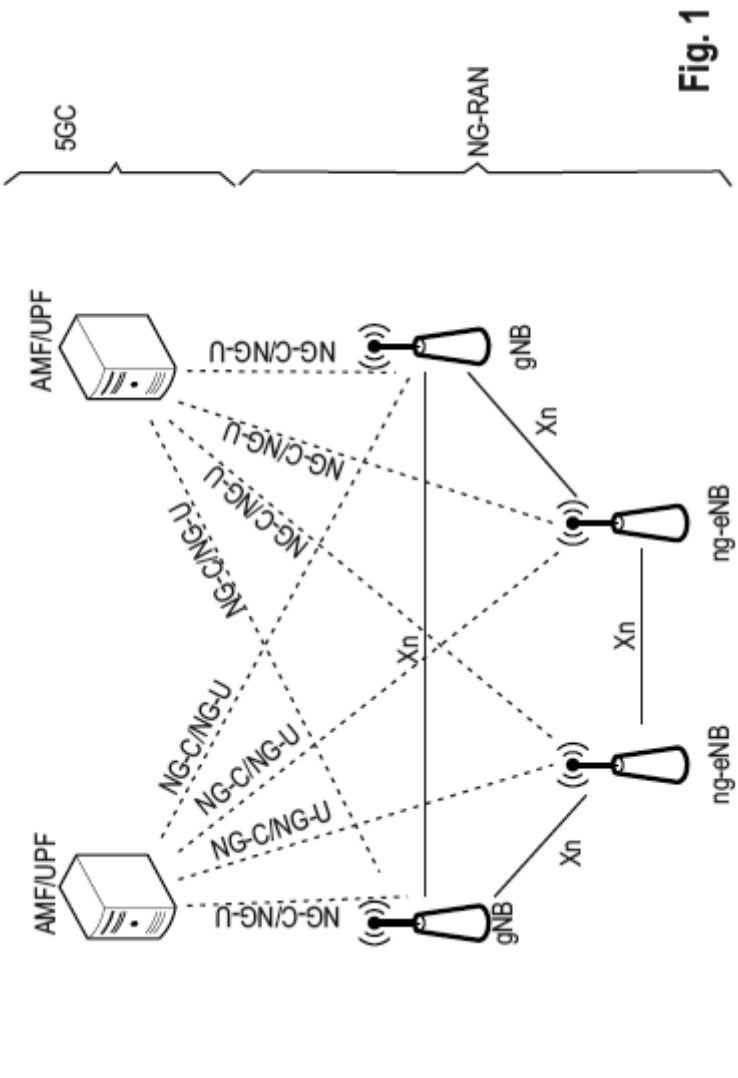

5GC
NG-RAN
AMF/UPF
AMF/UPF
gNB
gNB
ng-eNB
ng-eNB
Xn
Xn
Xn
Xn
NG-C/NG-U
NG-C/NG-U
NG-C/NG-U
NG-C/NG-U
NG-C/NG-U
NG-C/NG-U
NG-C/NG-U
NG-C/NG-U
100

Fig. 1

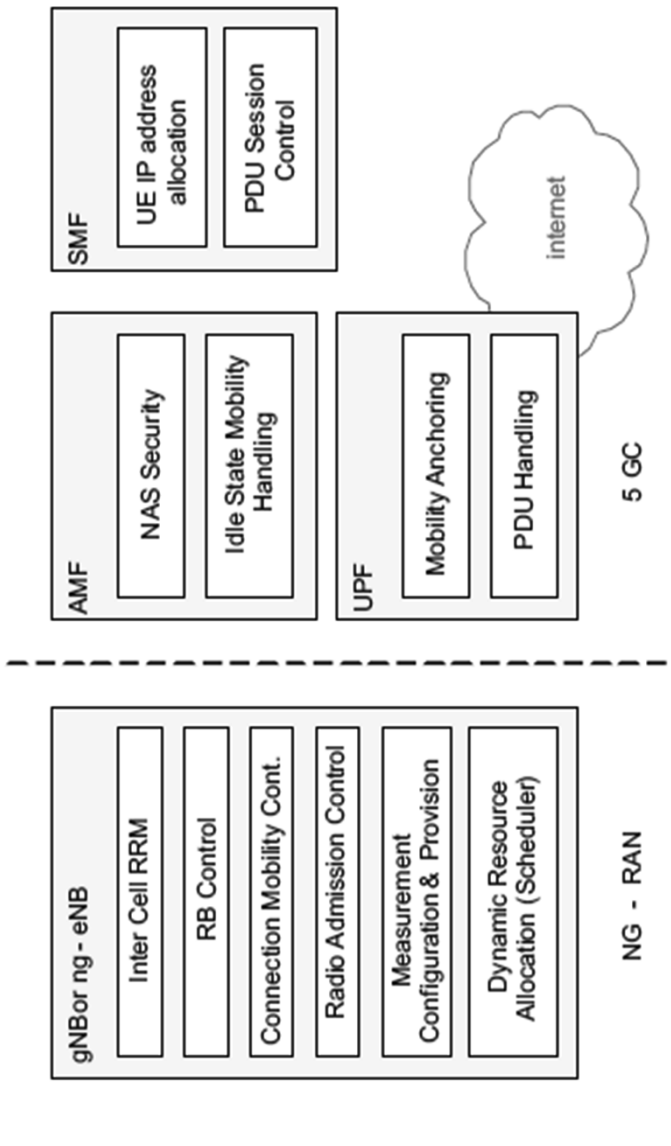

gNBor ng - eNB
Inter Cell RRM
RB Control
Connection Mobility Cont.
Radio Admission Control
Measurement Configuration & Provision
Dynamic Resource Allocation (Scheduler)
NG - RAN
AMF
NAS Security
Idle State Mobility Handling
UPF
Mobility Anchoring
PDU Handling
SMF
UE IP address allocation
PDU Session Control
internet
5 GC
200

Fig. 2

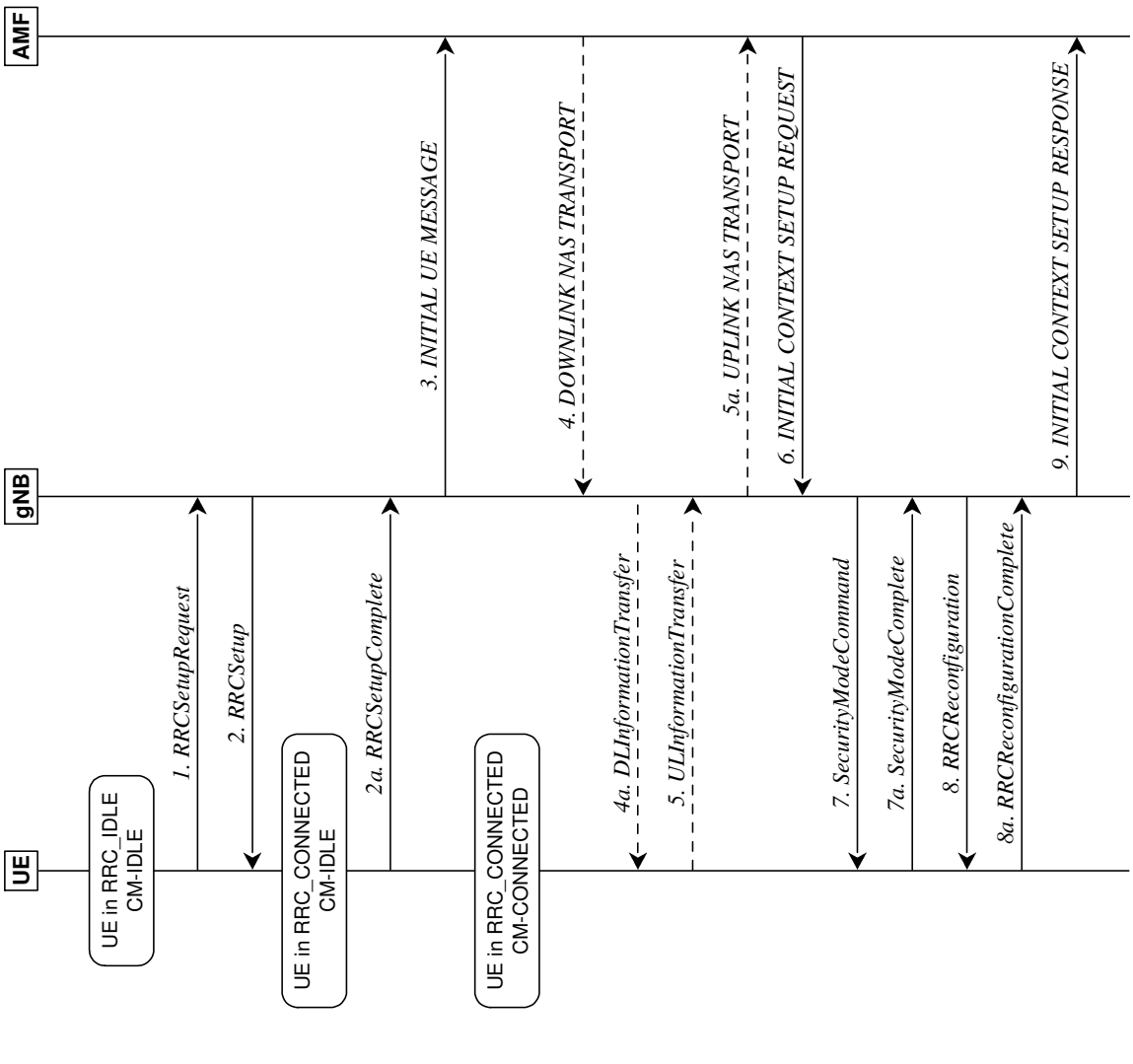

UE
gNB
AMF
UE in RRC_IDLE
CM-IDLE
1. RRCSetupRequest
2. RRCSetup
UE in RRC_CONNECTED
CM-IDLE
2a. RRCSetupComplete
3. INITIAL UE MESSAGE
4. DOWNLINK NAS TRANSPORT
5a. UPLINK NAS TRANSPORT
6. INITIAL CONTEXT SETUP REQUEST
9. INITIAL CONTEXT SETUP RESPONSE
UE in RRC_CONNECTED
CM-CONNECTED
4a. DLInformationTransfer
5. ULInformationTransfer
7. SecurityModeCommand
7a. SecurityModeComplete
8. RRCReconfiguration
8a. RRCReconfigurationComplete
300

Fig. 3

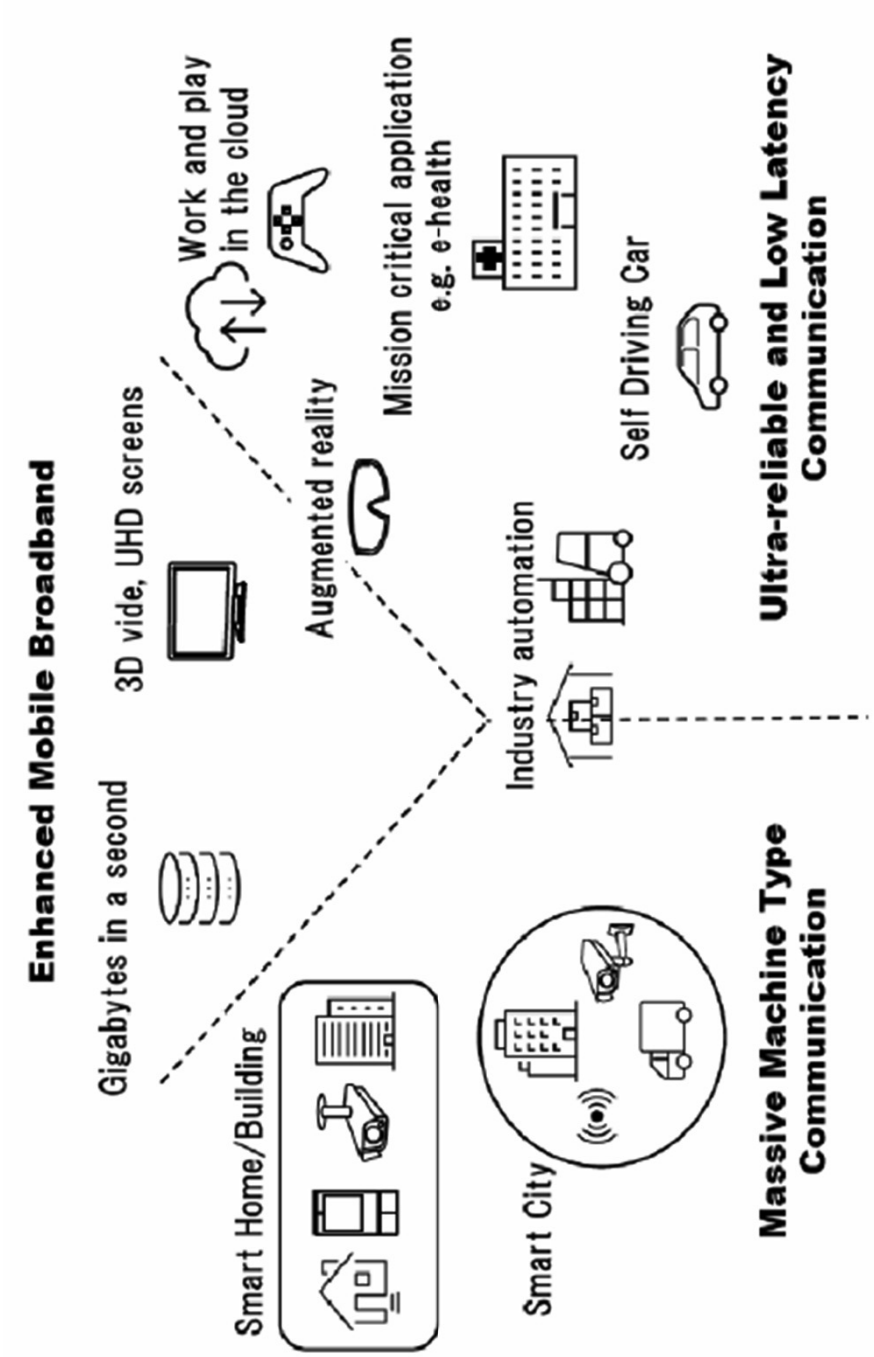

Enhanced Mobile Broadband
Gigabytes in a second
3D vide, UHD screens
Work and play in the cloud
Augmented reality
Mission critical application
e.g. e-health
Smart Home/Building
Industry automation
Self Driving Car
Ultra-reliable and Low Latency Communication
Smart City
Massive Machine Type Communication
400

Fig. 4

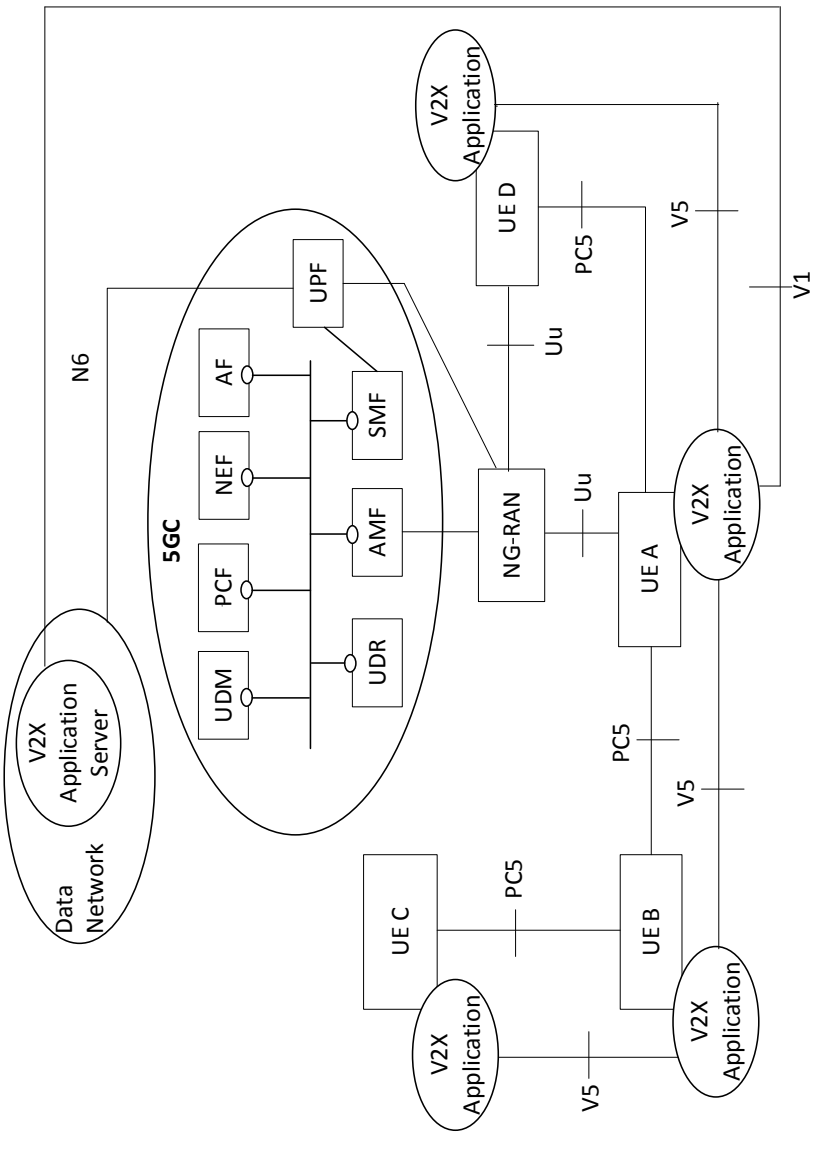

Data Network
V2X Application Server
N6
5GC
UPF
AF
NEF
PCF
UDM
SMF
AMF
UDR
NG-RAN
Uu
Uu
UE A
UE B
UE C
UE D
PC5
PC5
V5
V5
V5
V1
V2X Application
V2X Application
V2X Application
V2X Application
500

Fig. 5

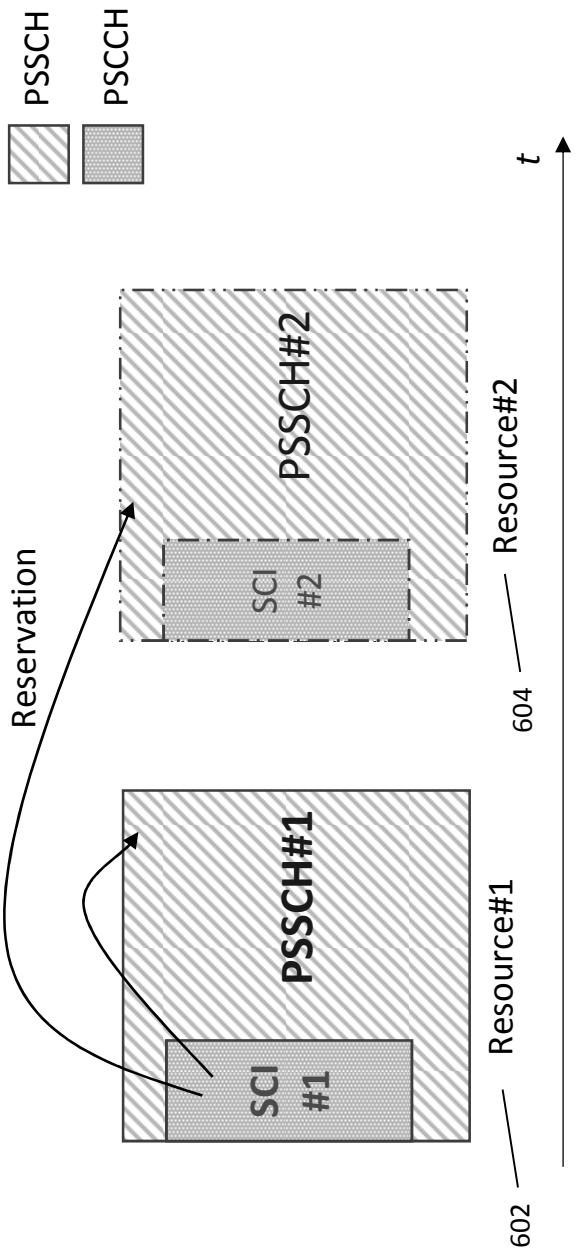

PSSCH
PSCCH
t
Reservation
PSSCH#2
SCI #2
PSSCH#1
SCI #1
Resource#2
Resource#1
604
602
600

Fig. 6

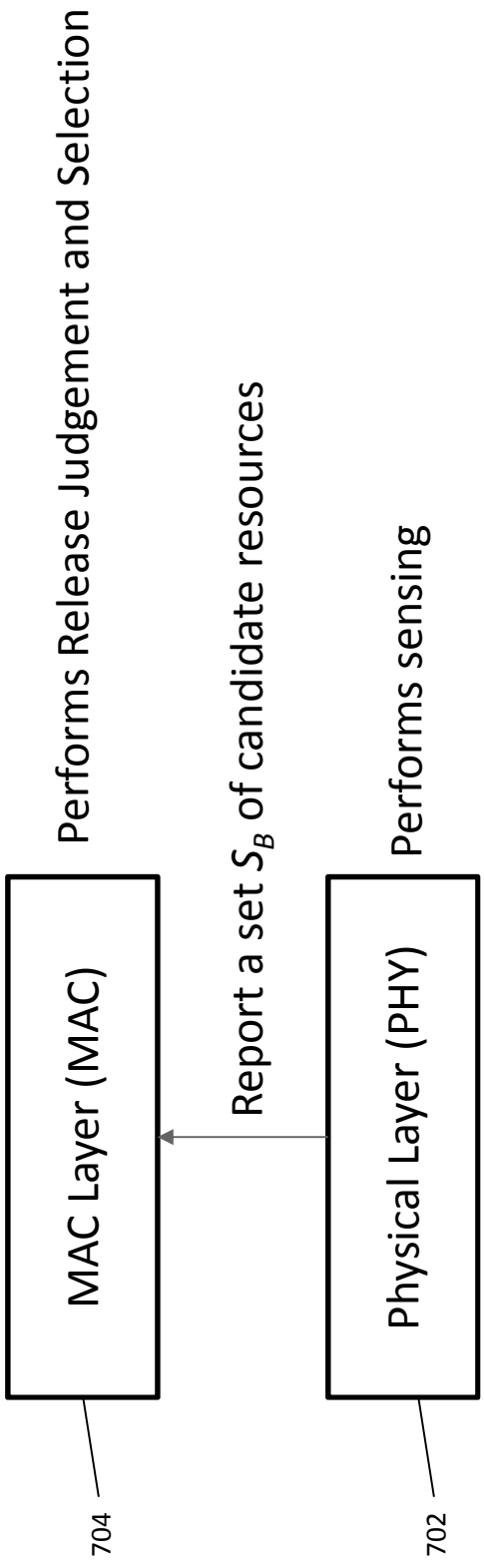

Performs Release Judgement and Selection
MAC Layer (MAC)
Report a set S_B of candidate resources
Physical Layer (PHY)
Performs sensing
704
702
700

Fig. 7

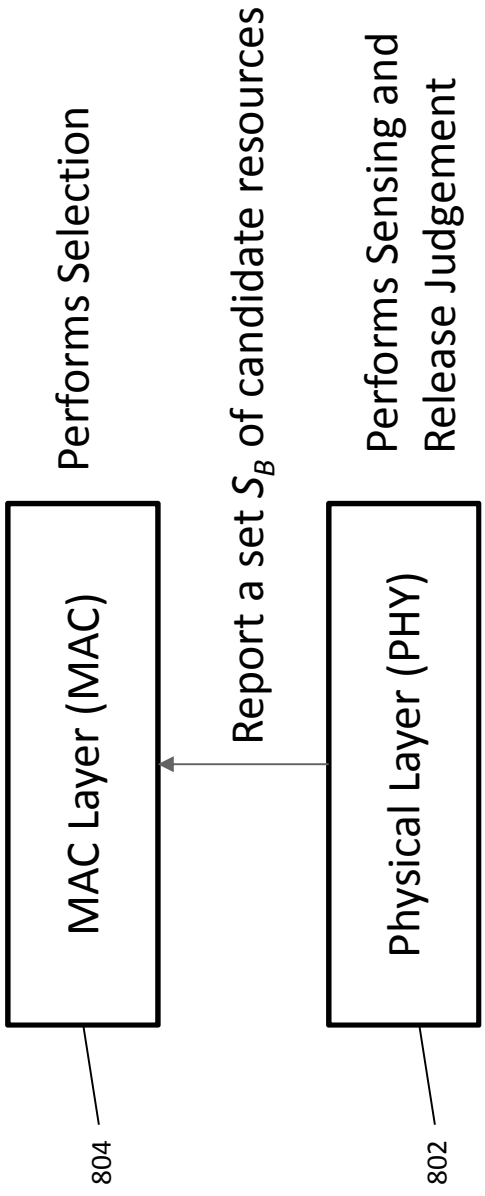

MAC Layer (MAC)
Performs Selection
Report a set S_B of candidate resources
Physical Layer (PHY)
Performs Sensing and Release Judgement
804
802
800

Fig. 8

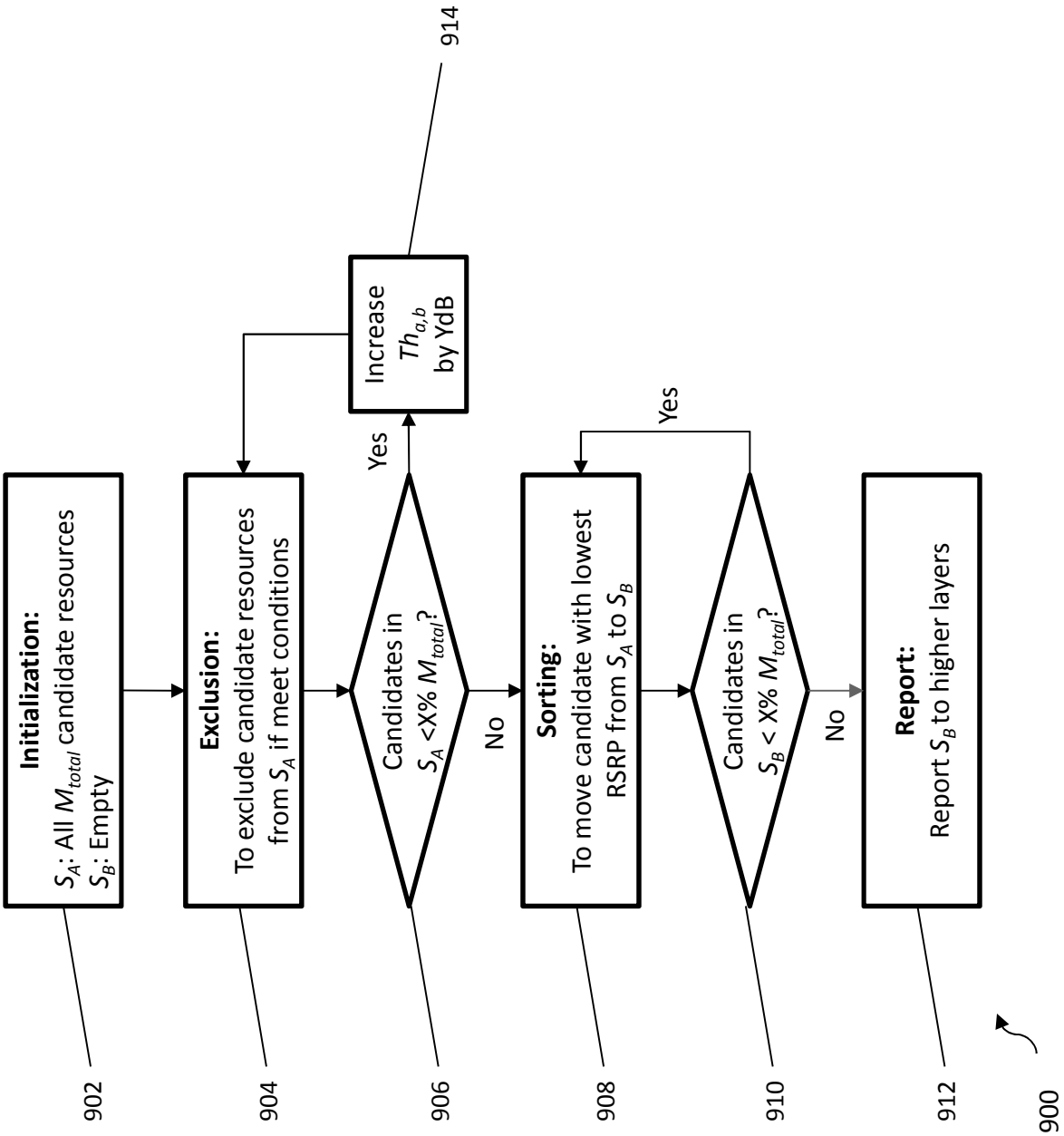

Initialization:
S_A: All M_{total} candidate resources
S_B: Empty
902
Exclusion:
To exclude candidate resources from S_A if meet conditions
904
Candidates in S_A <X% M_{total}?
906
Yes
Increase $Th_{a,b}$ by YdB
914
No
Sorting:
To move candidate with lowest RSRP from S_A to S_B
908
Candidates in S_B < X% M_{total}?
910
Yes
No
Report:
Report S_B to higher layers
912
900

Fig. 9

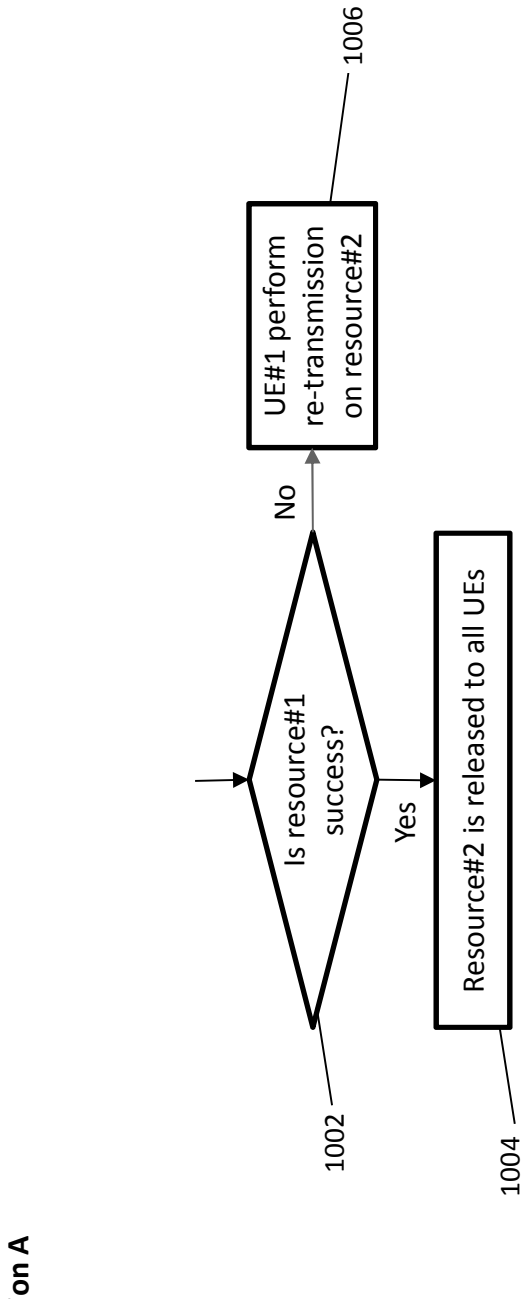

Operation A
Is resource#1 success?
Yes
No
Resource#2 is released to all UEs
UE#1 perform re-transmission on resource#2
1002
1004
1006
1000

Fig. 10

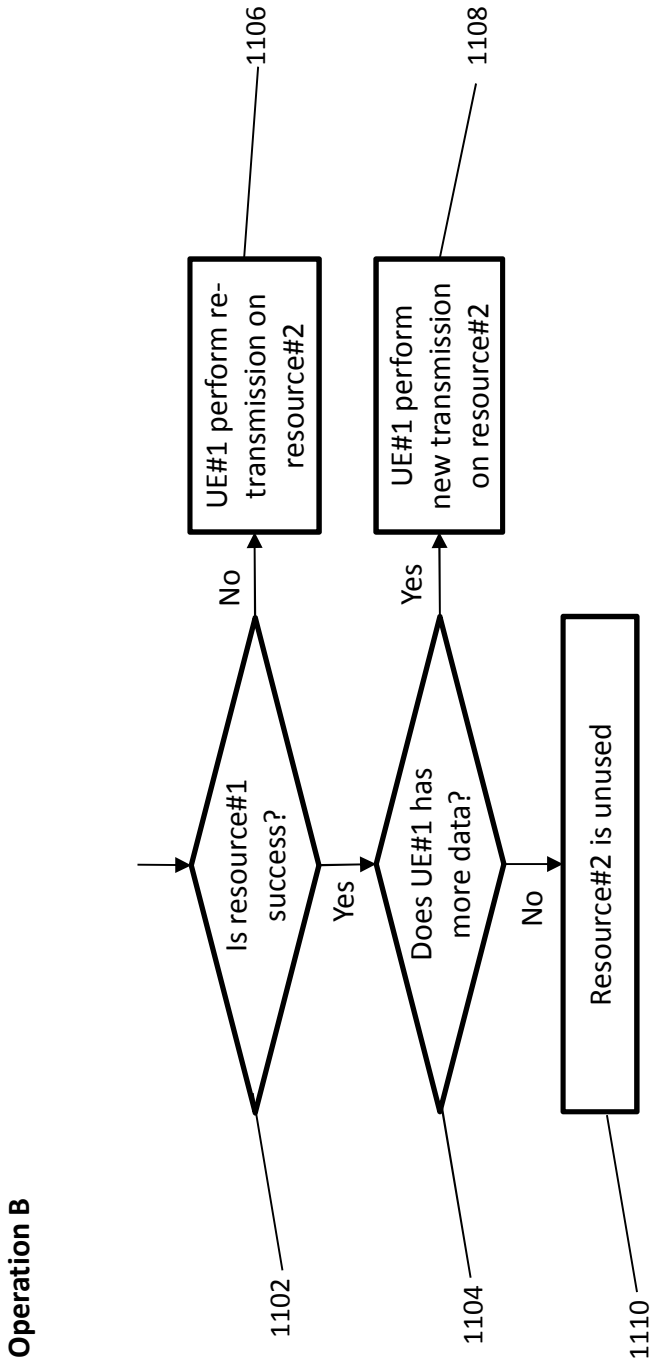

Operation B
Is resource#1 success?
No
Yes
Does UE#1 has more data?
Yes
No
UE#1 perform re-transmission on resource#2
UE#1 perform new transmission on resource#2
Resource#2 is unused
1102
1104
1106
1108
1110
1100

Fig. 11

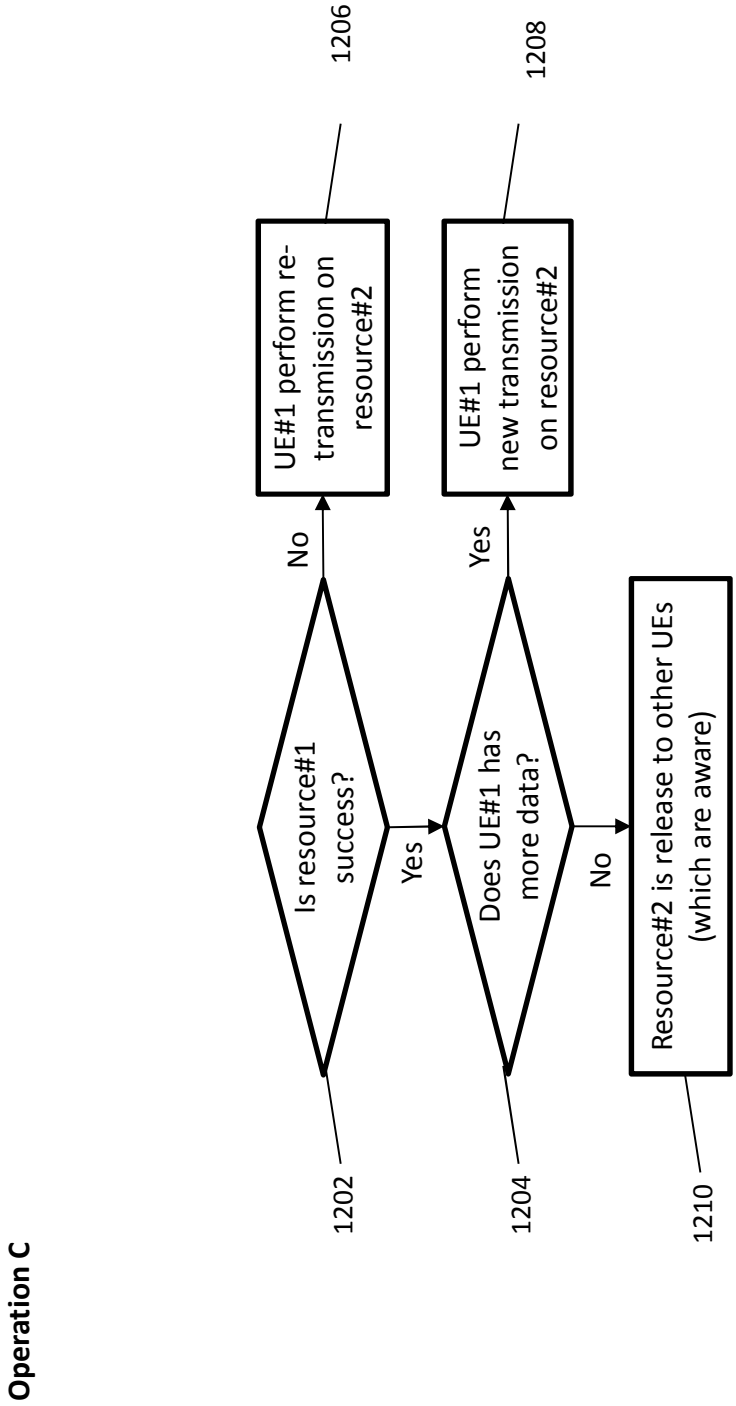

Operation C
1200
Is resource#1 success?
1202
No
Yes
Does UE#1 has more data?
1204
No
Yes
Resource#2 is release to other UEs (which are aware)
1210
UE#1 perform re-transmission on resource#2
1206
UE#1 perform new transmission on resource#2
1208

Fig. 12

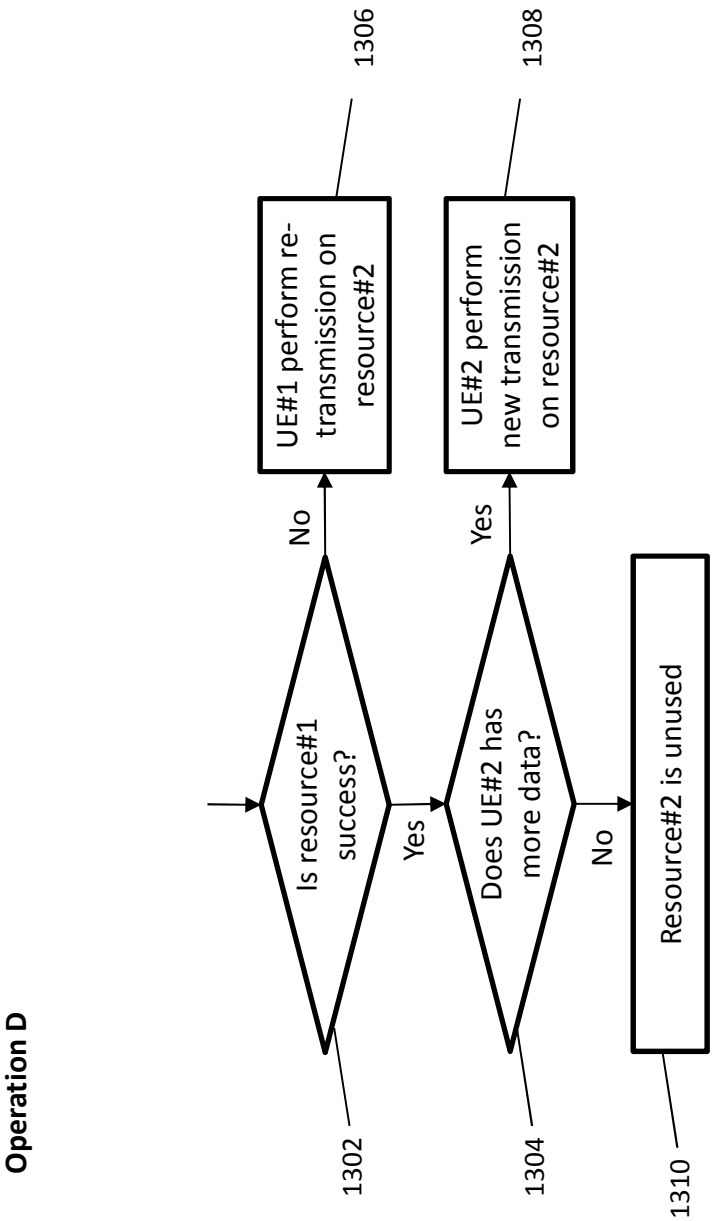

Operation D
Is resource#1 success?
No
Yes
Does UE#2 has more data?
Yes
No
Resource#2 is unused
UE#1 perform re-transmission on resource#2
UE#2 perform new transmission on resource#2
1302
1304
1306
1308
1310
1300

Fig. 13

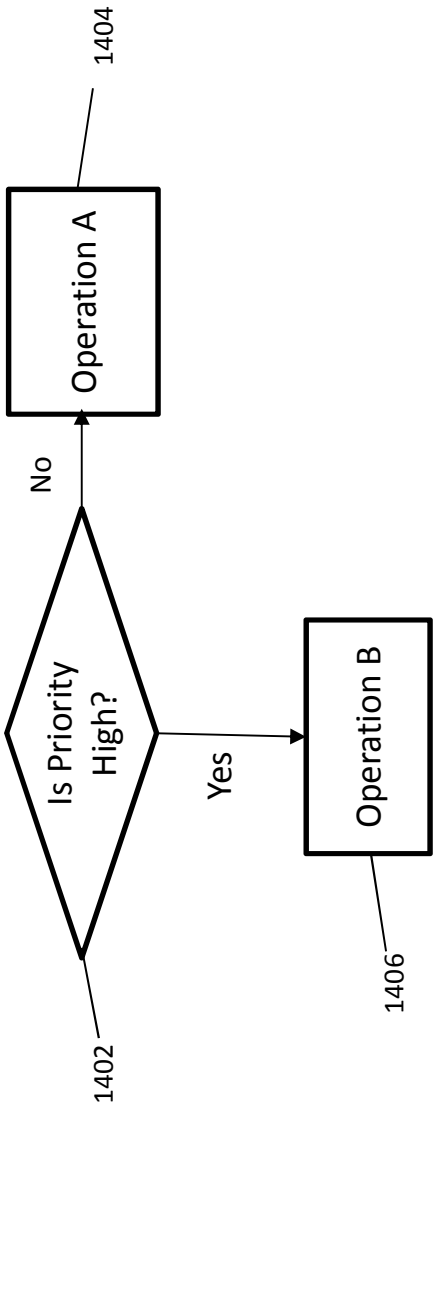

1404
Operation A
No
Is Priority High?
1402
Yes
Operation B
1406
1400

Fig. 14

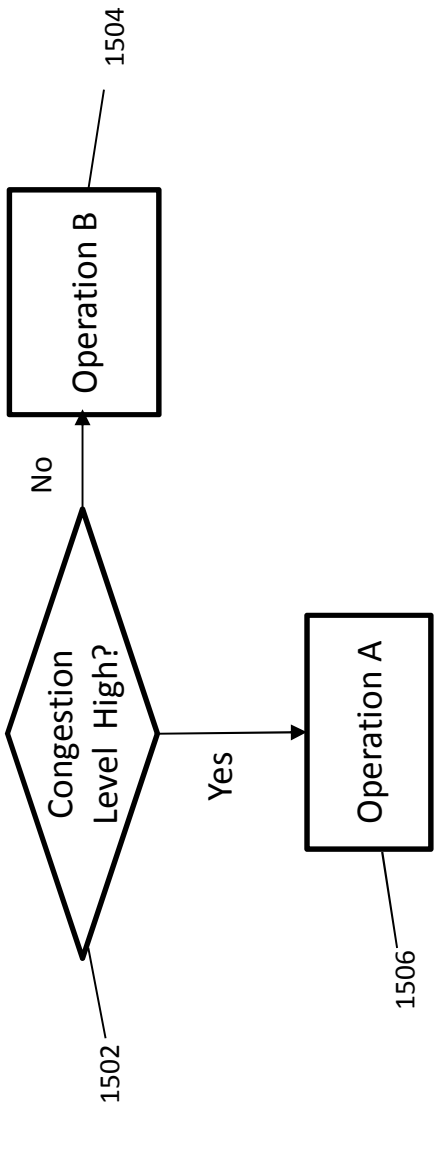

1504
Operation B
No
Congestion Level High?
Yes
Operation A
1502
1506
1500

Fig. 15

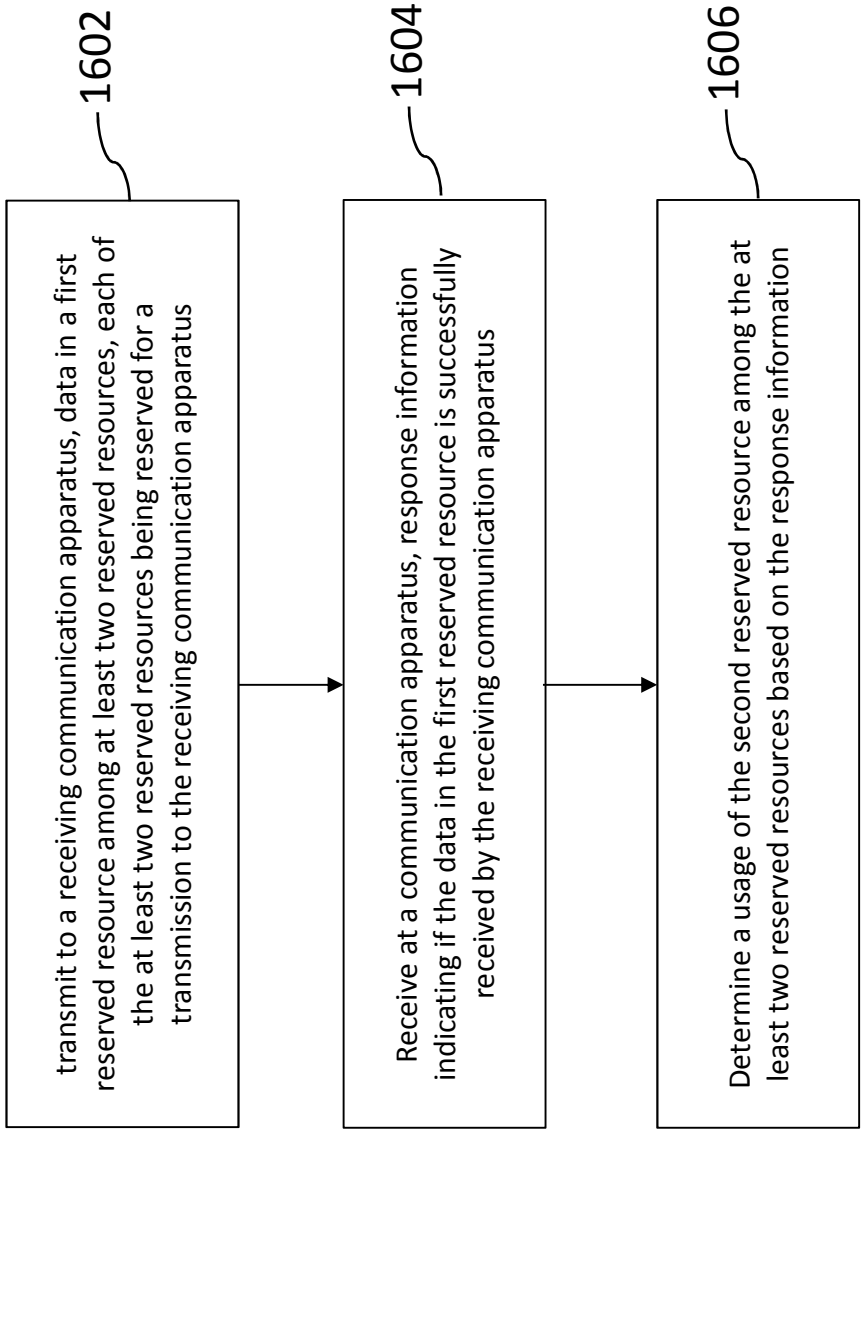

1602
transmit to a receiving communication apparatus, data in a first reserved resource among at least two reserved resources, each of the at least two reserved resources being reserved for a transmission to the receiving communication apparatus
1604
Receive at a communication apparatus, response information indicating if the data in the first reserved resource is successfully received by the receiving communication apparatus
1606
Determine a usage of the second reserved resource among the at least two reserved resources based on the response information
1600

Fig. 16

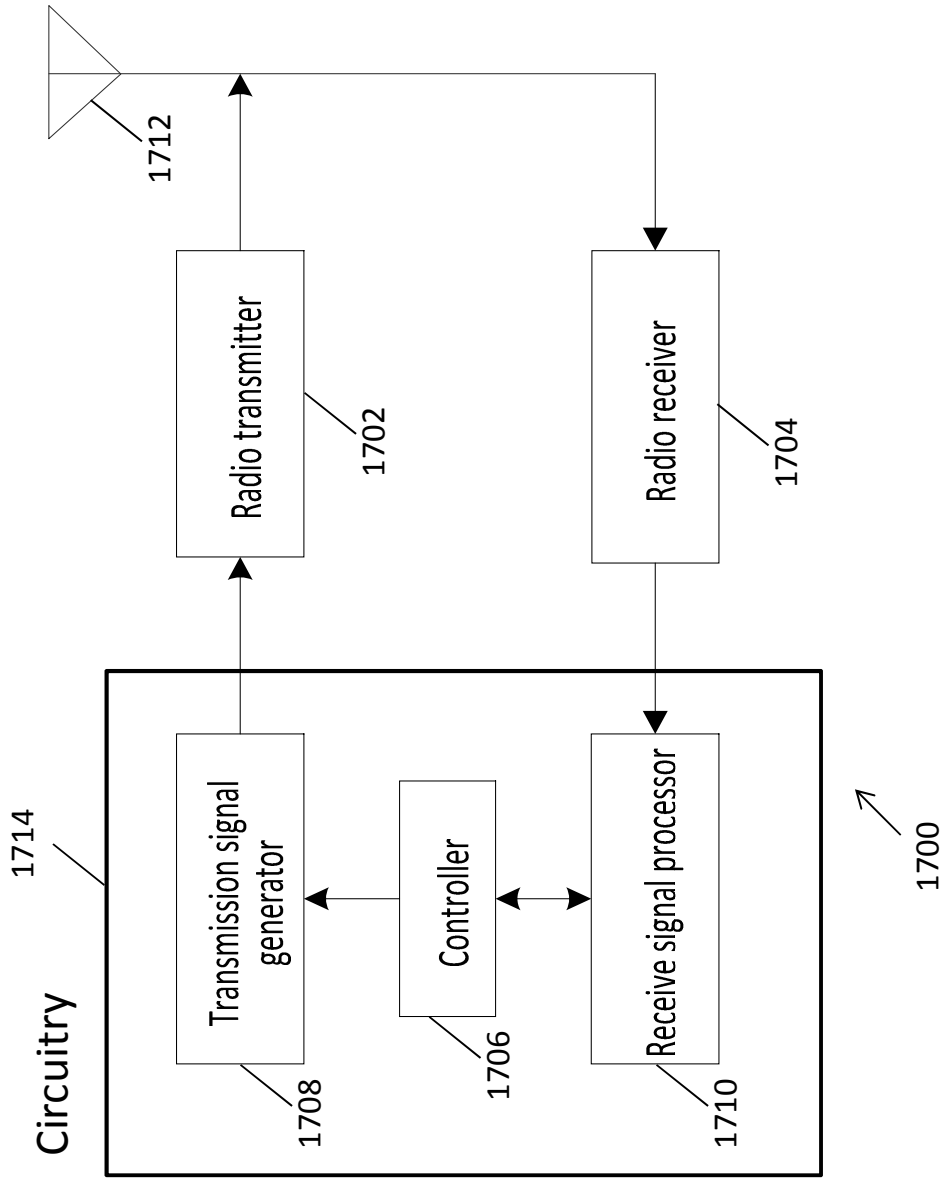

1712
Radio transmitter
1702
Radio receiver
1704
1714
Circuitry
Transmission signal generator
1708
Controller
1706
Receive signal processor
1710
1700

Fig. 17