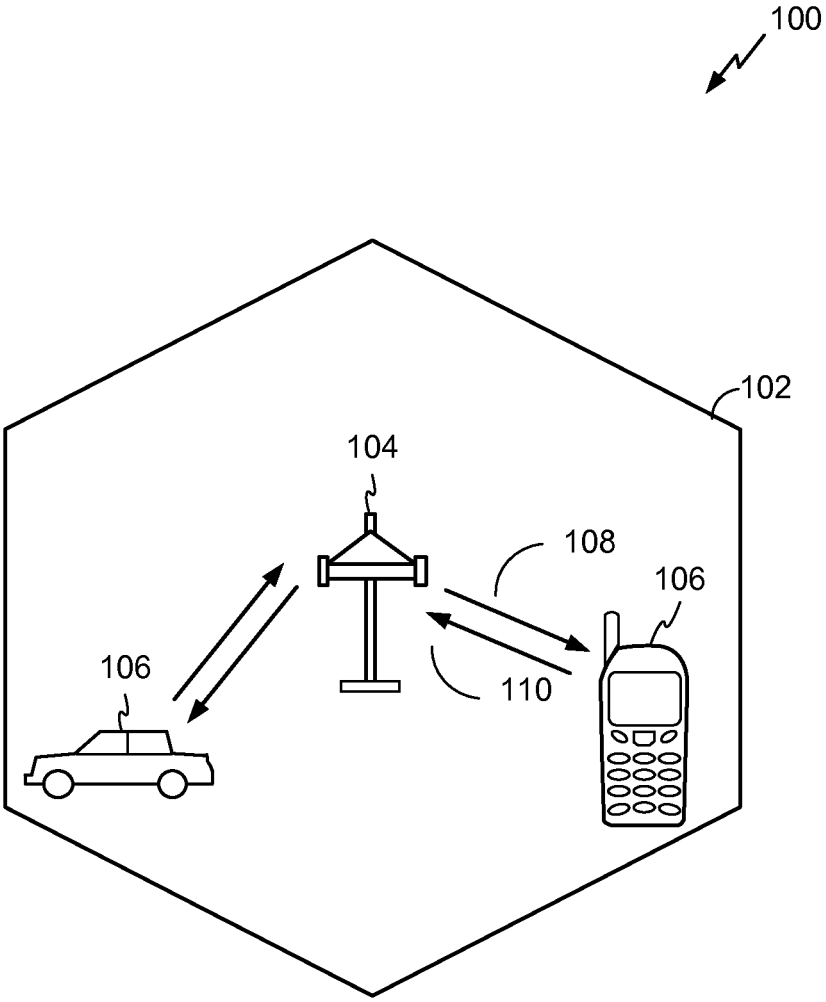


FIG. 1

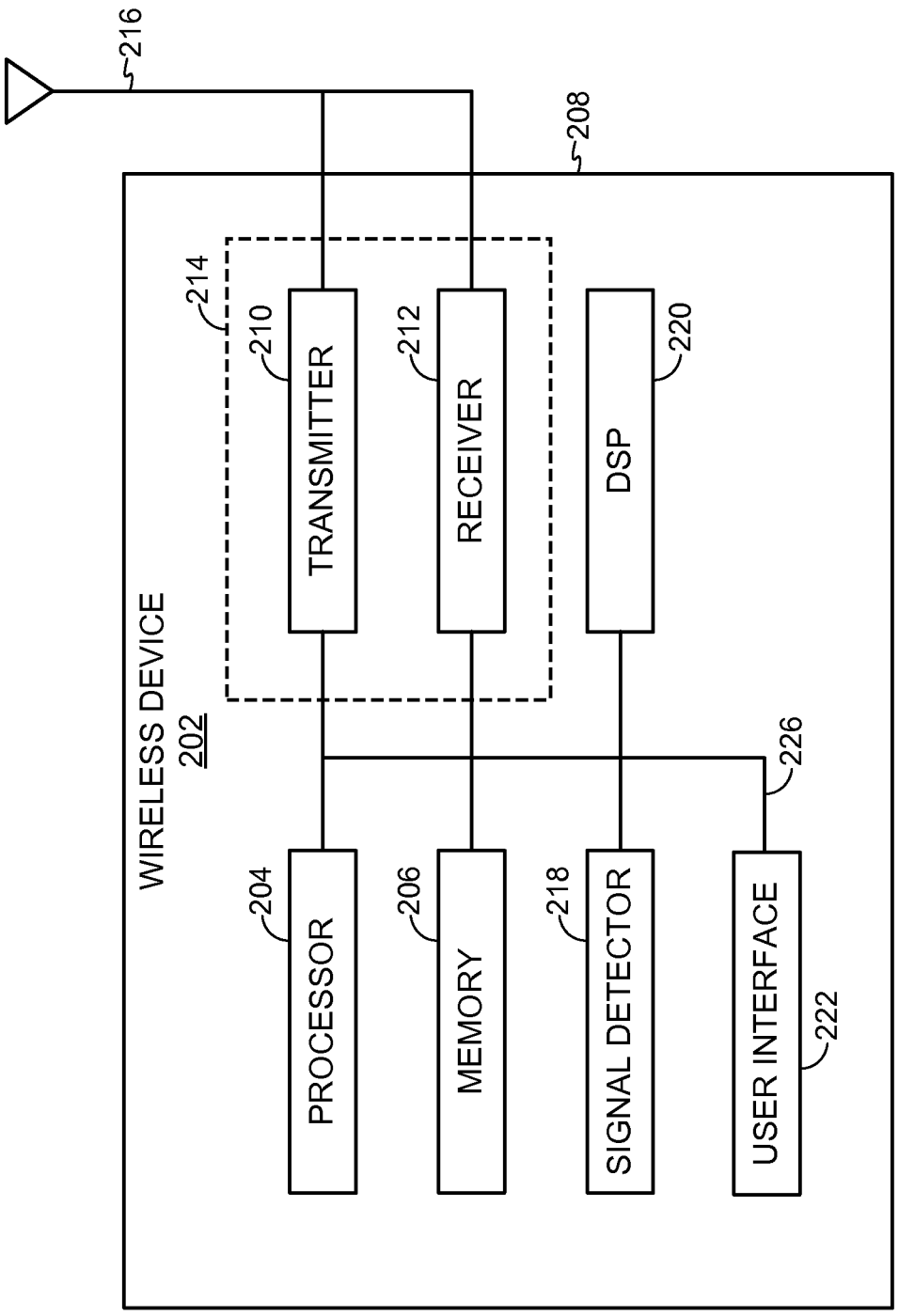

216
208
WIRELESS DEVICE
202
214
210
TRANSMITTER
212
RECEIVER
220
DSP
226
204
PROCESSOR
206
MEMORY
218
SIGNAL DETECTOR
222
USER INTERFACE

FIG. 2

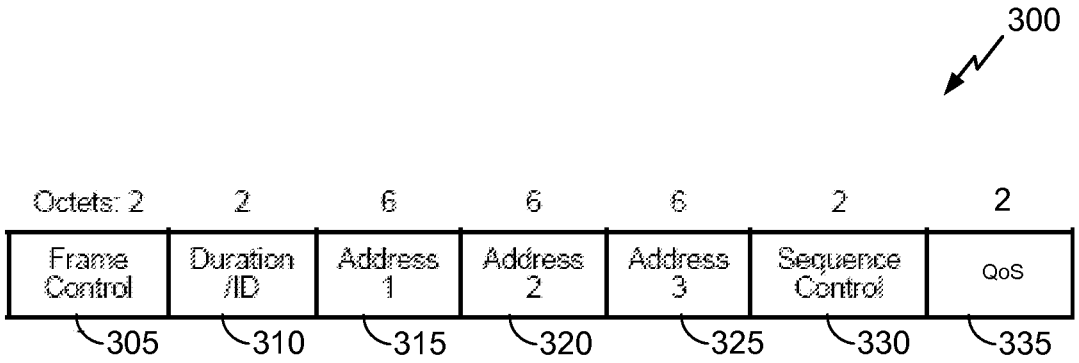

300
Octets: 2
2
6
6
6
2
2
Frame Control
Duration /ID
Address 1
Address 2
Address 3
Sequence Control
QoS
305
310
315
320
325
330
335

FIG. 3

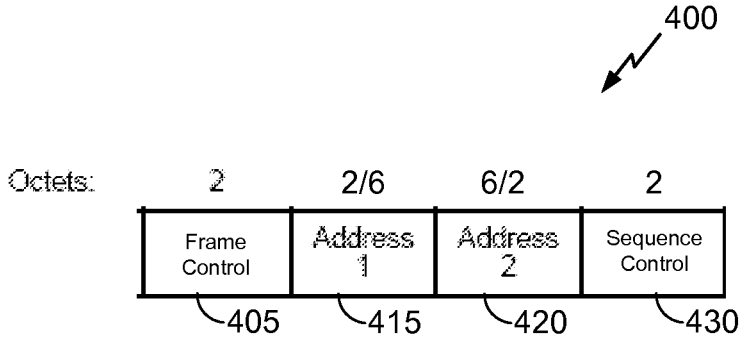
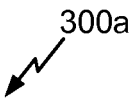

400
Octets:
2
2/6
6/2
2
Frame Control
Address 1
Address 2
Sequence Control
405
415
420
430

FIG. 4



Field Name	Size in Octets	Field Description	
fc	2	frame control	305a
dur	2	duration/id	310a
a1	6	receiver address	315a
a2	6	transmitter address	320a
a3	6	destination address	325a
sc	2	sequence control	330a
qc	2	quality of service control	335a
htc	4	header type control	340a
ccmp	8	counter-mode/cbc-mac protocol	345a
llc/snap	8	logical link control/subnetwork access protocol	350a
mic	8	message integrity check	360a
fcs	4	frame control sequence	365a
TOTAL SIZE:	58		

305a

Field Name	Size in Bits	Field Description	
pv	2	protocol version	372
type	2	frame type	374
subtype	4	frame subtype	376
to-ds	1	to distribution system	378
from-ds	1	from distribution system	380
more frag	1	more fragments	382
retry	1	retry	384
pm	1	power management	386
md	1	more data	388
pf	1	protected frame	390
order	1	order	392
TOTAL SIZE:	16		

FIG. 3A

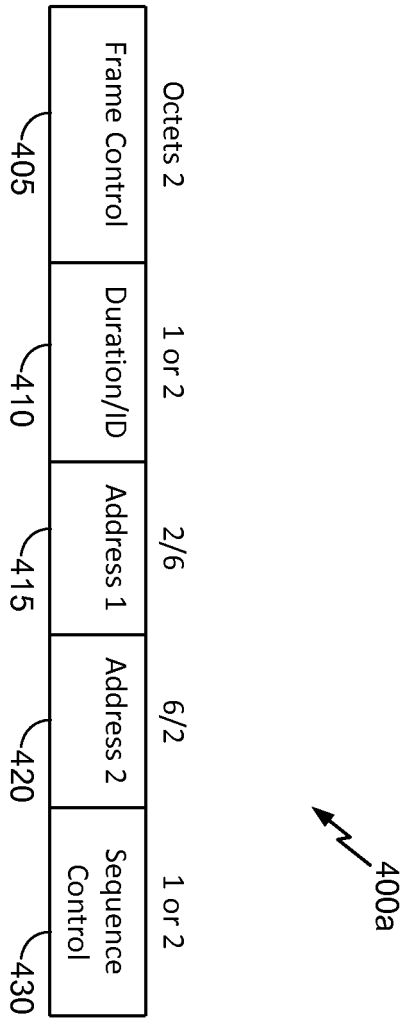

400a
Octets 2
1 or 2
2/6
6/2
1 or 2
Frame Control
Duration/ID
Address 1
Address 2
Sequence Control
405
410
415
420
430

FIG. 4A

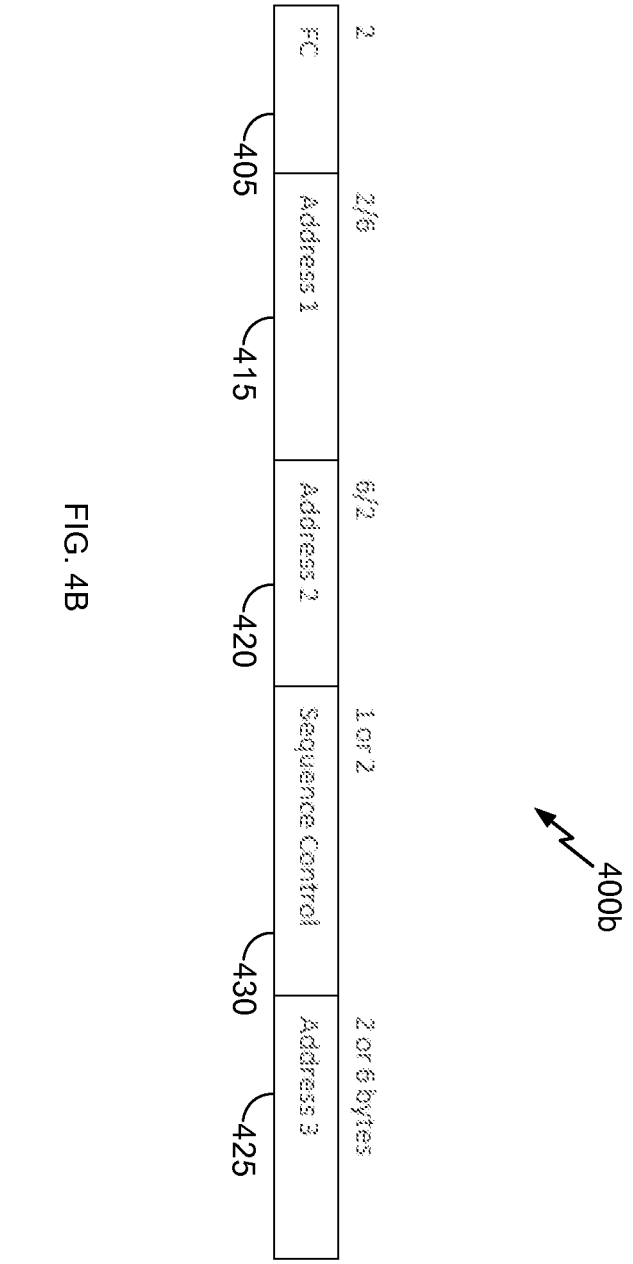

400b
2
2/6
6/2
1 or 2
2 or 6 bytes
FC
Address 1
Address 2
Sequence Control
Address 3
405
415
420
430
425

FIG. 4B

	Data 415 420				ACK
Direction	**To-DS/ From-DS**	**A1 (Rx)**	**A2 (Tx)**	**A3 (SA/DA)**	**A1 (Rx)**
DL	01	AID	BSSID	(SA)	pBSSID
UL	10	BSSID	AID	(DA)	AID
Direct	00	RA	AID		AID

FIG. 5

	Data 415 420				BA		
Direction	**To-DS/ From-DS**	**A1 (Rx)**	**A2 (Tx)**	**A3 (SA/DA)**	**To-DS/ From-DS**	**A1 (Rx)**	**A2 (Tx)**
DL	01	AID	BSSID	(SA)	10	BSSID	AID
UL	10	BSSID	AID	(DA)	01	AID	BSSID
Direct	00	RA	AID		00	AID	RA

FIG. 6

	415 Data Packet 420			Block ACK	
Direction	**Data-A1 (Rx)**	**Data-A2 (Tx)**	**Data-A3**	**BA-A1 (Tx)**	**BA-A2 (Rx)**
DL	AID	BSSID	(SA)	AID	BSSID
UL	0	STA_MAC	(DA)	0	STA_MAC
Direct	R-AID	TA		R-AID	TA

FIG. 7

	Data				BA		
Direction	**R-AID**	**T-AID**	**BSSID**	**(SA/DA)**	**R-AID**	**T-AID**	**BSSID**
DL	AID	0	BSSID	(SA)	0	AID	BSSID
UL	0	AID	BSSID	(DA)	AID	0	BSSID
Direct	AID1	AID2	BSSID		AID2	AID1	BSSID

FIG. 8

Data					ACK
Direction	**R-AID**	**T-AID**	**BSSID**	**(SA/DA)**	**R-ID**
DL	AID	0	BSSID	(SA)	0
UL	0	AID	BSSID	(DA)	AID
Direct	AID1	AID2	BSSID		AID2

FIG. 9

	Data 415 420				ACK
Direction	**to-DS/ from-DS**	**A1 (AID)**	**A2 (BSSID)**	**A3 (SA/DA)**	**A1 (Rx)**
DL	01	AID	BSSID	(SA)	pBSSID
UL	10	AID	BSSID	(DA)	AID
Direct	00	T-AID	RA		AID

FIG. 10

	Data 415 420				BA		
Direction	**to-DS/ from-DS**	**A1 (AID)**	**A2 (BSSID/RA)**	**A3 (SA/DA)**	**to-DS/ from-DS**	**A1 (Rx)**	**A2 (Tx)**
DL	01	AID	BSSID	(SA)	10	AID	BSSID
UL	10	AID	BSSID	(DA)	01	AID	BSSID
Direct	00	AID	RA		00	AID	RA

FIG. 11

	Data 415 420				ACK
Direction	**to-DS/ from-DS**	**A1 (AID)**	**A2 (BSSID)**	**A3 (SA/DA)**	**A1 (Rx)**
DL	01	BSSID	AID	(SA)	pBSSID
UL	10	BSSID	AID	(DA)	AID
Direct	00	RA	T-AID		AID

FIG. 12

RTS-A1	RTS-A2	CTS-A1
RA	T-AID	T-AID

FIG. 13

	Management frame 415 420			ACK
Direction	**to-DS/ from-DS**	**A1 (Rx)**	**A2 (Tx)**	**A1 (Rx)**
DL	01	AID	BSSID	pBSSID
UL	10	BSSID	AID	AID

FIG. 14

	Data 415 420		ACK
Direction	**A1 (Rx)**	**A2 (Tx)**	**A1 (Rx)**
DL	STA-AID	BSSID	BSSID
UL	BSSID	STA-MAC	STA-MAC
Direct	R-STA-MAC	T-STA-MAC	T-STA-MAC

FIG. 15

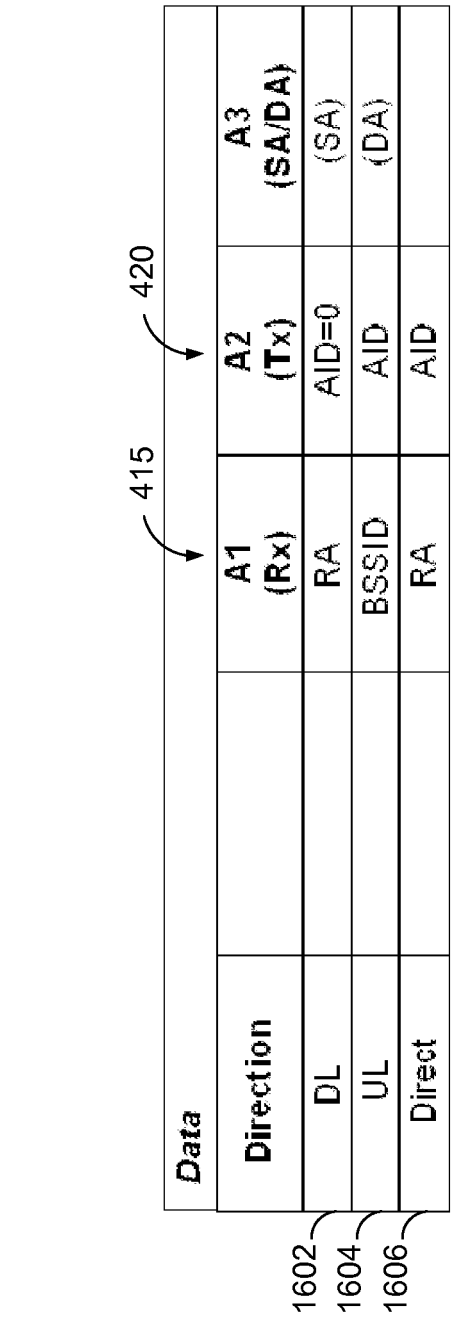

Data
Direction
A1 (Rx)
A2 (Tx)
A3 (SA/DA)
DL
RA
AID=0
(SA)
UL
BSSID
AID
(DA)
Direct
RA
AID
415
420
1602
1604
1606

FIG. 16

Data
Direction
From-AP
A1 (Rx)
A2 (Tx)
A3 (SA/DA)
DL
1
RA
(SA)
UL
0
BSSID
AID
(DA)
Direct
0
RA
AID
415
420
1702
1704
1706

FIG. 17

Field Name	Size in Bits	Size in Octets	Field Description
fc	16		frame control
pra	5		partial receiver address
pta	11		partial transmitter address
aci	2		access category index
hcs	4		header check sequence
ccmp	64	8	counter-mode/cbc-mac protocol
ethertype	16	2	ethertype
mic	64	8	message integrity check
TOTAL SIZE:	182	23	
SIZE REDUCTION:	61%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
subtype	4	frame subtype
to-ds	1	to distribution system
from-ds	1	from distribution system
more frag	1	more fragments
retry	1	retry
pm	1	power management
md	1	more data
pf	1	protected frame
order	1	order
TOTAL SIZE:	16	

FIG. 18

Field Name	Size in Bits	Size in Octets	Field Description
fc	8		frame control
pra	5		partial receiver address
pta	11		partial transmitter address
aci	2		access category index
hcs	4		header check sequence
ccmp	64	8	counter-mode/cbc-mac protocol
ethertype	16	2	ethertype
mic	64	8	message integrity check
TOTAL SIZE:	174	22	
SIZE REDUCTION:	63%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	8	

FIG. 19

Field Name	Size in Bits	Size in Octets	Field Description
fc	8		frame control
pta	11		partial transmitter address
aci	2		access category index
hcs	4		header check sequence
ccmp	64	8	counter-mode/cbc-mac protocol
ethertype	16	2	ethertype
mic	64	8	message integrity check
TOTAL SIZE:	169	21	
SIZE REDUCTION:	64%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	8	

FIG. 20

Field Name	Size in Bits	Size in Octets	Field Description
fc	8		frame control
pra	5		partial receiver address
pta	11		partial transmitter address
a3	48	6	address 3
aci	2		access category index
hcs	4		header check sequence
ccmp	64	8	counter-mode/cbc-mac protocol
ethertype	16	2	ethertype
mic	64	8	message integrity check
TOTAL SIZE:	222	28	
SIZE REDUCTION:	52%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	8	

FIG. 21

Field Name	Size in Bits	Size in Octets	Field Description
fc	9		frame control
pra	5		partial receiver address
pta	11		partial transmitter address
aci	2		access category index
hcs	4		header check sequence
ccmp	64	8	counter-mode/cbc-mac protocol
ethertype	16	2	ethertype
mic	64	8	message integrity check
TOTAL SIZE:	175	22	
SIZE REDUCTION:	62%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
compr a3	1	compressed a3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	9	

FIG. 22

Field Name	Size in Bits	Size in Octets	Field Description
fc	9		frame control
pta	11		partial transmitter address
aci	2		access category index
hcs	4		header check sequence
ccmp	64	8	counter-mode/cbc-mac protocol
ethertype	16	2	ethertype
mic	64	8	message integrity check
TOTAL SIZE:	170	22	
SIZE REDUCTION:	63%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
compr a3	1	compressed a3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	9	

FIG. 23

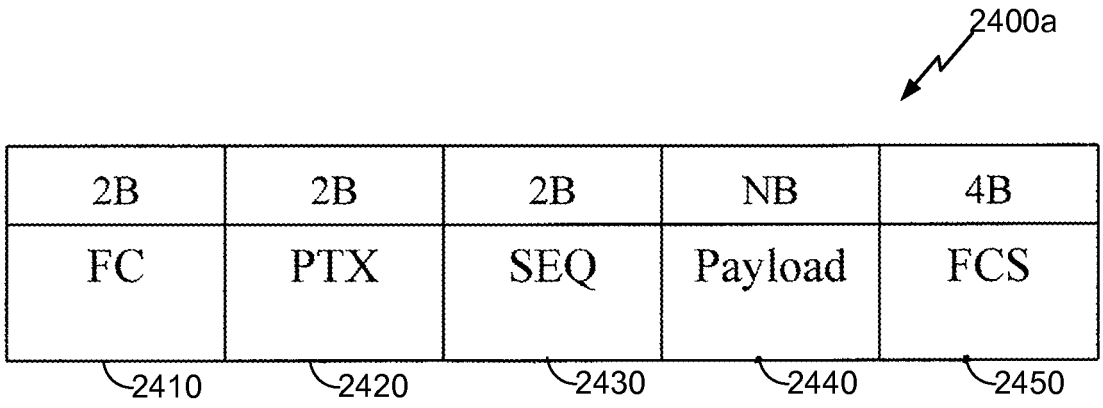


FIG. 24A

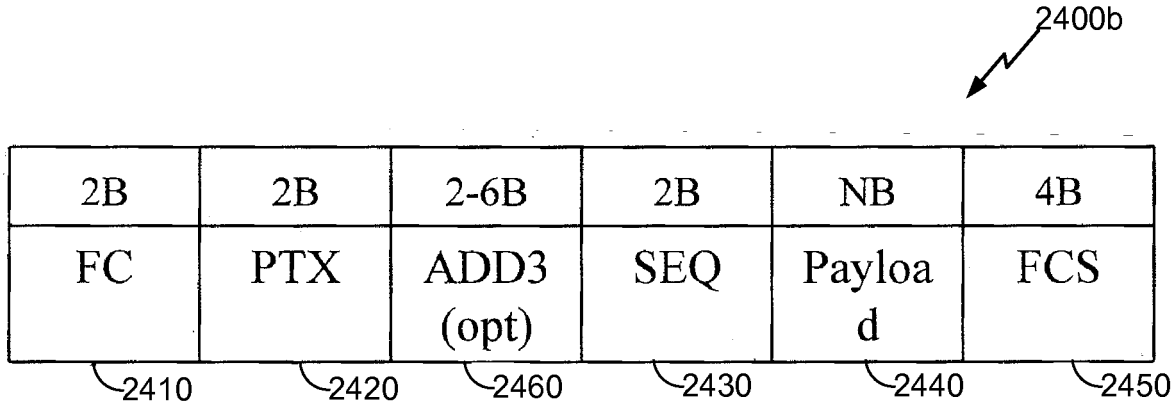


FIG. 24B

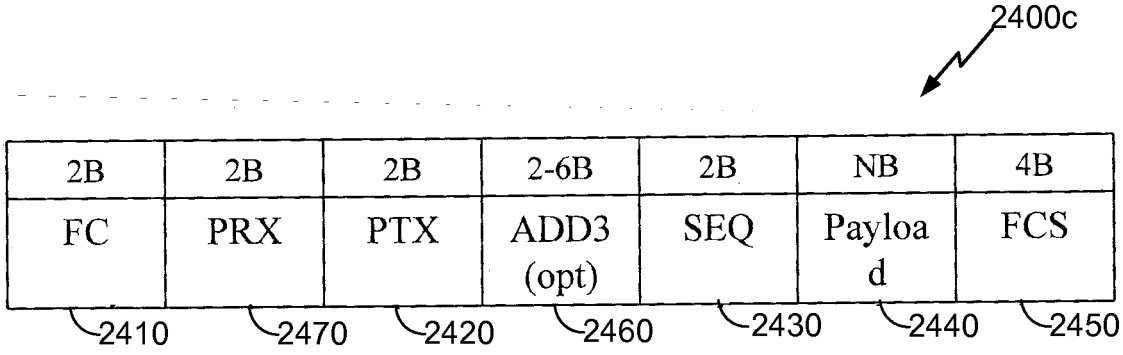


FIG. 24C

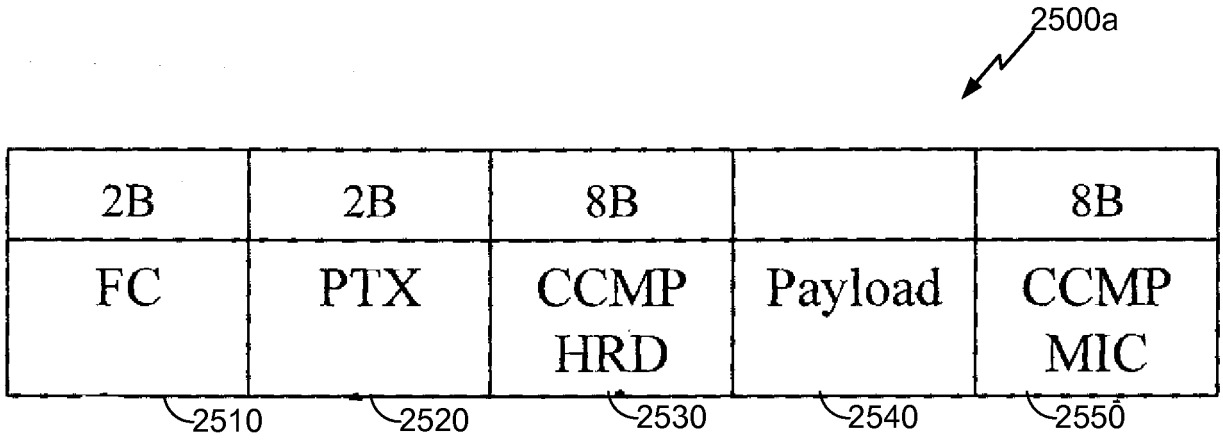


FIG. 25A

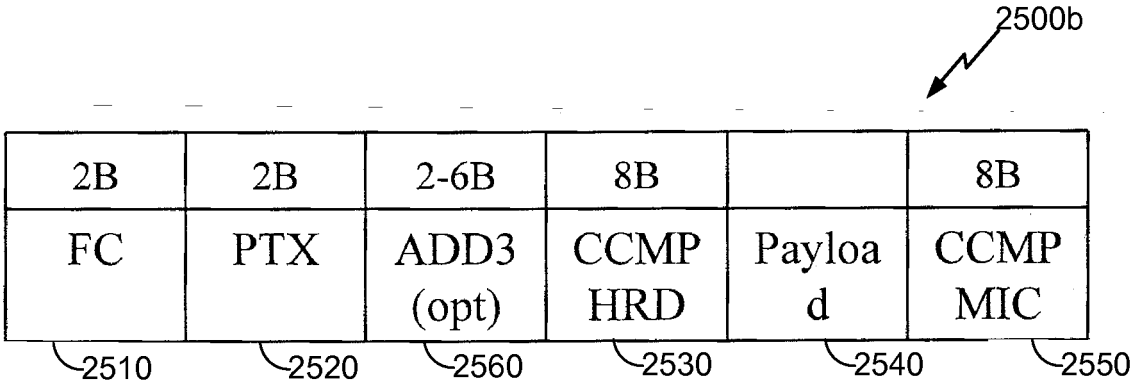


FIG. 25B

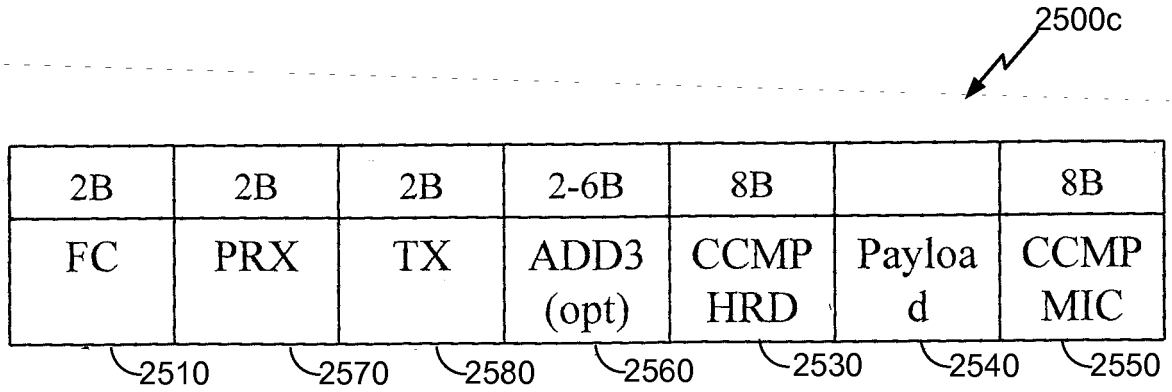
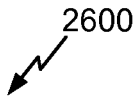


FIG. 25C



Field Name	Size in Octets	Field Description
fc	2	frame control
dur	2	duration
a1	6	address 1
fcs	4	frame control sequence
TOTAL SIZE:	14	

2605
2610
2615
2620

2605

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
subtype	4	frame subtype
to-ds	1	to distribution system
from-ds	1	from distribution system
more frag	1	more fragments
retry	1	retry
pm	1	power management
md	1	more data
pf	1	protected frame
order	1	order
TOTAL SIZE:	16	

FIG. 26

Field Name	Size in Bits	Size in Octets	Field Description
fc	9		frame control
hcs	4		header check sequence
TOTAL SIZE:	13	2	
SIZE REDUCTION:	88%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
compr a3	1	compressed a3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	9	

FIG. 27

Field Name	Size in Bits	Size in Octets	Field Description
fc	9		frame control
pra	5		partial receiver address
hcs	4		header check sequence
TOTAL SIZE:	18	2	
SIZE REDUCTION:	84%		

Field Name	Size in Bits	Field Description
pv	2	protocol version
type	2	frame type
a3 present	1	address 3 present
compr a3	1	compressed a3 present
retry	1	retry
pm	1	power management
md	1	more data
TOTAL SIZE:	9	

FIG. 28

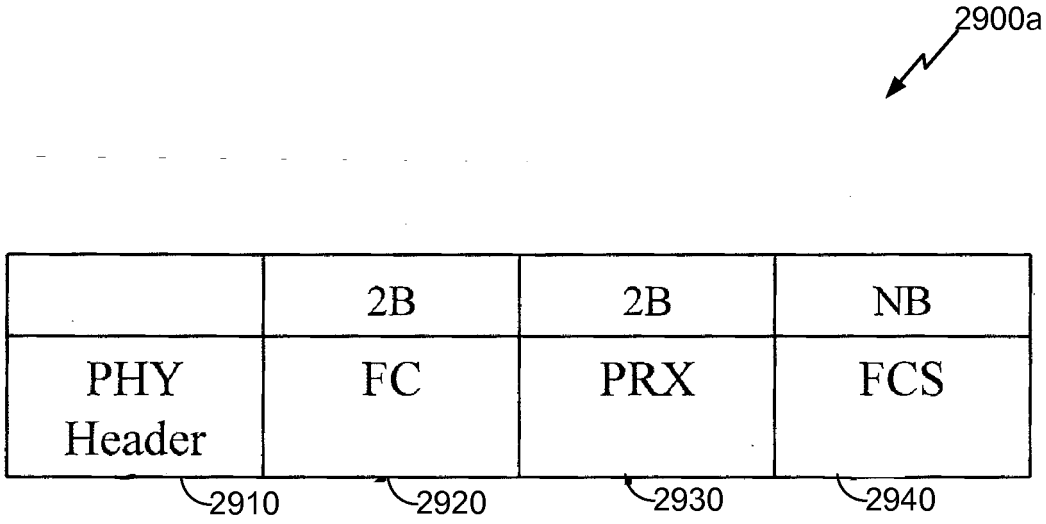


FIG. 29A

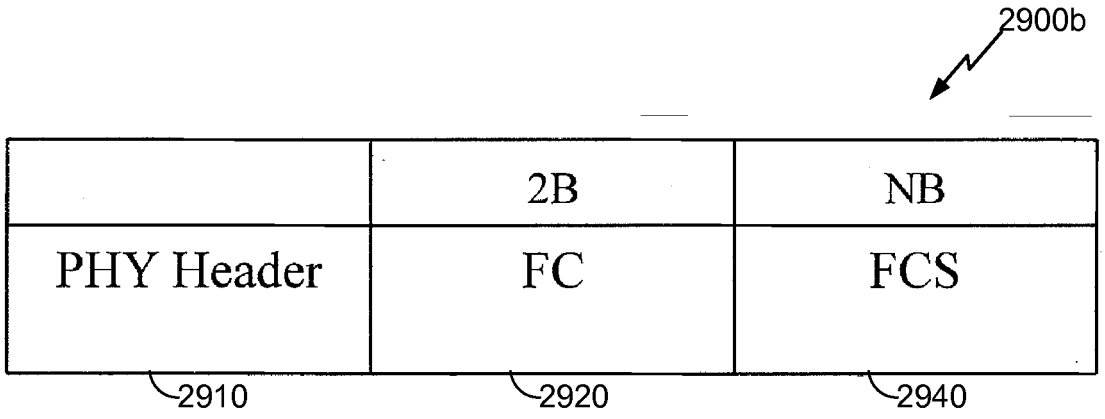


FIG. 29B

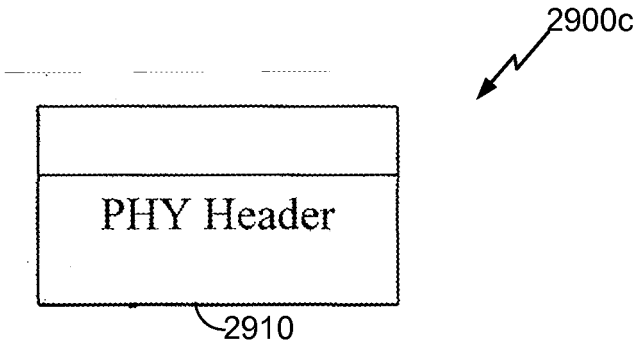


FIG. 29C

	Frame Control	bits	
3002	pv	2	Protocol Value (1)
3004	type	4	Frame Type (16 total)
3006	from-ap	1	From-AP
3008	ac	2	Access Category
3010	retry	1	Retry
3012	pm	1	Power Management
3014	md	1	Mode Data
3016	pf	1	Protected Frame (0)
3018	a-msdu	1	A-MSDU
3020	eosp	1	End of Service Period
3022	a3 present	1	A3 present
	total	**16**	

3000

	MPDU	octets	
3000	fc	2	Frame Control (PV=1)
3052	aid	13 bits	AID (T-AID or R-AID)*
3054	efc	3 bits	Extended FC (reserved)
3056	ta/ra	6	RA or TA**
3058	a3		SA or DA***
3060	sn	2	Sequence Number
	total	**12**	

3050

FIG. 30

3000a

	bits	Description
3002a	2	Protocol Value (0)
3004a	2	Frame Type
3005a	4	Frame subtype
3006a	1	From-AP
3012a	1	Power Management
3014a	1	Mode Data
3016a	1	Protected Frame (0)
3018a	1	A-MSDU
3020a	1	End of Service Period
3022a	1	A3 present
3024a	1	More PPDU/RDG
	16	

3050a

	octets	
3000a	2	Frame Control (PV=1)
3052a	13 bits	AID (T-AID or R-AID)*
3054a	3 bits	Reserved
3056a	6	RA or TA**
3058a		SA or DA***
3060a	2	Sequence Control
	12	

FIG. 30A

3000b

	bits	Description
3002b	2	Protocol Value (1)
3004b	4	Frame Type (16 total)
3006b	1	From-AP
3012b	1	Power Management
	8	

3050b

	octets	
3000b	1	Frame Control (PV=1)
3052b	13 bits	AID (T-AID or R-AID)*
3072b	1 bit	More Data
3074b	1 bit	Protected Frame
3076b	1 bit	EOSP
3056b	6	RA or TA**
3058b		SA or DA***
3060b	2	Sequence Control
	11	

FIG. 30B

Frame Control	bits	
2202 pv	2	Protocol Value (1)
2204 type	4	Frame Type (16 total)
2206 from-ap	1	From-AP
2208 ac	2	Access Category
2210 retry	1	Retry
2212 pm	1	Power Management
2214 md	1	Mode Data
2216 pf	1	Protected Frame (1)
2218 a-msdu	1	A-MSDU
2220 eosp	1	End of Service Period
2222 a3 present	1	A3 present
total	**16**	

3100

MPDU	octets	
2200 fc	2	Frame Control (PV=1)
2252 aid	13 bits	AID (T-AID or R-AID)*
2254 efc	3 bits	Extended FC (reserved)
2256 ta/ra	6	RA or TA**
2258 a3		SA or DA***
2260 sn	2	Sequence Number
3162 ppn	2	Packet PN
3164 mic	8	MIC
total	**22**	

3150

FIG. 31

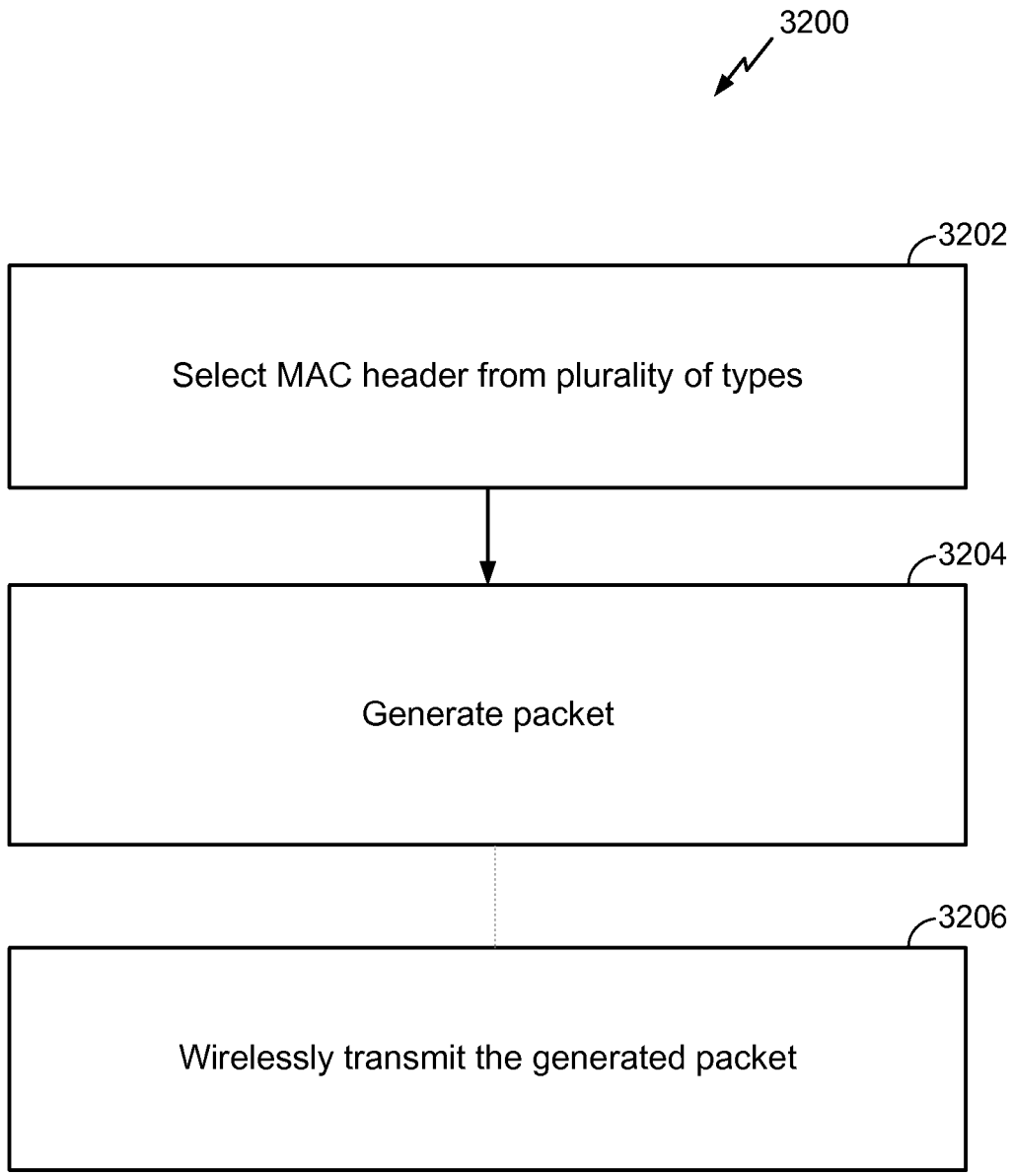

3200
3202
Select MAC header from plurality of types
3204
Generate packet
3206
Wirelessly transmit the generated packet

Figure 32

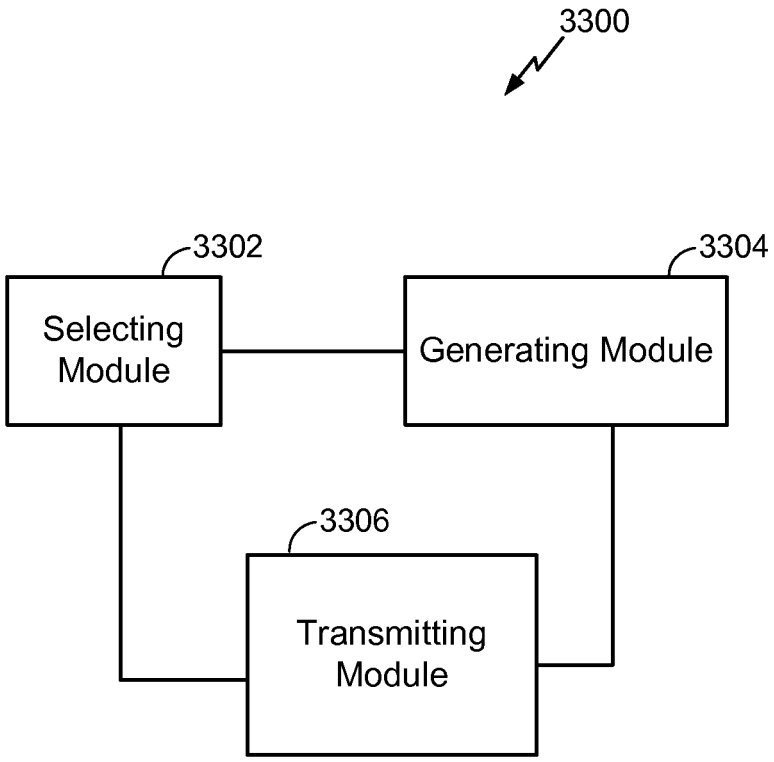

3300
3302
3304
Selecting Module
Generating Module
3306
Transmitting Module

FIG. 33

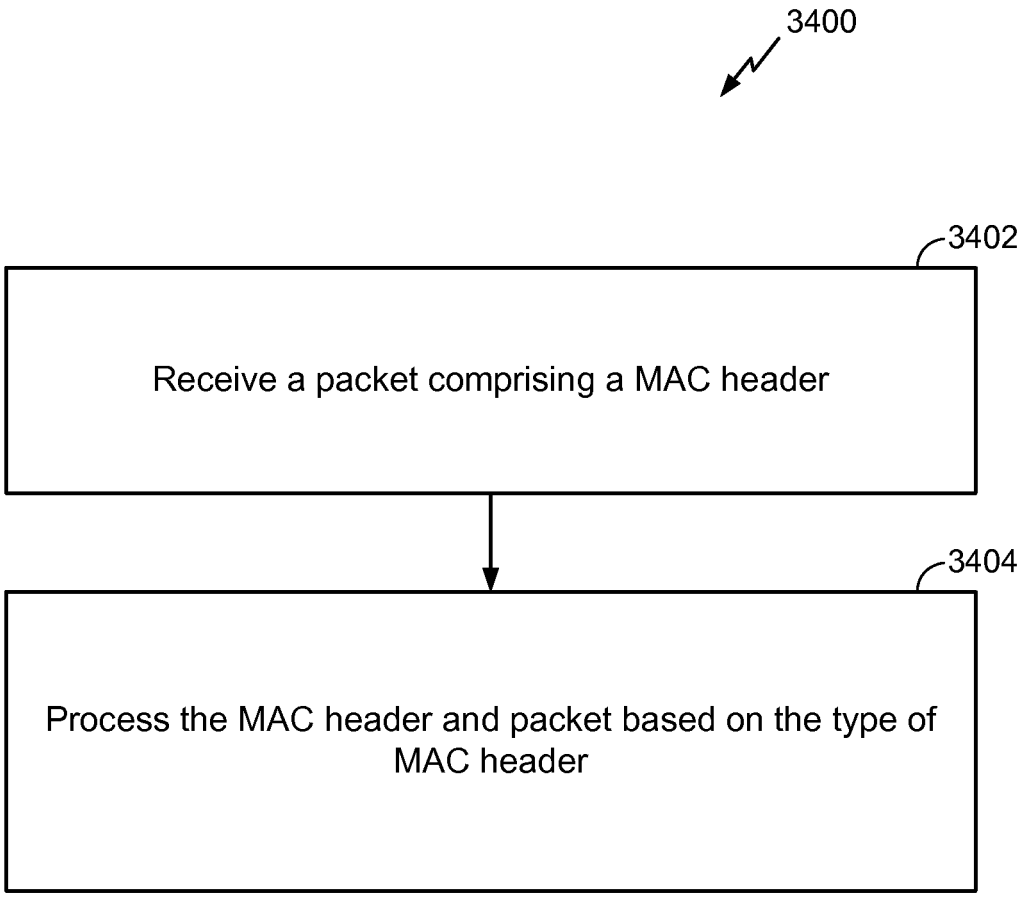

3400
3402
Receive a packet comprising a MAC header
3404
Process the MAC header and packet based on the type of MAC header

FIG. 34

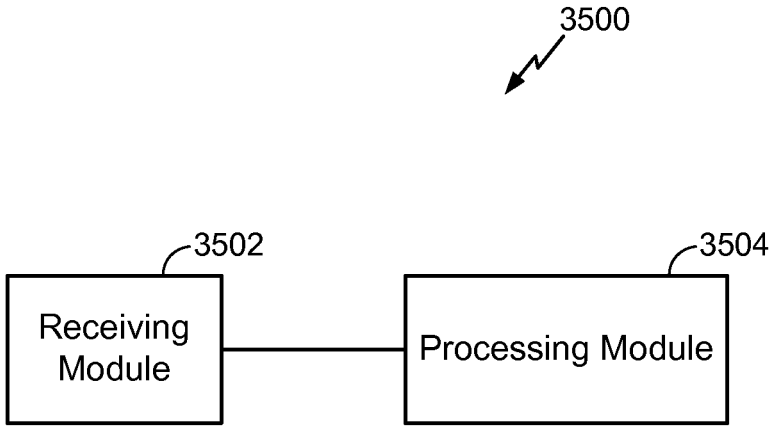


FIG. 35

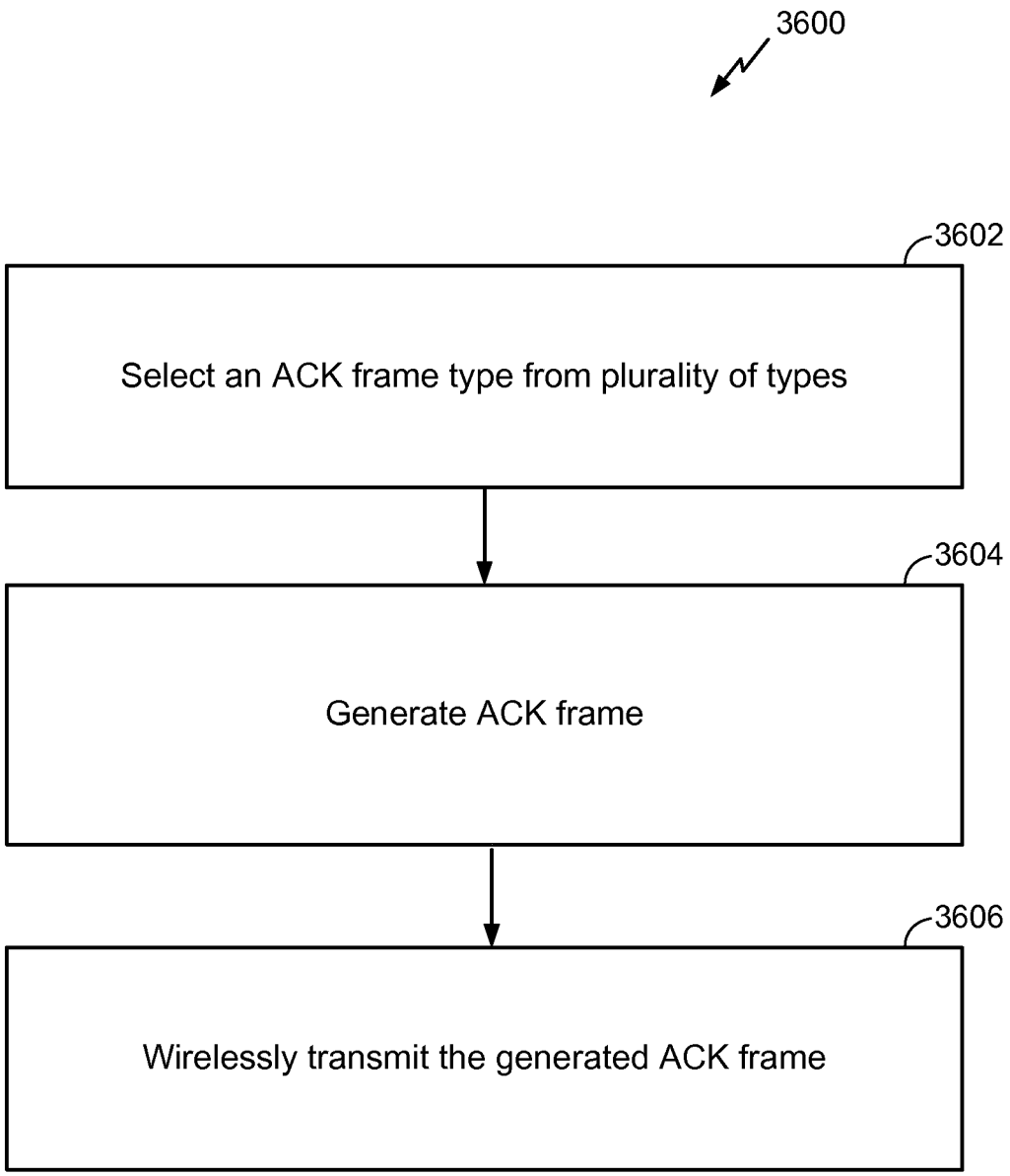

3600
3602
Select an ACK frame type from plurality of types
3604
Generate ACK frame
3606
Wirelessly transmit the generated ACK frame

Figure 36

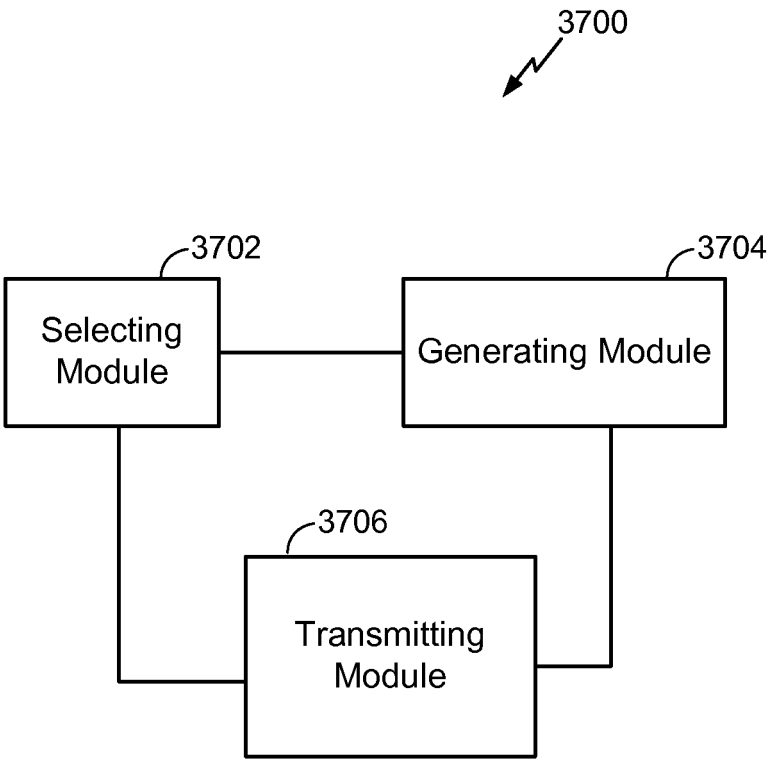

3700
3702
3704
Selecting Module
Generating Module
3706
Transmitting Module

FIG. 37

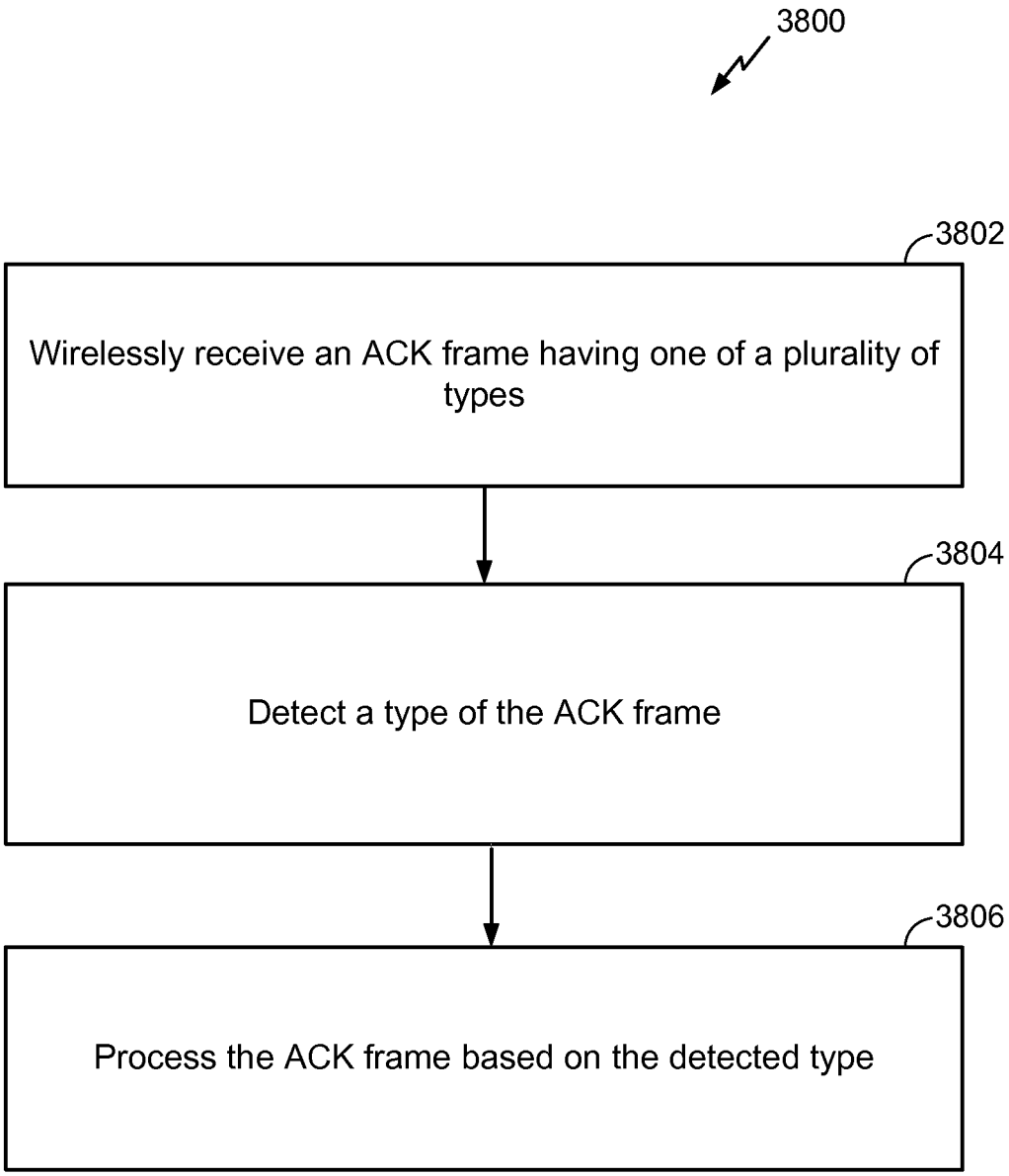

3800
3802
Wirelessly receive an ACK frame having one of a plurality of types
3804
Detect a type of the ACK frame
3806
Process the ACK frame based on the detected type

Figure 38

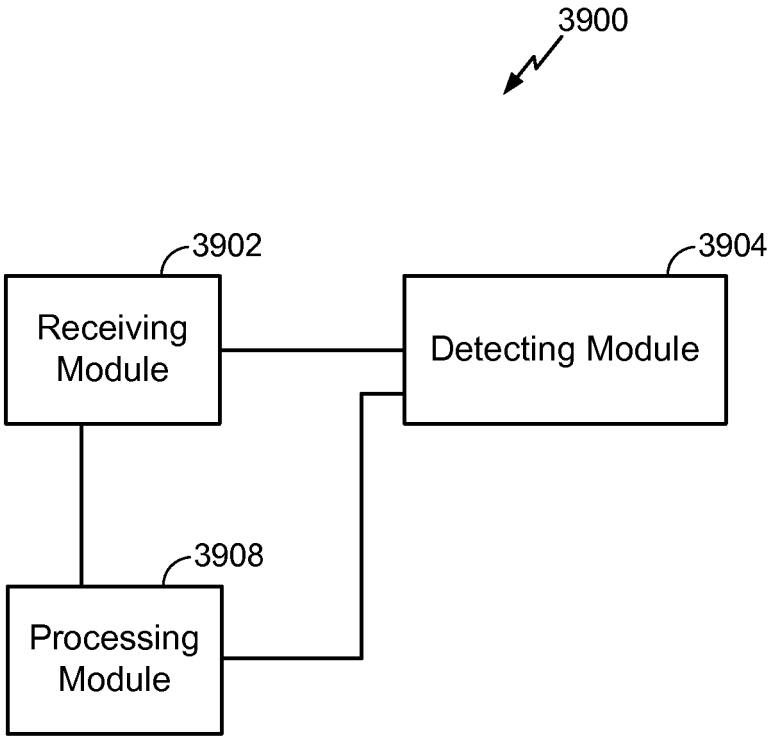

3900
3902
3904
Receiving Module
Detecting Module
3908
Processing Module

FIG. 39

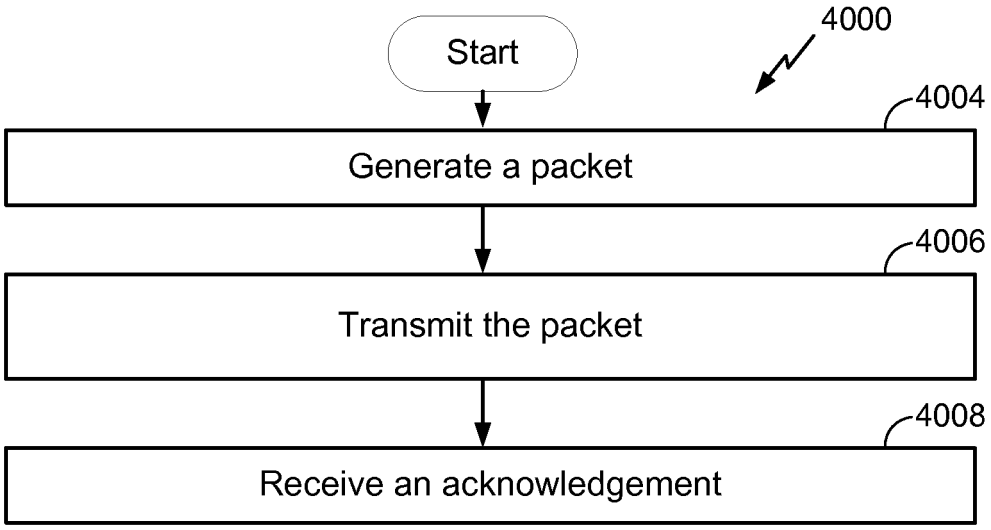

Start
4000
4004
Generate a packet
4006
Transmit the packet
4008
Receive an acknowledgement

FIG. 40

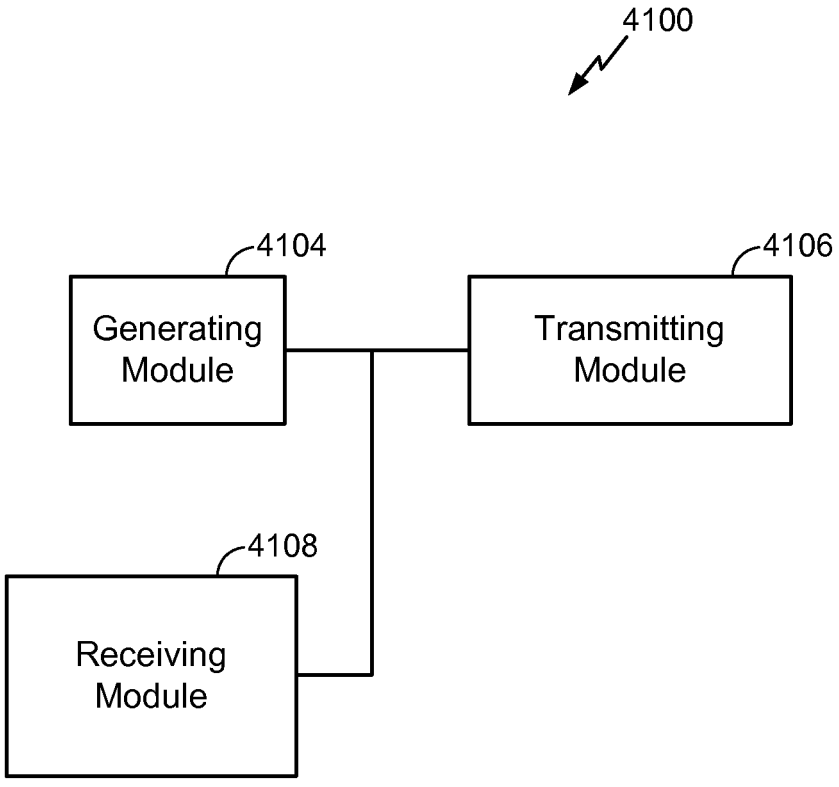

4100
4104
Generating Module
4106
Transmitting Module
4108
Receiving Module

FIG. 41

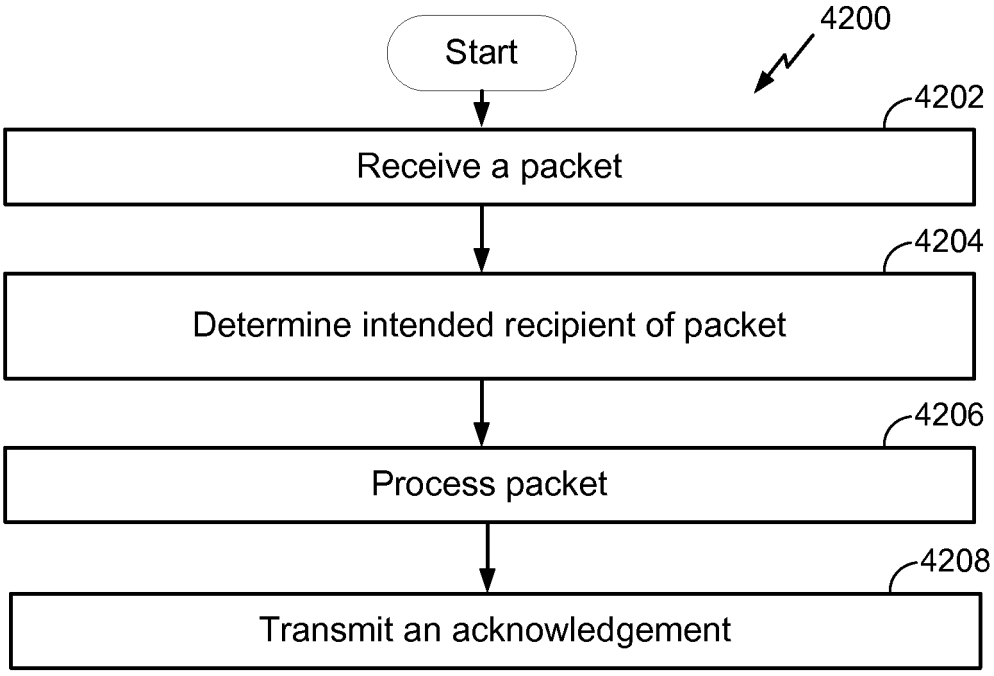

Start
4200
4202
Receive a packet
4204
Determine intended recipient of packet
4206
Process packet
4208
Transmit an acknowledgement

FIG. 42

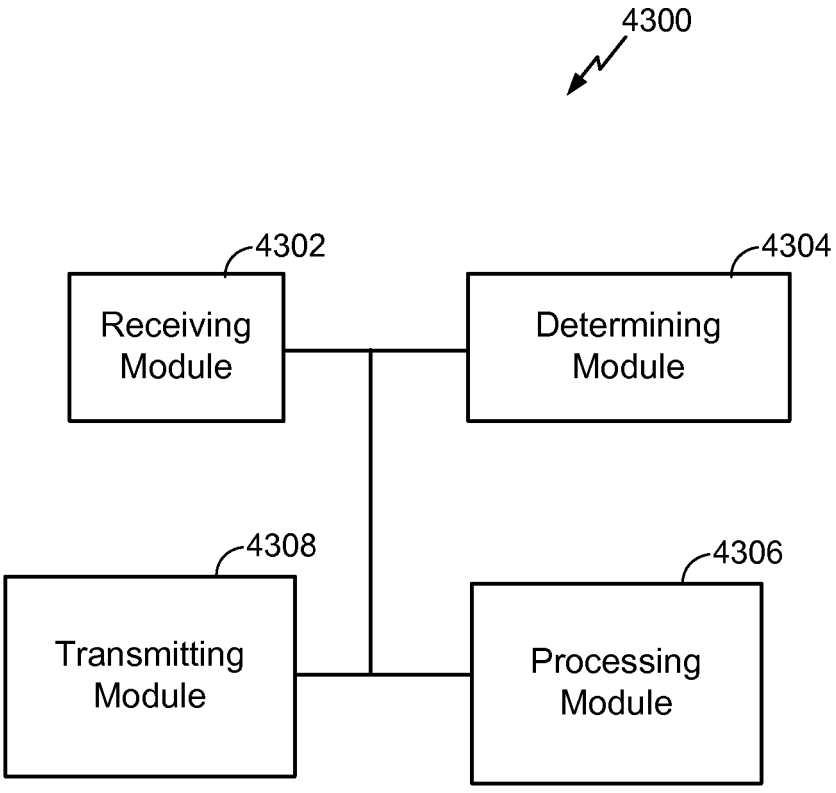

4300
4302
Receiving Module
4304
Determining Module
4308
Transmitting Module
4306
Processing Module

FIG. 43