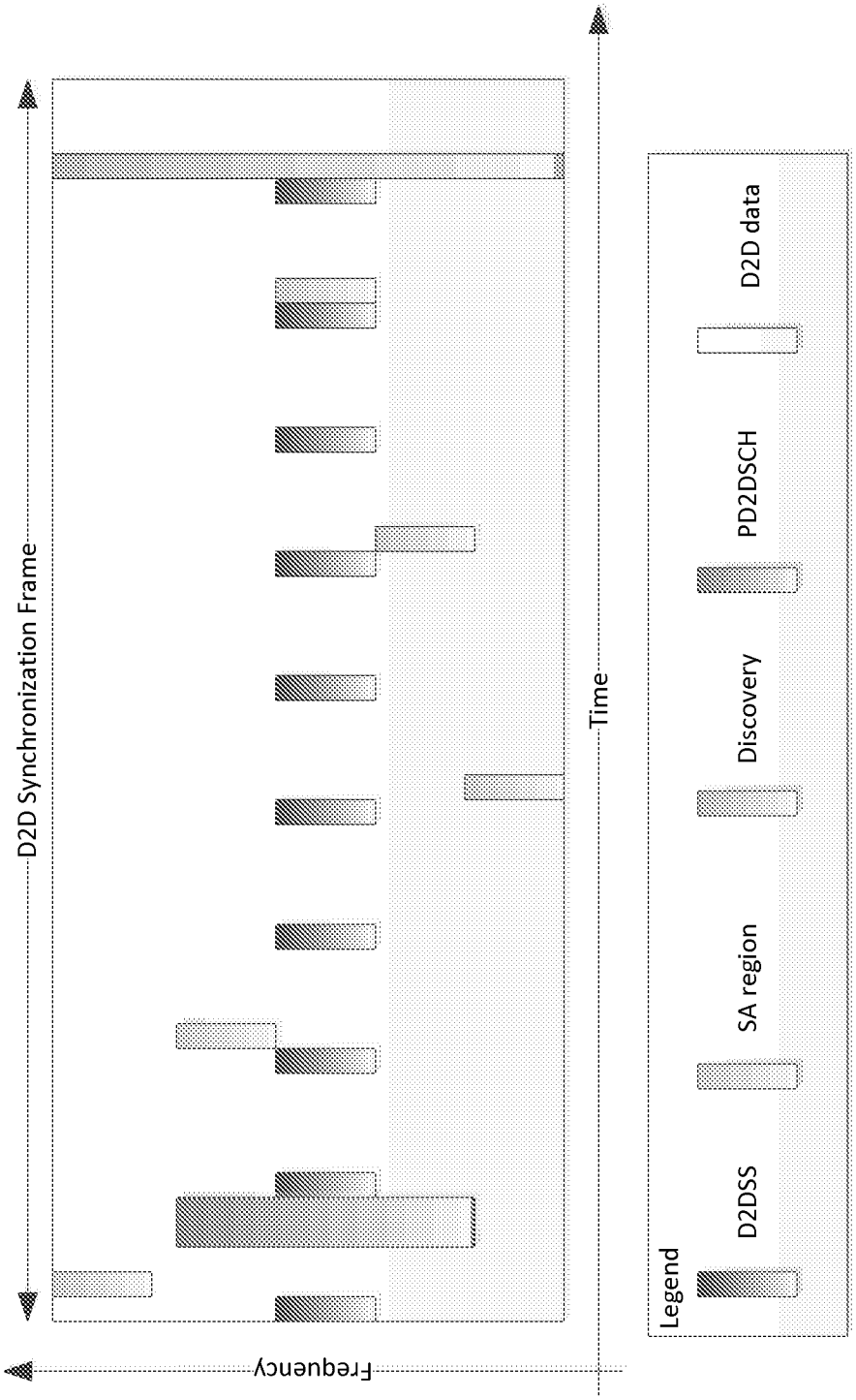
D2D Synchronization Frame
Time
Frequency
Legend
D2DSS
SA region
Discovery
PD2DSCH
D2D data

FIG. 6

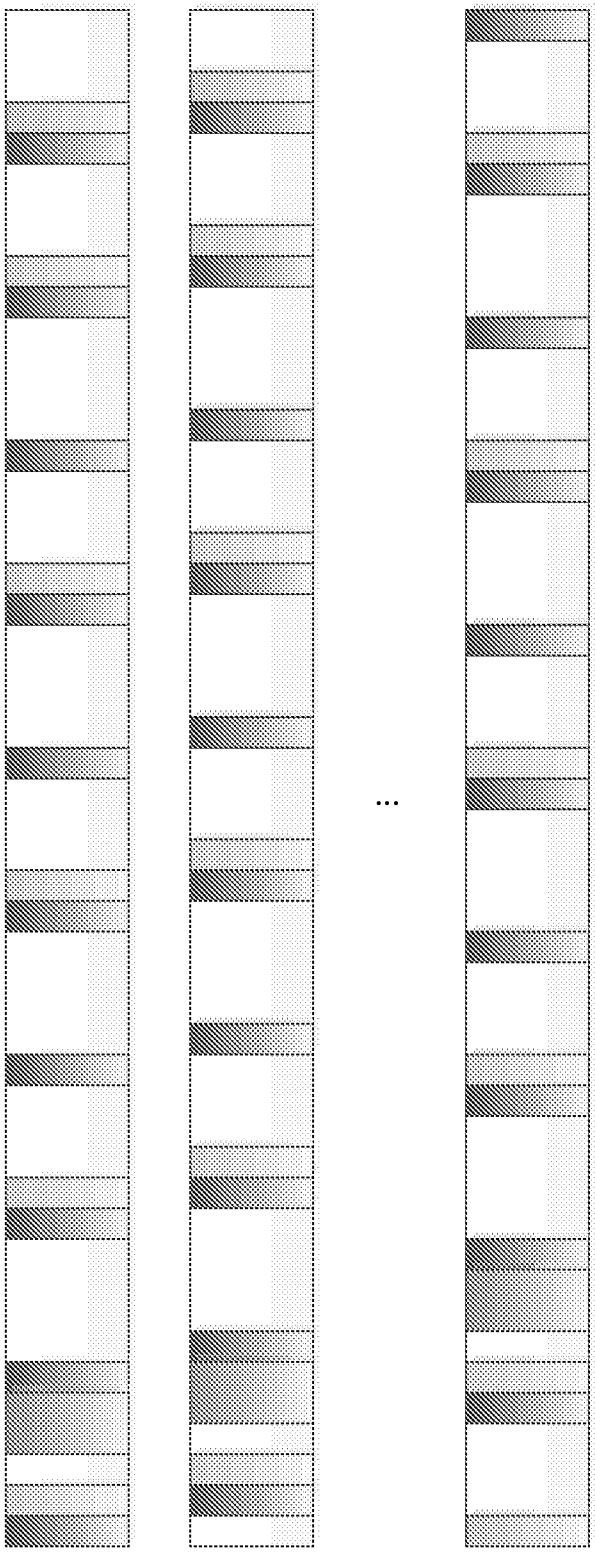

FIG. 7

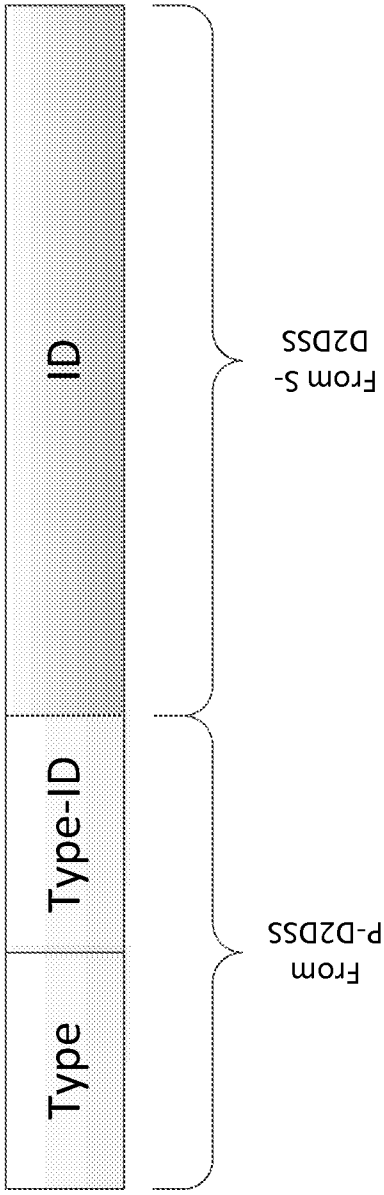

FIG. 8

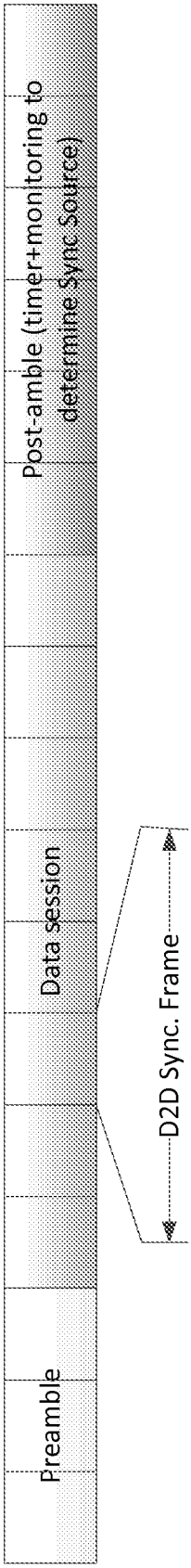
Post-amble (timer+monitoring to determine Sync Source)
Data session
Preamble
D2D Sync. Frame

FIG. 9

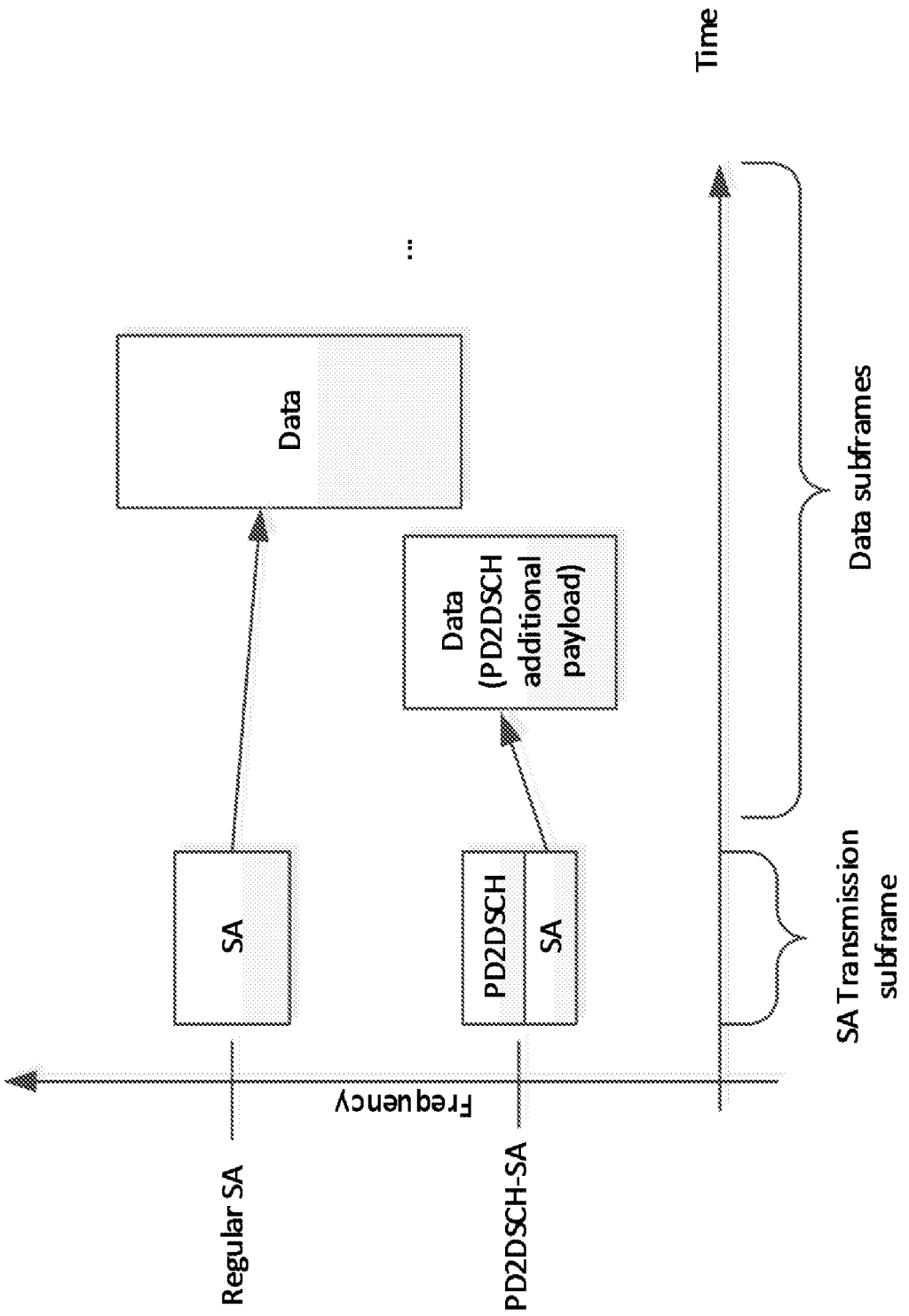
Time
Data subframes
SA Transmission subframe
Frequency
Regular SA
PD2DSCH-SA
SA
PD2DSCH
SA
Data (PD2DSCH additional payload)
Data

FIG. 10

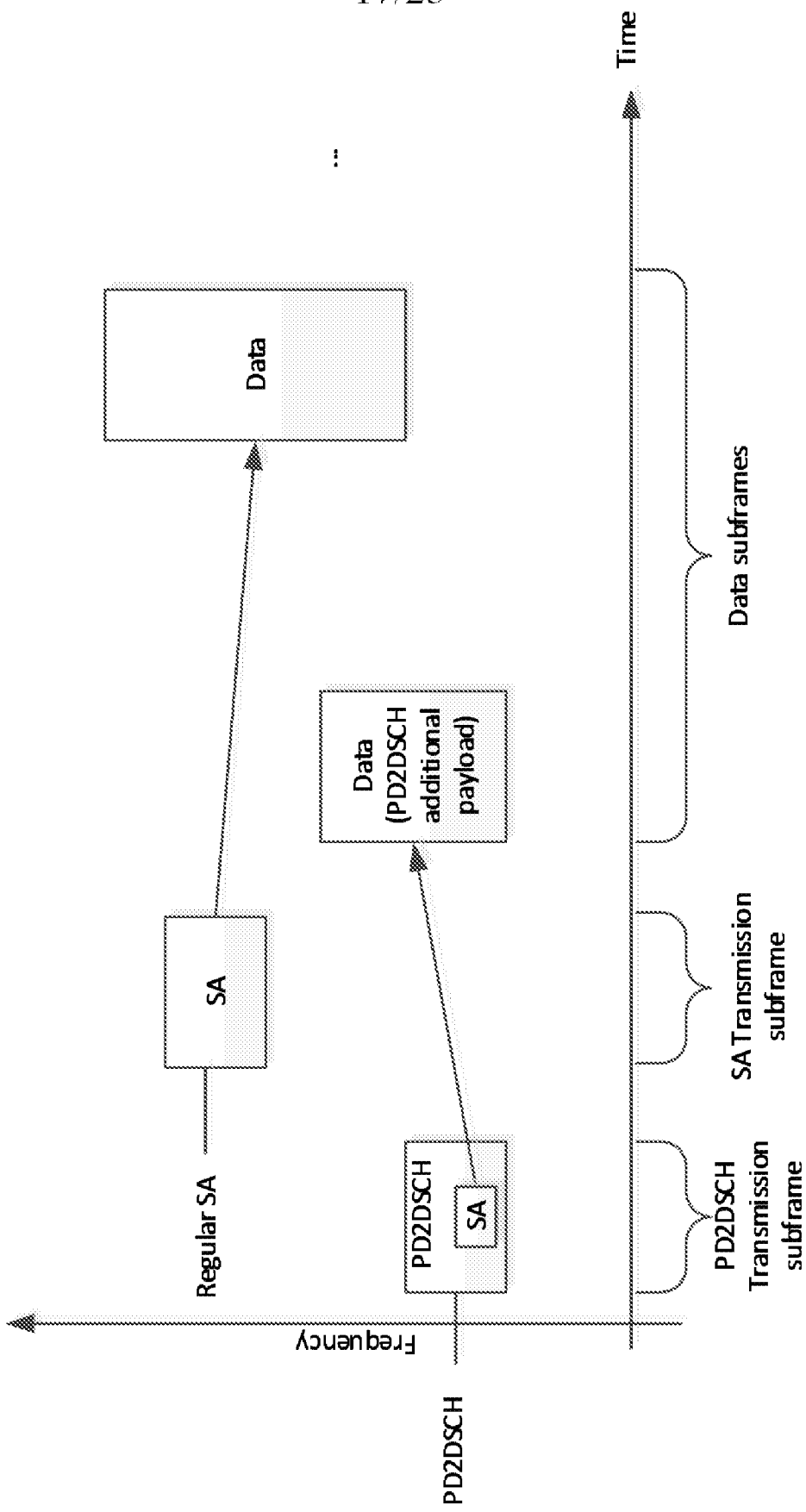
Time
Data
Data (PD2DSCH additional payload)
SA
Regular SA
PD2DSCH
SA
Frequency
PD2DSCH
Data subframes
SA Transmission subframe
PD2DSCH Transmission subframe

FIG. 11

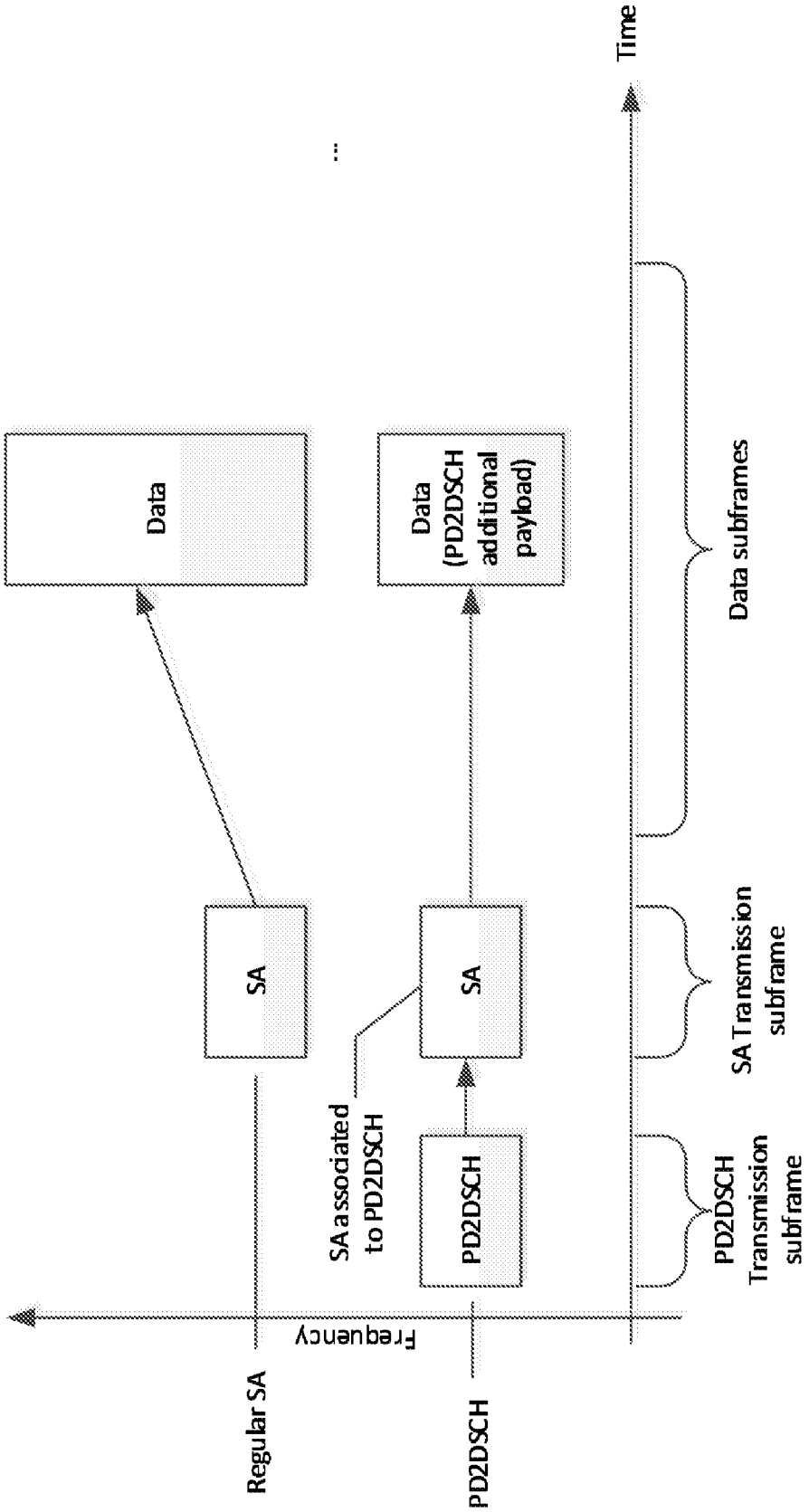
Time
Data
Data (PD2DSCH additional payload)
Data subframes
SA
SA
SA Transmission subframe
SA associated to PD2DSCH
PD2DSCH
PD2DSCH Transmission subframe
Frequency
Regular SA
PD2DSCH

FIG. 12

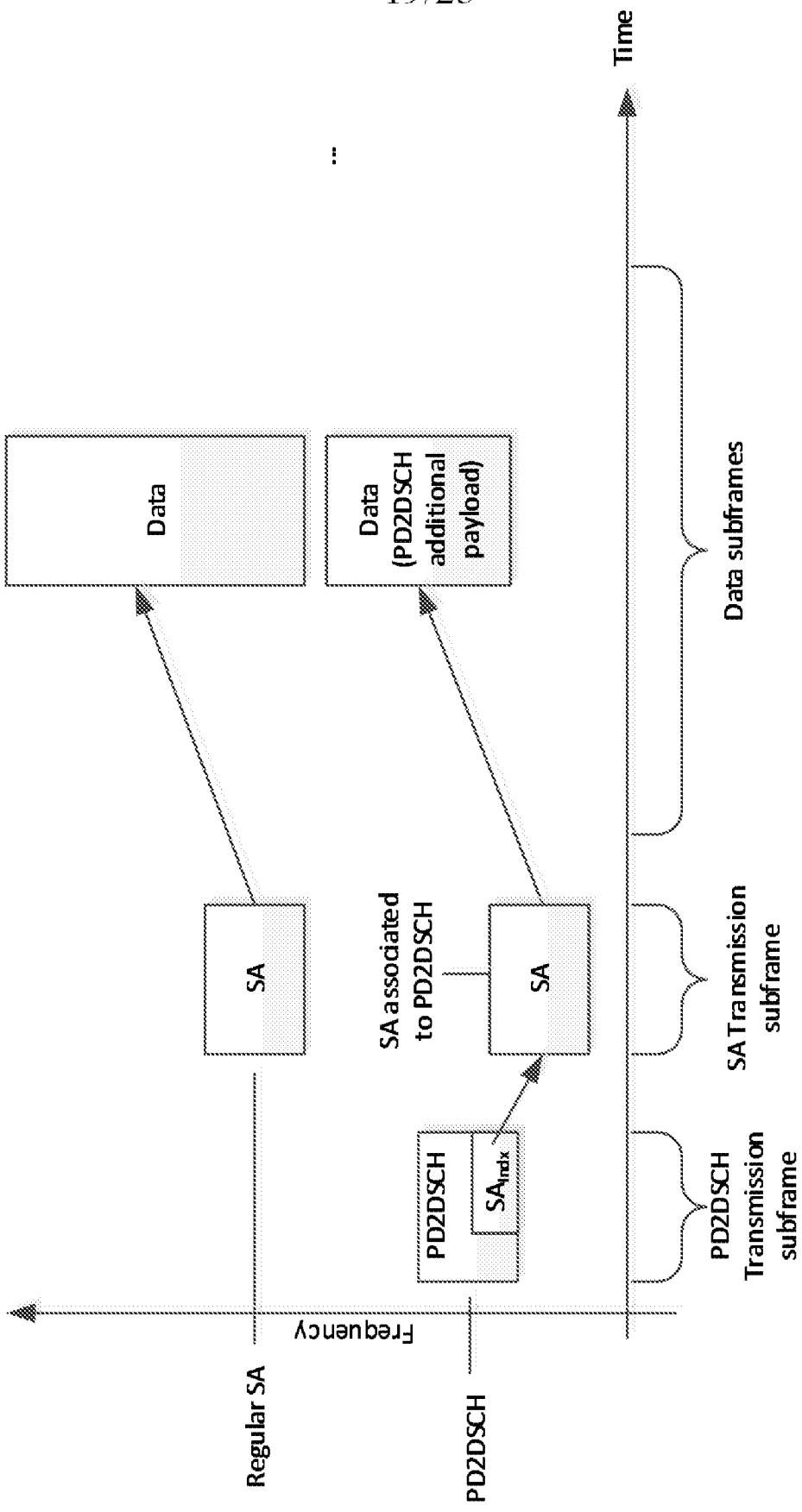
Time
Data
Data (PD2DSCH additional payload)
Data subframes
SA
SA associated to PD2DSCH
SA
SA Transmission subframe
PD2DSCH
SA$_{Indx}$
PD2DSCH Transmission subframe
Frequency
Regular SA
PD2DSCH

FIG. 13

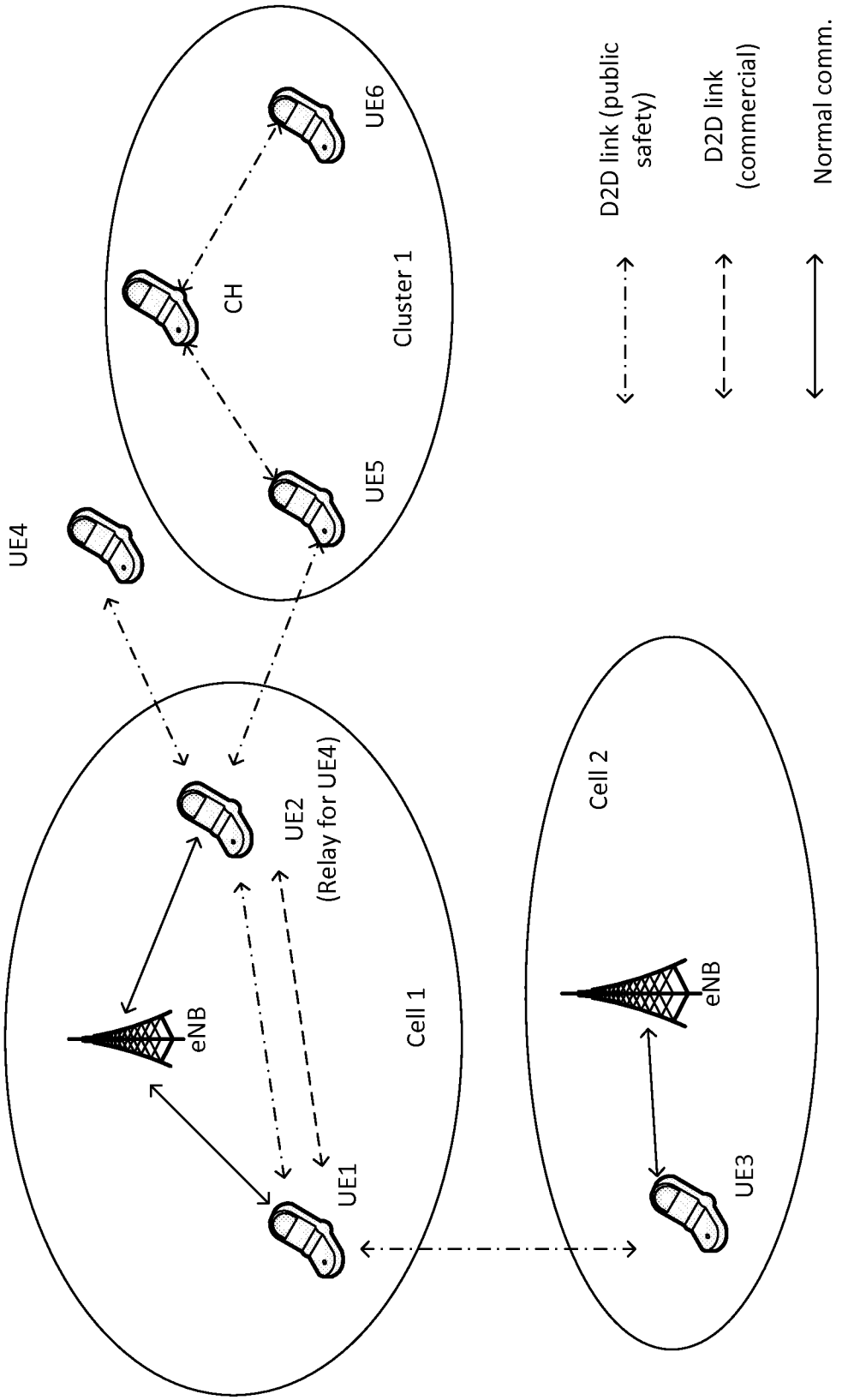
UE6
CH
Cluster 1
UE5
UE4
D2D link (public safety)
D2D link (commercial)
Normal comm.
UE2
(Relay for UE4)
eNB
Cell 1
UE1
Cell 2
eNB
UE3

FIG. 14

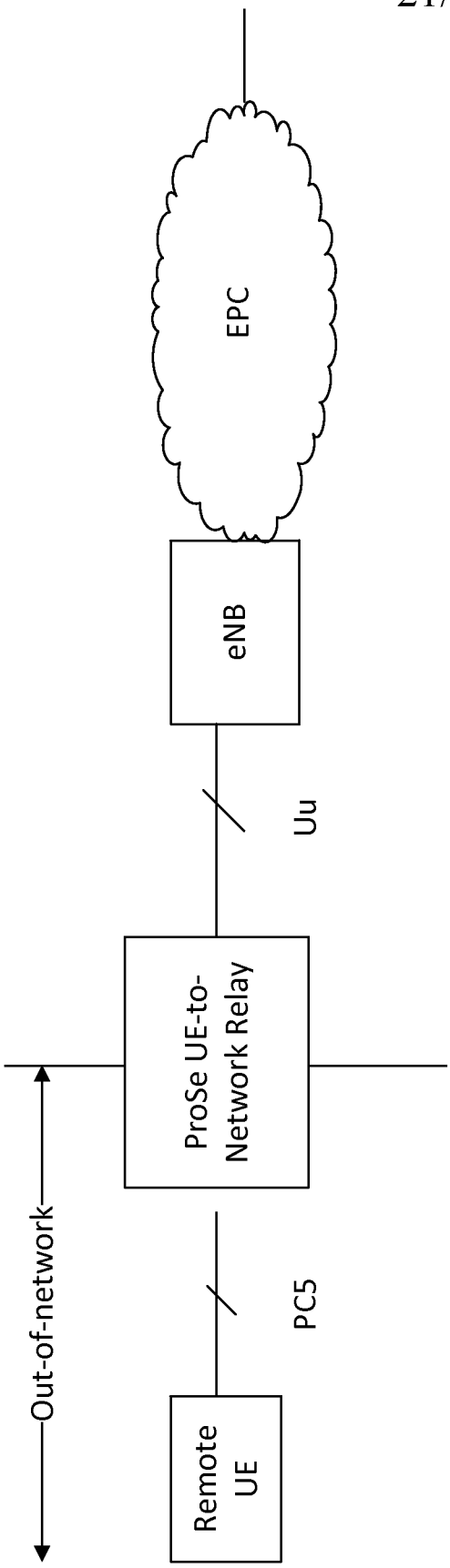
EPC
eNB
Uu
ProSe UE-to-Network Relay
PC5
Remote UE
Out-of-network

FIG. 15

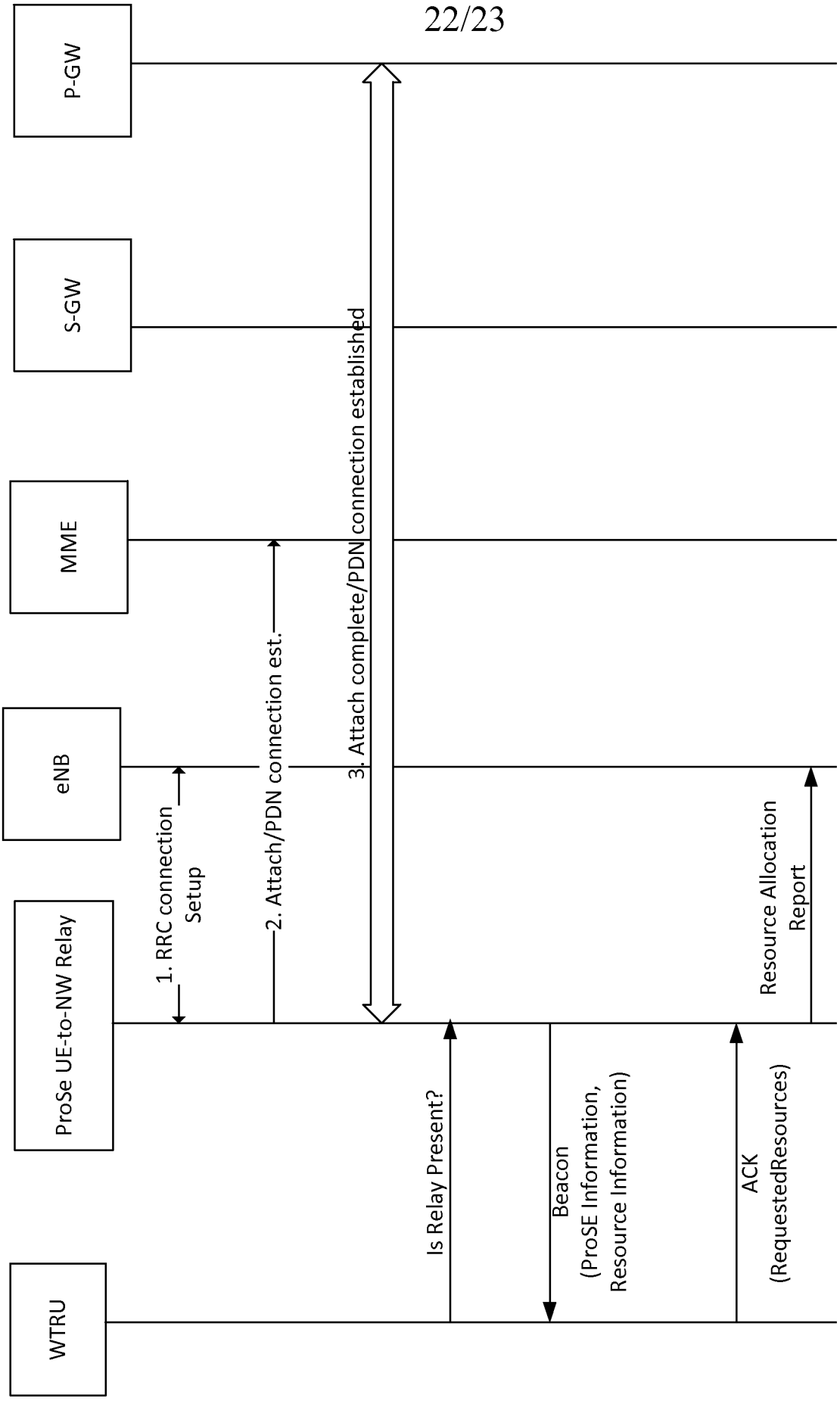
P-GW
S-GW
MME
eNB
ProSe UE-to-NW Relay
WTRU
1. RRC connection Setup
2. Attach/PDN connection est.
3. Attach complete/PDN connection established
Is Relay Present?
Beacon (ProSE Information, Resource Information)
ACK (RequestedResources)
Resource Allocation Report

FIG. 16

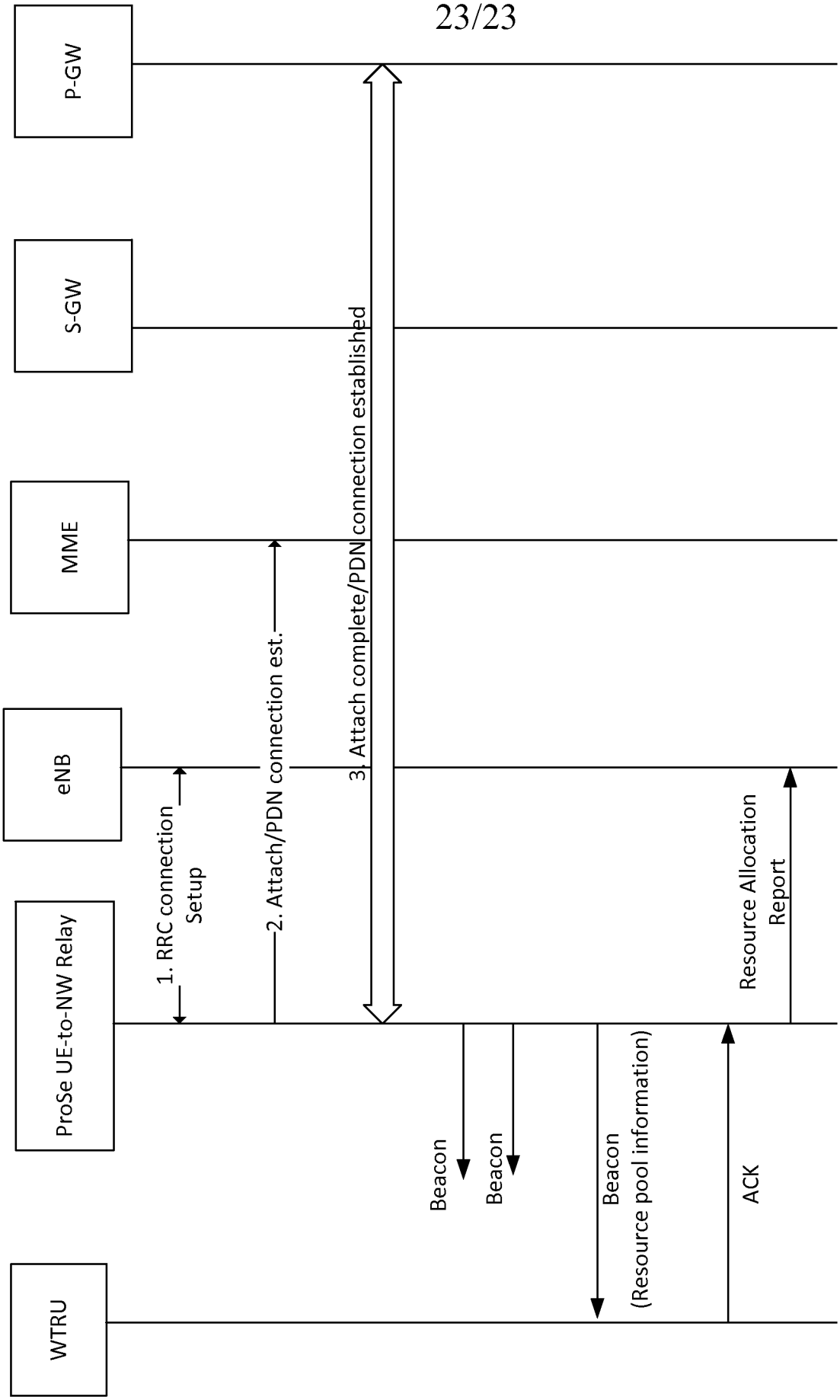
P-GW
S-GW
MME
eNB
ProSe UE-to-NW Relay
WTRU
1. RRC connection Setup
2. Attach/PDN connection est.
3. Attach complete/PDN connection established
Beacon
Beacon
Beacon (Resource pool information)
ACK
Resource Allocation Report

FIG. 17