FIG. 1

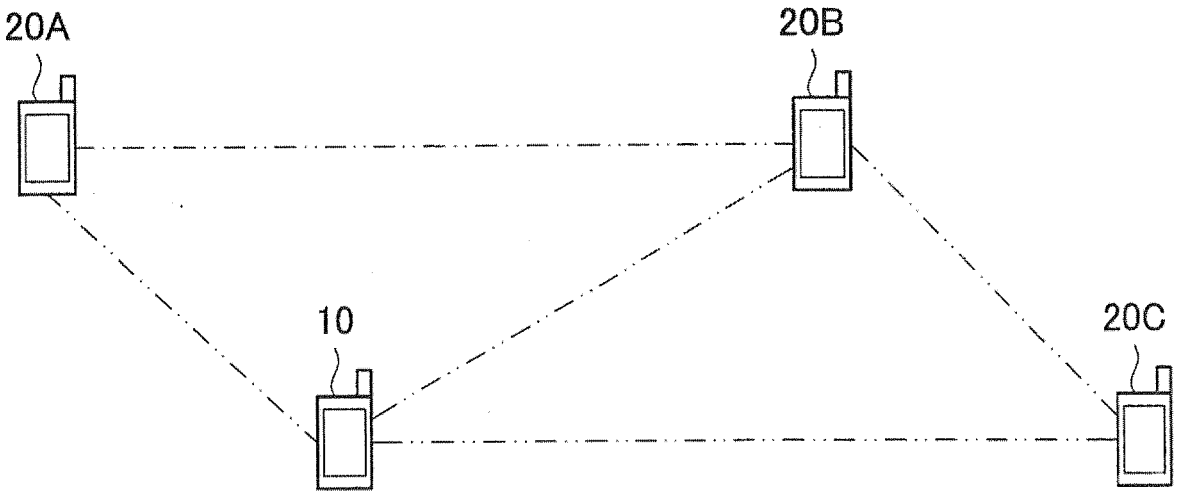


FIG. 2

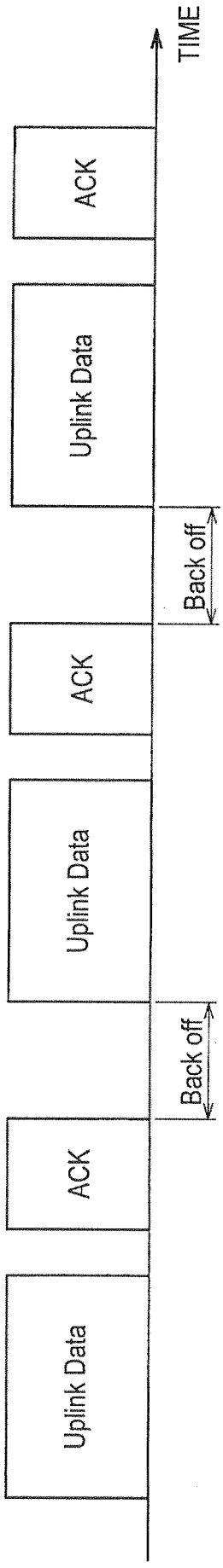

TIME
Uplink Data
ACK
Back off
Uplink Data
ACK
Back off
Uplink Data
ACK

FIG. 3

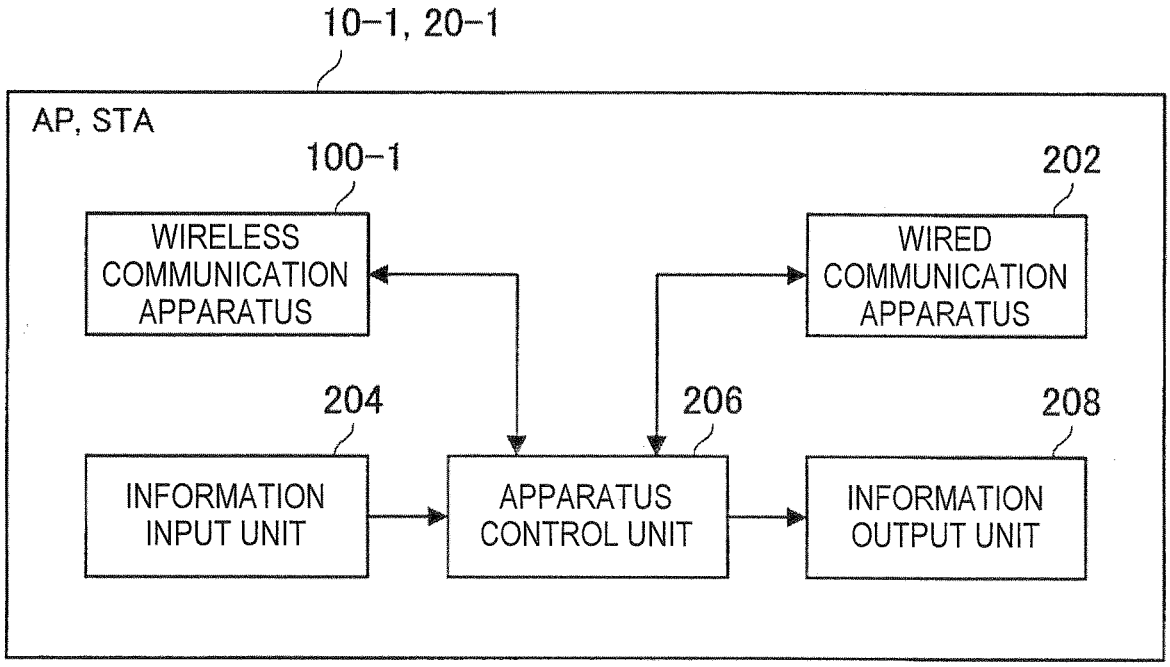

10-1, 20-1
AP, STA
100-1
WIRELESS COMMUNICATION APPARATUS
202
WIRED COMMUNICATION APPARATUS
204
INFORMATION INPUT UNIT
206
APPARATUS CONTROL UNIT
208
INFORMATION OUTPUT UNIT

FIG. 4

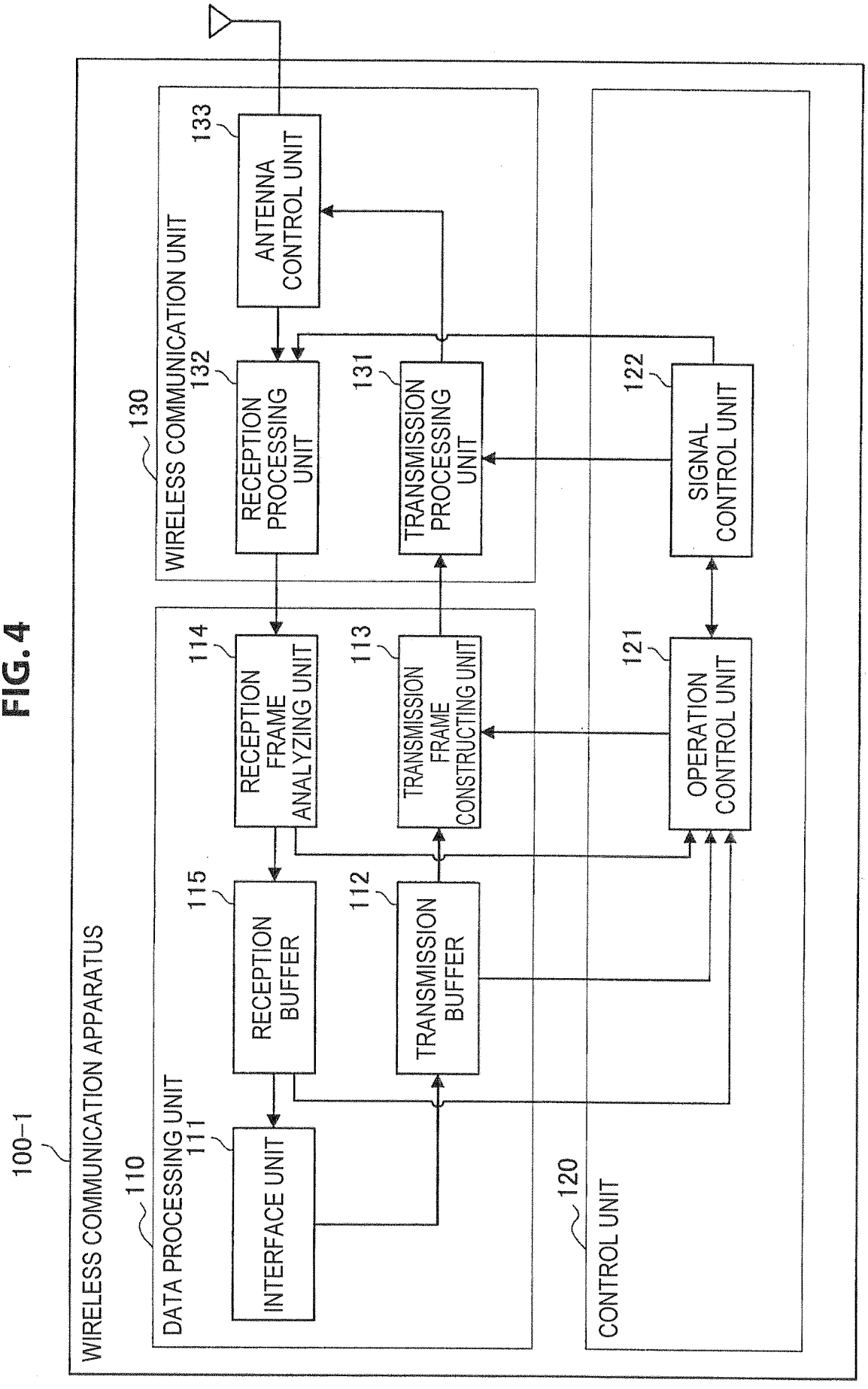

100-1
WIRELESS COMMUNICATION APPARATUS
110
DATA PROCESSING UNIT
111
INTERFACE UNIT
115
RECEPTION BUFFER
112
TRANSMISSION BUFFER
114
RECEPTION FRAME ANALYZING UNIT
113
TRANSMISSION FRAME CONSTRUCTING UNIT
130
WIRELESS COMMUNICATION UNIT
132
RECEPTION PROCESSING UNIT
131
TRANSMISSION PROCESSING UNIT
133
ANTENNA CONTROL UNIT
120
CONTROL UNIT
121
OPERATION CONTROL UNIT
122
SIGNAL CONTROL UNIT

FIG.5

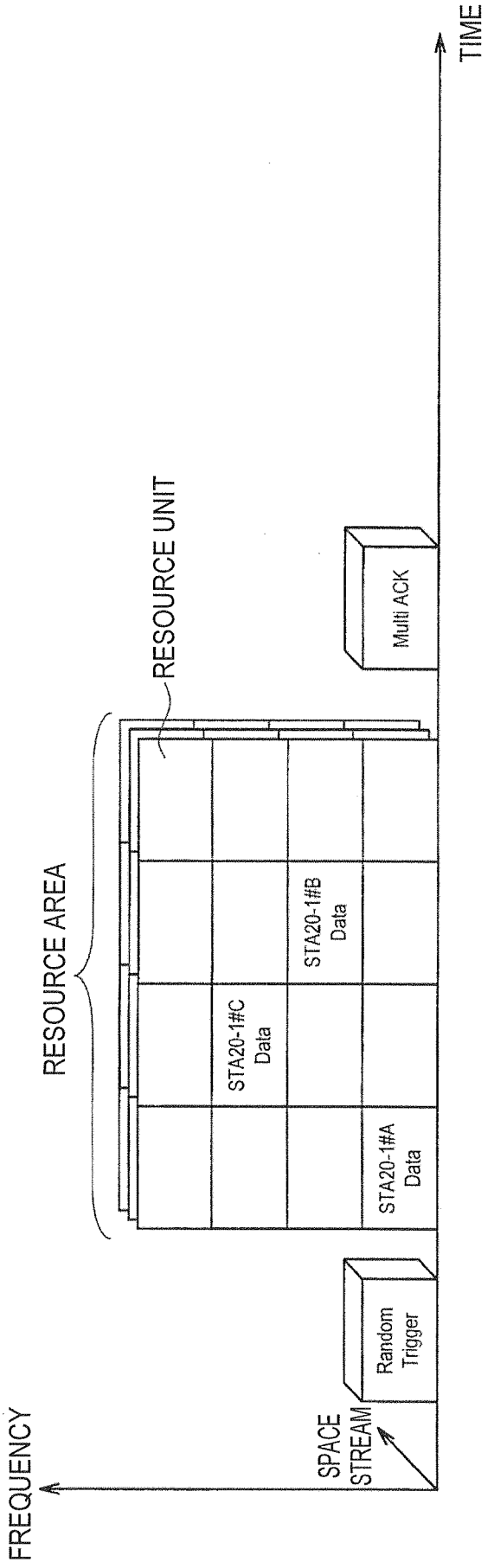

TIME
FREQUENCY
SPACE STREAM
Random Trigger
STA20-1#A Data
STA20-1#C Data
STA20-1#B Data
RESOURCE UNIT
RESOURCE AREA
Multi ACK

FIG. 6

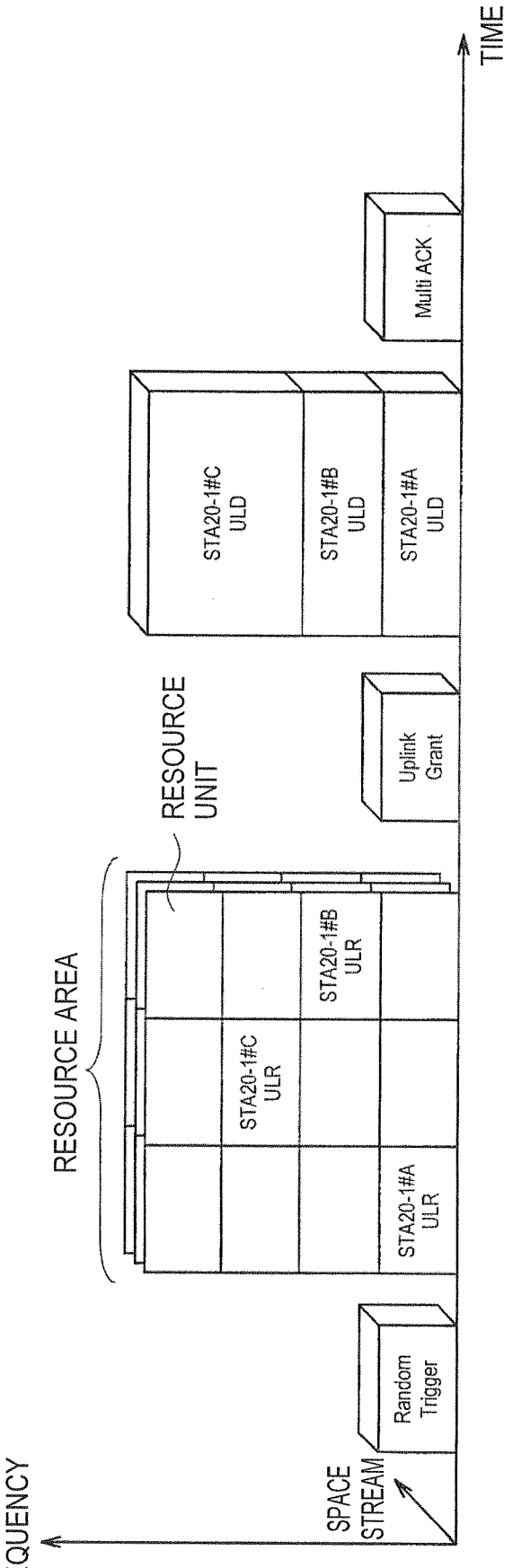

FREQUENCY
SPACE STREAM
TIME
RESOURCE AREA
RESOURCE UNIT
Random Trigger
STA20-1#A ULR
STA20-1#C ULR
STA20-1#B ULR
Uplink Grant
STA20-1#C ULD
STA20-1#B ULD
STA20-1#A ULD
Multi ACK

FIG. 7

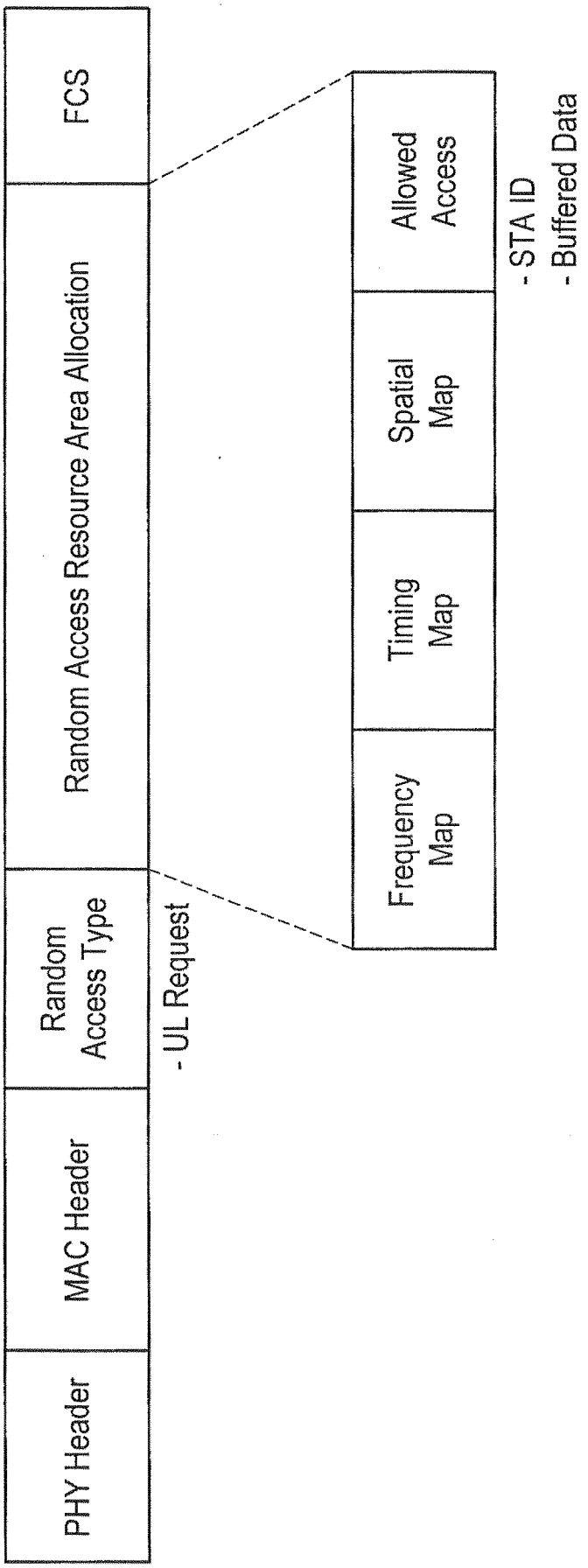

PHY Header
MAC Header
Random Access Type
- UL Request
Random Access Resource Area Allocation
Frequency Map
Timing Map
Spatial Map
Allowed Access
- STA ID
- Buffered Data
FCS

FIG. 8

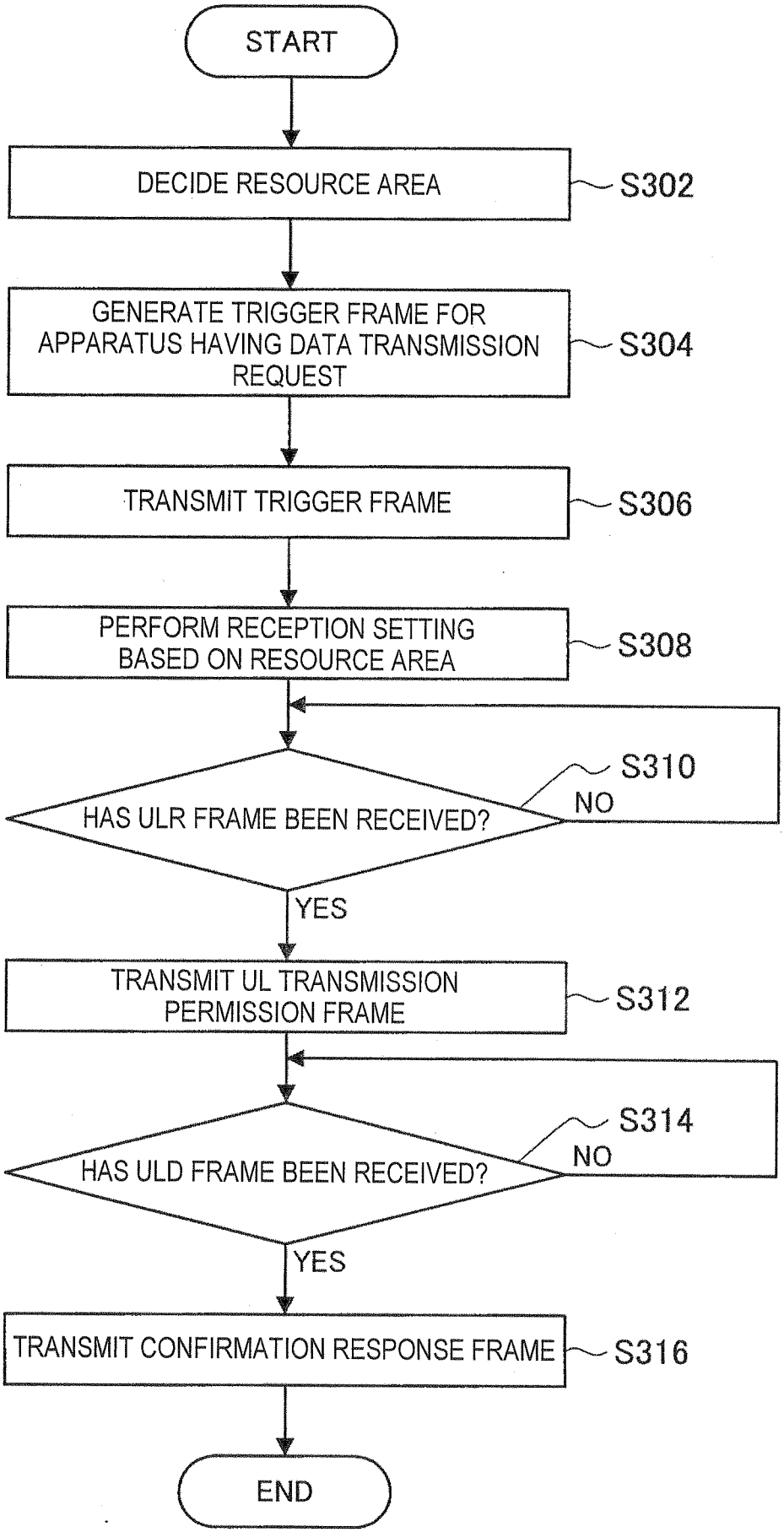

START
DECIDE RESOURCE AREA
S302
GENERATE TRIGGER FRAME FOR APPARATUS HAVING DATA TRANSMISSION REQUEST
S304
TRANSMIT TRIGGER FRAME
S306
PERFORM RECEPTION SETTING BASED ON RESOURCE AREA
S308
HAS ULR FRAME BEEN RECEIVED?
S310
NO
YES
TRANSMIT UL TRANSMISSION PERMISSION FRAME
S312
HAS ULD FRAME BEEN RECEIVED?
S314
NO
YES
TRANSMIT CONFIRMATION RESPONSE FRAME
S316
END

FIG. 9

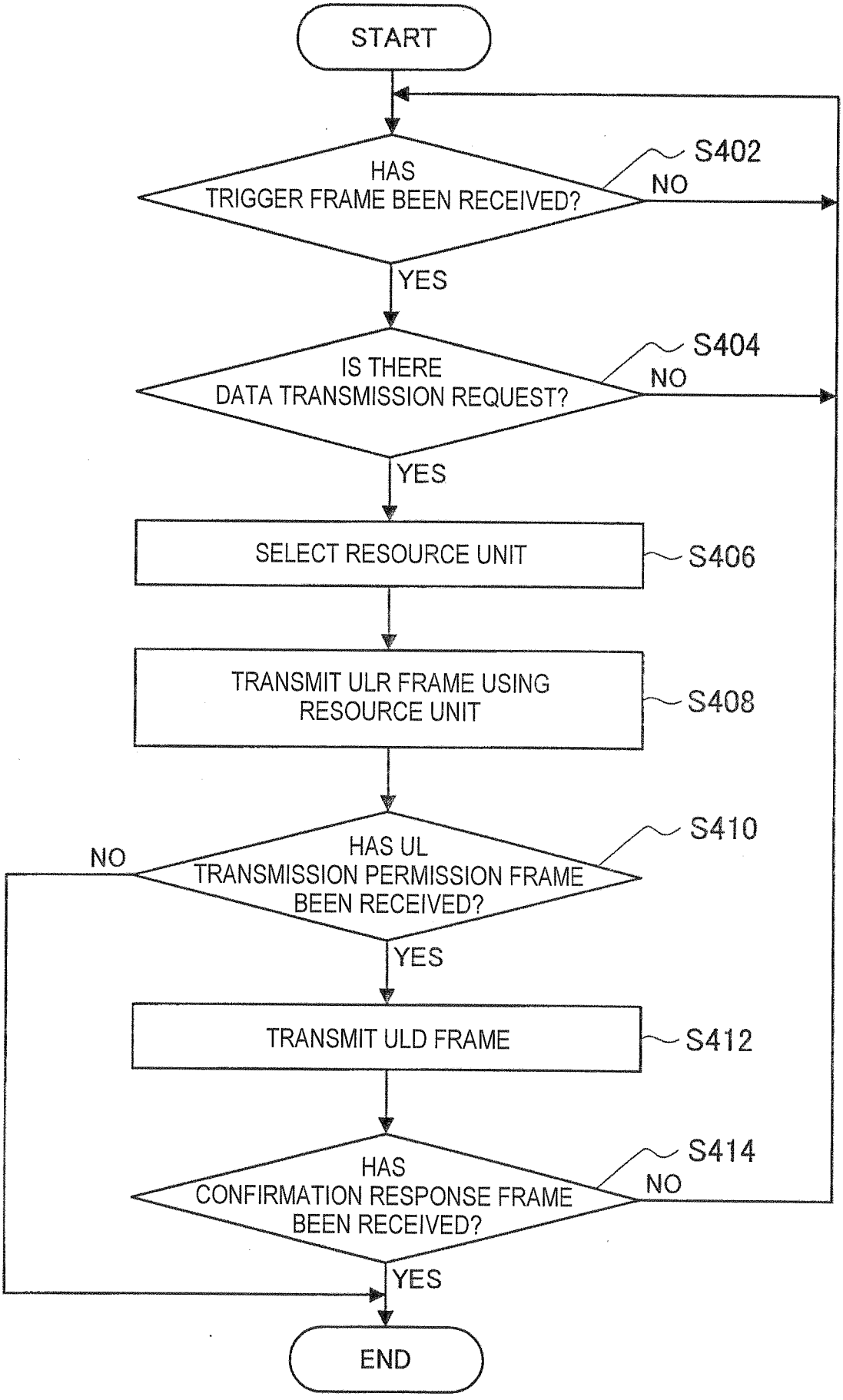

START
HAS TRIGGER FRAME BEEN RECEIVED?
S402
NO
YES
IS THERE DATA TRANSMISSION REQUEST?
S404
NO
YES
SELECT RESOURCE UNIT
S406
TRANSMIT ULR FRAME USING RESOURCE UNIT
S408
HAS UL TRANSMISSION PERMISSION FRAME BEEN RECEIVED?
S410
NO
YES
TRANSMIT ULD FRAME
S412
HAS CONFIRMATION RESPONSE FRAME BEEN RECEIVED?
S414
NO
YES
END

FIG. 10

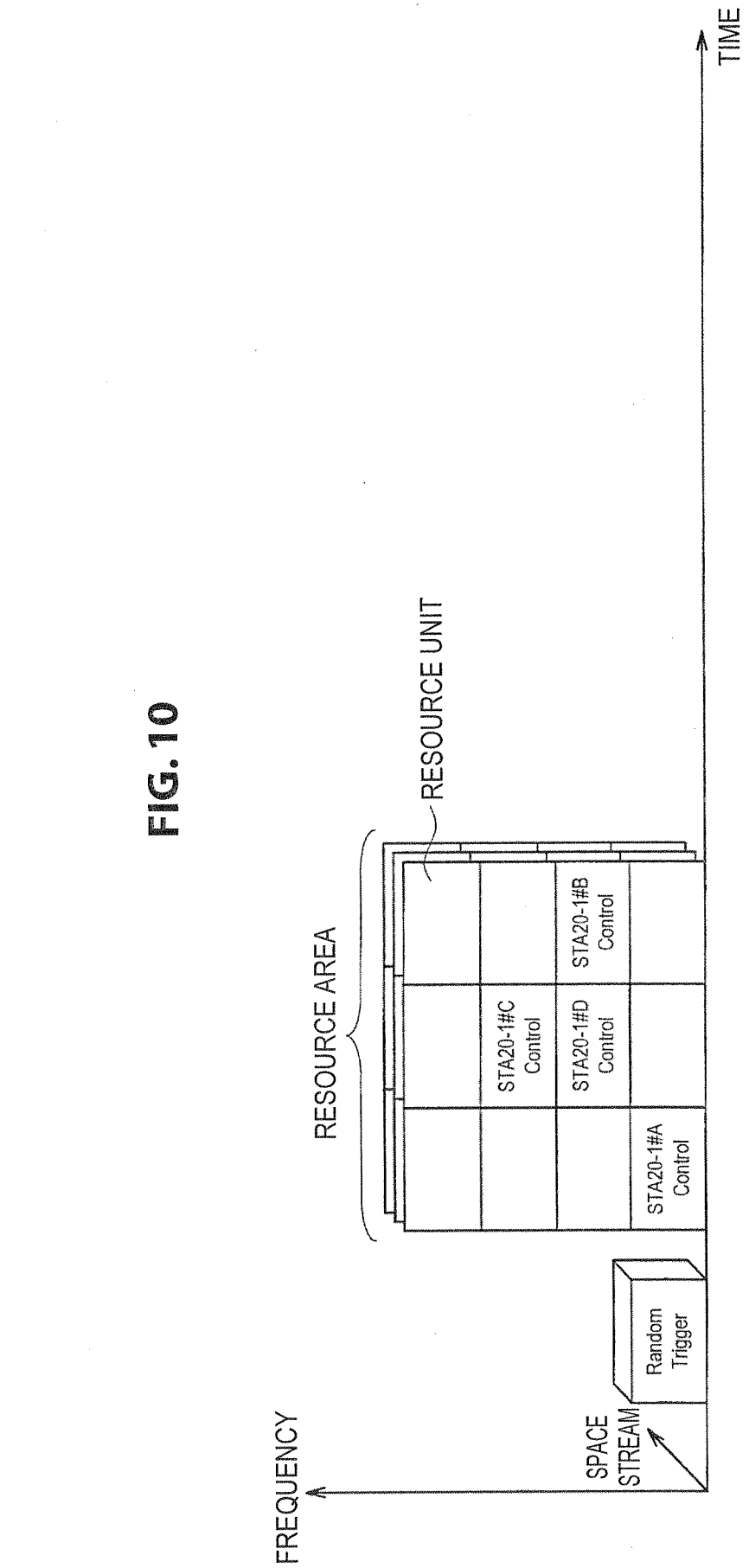

FREQUENCY
SPACE STREAM
Random Trigger
RESOURCE AREA
RESOURCE UNIT
STA20-1#A Control
STA20-1#C Control
STA20-1#D Control
STA20-1#B Control
TIME

FIG. 11

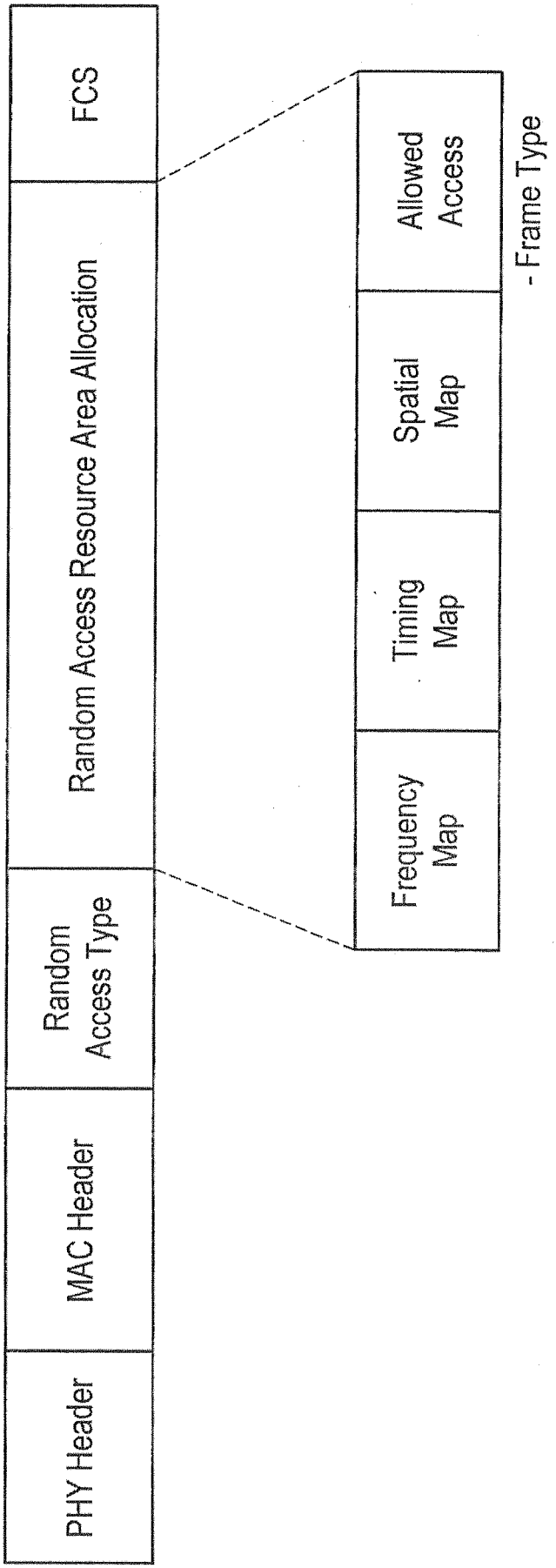

PHY Header
MAC Header
Random Access Type
Random Access Resource Area Allocation
FCS
Frequency Map
Timing Map
Spatial Map
Allowed Access
- Frame Type

FIG. 12

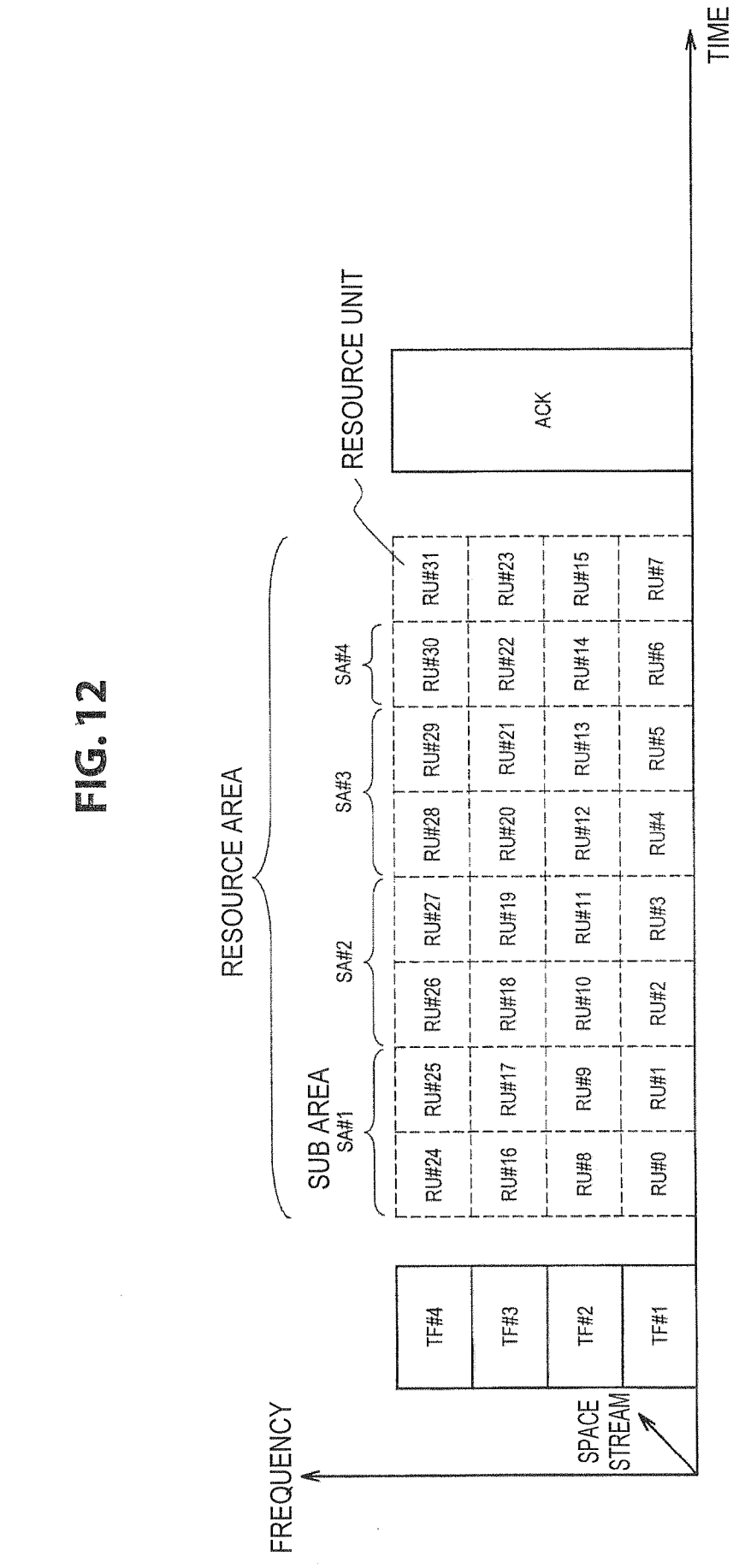

FREQUENCY
SPACE STREAM
TF#1
TF#2
TF#3
TF#4
RESOURCE AREA
SUB AREA
SA#1
SA#2
SA#3
SA#4
RESOURCE UNIT
RU#0
RU#1
RU#2
RU#3
RU#4
RU#5
RU#6
RU#7
RU#8
RU#9
RU#10
RU#11
RU#12
RU#13
RU#14
RU#15
RU#16
RU#17
RU#18
RU#19
RU#20
RU#21
RU#22
RU#23
RU#24
RU#25
RU#26
RU#27
RU#28
RU#29
RU#30
RU#31
ACK
TIME

FIG. 13

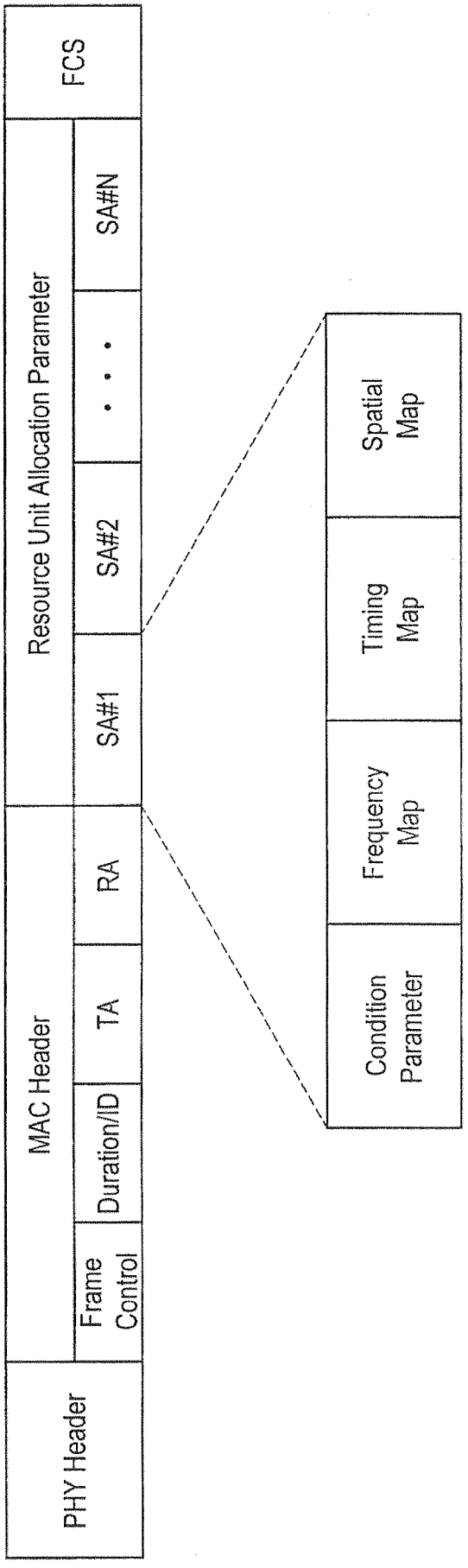

PHY Header
MAC Header
Frame Control
Duration/ID
TA
RA
Resource Unit Allocation Parameter
SA#1
SA#2
• • •
SA#N
FCS
Condition Parameter
Frequency Map
Timing Map
Spatial Map

FIG. 14

Parameter	Condition
0x00	Reserved
0x01	Frame Type : Probe Request
0x02	Frame Type : Power Save Polling
0x03	Frame Type : Other Control Frame
0x04	Frame Type : Data Frame
0x05-0x08	Reserved
0x09	Buffered Data Length : 1-127 Octets
0x0A	Buffered Data Length : 128-1023 Octets
0x0B	Buffered Data Length : 1K-1M Octets
0x0C	Buffered Data Length : LARGER THAN 1M OCTETS
0x0D-0x0F	Reserved
0x10	Receive Signal Strength : WEAK
0x11	Receive Signal Strength : STRONG
0x12-0x1F	Reserved
0x20	MCS(Modulation and Coding Scheme) : BPSK / QPSK
0x21	MCS(Modulation and Coding Scheme) : 16QAM / 64 QAM
0x22	MCS(Modulation and Coding Scheme) : 256QAM
0x23-0x3F	Reserved
0x40-0xFF	Reserved

FIG. 15A

Bit	Channel ID
0	Channel 36
1	Channel 40
2	Channel 44
3	Channel 48
4	Channel 52
5	Channel 56
6	Channel 60
7	Channel 62

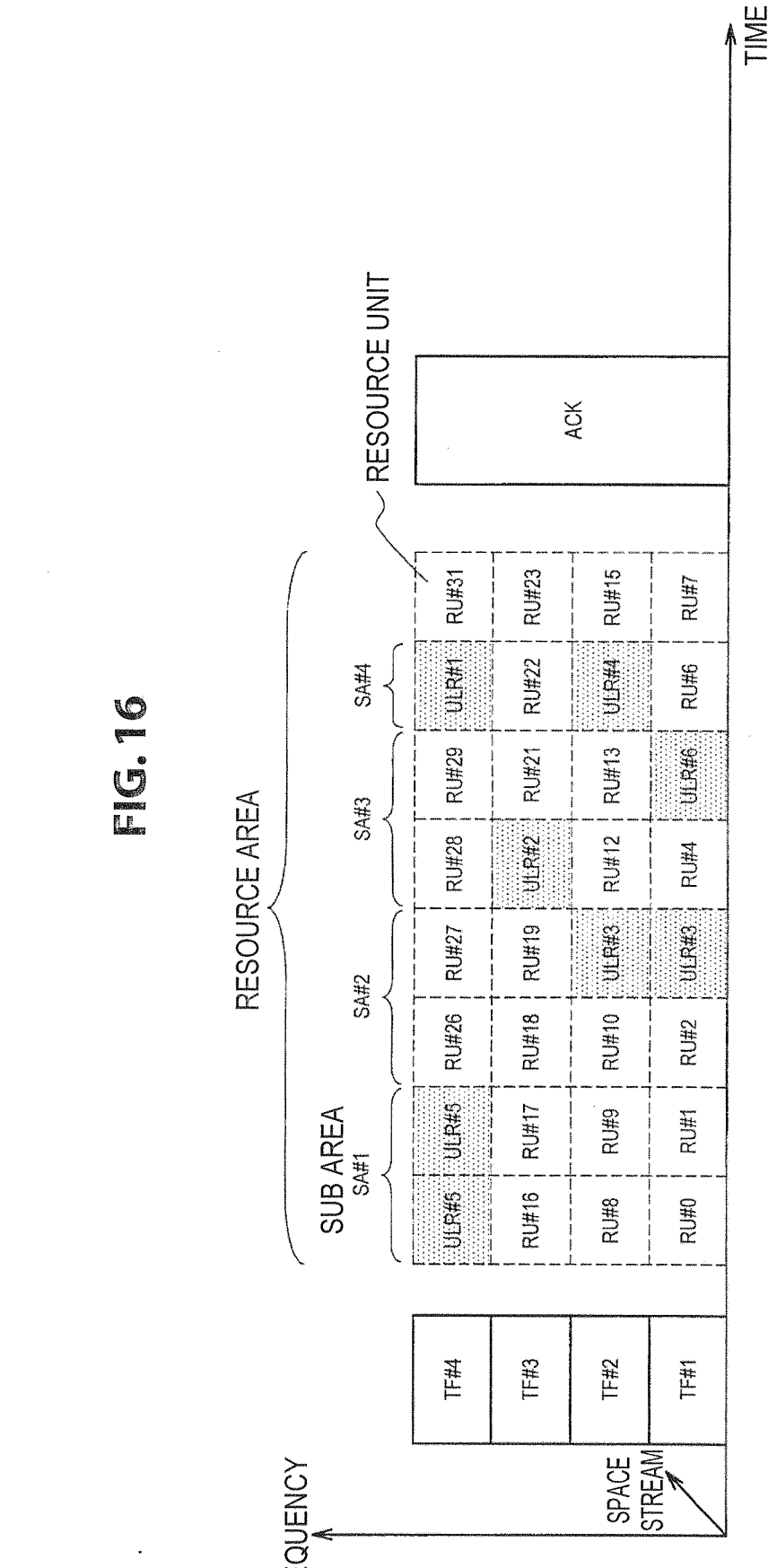
FIG. 15B

Bit	IFS
0	SIFS×2
1	SIFS×4
2	SIFS×6
3	SIFS×8
4	SIFS×10
5	SIFS×12
6	SIFS×14
7	SIFS×16

FIG. 15C

Bit	Stream Index
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7

FIG. 16


FREQUENCY
SPACE STREAM
TIME
TF#1
TF#2
TF#3
TF#4
RESOURCE AREA
SUB AREA
SA#1
SA#2
SA#3
SA#4
RESOURCE UNIT
RU#0
RU#1
RU#2
ULR#3
RU#4
ULR#6
RU#6
RU#7
RU#8
RU#9
RU#10
ULR#3
RU#12
RU#13
ULR#4
RU#15
RU#16
RU#17
RU#18
RU#19
ULR#2
RU#21
RU#22
RU#23
ULR#5
ULR#5
RU#26
RU#27
RU#28
RU#29
ULR#1
RU#31
ACK

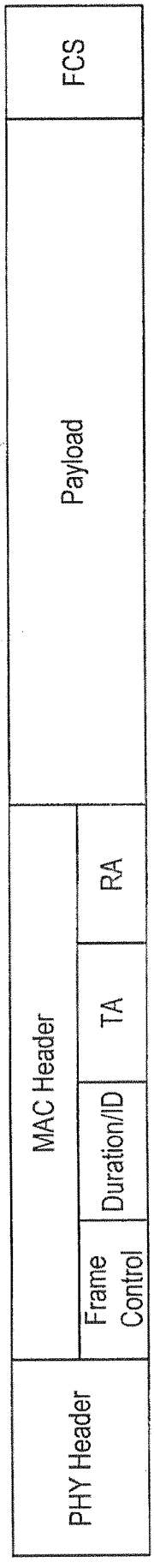

PHY Header
MAC Header
Frame Control
Duration/ID
TA
RA
Payload
FCS

FIG. 17

FIG. 18

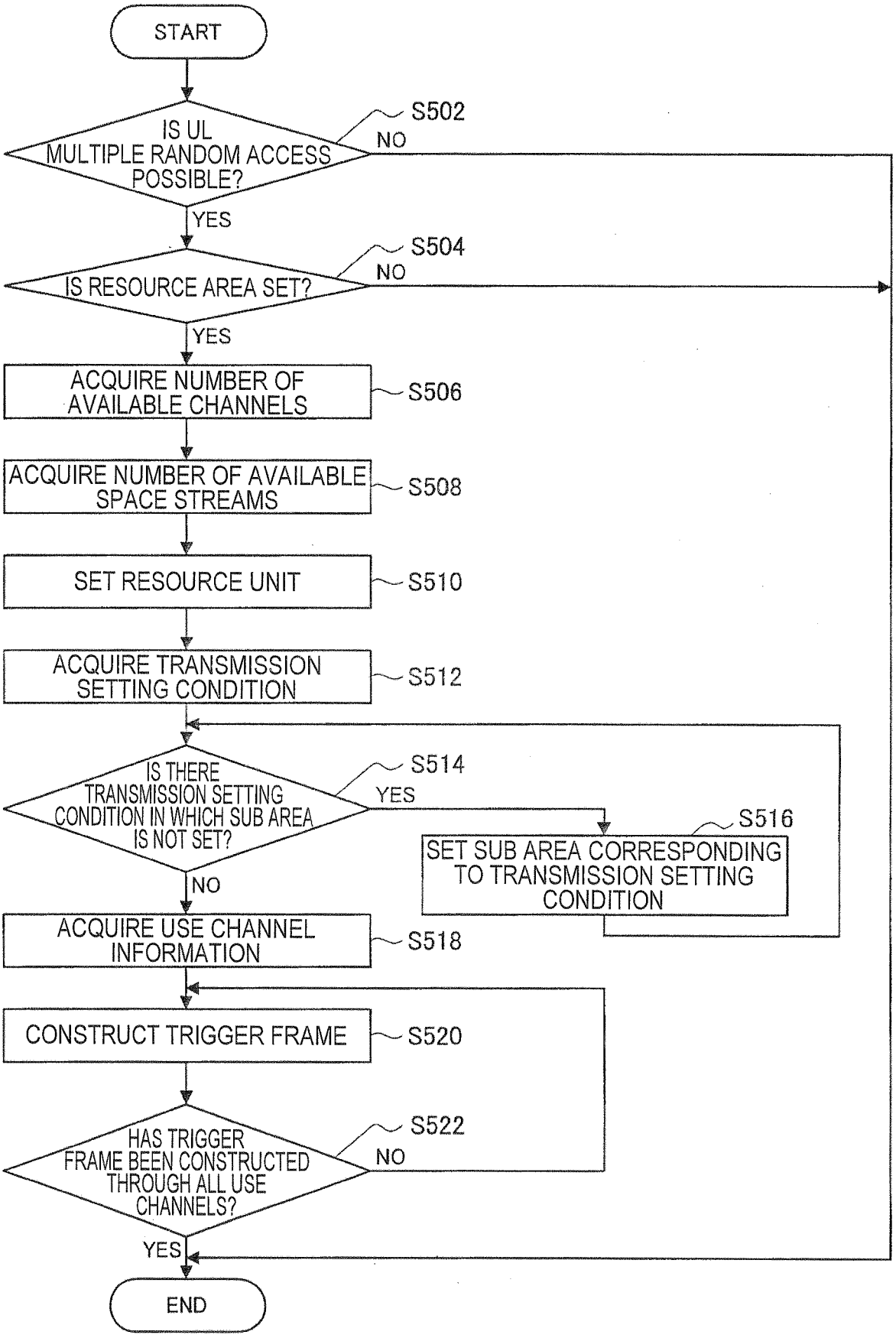

START
IS UL MULTIPLE RANDOM ACCESS POSSIBLE?
S502
NO
YES
IS RESOURCE AREA SET?
S504
NO
YES
ACQUIRE NUMBER OF AVAILABLE CHANNELS
S506
ACQUIRE NUMBER OF AVAILABLE SPACE STREAMS
S508
SET RESOURCE UNIT
S510
ACQUIRE TRANSMISSION SETTING CONDITION
S512
IS THERE TRANSMISSION SETTING CONDITION IN WHICH SUB AREA IS NOT SET?
S514
YES
SET SUB AREA CORRESPONDING TO TRANSMISSION SETTING CONDITION
S516
NO
ACQUIRE USE CHANNEL INFORMATION
S518
CONSTRUCT TRIGGER FRAME
S520
HAS TRIGGER FRAME BEEN CONSTRUCTED THROUGH ALL USE CHANNELS?
S522
NO
YES
END

FIG. 19

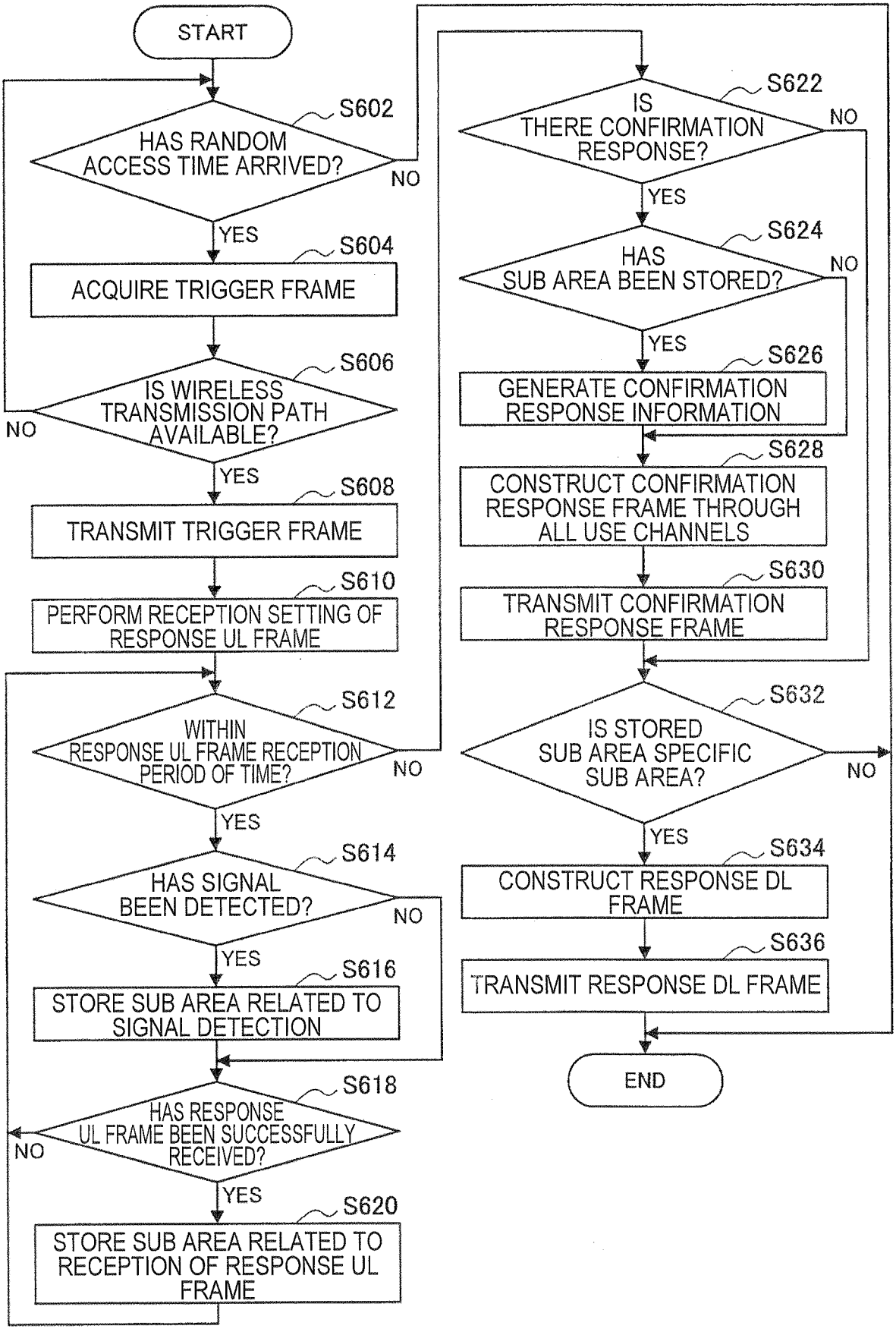

START
S602
HAS RANDOM ACCESS TIME ARRIVED?
NO
YES
S604
ACQUIRE TRIGGER FRAME
S606
IS WIRELESS TRANSMISSION PATH AVAILABLE?
NO
YES
S608
TRANSMIT TRIGGER FRAME
S610
PERFORM RECEPTION SETTING OF RESPONSE UL FRAME
S612
WITHIN RESPONSE UL FRAME RECEPTION PERIOD OF TIME?
NO
YES
S614
HAS SIGNAL BEEN DETECTED?
NO
YES
S616
STORE SUB AREA RELATED TO SIGNAL DETECTION
S618
HAS RESPONSE UL FRAME BEEN SUCCESSFULLY RECEIVED?
NO
YES
S620
STORE SUB AREA RELATED TO RECEPTION OF RESPONSE UL FRAME
S622
IS THERE CONFIRMATION RESPONSE?
NO
YES
S624
HAS SUB AREA BEEN STORED?
NO
YES
S626
GENERATE CONFIRMATION RESPONSE INFORMATION
S628
CONSTRUCT CONFIRMATION RESPONSE FRAME THROUGH ALL USE CHANNELS
S630
TRANSMIT CONFIRMATION RESPONSE FRAME
S632
IS STORED SUB AREA SPECIFIC SUB AREA?
NO
YES
S634
CONSTRUCT RESPONSE DL FRAME
S636
TRANSMIT RESPONSE DL FRAME
END

FIG. 20

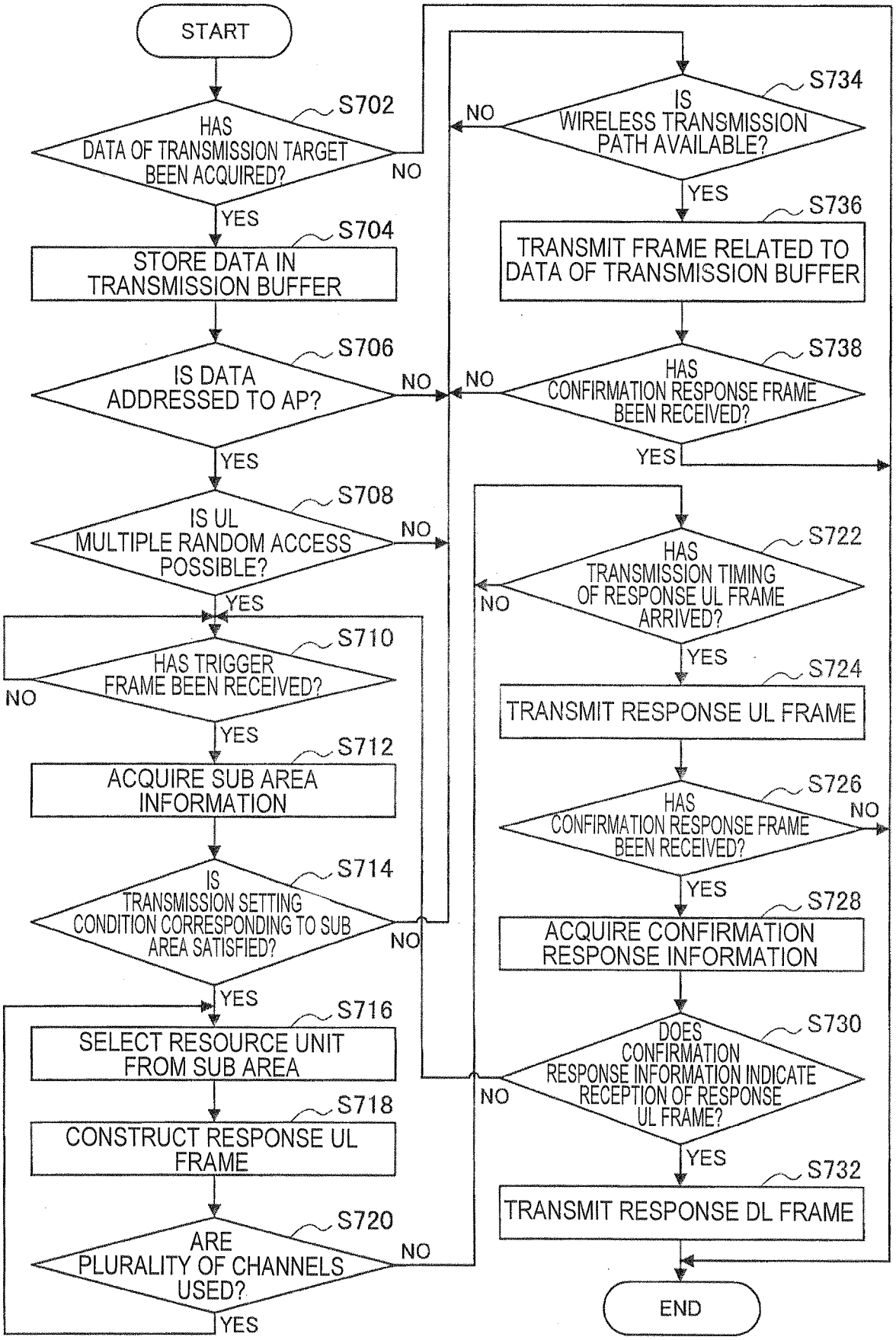

START
S702
HAS DATA OF TRANSMISSION TARGET BEEN ACQUIRED?
NO
YES
S704
STORE DATA IN TRANSMISSION BUFFER
S706
IS DATA ADDRESSED TO AP?
NO
YES
S708
IS UL MULTIPLE RANDOM ACCESS POSSIBLE?
NO
YES
S710
HAS TRIGGER FRAME BEEN RECEIVED?
NO
YES
S712
ACQUIRE SUB AREA INFORMATION
S714
IS TRANSMISSION SETTING CONDITION CORRESPONDING TO SUB AREA SATISFIED?
NO
YES
S716
SELECT RESOURCE UNIT FROM SUB AREA
S718
CONSTRUCT RESPONSE UL FRAME
S720
ARE PLURALITY OF CHANNELS USED?
NO
YES
S734
IS WIRELESS TRANSMISSION PATH AVAILABLE?
NO
YES
S736
TRANSMIT FRAME RELATED TO DATA OF TRANSMISSION BUFFER
S738
HAS CONFIRMATION RESPONSE FRAME BEEN RECEIVED?
NO
YES
S722
HAS TRANSMISSION TIMING OF RESPONSE UL FRAME ARRIVED?
NO
YES
S724
TRANSMIT RESPONSE UL FRAME
S726
HAS CONFIRMATION RESPONSE FRAME BEEN RECEIVED?
NO
YES
S728
ACQUIRE CONFIRMATION RESPONSE INFORMATION
S730
DOES CONFIRMATION RESPONSE INFORMATION INDICATE RECEPTION OF RESPONSE UL FRAME?
NO
YES
S732
TRANSMIT RESPONSE DL FRAME
END

FIG. 21

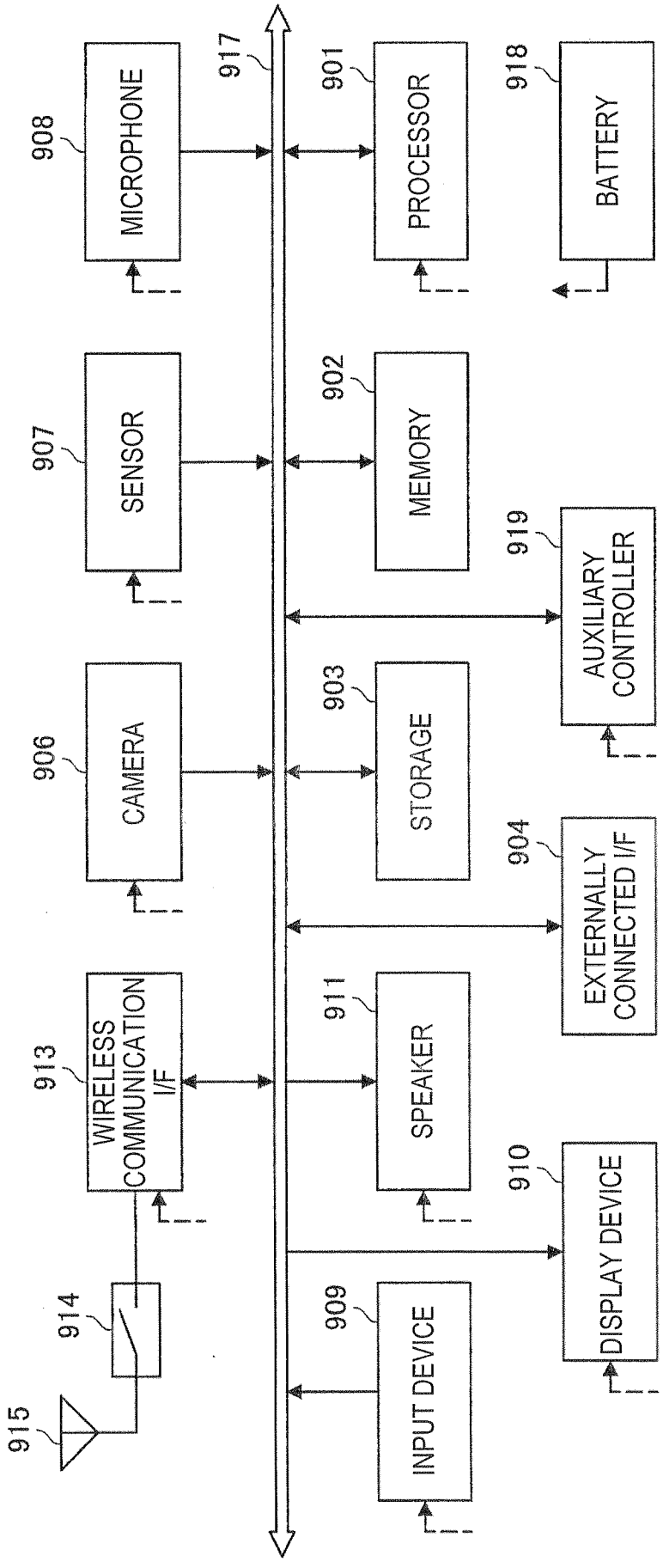

900
908
MICROPHONE
917
901
PROCESSOR
918
BATTERY
907
SENSOR
902
MEMORY
919
AUXILIARY CONTROLLER
906
CAMERA
903
STORAGE
904
EXTERNALLY CONNECTED I/F
913
WIRELESS COMMUNICATION I/F
911
SPEAKER
914
915
910
DISPLAY DEVICE
909
INPUT DEVICE

FIG. 22

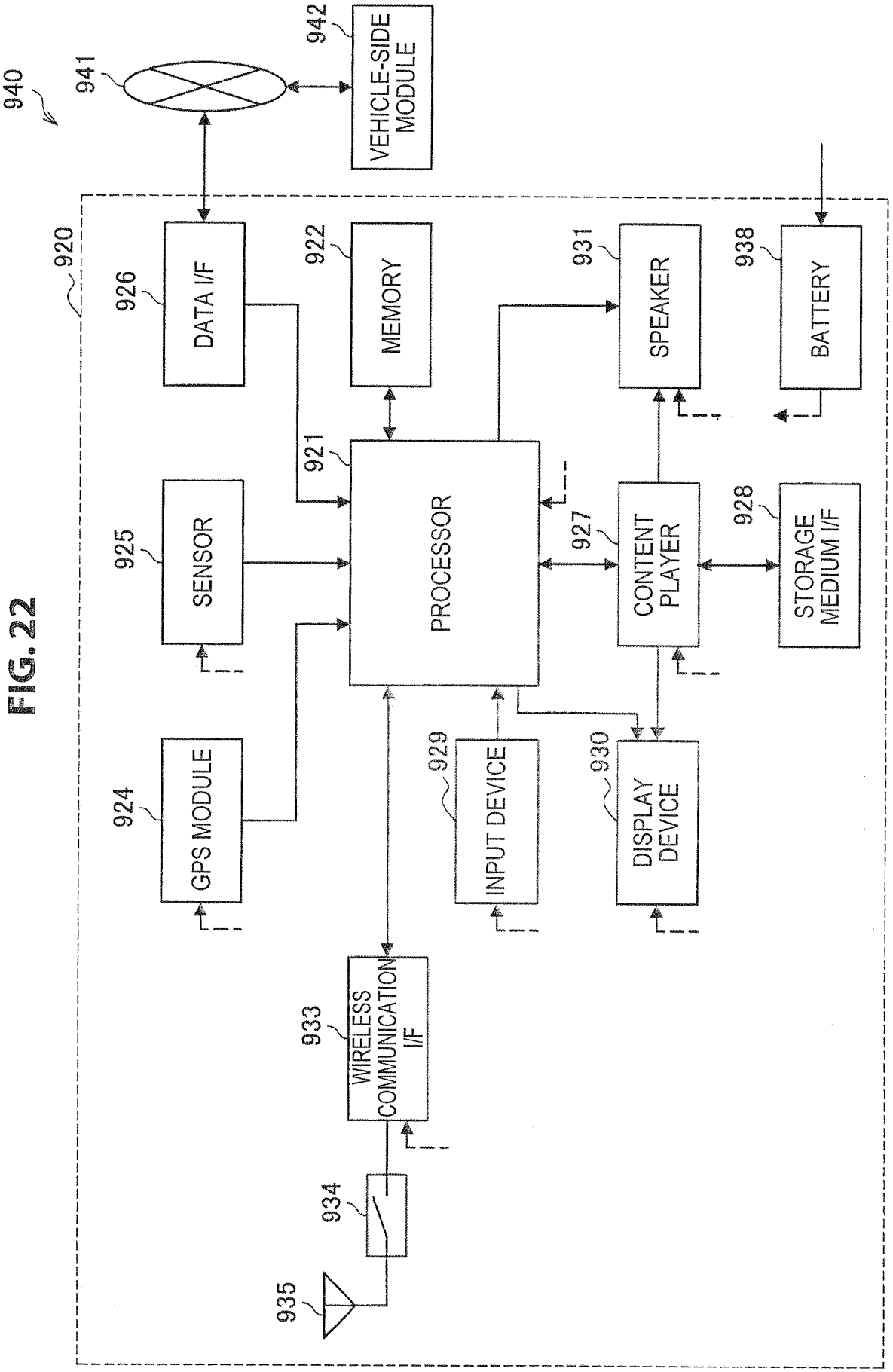
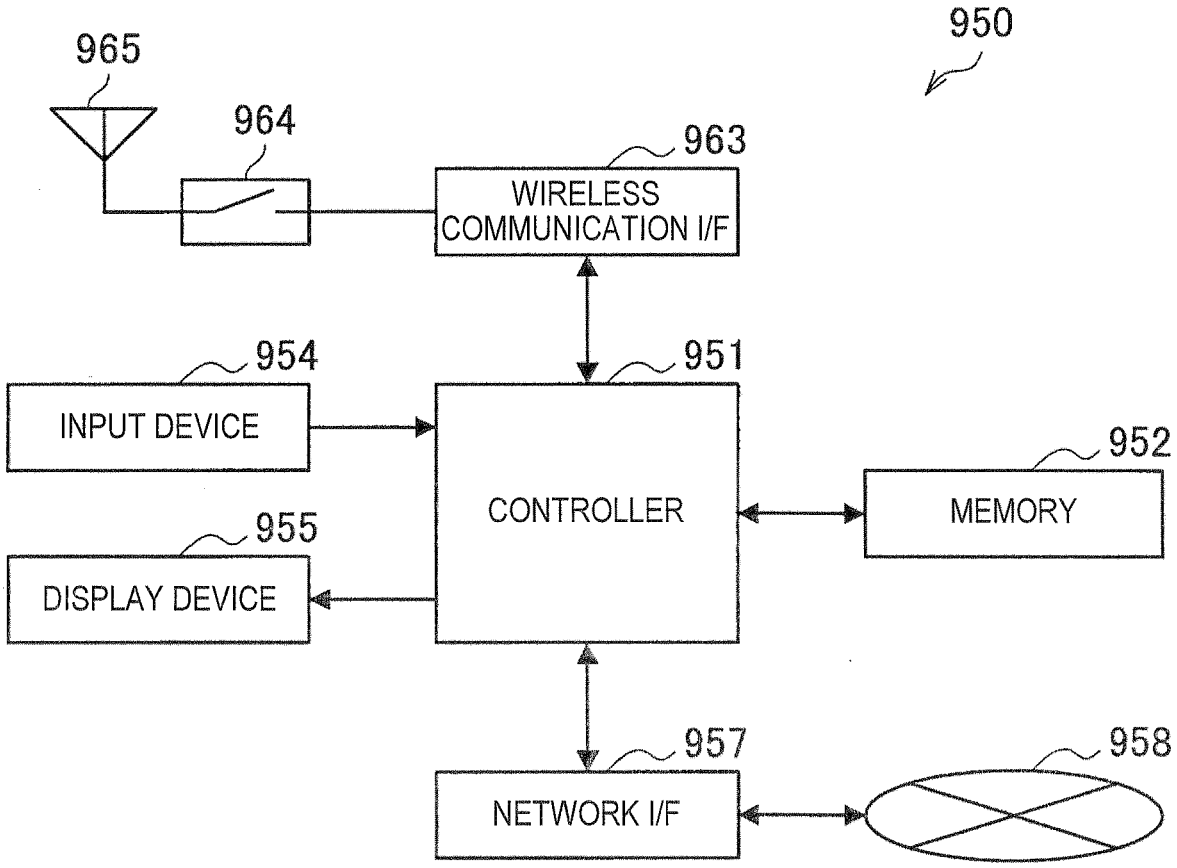

940
941
942
VEHICLE-SIDE MODULE
920
926
DATA I/F
922
MEMORY
931
SPEAKER
938
BATTERY
921
PROCESSOR
925
SENSOR
927
CONTENT PLAYER
928
STORAGE MEDIUM I/F
924
GPS MODULE
929
INPUT DEVICE
930
DISPLAY DEVICE
933
WIRELESS COMMUNICATION I/F
934
935

FIG. 23


950
965
964
963
WIRELESS COMMUNICATION I/F
954
951
INPUT DEVICE
CONTROLLER
952
MEMORY
955
DISPLAY DEVICE
957
958
NETWORK I/F