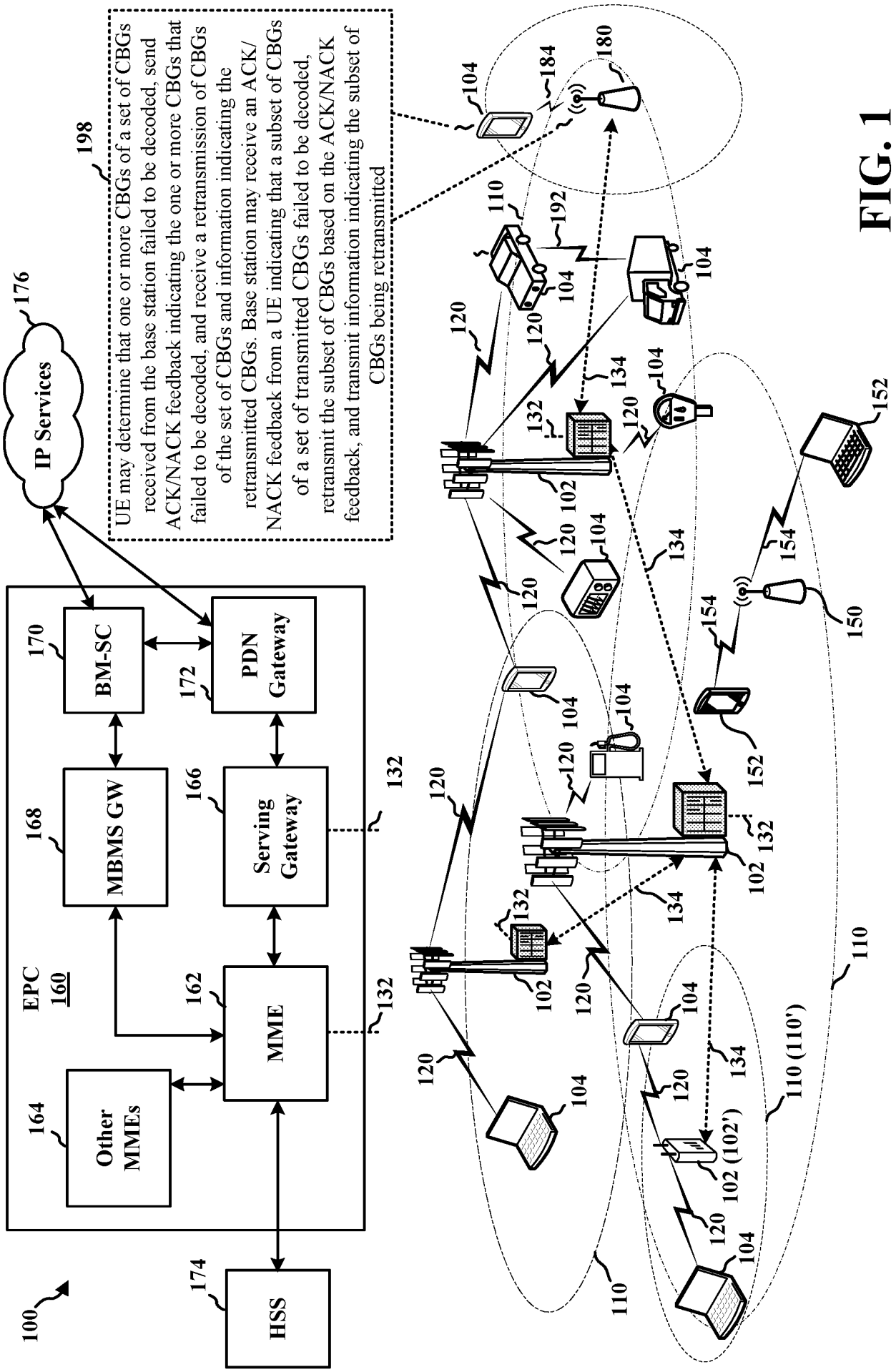
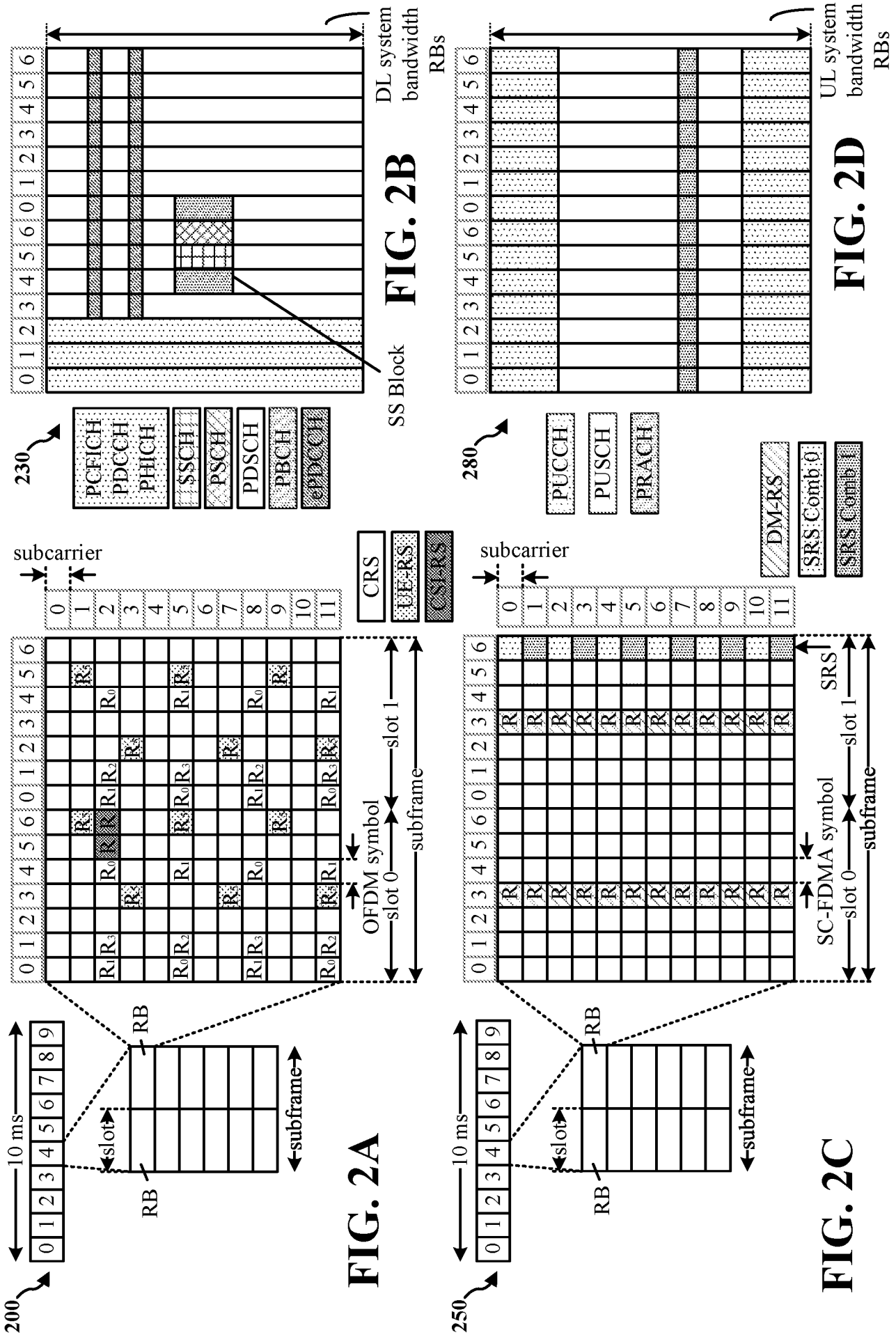

100
HSS
174
EPC
160
Other MMEs
164
MME
162
MBMS GW
168
Serving Gateway
166
BM-SC
170
PDN Gateway
172
IP Services
176
198
UE may determine that one or more CBGs of a set of CBGs received from the base station failed to be decoded, send ACK/NACK feedback indicating the one or more CBGs that failed to be decoded, and receive a retransmission of CBGs of the set of CBGs and information indicating the retransmitted CBGs. Base station may receive an ACK/NACK feedback from a UE indicating that a subset of CBGs of a set of transmitted CBGs failed to be decoded, retransmit the subset of CBGs based on the ACK/NACK feedback, and transmit information indicating the subset of CBGs being retransmitted
102
102 (102')
104
110
110 (110')
120
132
134
150
152
154
180
184
192

FIG. 1


200
10 ms
slot
subframe
RB
FIG. 2A
230
PCFICH
PDCCH
PHICH
SSCH
PSCH
PDSCH
PBCH
ePDCCH
SS Block
DL system bandwidth RBs
FIG. 2B
CRS
UE-RS
CSI-RS
subcarrier
OFDM symbol
slot 0
slot 1
subframe
250
SC-FDMA symbol
SRS
FIG. 2C
280
PUCCH
PUSCH
PRACH
DM-RS
SRS Comb 0
SRS Comb 1
UL system bandwidth RBs
FIG. 2D

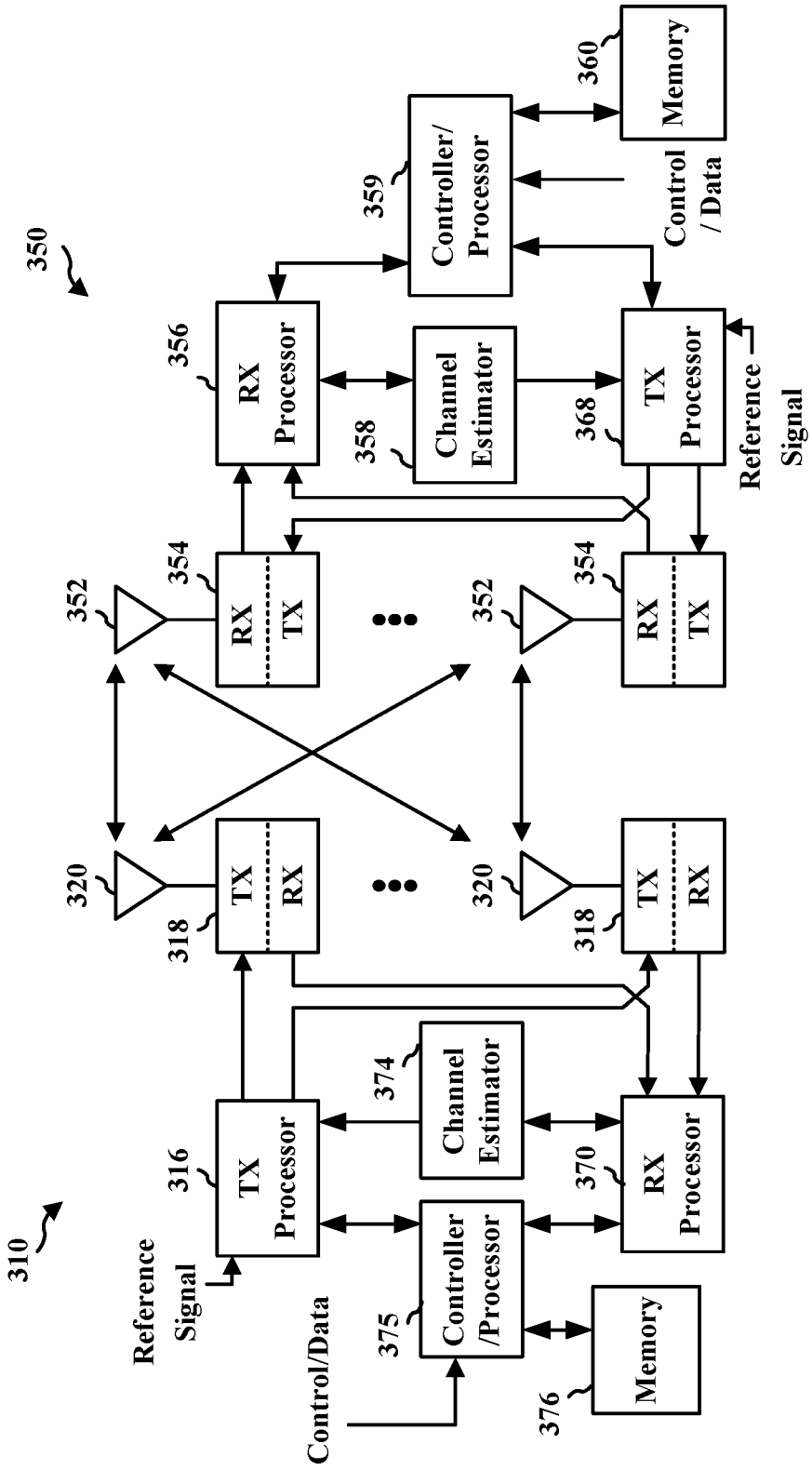

350
310
Reference Signal
Control/Data
316
TX Processor
375
Controller /Processor
376
Memory
374
Channel Estimator
370
RX Processor
318
TX RX
320
352
354
RX TX
356
RX Processor
358
Channel Estimator
359
Controller/ Processor
360
Memory
Control / Data
368
TX Processor
Reference Signal

FIG. 3

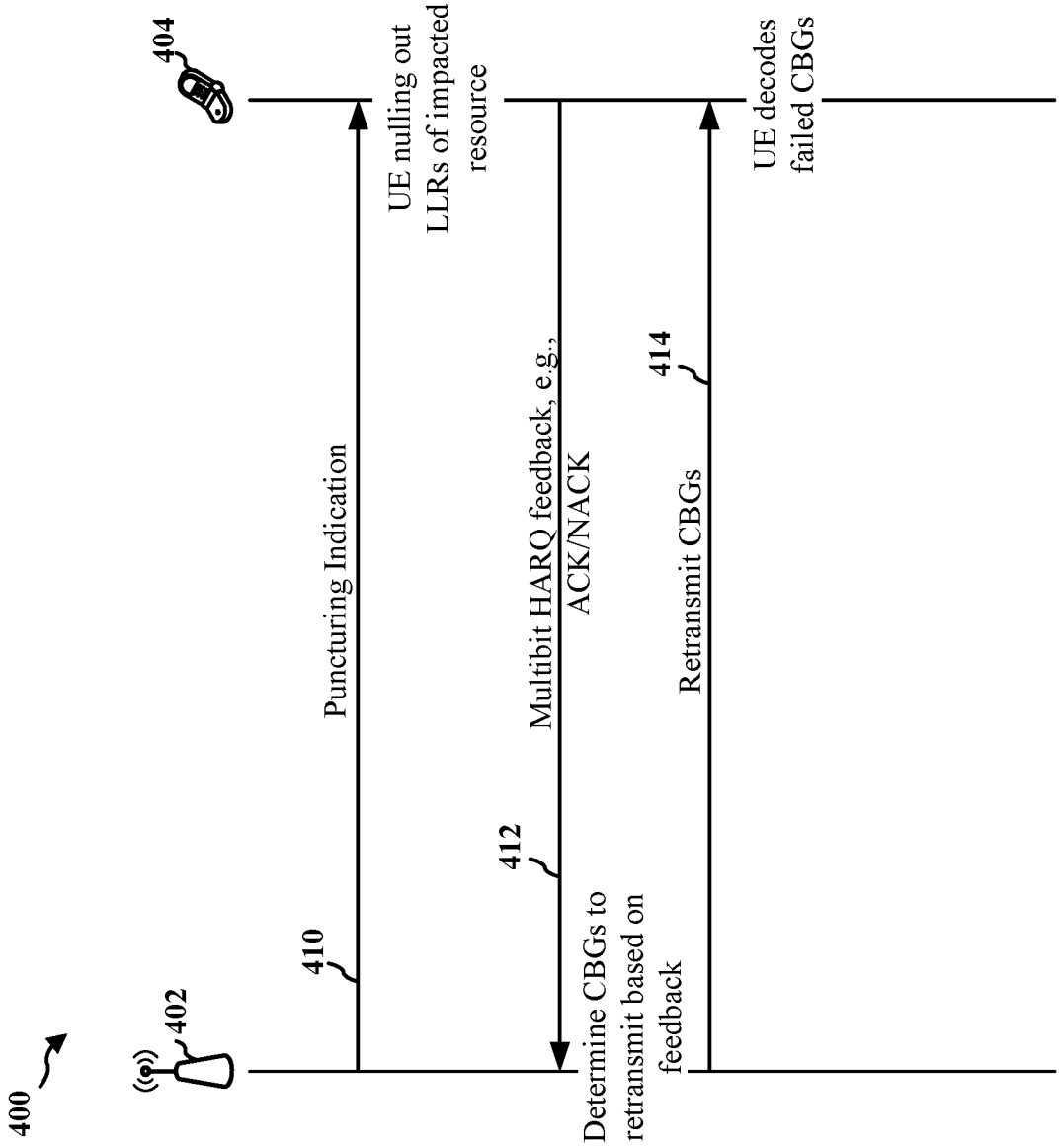

400
402
404
410
Puncturing Indication
UE nulling out LLRs of impacted resource
412
Multibit HARQ feedback, e.g., ACK/NACK
Determine CBGs to retransmit based on feedback
414
Retransmit CBGs
UE decodes failed CBGs

FIG. 4

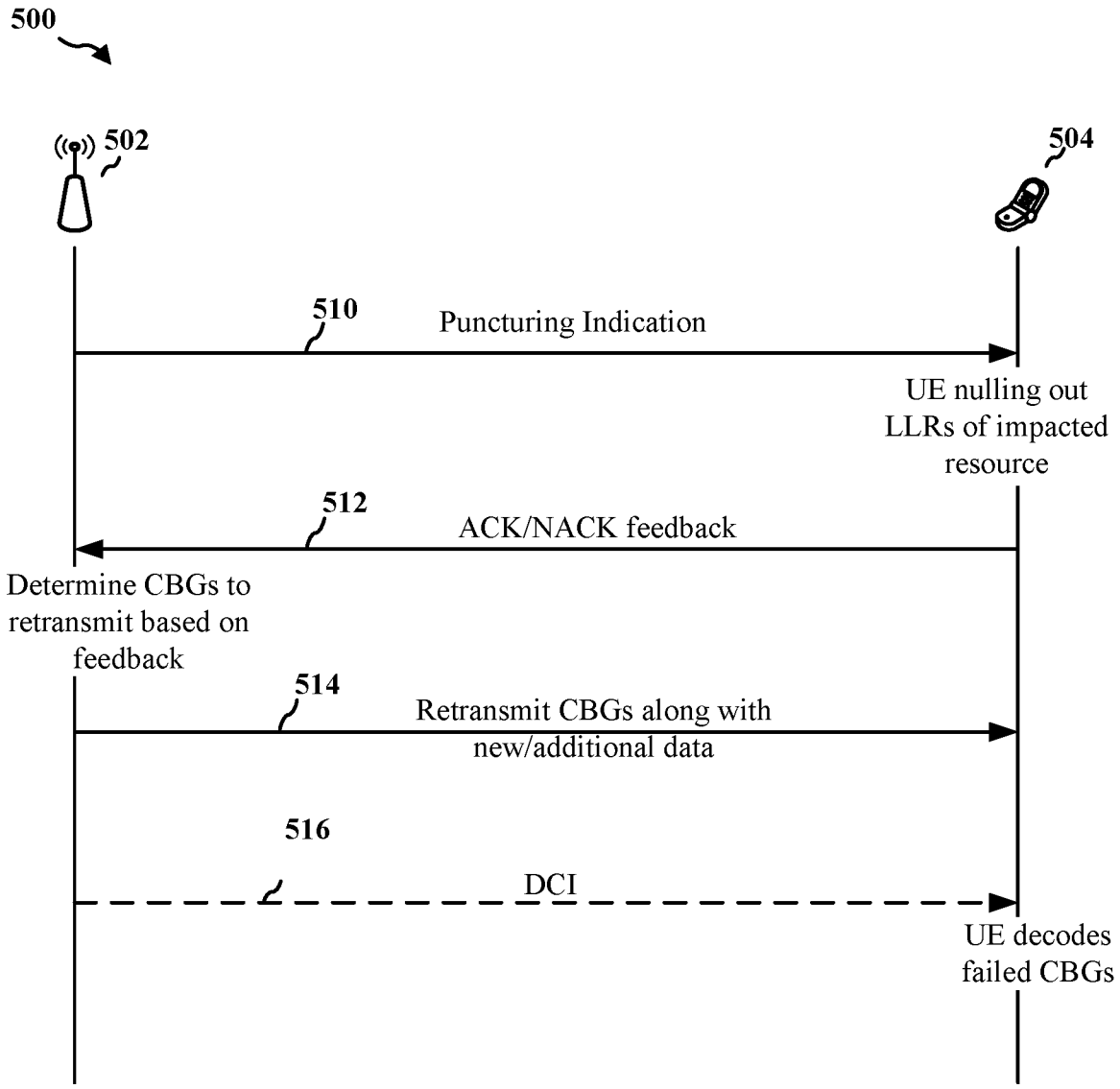

500
502
504
510
Puncturing Indication
UE nulling out LLRs of impacted resource
512
ACK/NACK feedback
Determine CBGs to retransmit based on feedback
514
Retransmit CBGs along with new/additional data
516
DCI
UE decodes failed CBGs

FIG. 5

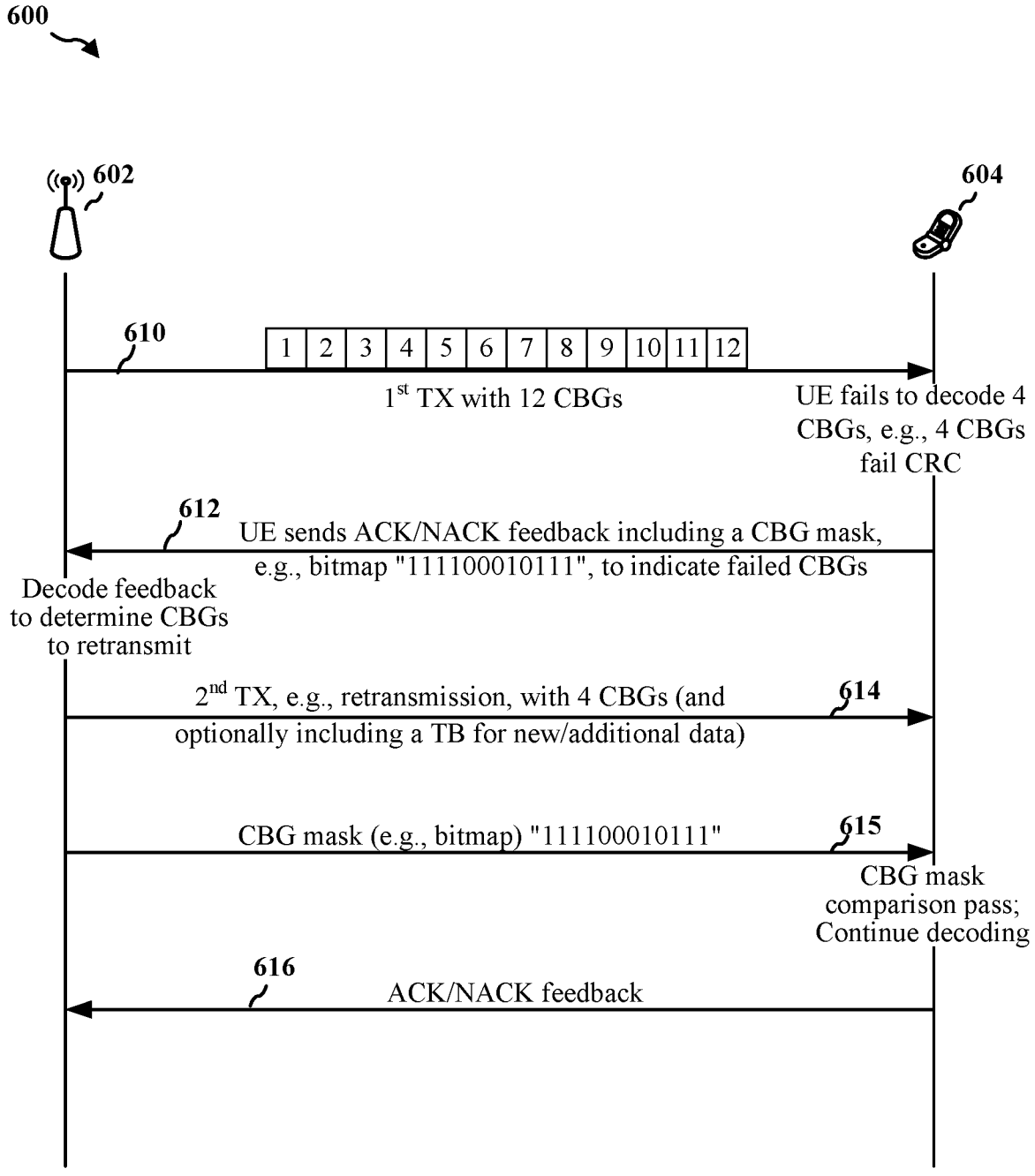

600
602
604
610
1 2 3 4 5 6 7 8 9 10 11 12
1st TX with 12 CBGs
UE fails to decode 4 CBGs, e.g., 4 CBGs fail CRC
612
UE sends ACK/NACK feedback including a CBG mask, e.g., bitmap "111100010111", to indicate failed CBGs
Decode feedback to determine CBGs to retransmit
2nd TX, e.g., retransmission, with 4 CBGs (and optionally including a TB for new/additional data)
614
CBG mask (e.g., bitmap) "111100010111"
615
CBG mask comparison pass; Continue decoding
616
ACK/NACK feedback

FIG. 6

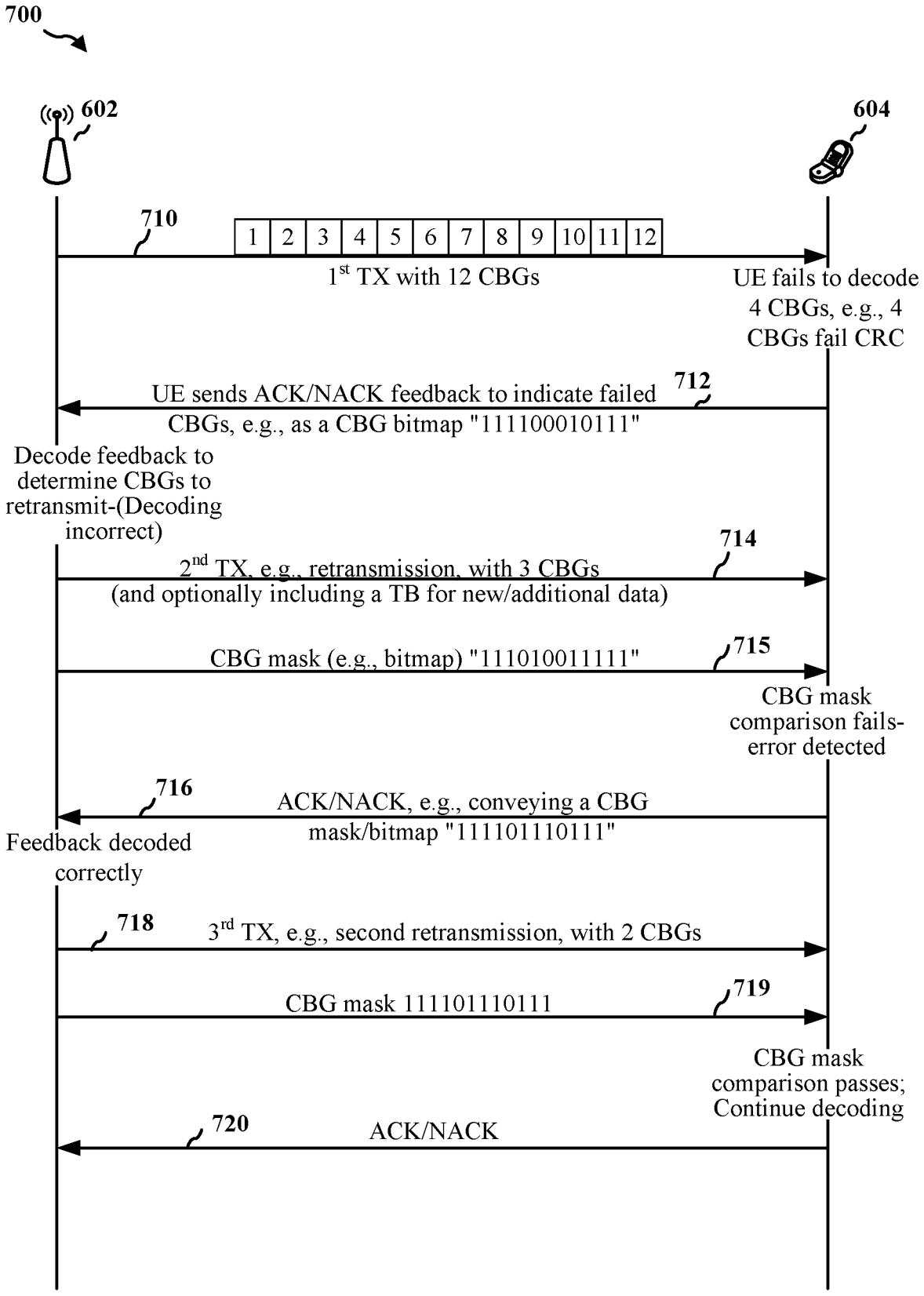

700
602
604
710
1 2 3 4 5 6 7 8 9 10 11 12
1st TX with 12 CBGs
UE fails to decode 4 CBGs, e.g., 4 CBGs fail CRC
712
UE sends ACK/NACK feedback to indicate failed CBGs, e.g., as a CBG bitmap "111100010111"
Decode feedback to determine CBGs to retransmit-(Decoding incorrect)
714
2nd TX, e.g., retransmission, with 3 CBGs (and optionally including a TB for new/additional data)
715
CBG mask (e.g., bitmap) "111010011111"
CBG mask comparison fails-error detected
716
ACK/NACK, e.g., conveying a CBG mask/bitmap "111101110111"
Feedback decoded correctly
718
3rd TX, e.g., second retransmission, with 2 CBGs
719
CBG mask 111101110111
CBG mask comparison passes; Continue decoding
720
ACK/NACK

FIG. 7

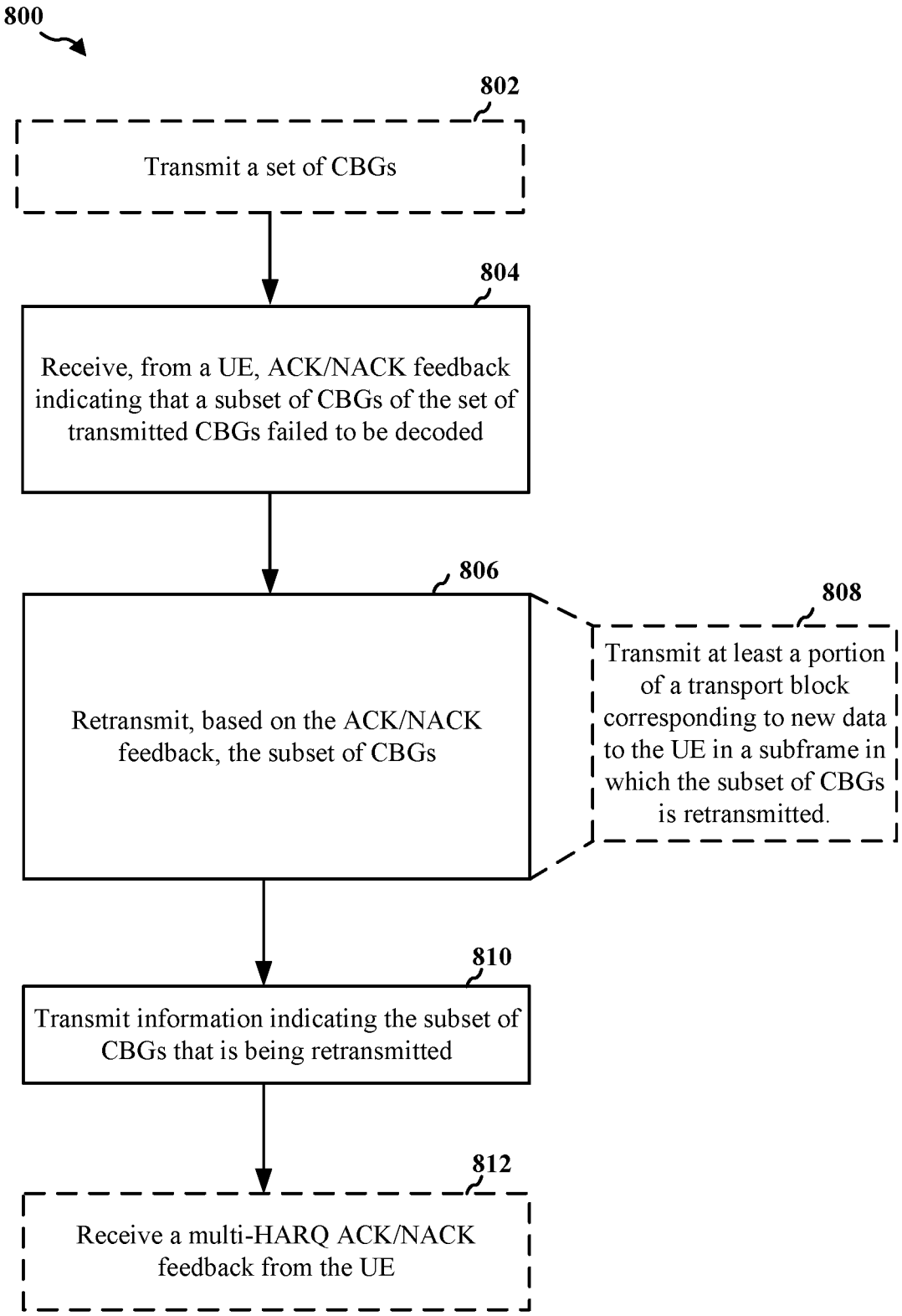

800
802
Transmit a set of CBGs
804
Receive, from a UE, ACK/NACK feedback indicating that a subset of CBGs of the set of transmitted CBGs failed to be decoded
806
Retransmit, based on the ACK/NACK feedback, the subset of CBGs
808
Transmit at least a portion of a transport block corresponding to new data to the UE in a subframe in which the subset of CBGs is retransmitted.
810
Transmit information indicating the subset of CBGs that is being retransmitted
812
Receive a multi-HARQ ACK/NACK feedback from the UE

FIG. 8

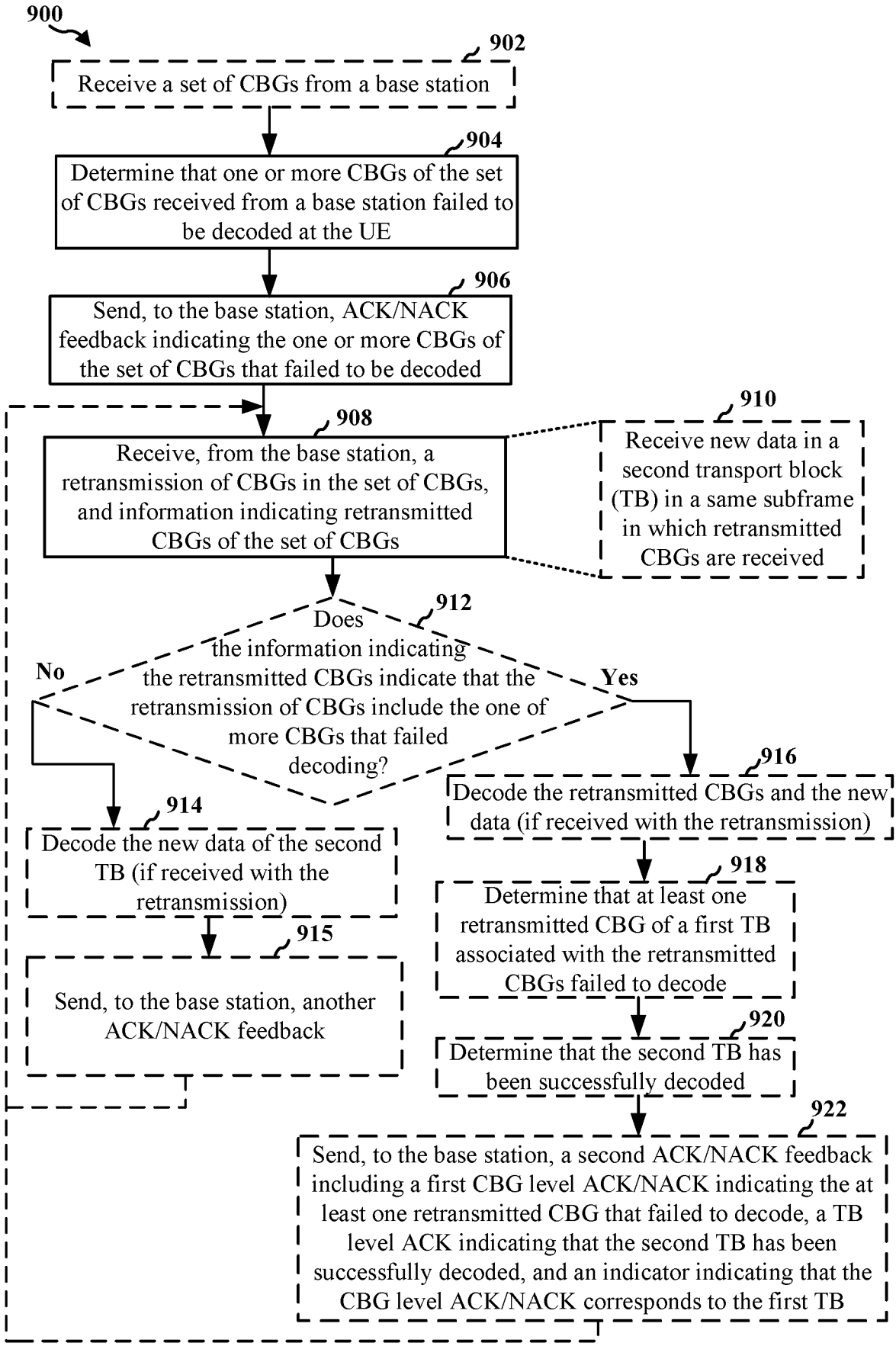

900
902
Receive a set of CBGs from a base station
904
Determine that one or more CBGs of the set of CBGs received from a base station failed to be decoded at the UE
906
Send, to the base station, ACK/NACK feedback indicating the one or more CBGs of the set of CBGs that failed to be decoded
908
Receive, from the base station, a retransmission of CBGs in the set of CBGs, and information indicating retransmitted CBGs of the set of CBGs
910
Receive new data in a second transport block (TB) in a same subframe in which retransmitted CBGs are received
912
Does the information indicating the retransmitted CBGs indicate that the retransmission of CBGs include the one of more CBGs that failed decoding?
No
Yes
914
Decode the new data of the second TB (if received with the retransmission)
915
Send, to the base station, another ACK/NACK feedback
916
Decode the retransmitted CBGs and the new data (if received with the retransmission)
918
Determine that at least one retransmitted CBG of a first TB associated with the retransmitted CBGs failed to decode
920
Determine that the second TB has been successfully decoded
922
Send, to the base station, a second ACK/NACK feedback including a first CBG level ACK/NACK indicating the at least one retransmitted CBG that failed to decode, a TB level ACK indicating that the second TB has been successfully decoded, and an indicator indicating that the CBG level ACK/NACK corresponds to the first TB

FIG. 9

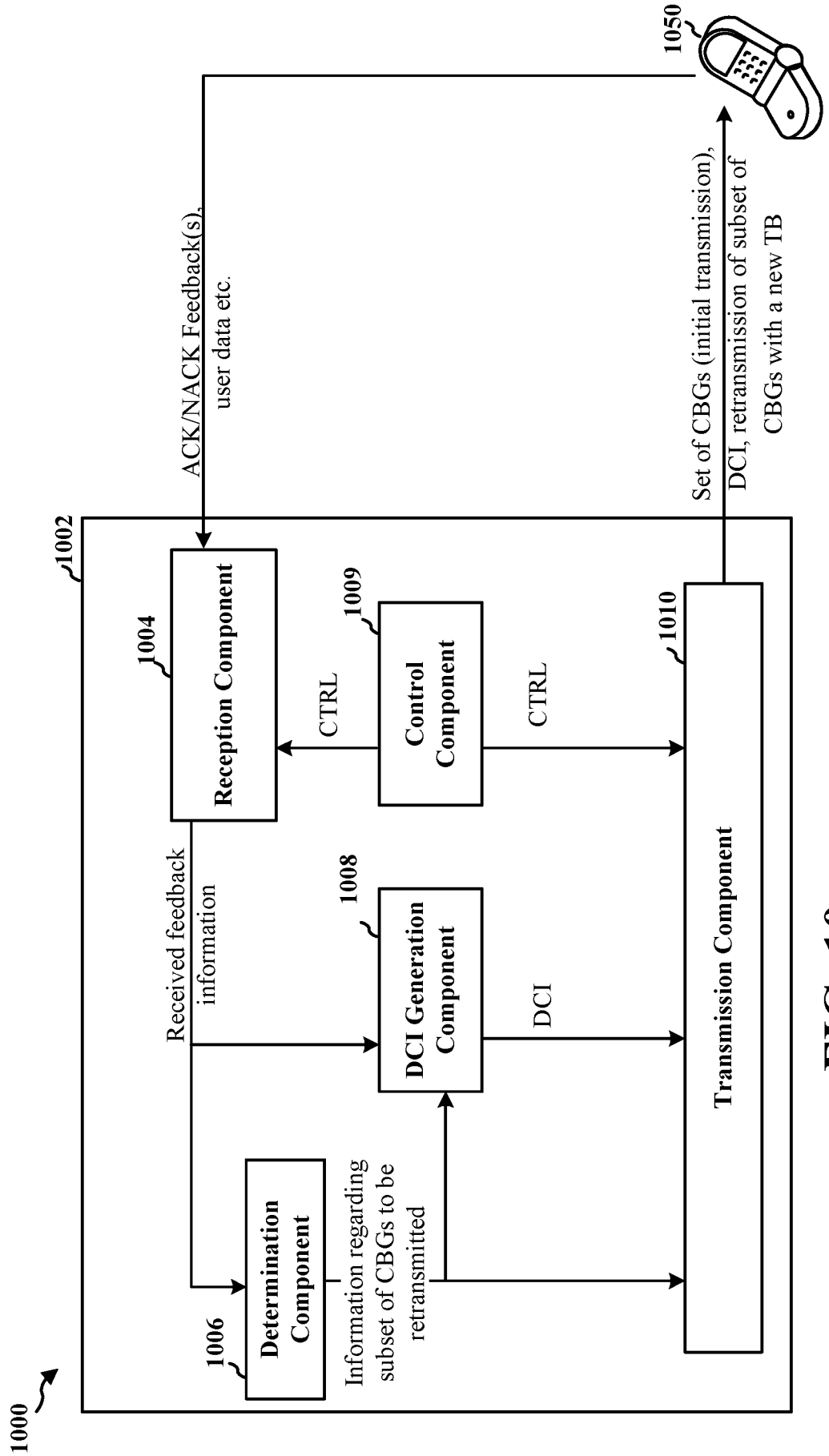

1000
1002
1004
Reception Component
1006
Determination Component
1008
DCI Generation Component
1009
Control Component
1010
Transmission Component
1050
ACK/NACK Feedback(s), user data etc.
Received feedback information
Information regarding subset of CBGs to be retransmitted
CTRL
CTRL
DCI
Set of CBGs (initial transmission), DCI, retransmission of subset of CBGs with a new TB

FIG. 10

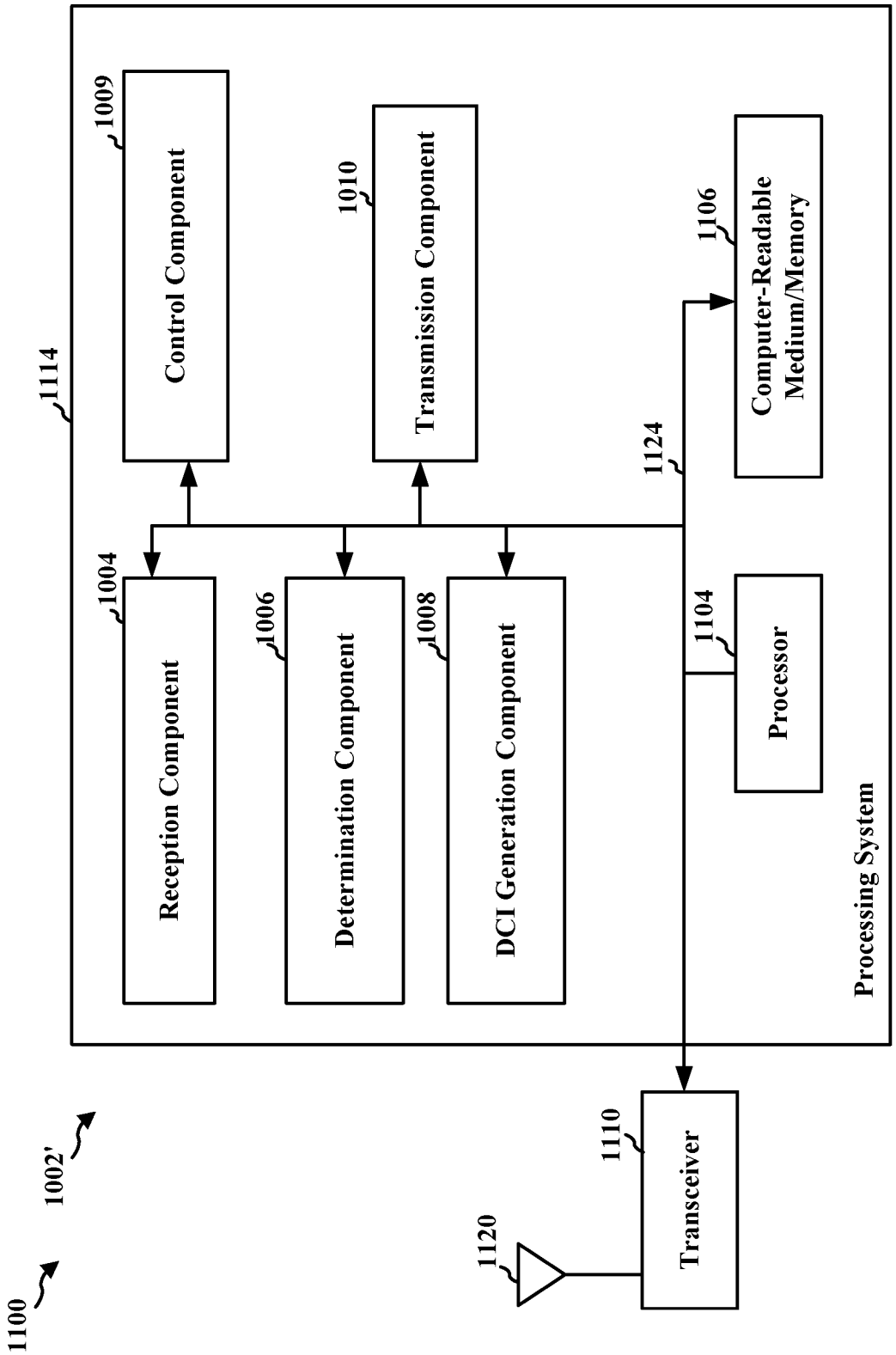

1100
1002'
1114
1009
Control Component
1010
Transmission Component
1106
Computer-Readable Medium/Memory
1124
1004
Reception Component
1006
Determination Component
1008
DCI Generation Component
1104
Processor
Processing System
1110
Transceiver
1120

FIG. 11

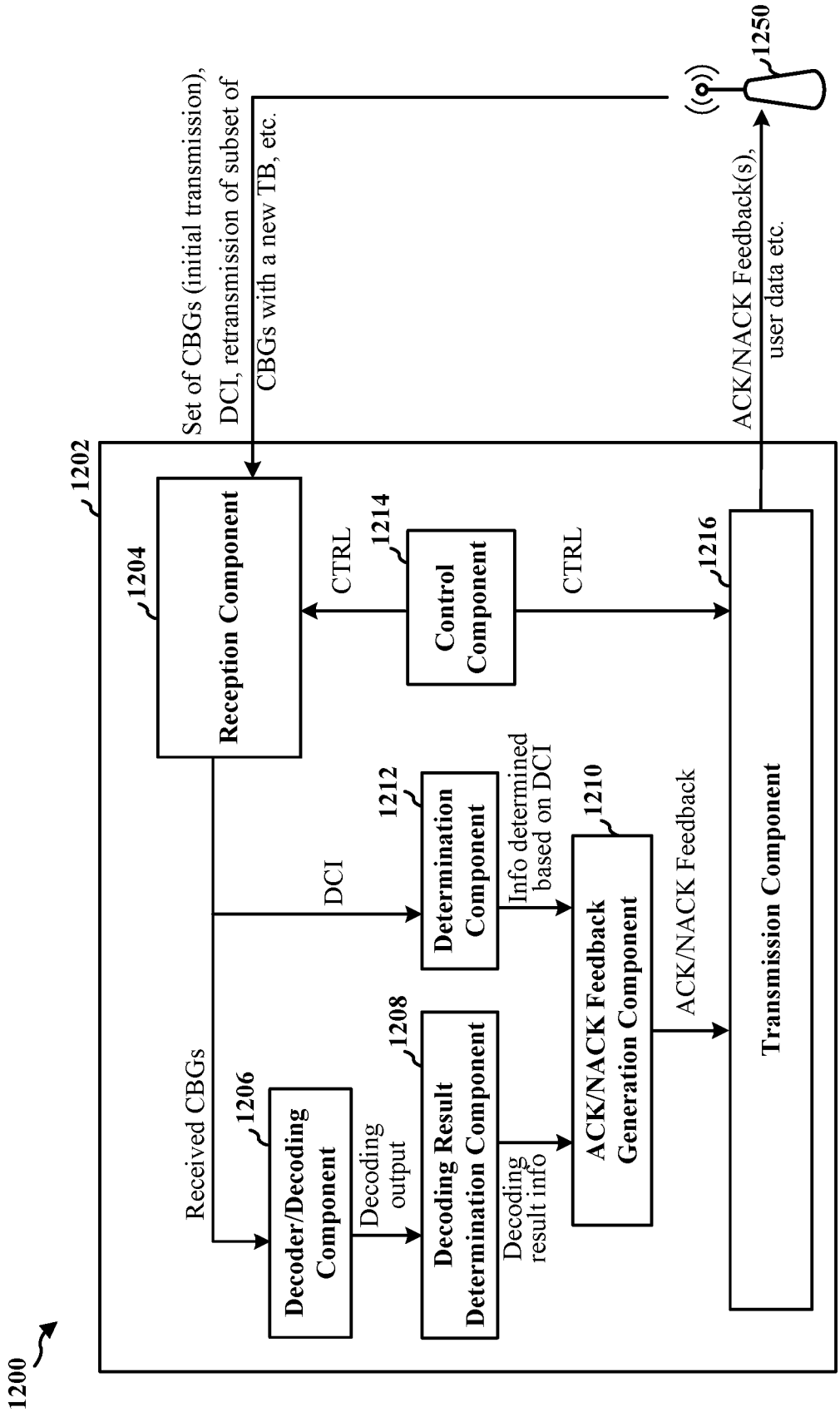

1200
1202
1250
Set of CBGs (initial transmission), DCI, retransmission of subset of CBGs with a new TB, etc.
ACK/NACK Feedback(s), user data etc.
1204
Reception Component
CTRL
1214
Control Component
CTRL
1216
Transmission Component
DCI
1212
Determination Component
Info determined based on DCI
1210
ACK/NACK Feedback Generation Component
ACK/NACK Feedback
Received CBGs
1206
Decoder/Decoding Component
Decoding output
1208
Decoding Result Determination Component
Decoding result info

FIG. 12

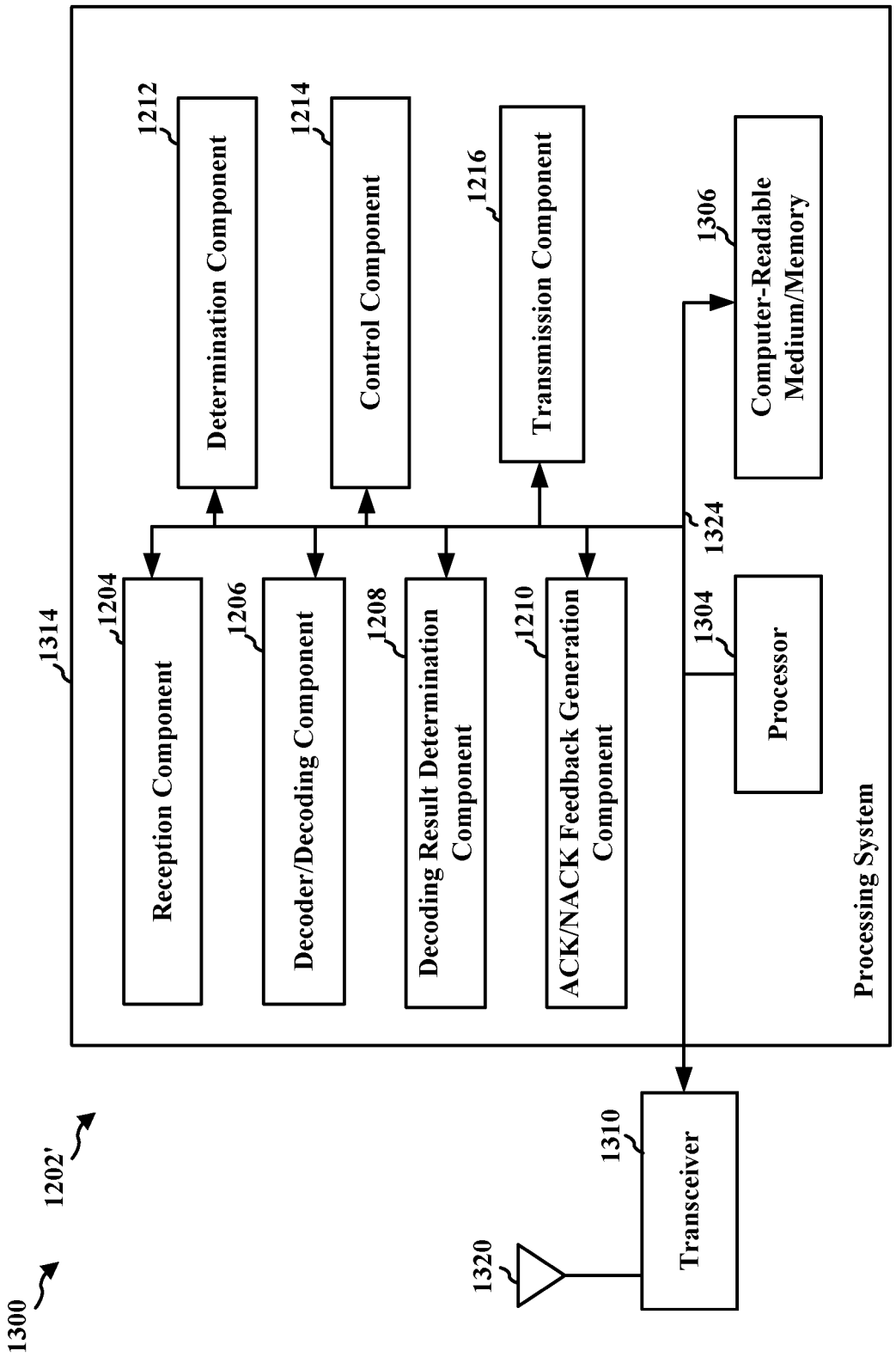

1300
1202'
1320
1310
Transceiver
1314
Processing System
1204
Reception Component
1206
Decoder/Decoding Component
1208
Decoding Result Determination Component
1210
ACK/NACK Feedback Generation Component
1212
Determination Component
1214
Control Component
1216
Transmission Component
1304
Processor
1306
Computer-Readable Medium/Memory
1324

FIG. 13