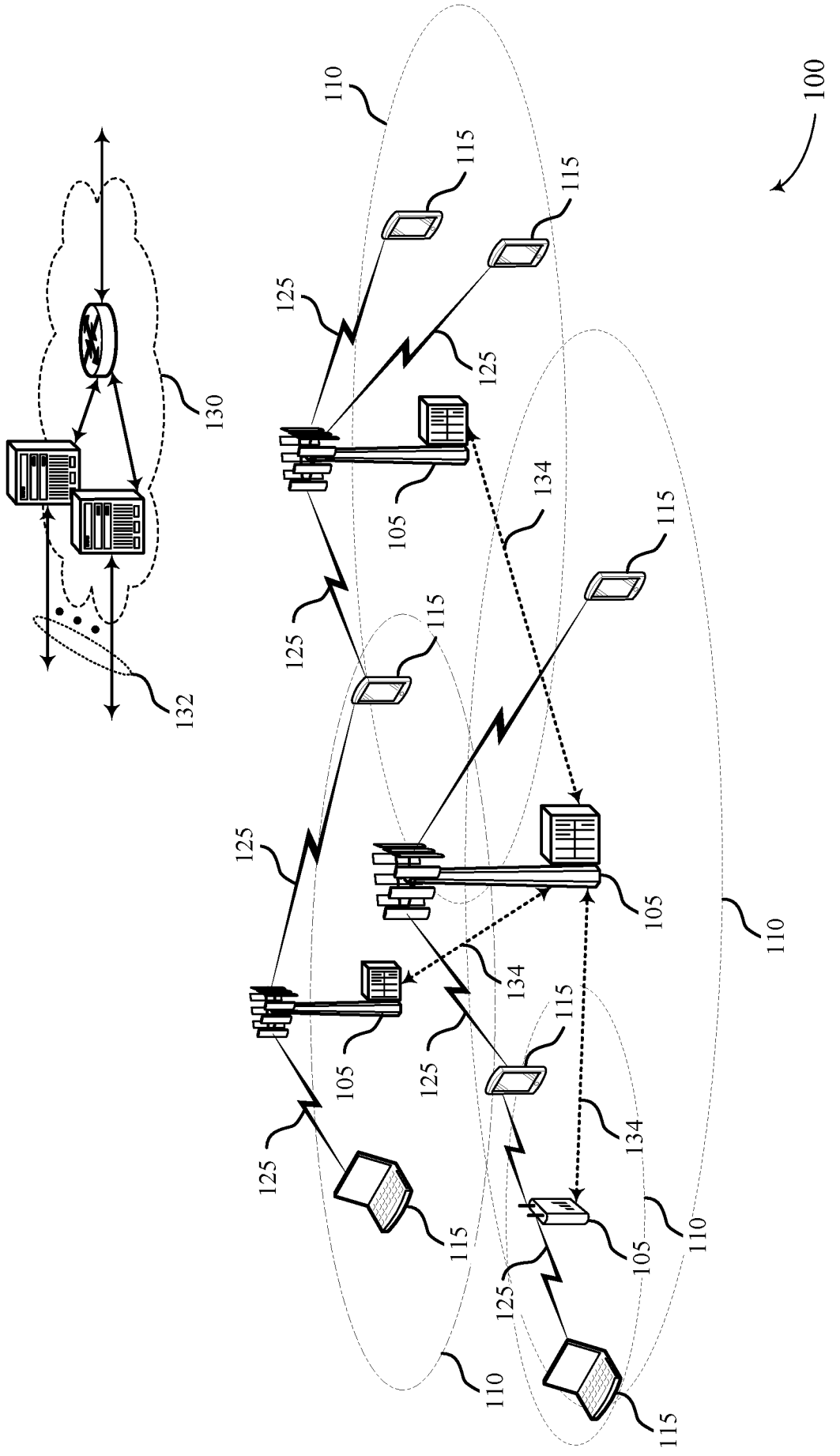


FIG. 1

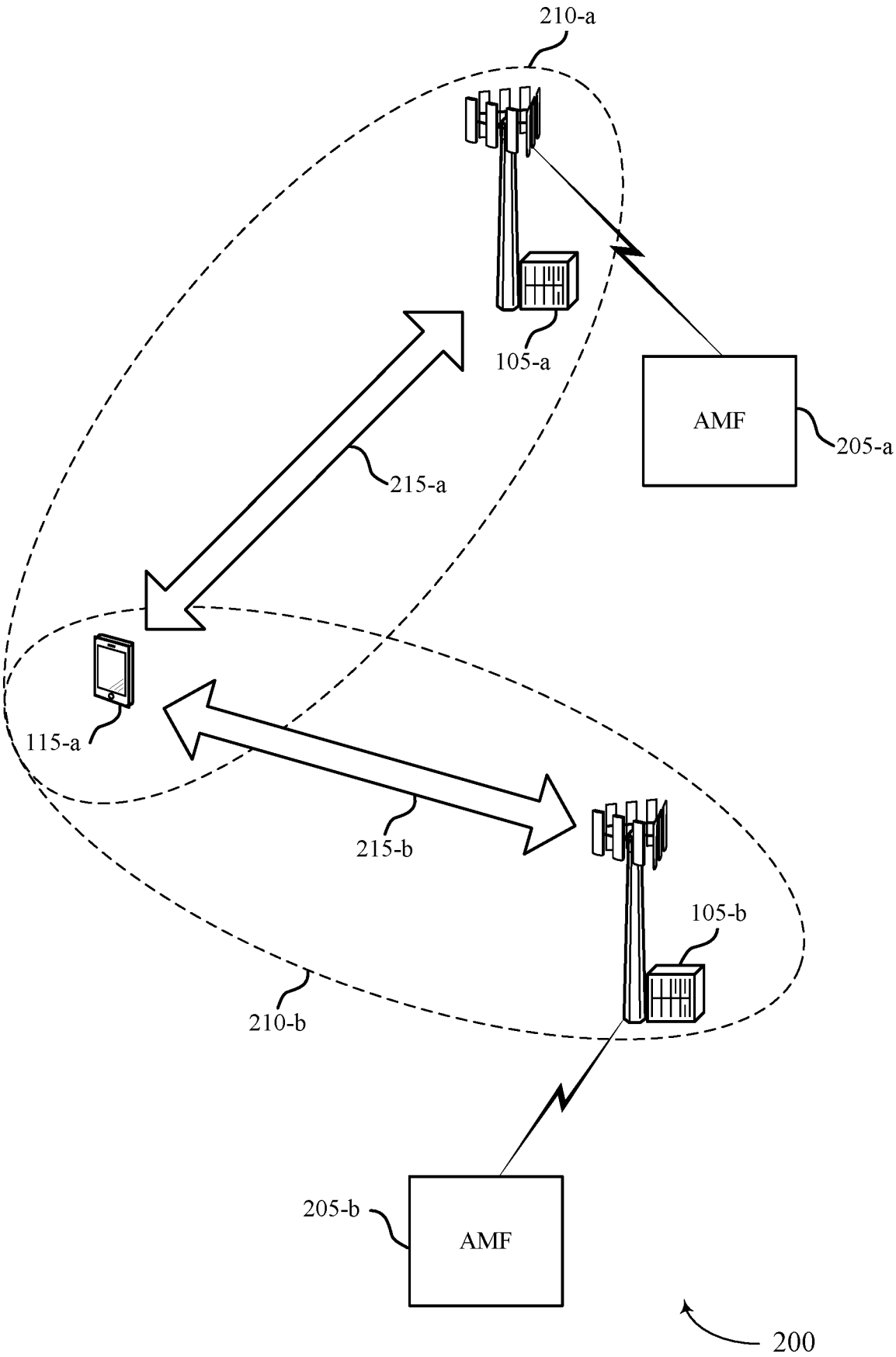


FIG. 2

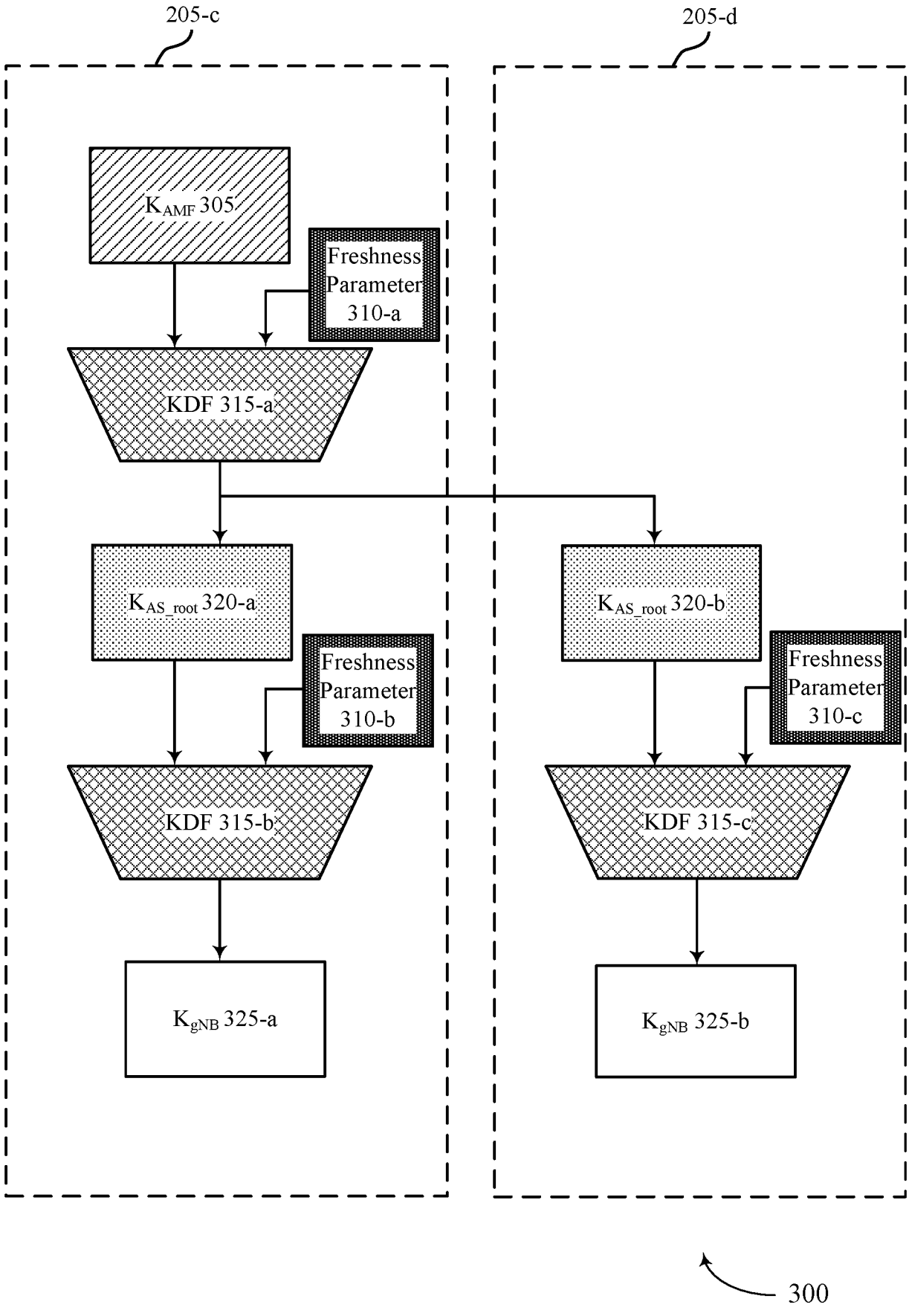

205-c
205-d
K_{AMF} 305
Freshness Parameter 310-a
KDF 315-a
K_{AS_root} 320-a
K_{AS_root} 320-b
Freshness Parameter 310-b
Freshness Parameter 310-c
KDF 315-b
KDF 315-c
K_{gNB} 325-a
K_{gNB} 325-b
300

FIG. 3

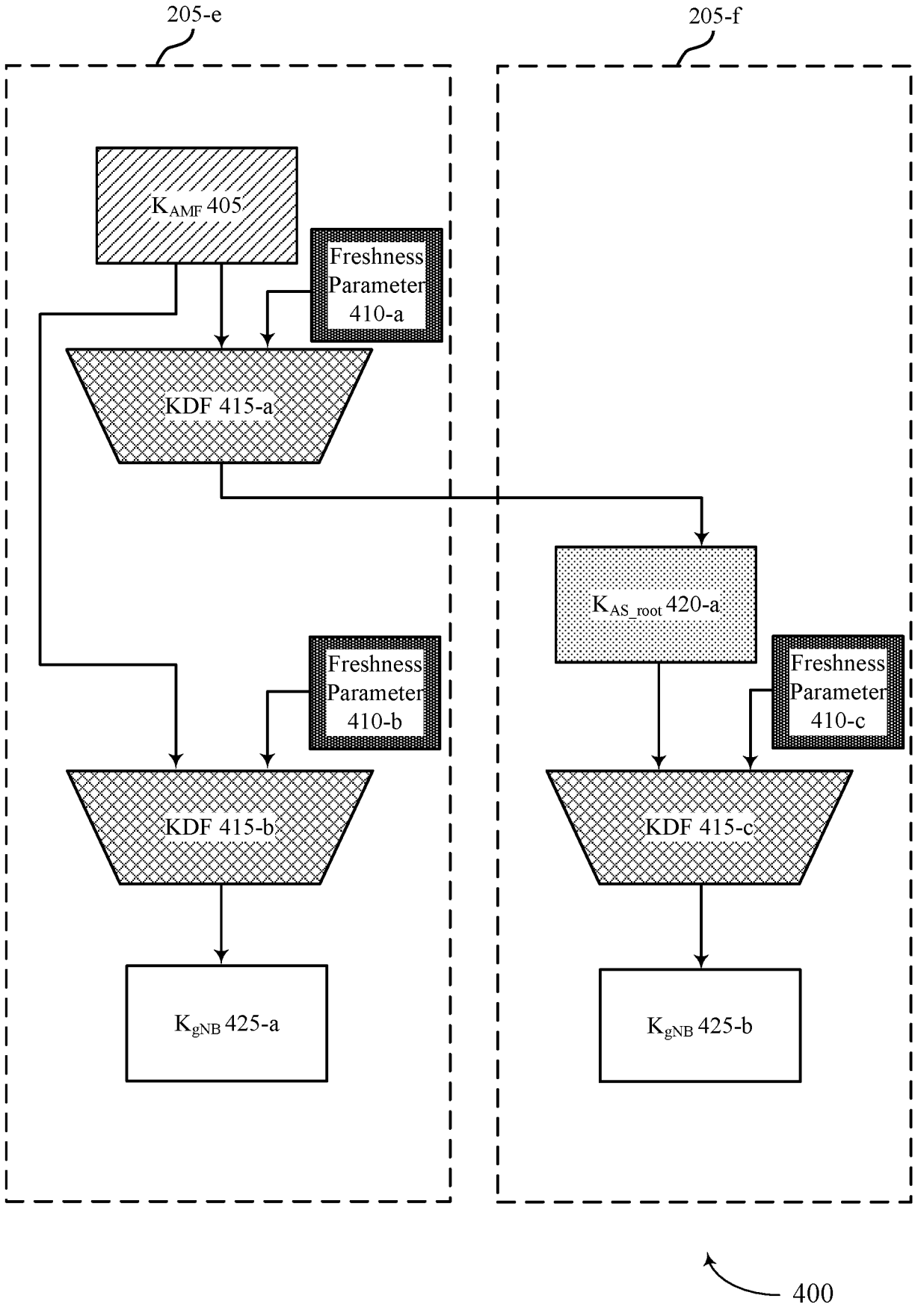

205-e
205-f
K_{AMF} 405
Freshness Parameter 410-a
KDF 415-a
K_{AS_root} 420-a
Freshness Parameter 410-b
Freshness Parameter 410-c
KDF 415-b
KDF 415-c
K_{gNB} 425-a
K_{gNB} 425-b
400

FIG. 4

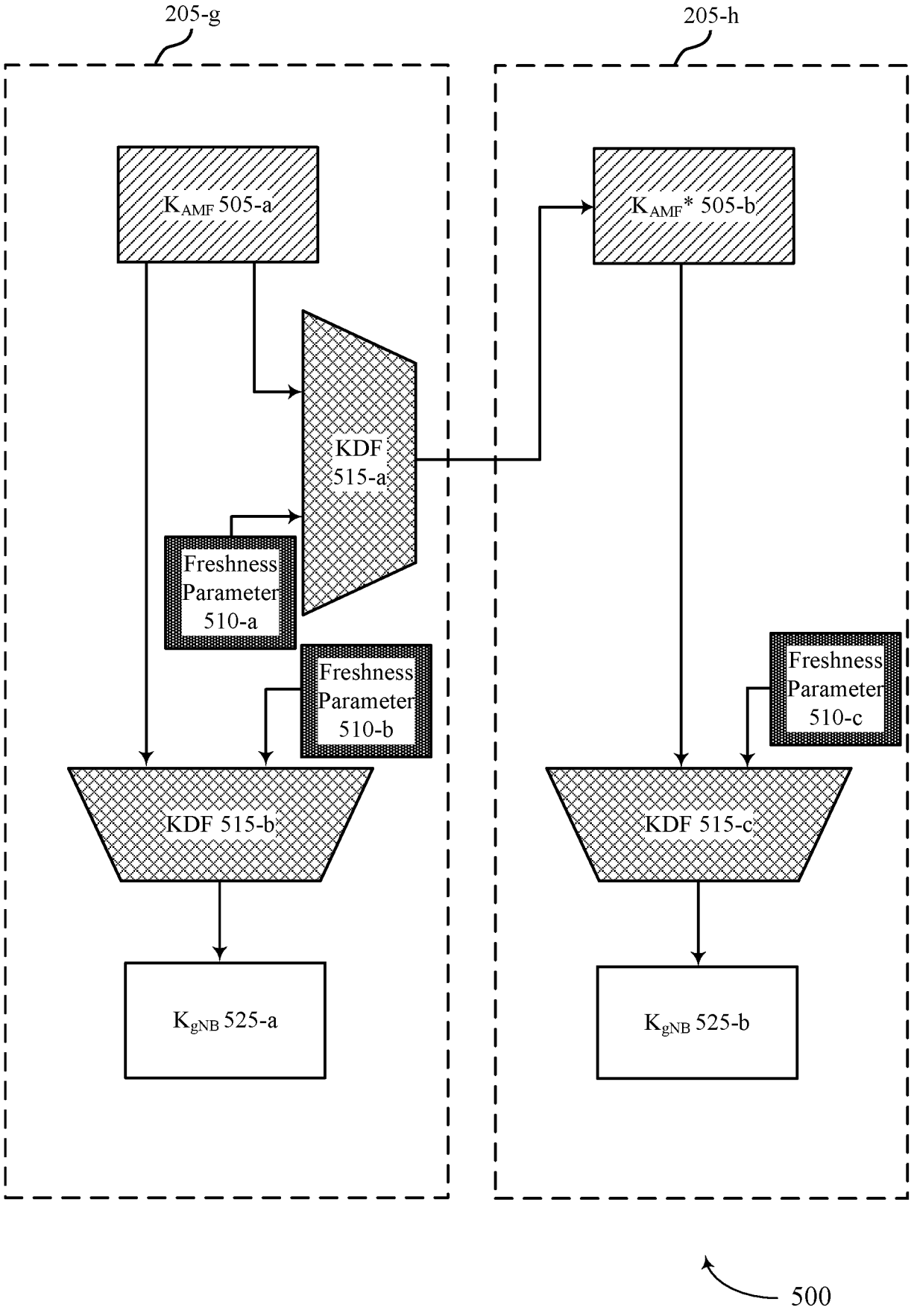

205-g
205-h
K_{AMF} 505-a
K_{AMF}* 505-b
KDF 515-a
Freshness Parameter 510-a
Freshness Parameter 510-b
Freshness Parameter 510-c
KDF 515-b
KDF 515-c
K_{gNB} 525-a
K_{gNB} 525-b
500

FIG. 5

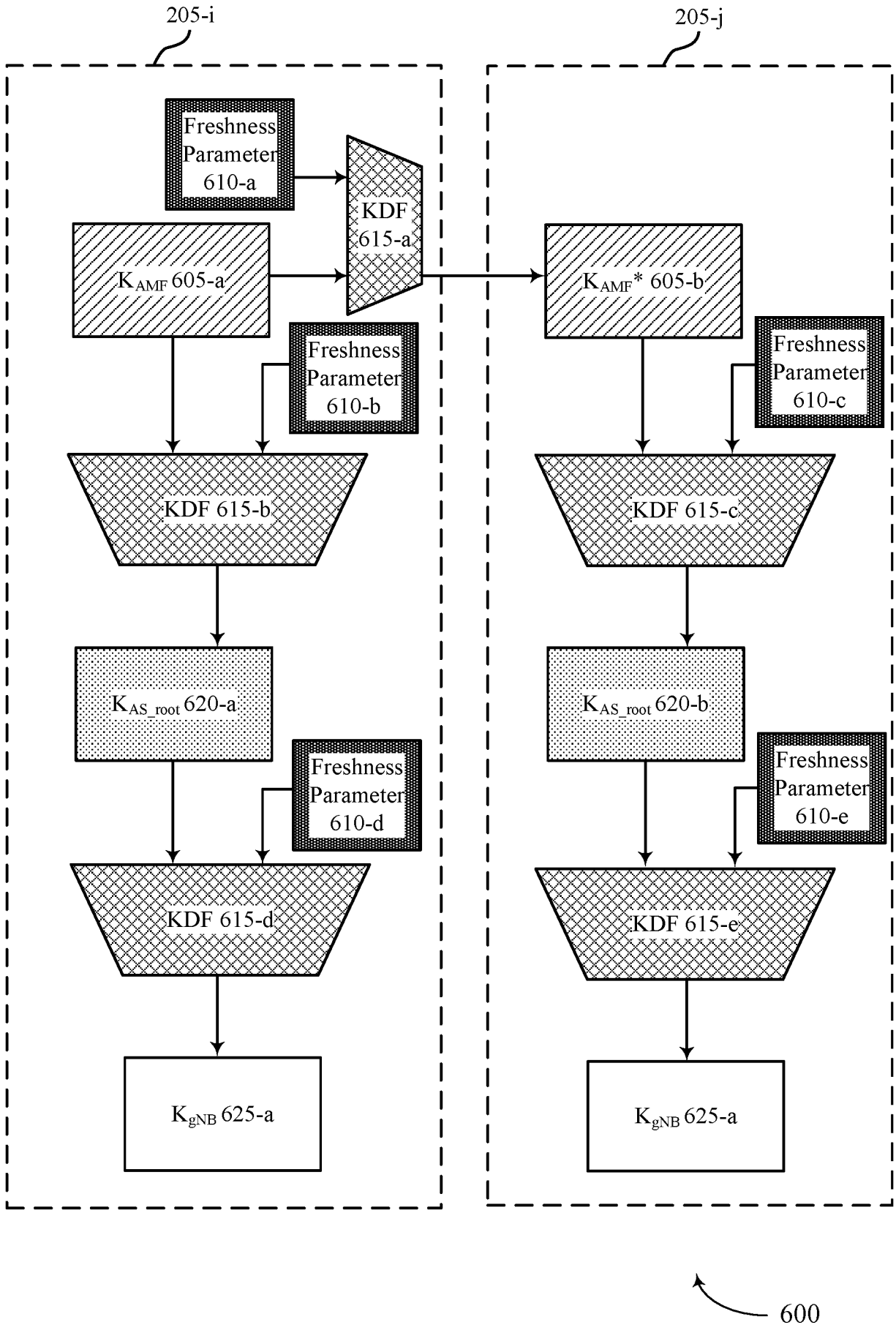

205-i
205-j
Freshness Parameter 610-a
KDF 615-a
K_{AMF} 605-a
K_{AMF}* 605-b
Freshness Parameter 610-b
Freshness Parameter 610-c
KDF 615-b
KDF 615-c
K_{AS_root} 620-a
K_{AS_root} 620-b
Freshness Parameter 610-d
Freshness Parameter 610-e
KDF 615-d
KDF 615-e
K_{gNB} 625-a
K_{gNB} 625-a
600

FIG. 6

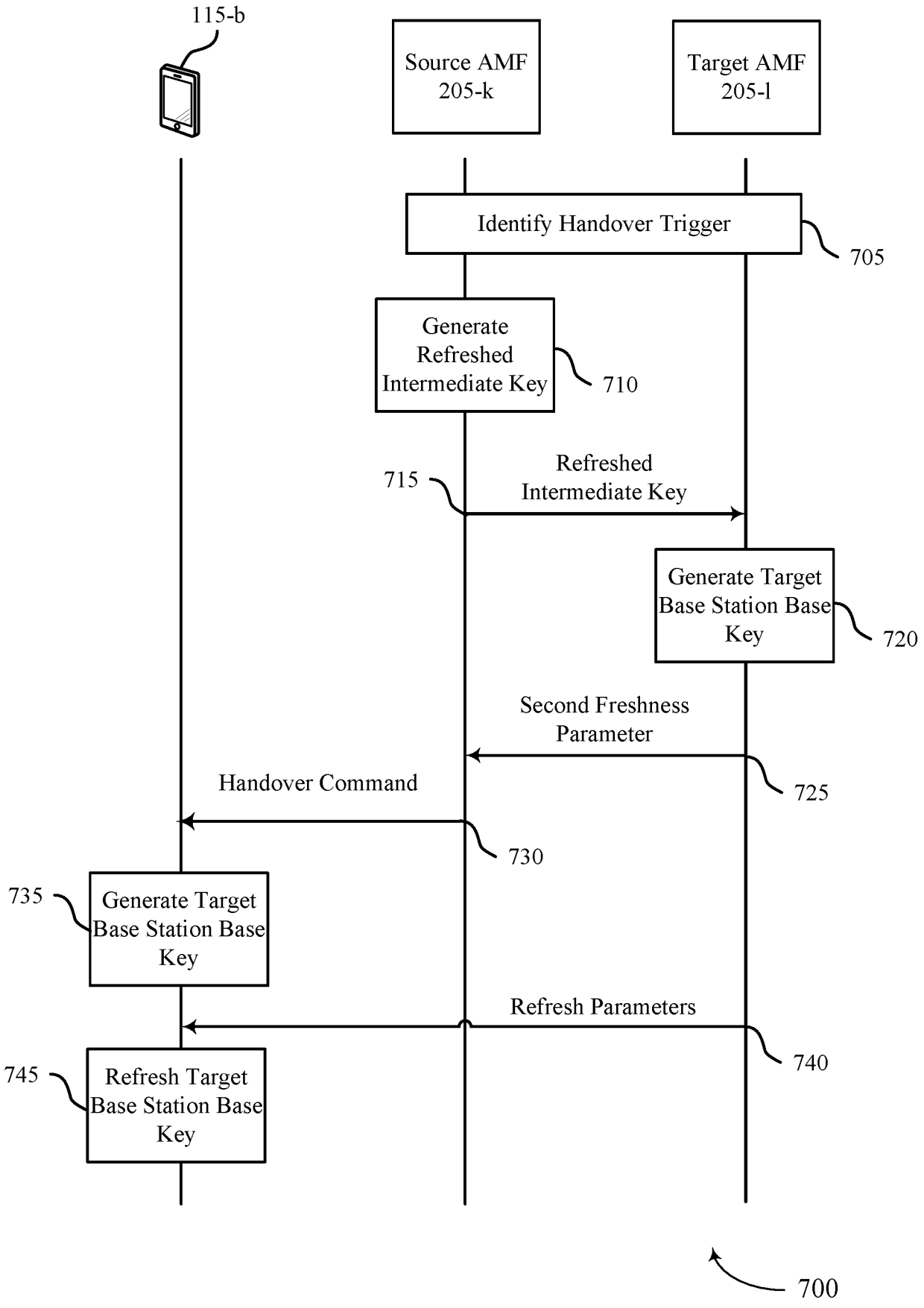

115-b
Source AMF 205-k
Target AMF 205-l
Identify Handover Trigger
705
Generate Refreshed Intermediate Key
710
715
Refreshed Intermediate Key
Generate Target Base Station Base Key
720
Second Freshness Parameter
725
Handover Command
730
735
Generate Target Base Station Base Key
Refresh Parameters
740
745
Refresh Target Base Station Base Key
700

FIG. 7

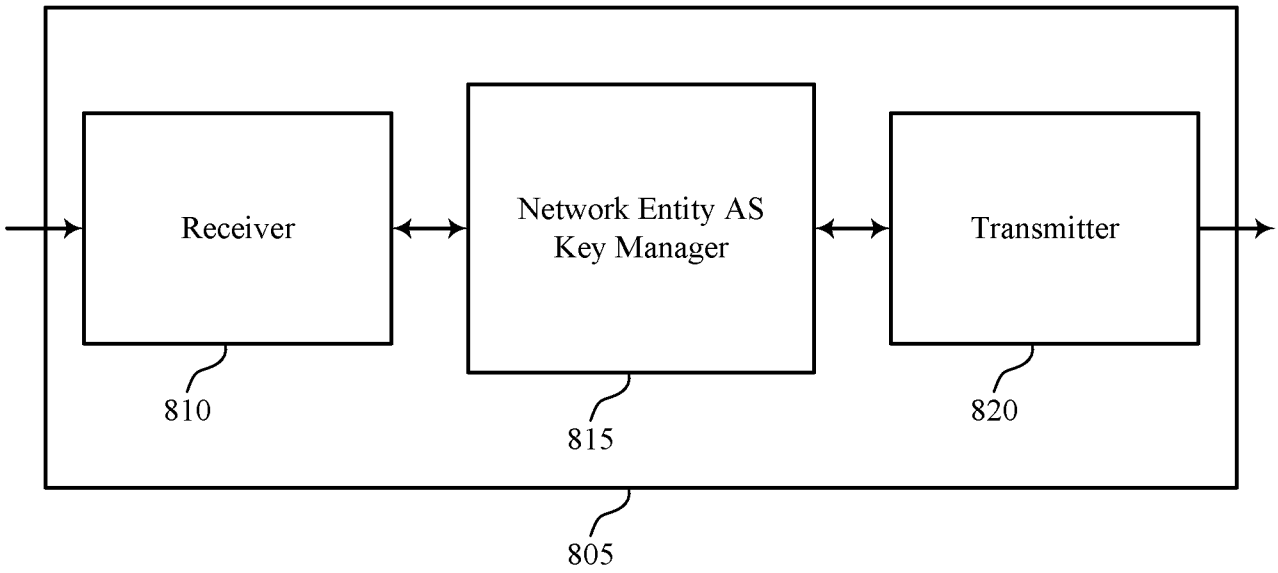

Receiver
Network Entity AS
Key Manager
Transmitter
810
815
820
805
800

FIG. 8

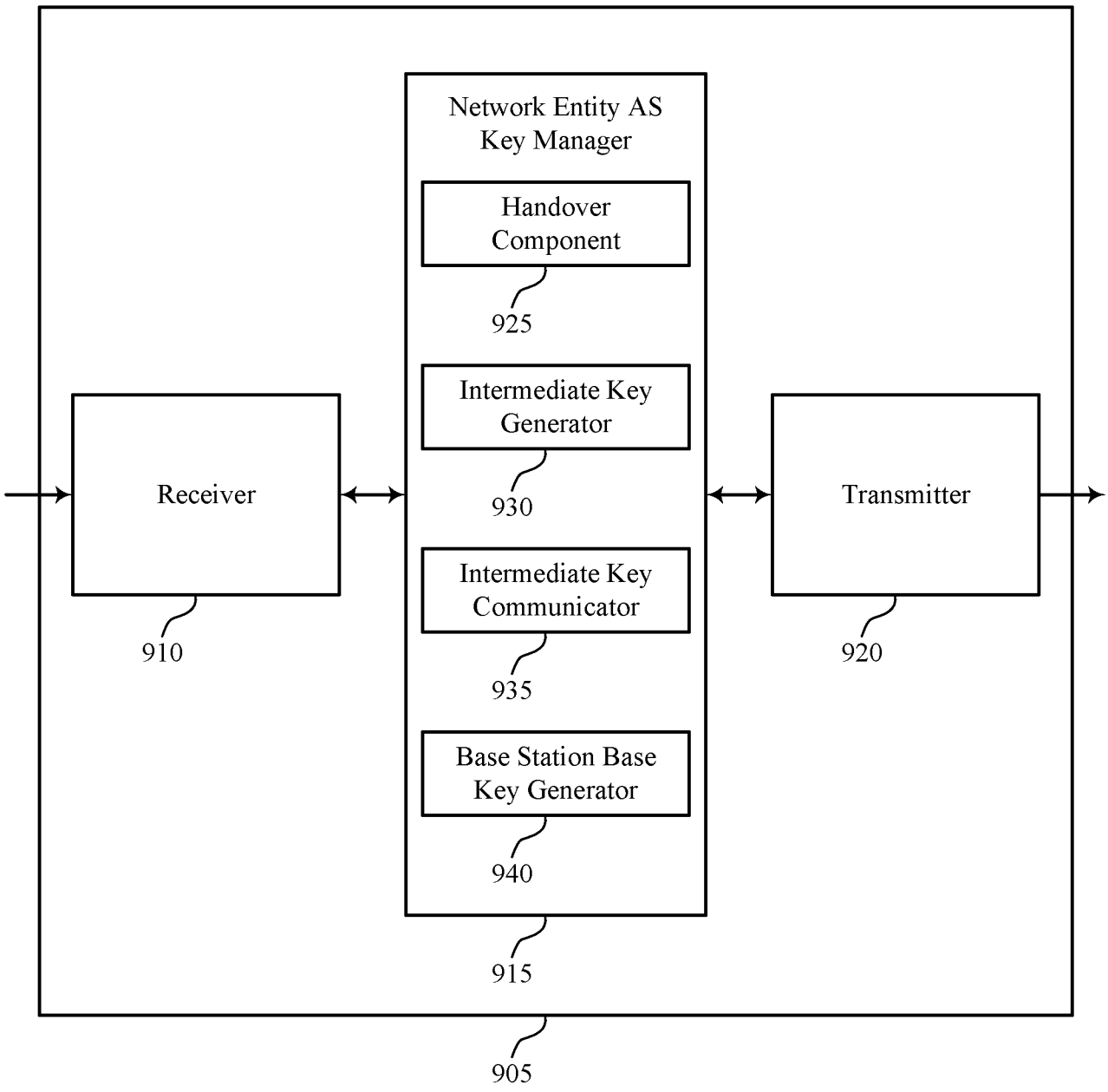

Network Entity AS Key Manager
Handover Component
925
Intermediate Key Generator
930
Intermediate Key Communicator
935
Base Station Base Key Generator
940
915
Receiver
910
Transmitter
920
905
900

FIG. 9

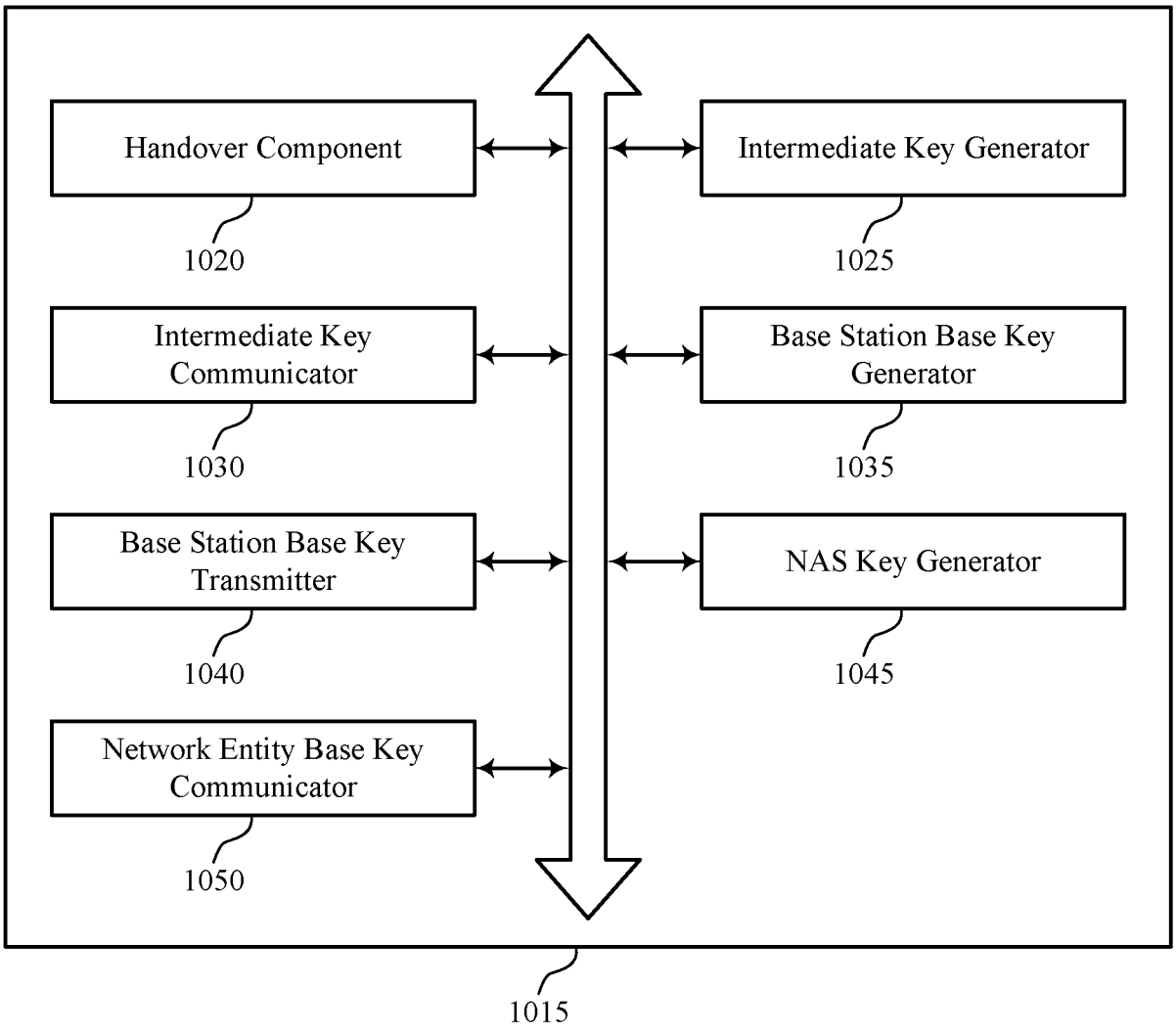

Handover Component
1020
Intermediate Key Generator
1025
Intermediate Key Communicator
1030
Base Station Base Key Generator
1035
Base Station Base Key Transmitter
1040
NAS Key Generator
1045
Network Entity Base Key Communicator
1050
1015
1000

FIG. 10

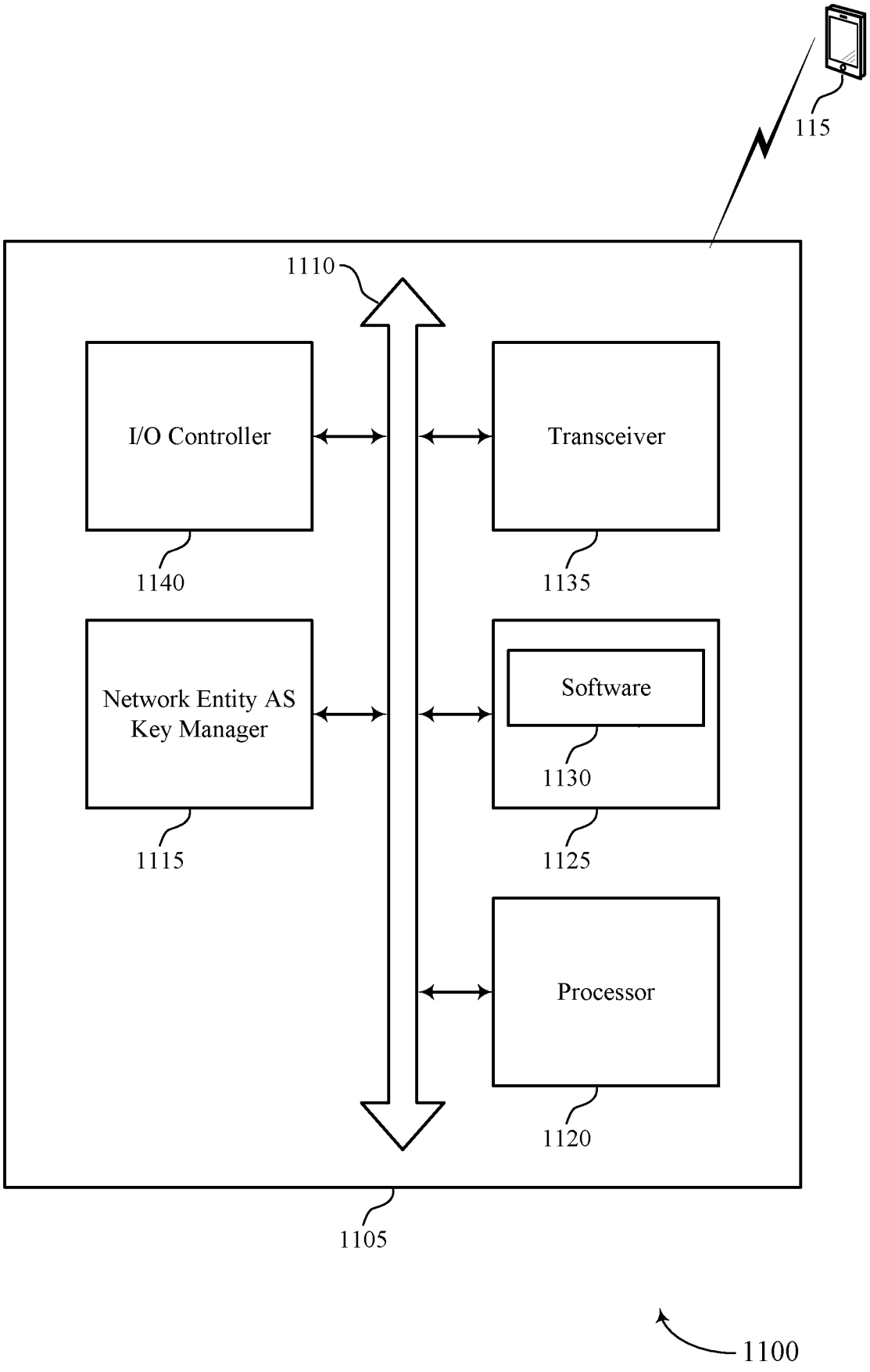

115
1110
I/O Controller
Transceiver
1140
1135
Network Entity AS Key Manager
Software
1130
1115
1125
Processor
1120
1105
1100

FIG. 11

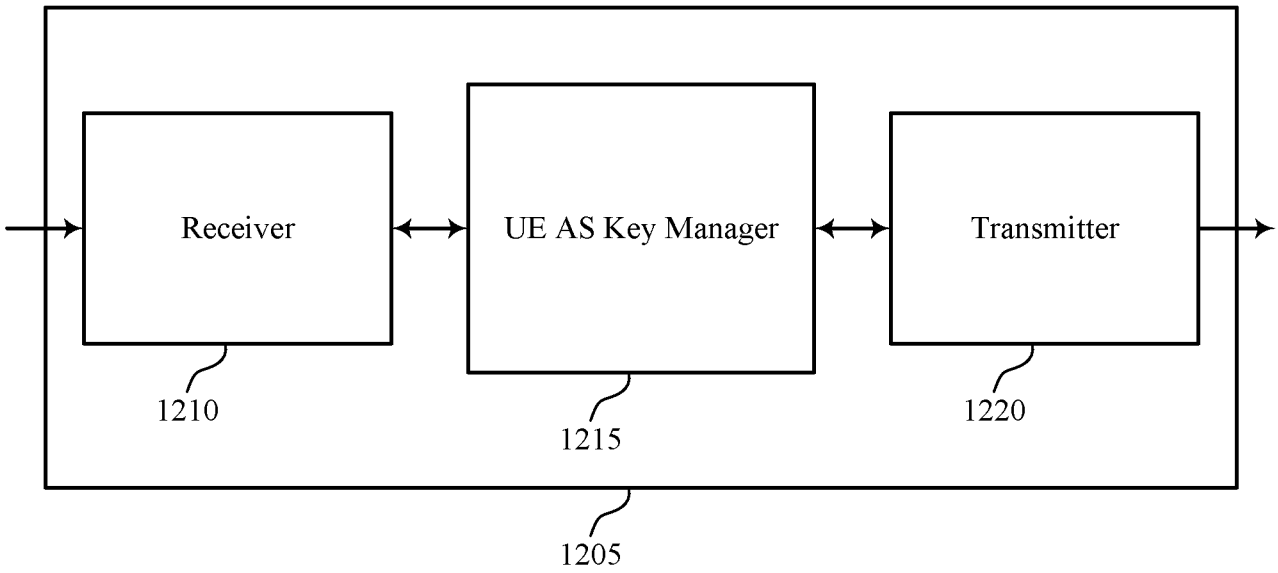

Receiver
UE AS Key Manager
Transmitter
1210
1215
1220
1205
1200

FIG. 12

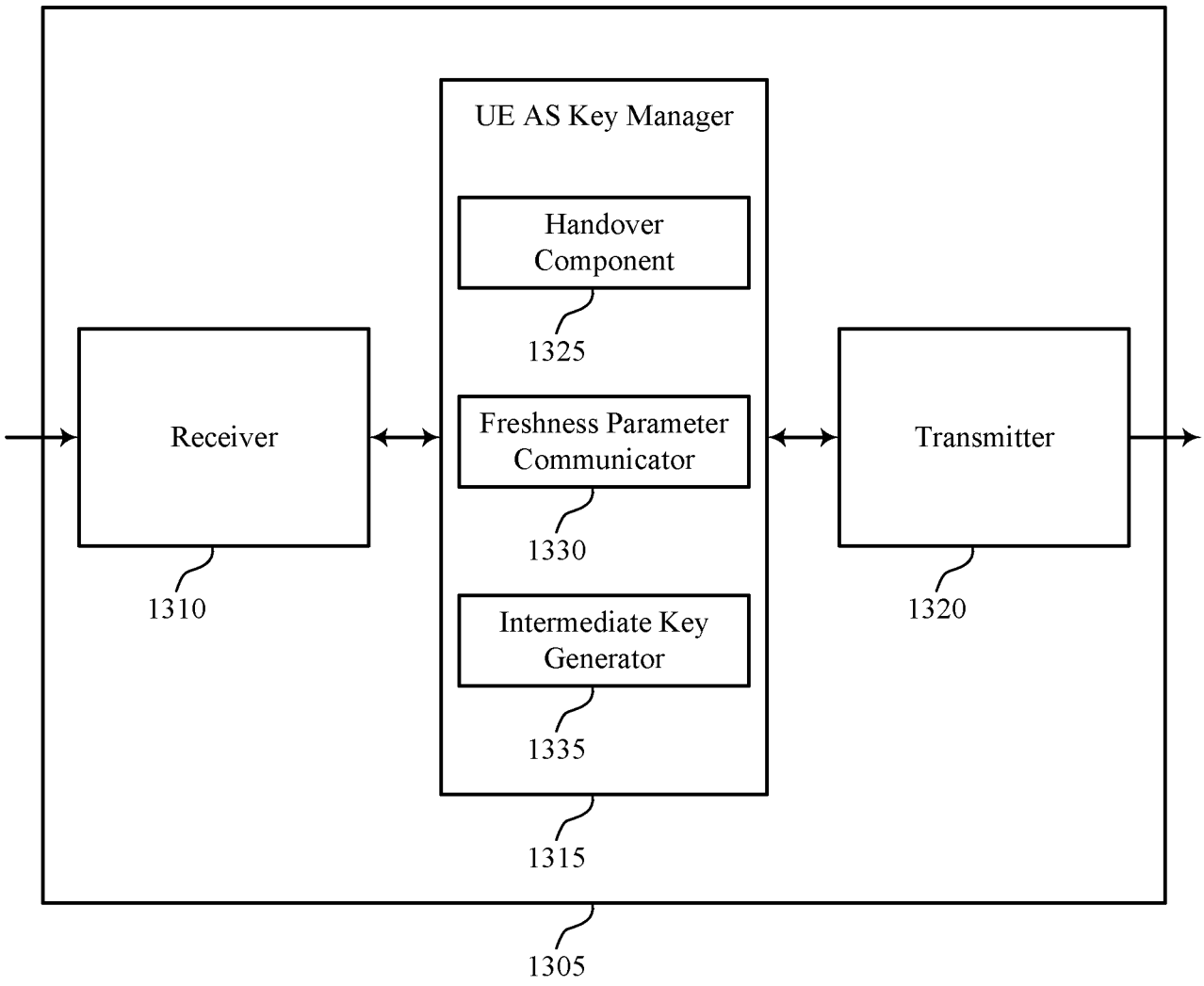

UE AS Key Manager
Handover Component
1325
Receiver
Freshness Parameter Communicator
Transmitter
1330
1310
1320
Intermediate Key Generator
1335
1315
1305
1300

FIG. 13

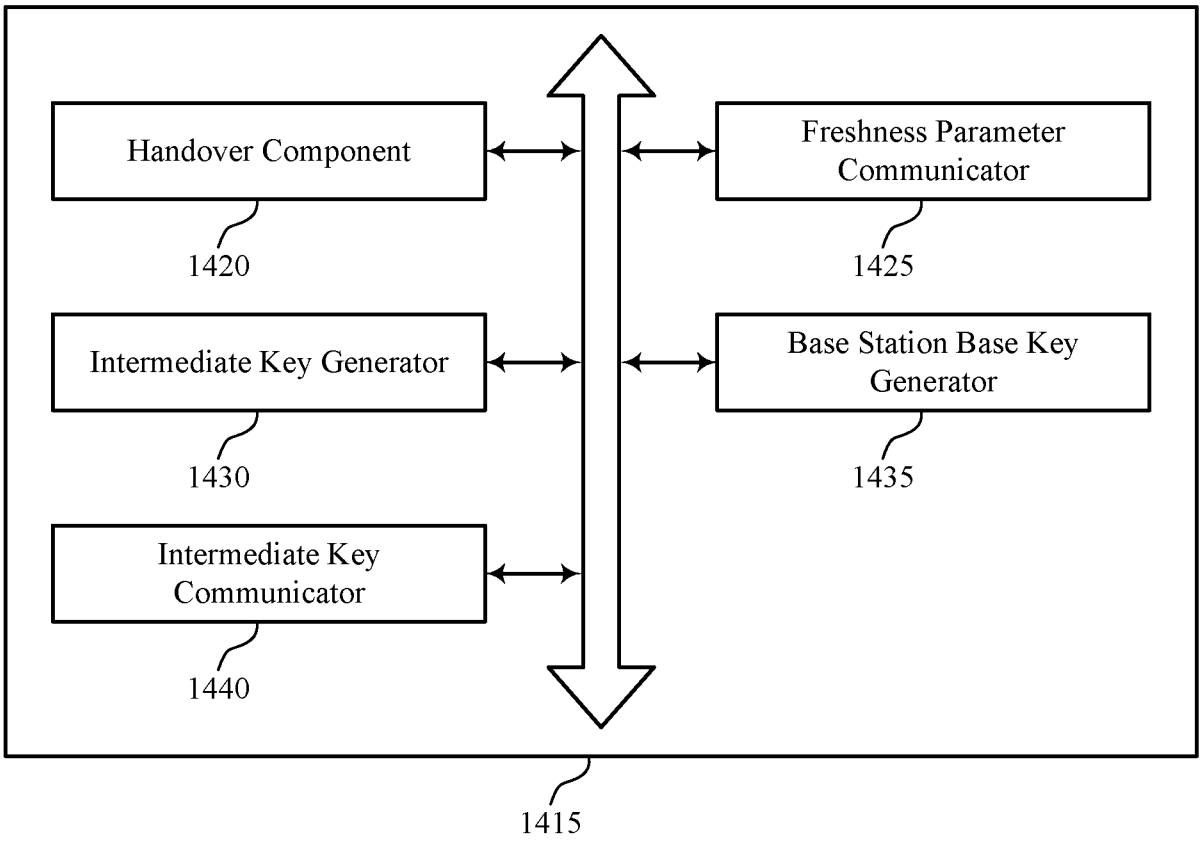

Handover Component
1420
Freshness Parameter Communicator
1425
Intermediate Key Generator
1430
Base Station Base Key Generator
1435
Intermediate Key Communicator
1440
1415
1400

FIG. 14

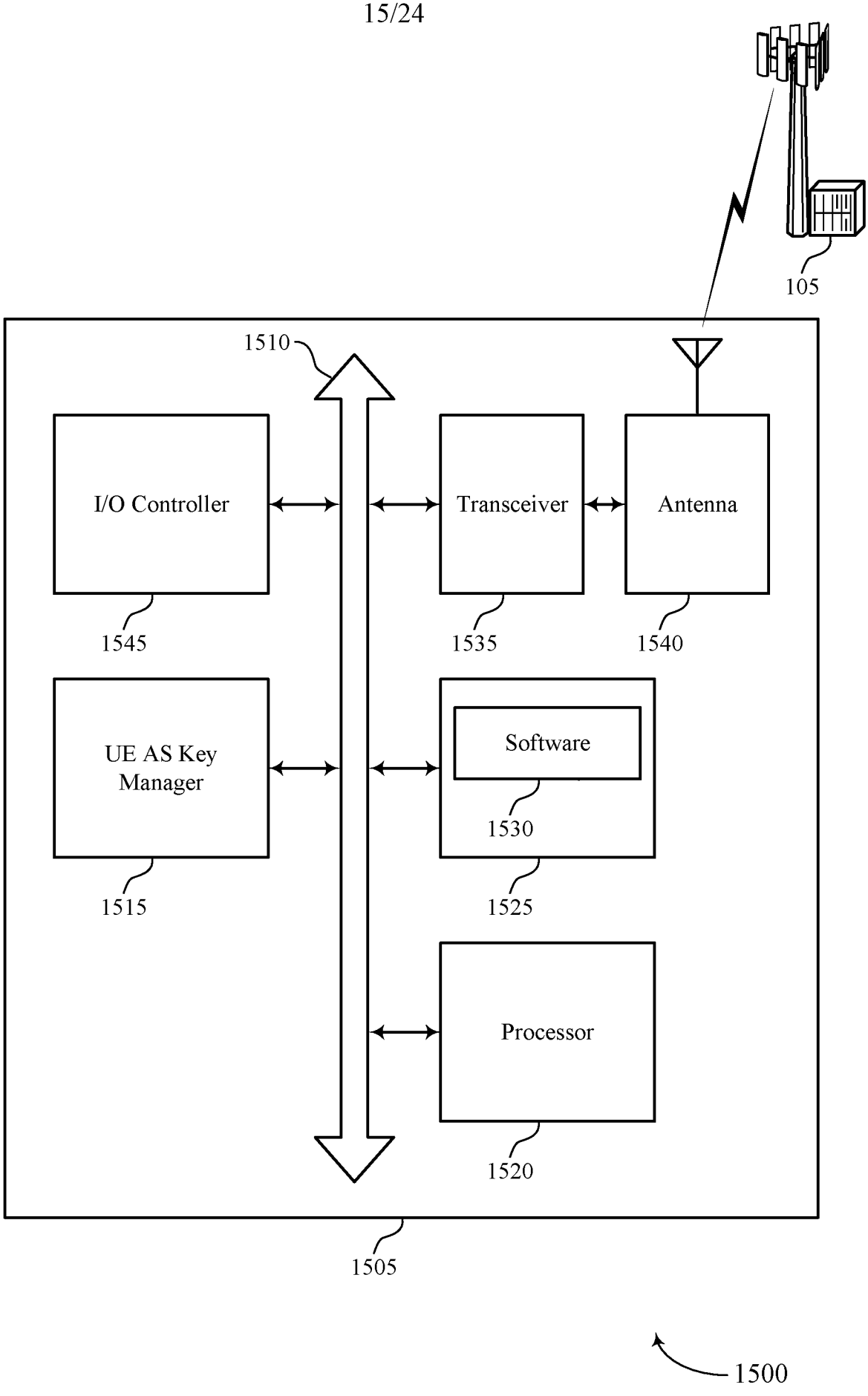

105
1510
I/O Controller
Transceiver
Antenna
1545
1535
1540
UE AS Key Manager
Software
1530
1515
1525
Processor
1520
1505
1500

FIG. 15

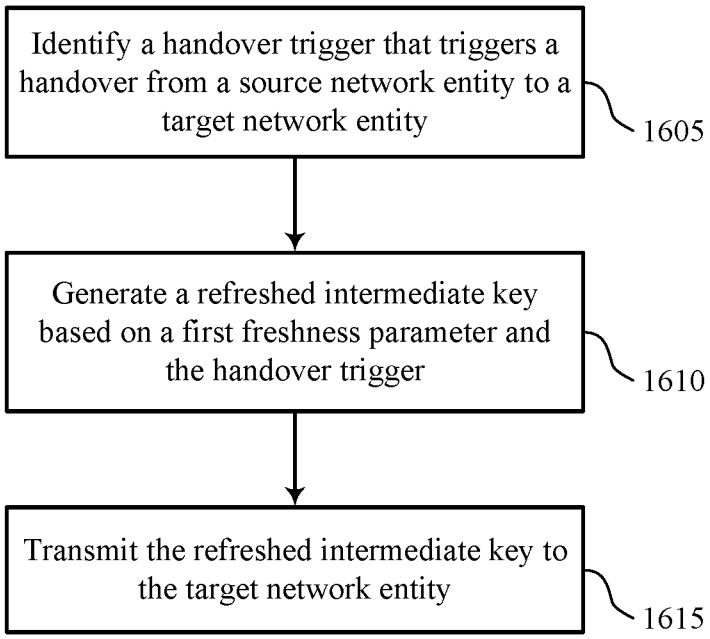

Identify a handover trigger that triggers a handover from a source network entity to a target network entity
1605
Generate a refreshed intermediate key based on a first freshness parameter and the handover trigger
1610
Transmit the refreshed intermediate key to the target network entity
1615
1600

FIG. 16

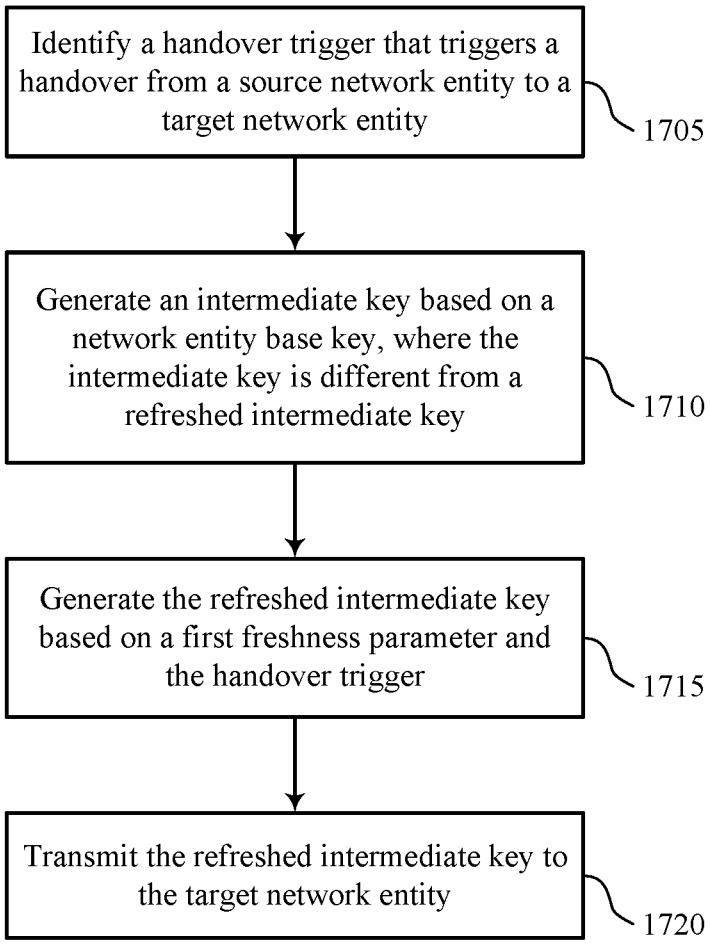

Identify a handover trigger that triggers a handover from a source network entity to a target network entity
1705
Generate an intermediate key based on a network entity base key, where the intermediate key is different from a refreshed intermediate key
1710
Generate the refreshed intermediate key based on a first freshness parameter and the handover trigger
1715
Transmit the refreshed intermediate key to the target network entity
1720
1700

FIG. 17

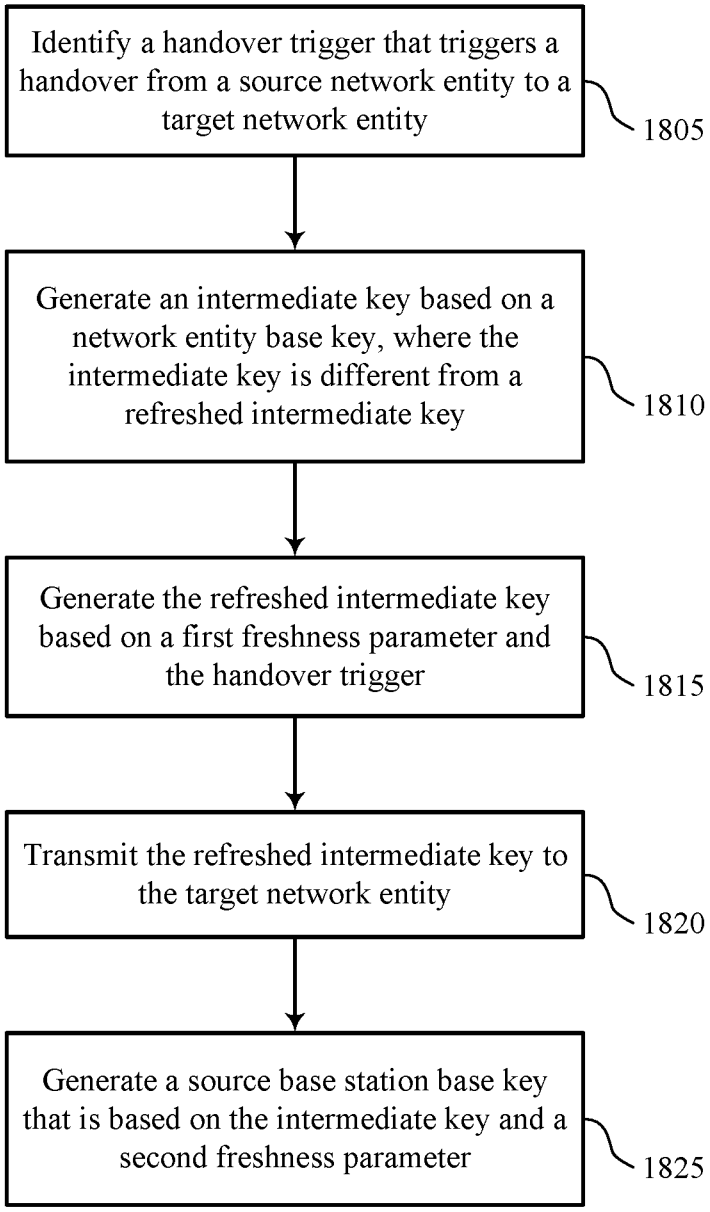

Identify a handover trigger that triggers a handover from a source network entity to a target network entity
1805
Generate an intermediate key based on a network entity base key, where the intermediate key is different from a refreshed intermediate key
1810
Generate the refreshed intermediate key based on a first freshness parameter and the handover trigger
1815
Transmit the refreshed intermediate key to the target network entity
1820
Generate a source base station base key that is based on the intermediate key and a second freshness parameter
1825
1800

FIG. 18

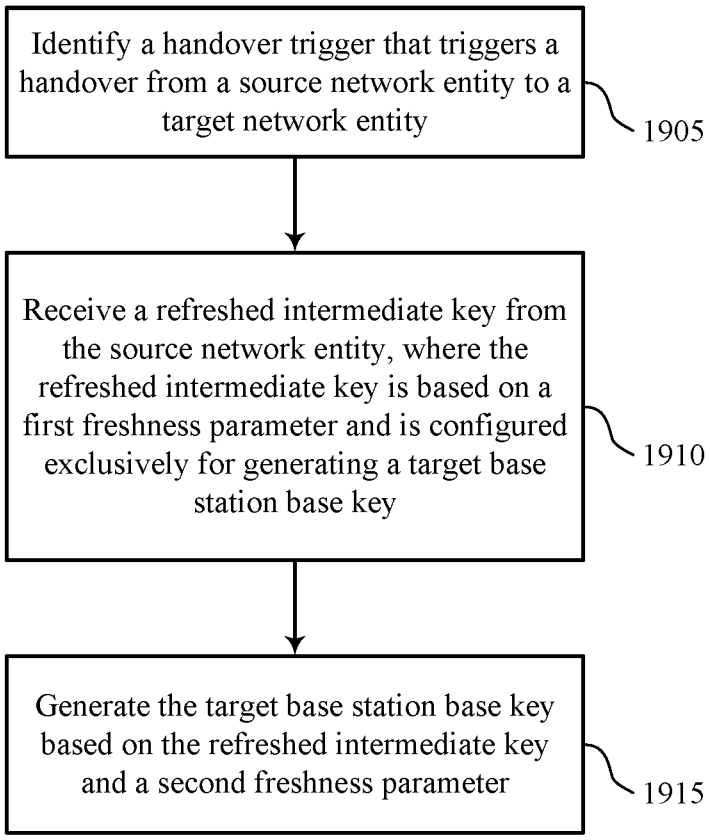

Identify a handover trigger that triggers a handover from a source network entity to a target network entity
1905
Receive a refreshed intermediate key from the source network entity, where the refreshed intermediate key is based on a first freshness parameter and is configured exclusively for generating a target base station base key
1910
Generate the target base station base key based on the refreshed intermediate key and a second freshness parameter
1915
1900

FIG. 19

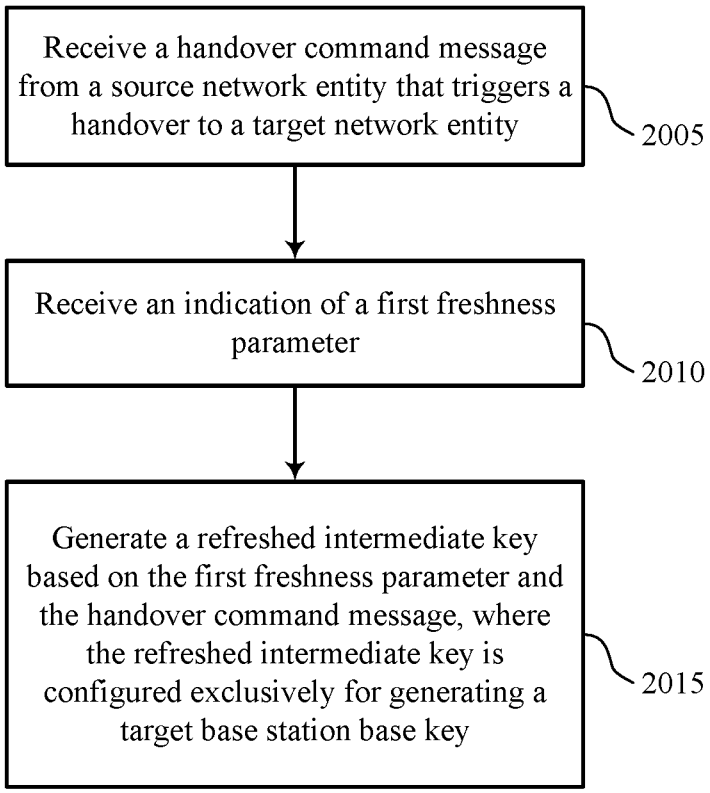

Receive a handover command message from a source network entity that triggers a handover to a target network entity
2005
Receive an indication of a first freshness parameter
2010
Generate a refreshed intermediate key based on the first freshness parameter and the handover command message, where the refreshed intermediate key is configured exclusively for generating a target base station base key
2015
2000

FIG. 20

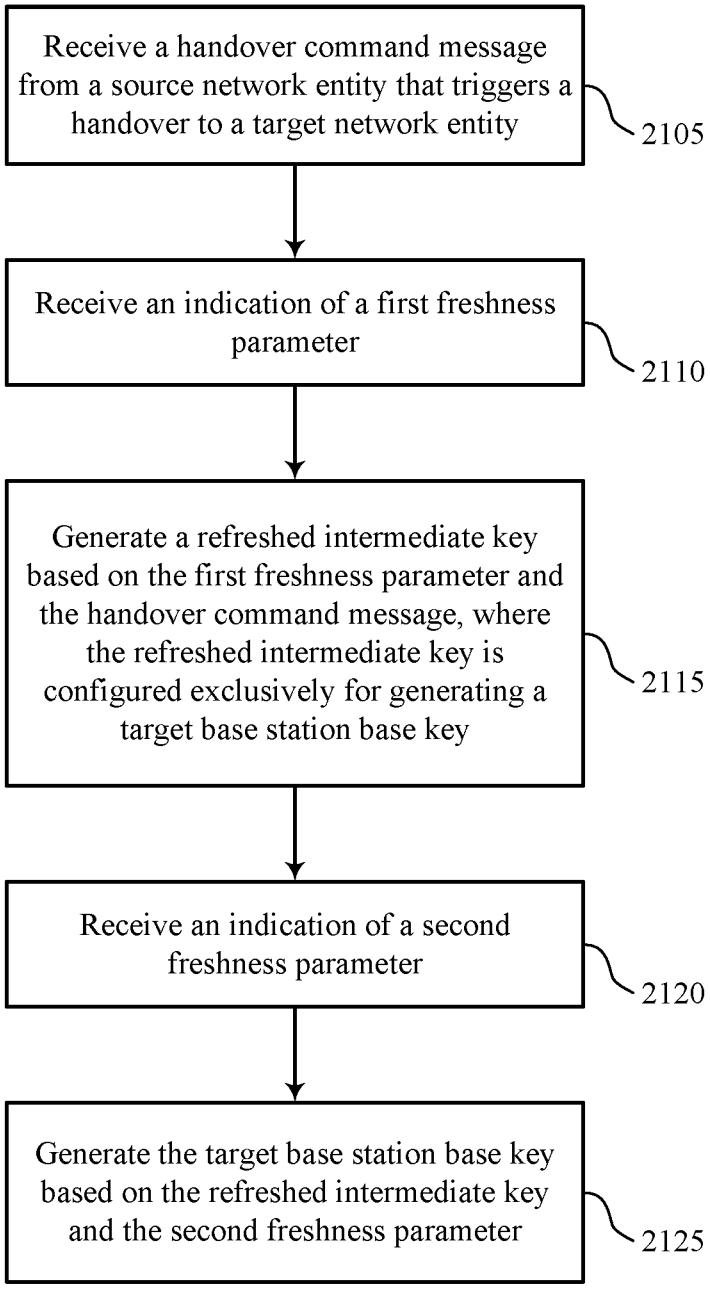

Receive a handover command message from a source network entity that triggers a handover to a target network entity
2105
Receive an indication of a first freshness parameter
2110
Generate a refreshed intermediate key based on the first freshness parameter and the handover command message, where the refreshed intermediate key is configured exclusively for generating a target base station base key
2115
Receive an indication of a second freshness parameter
2120
Generate the target base station base key based on the refreshed intermediate key and the second freshness parameter
2125
2100

FIG. 21

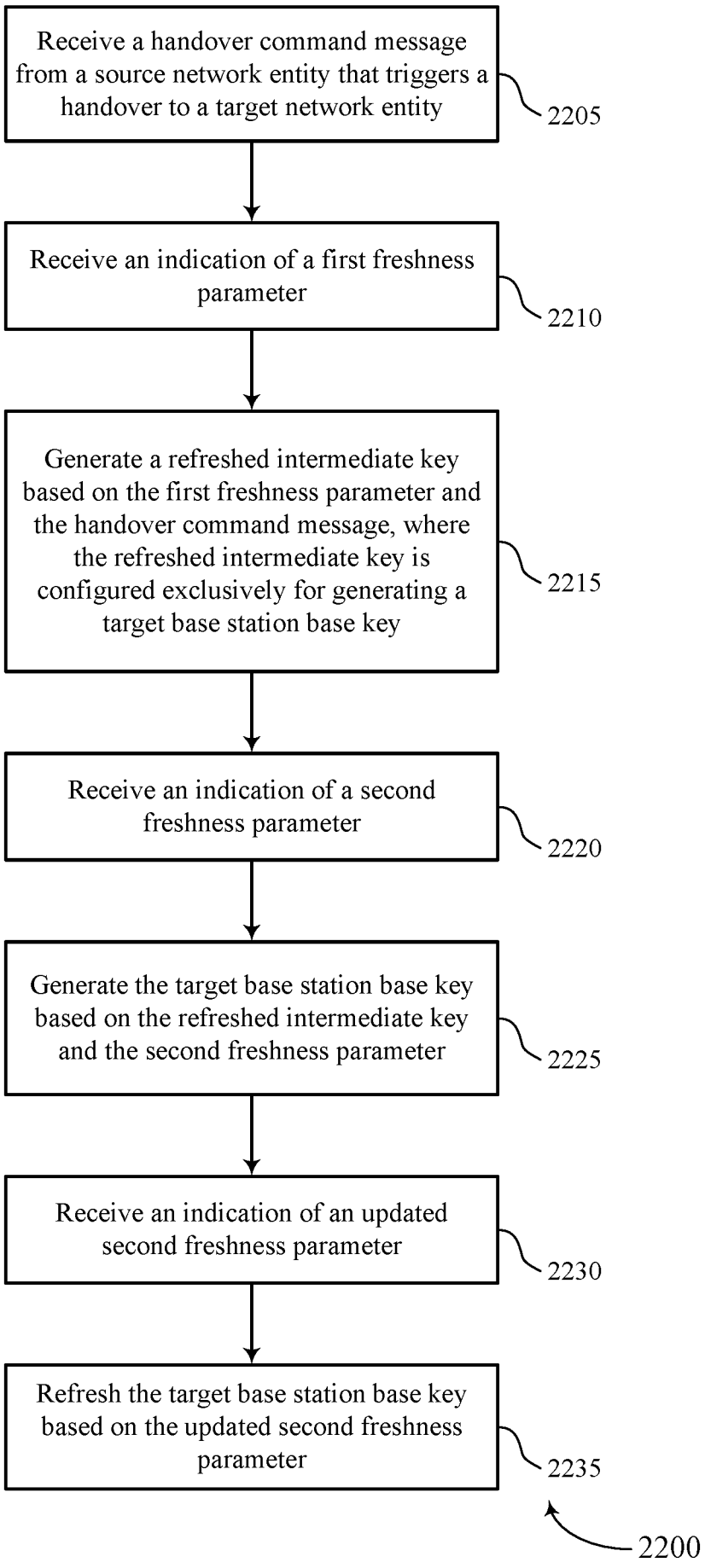

Receive a handover command message from a source network entity that triggers a handover to a target network entity
2205
Receive an indication of a first freshness parameter
2210
Generate a refreshed intermediate key based on the first freshness parameter and the handover command message, where the refreshed intermediate key is configured exclusively for generating a target base station base key
2215
Receive an indication of a second freshness parameter
2220
Generate the target base station base key based on the refreshed intermediate key and the second freshness parameter
2225
Receive an indication of an updated second freshness parameter
2230
Refresh the target base station base key based on the updated second freshness parameter
2235
2200

FIG. 22

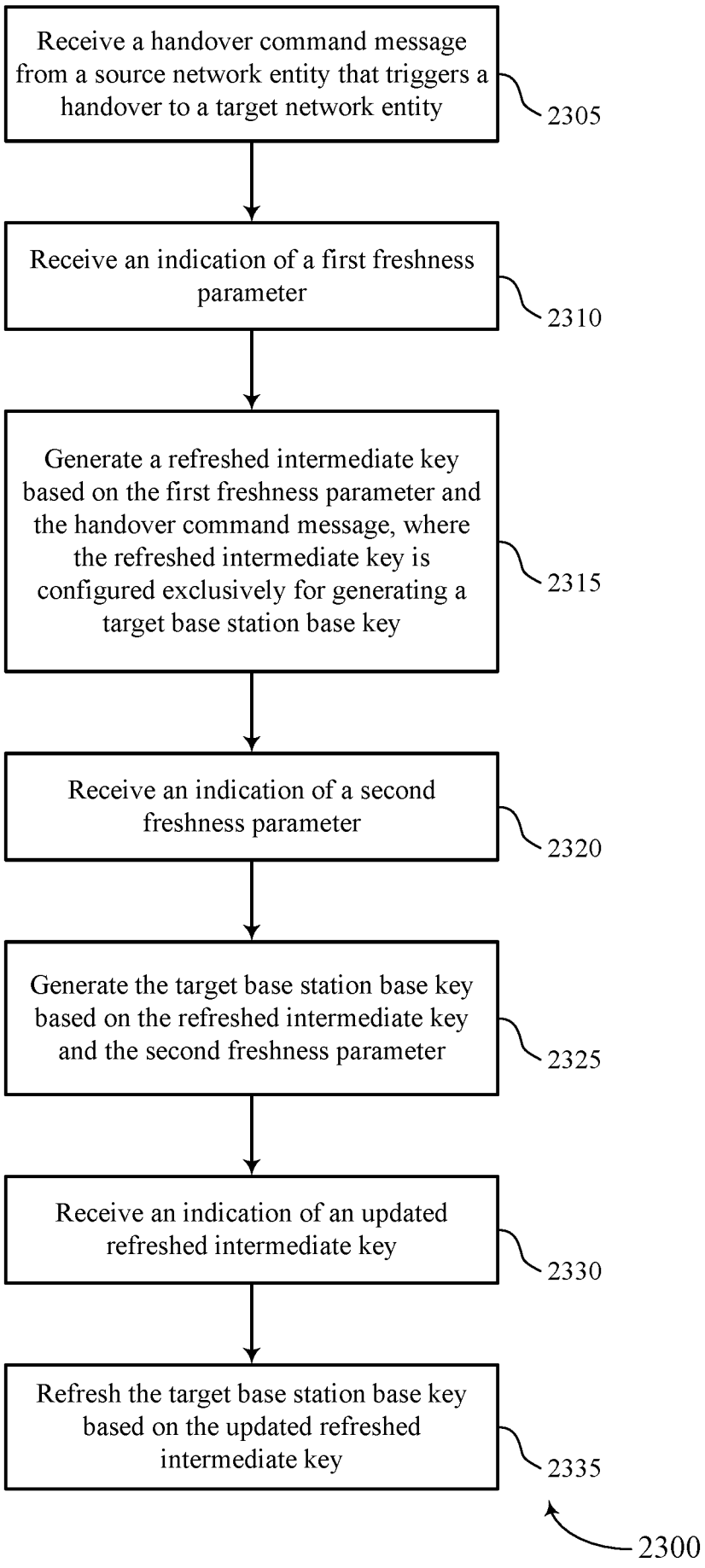

Receive a handover command message from a source network entity that triggers a handover to a target network entity
2305
Receive an indication of a first freshness parameter
2310
Generate a refreshed intermediate key based on the first freshness parameter and the handover command message, where the refreshed intermediate key is configured exclusively for generating a target base station base key
2315
Receive an indication of a second freshness parameter
2320
Generate the target base station base key based on the refreshed intermediate key and the second freshness parameter
2325
Receive an indication of an updated refreshed intermediate key
2330
Refresh the target base station base key based on the updated refreshed intermediate key
2335
2300

FIG. 23

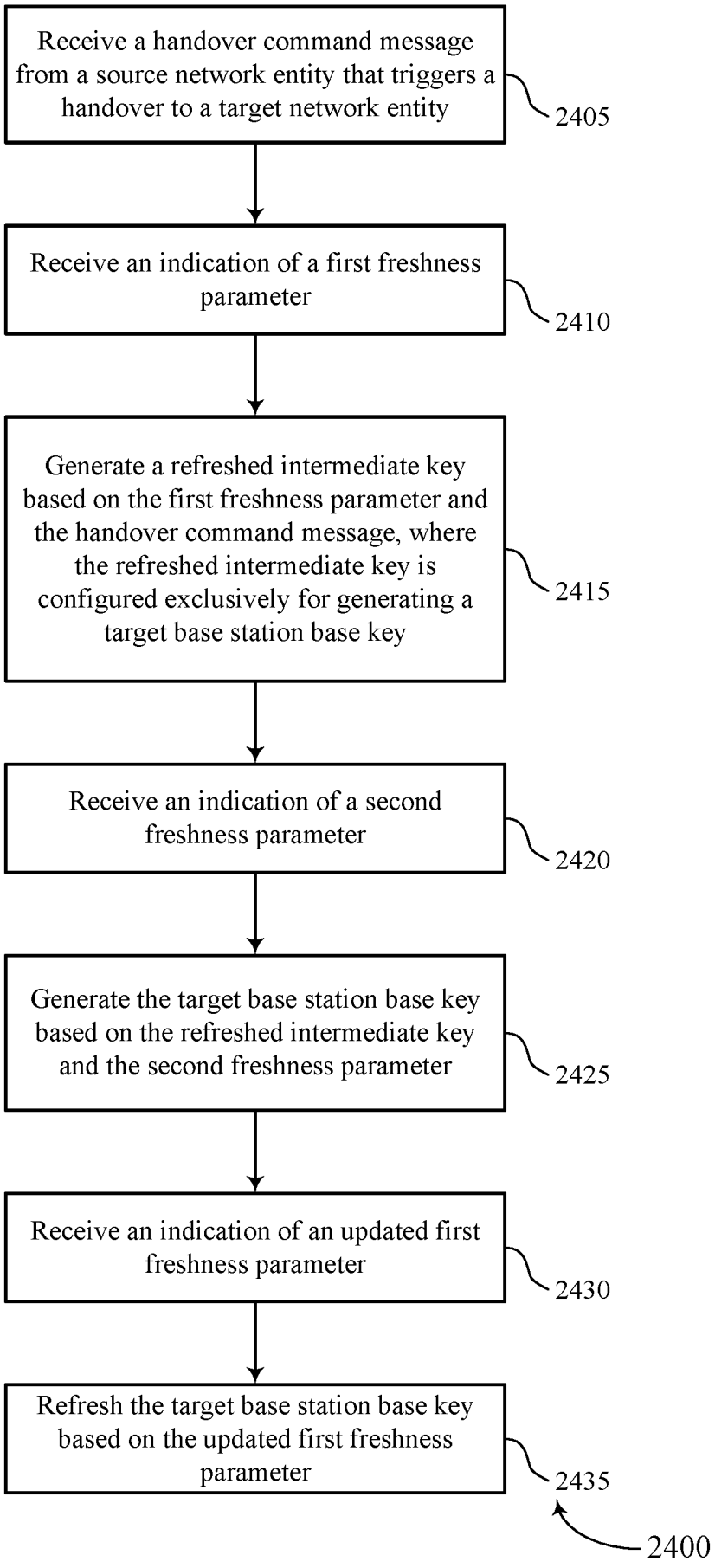

Receive a handover command message from a source network entity that triggers a handover to a target network entity
2405
Receive an indication of a first freshness parameter
2410
Generate a refreshed intermediate key based on the first freshness parameter and the handover command message, where the refreshed intermediate key is configured exclusively for generating a target base station base key
2415
Receive an indication of a second freshness parameter
2420
Generate the target base station base key based on the refreshed intermediate key and the second freshness parameter
2425
Receive an indication of an updated first freshness parameter
2430
Refresh the target base station base key based on the updated first freshness parameter
2435
2400

FIG. 24