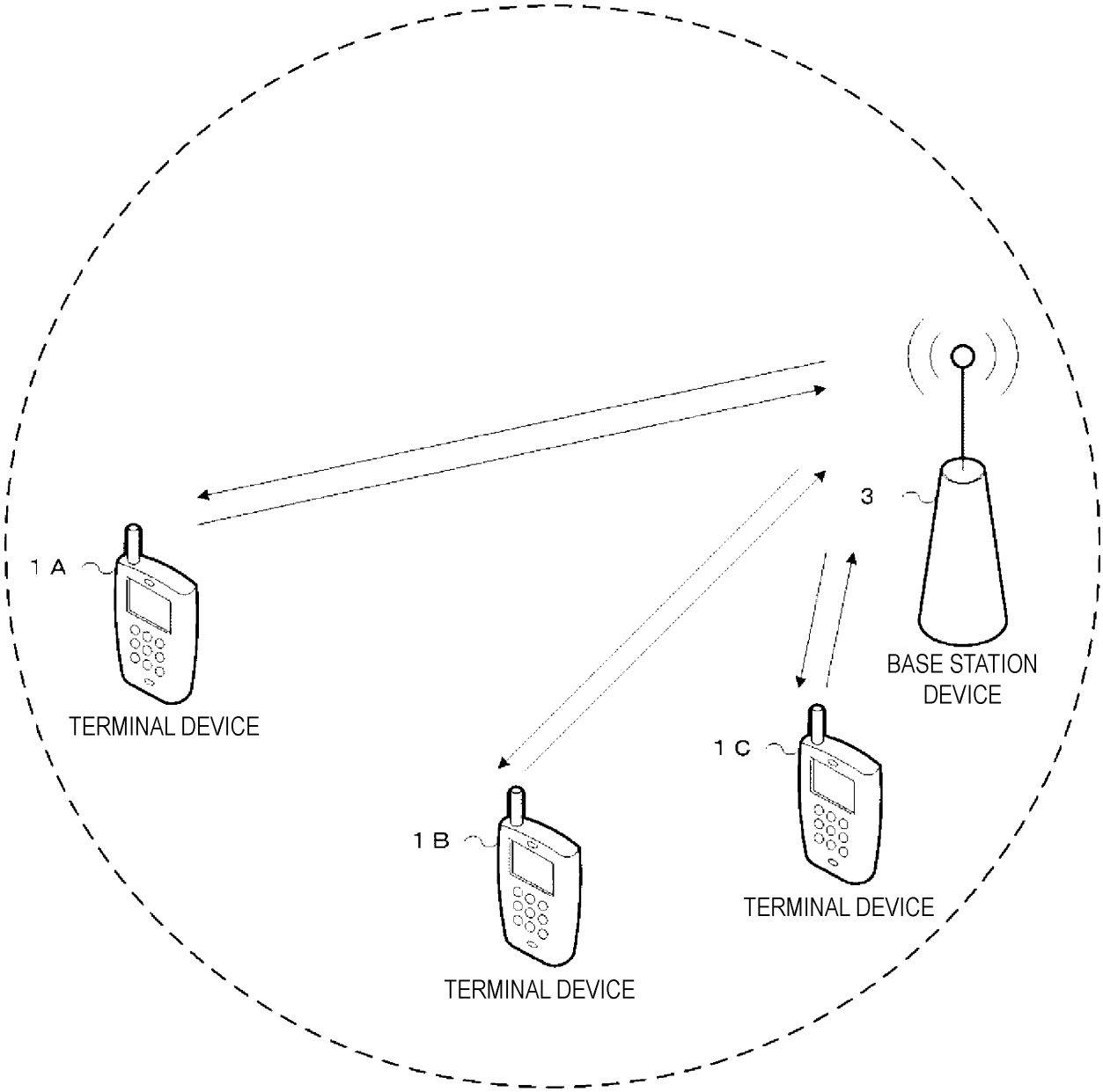

1 A
TERMINAL DEVICE
3
BASE STATION
DEVICE
1 B
TERMINAL DEVICE
1 C
TERMINAL DEVICE

FIG. 1

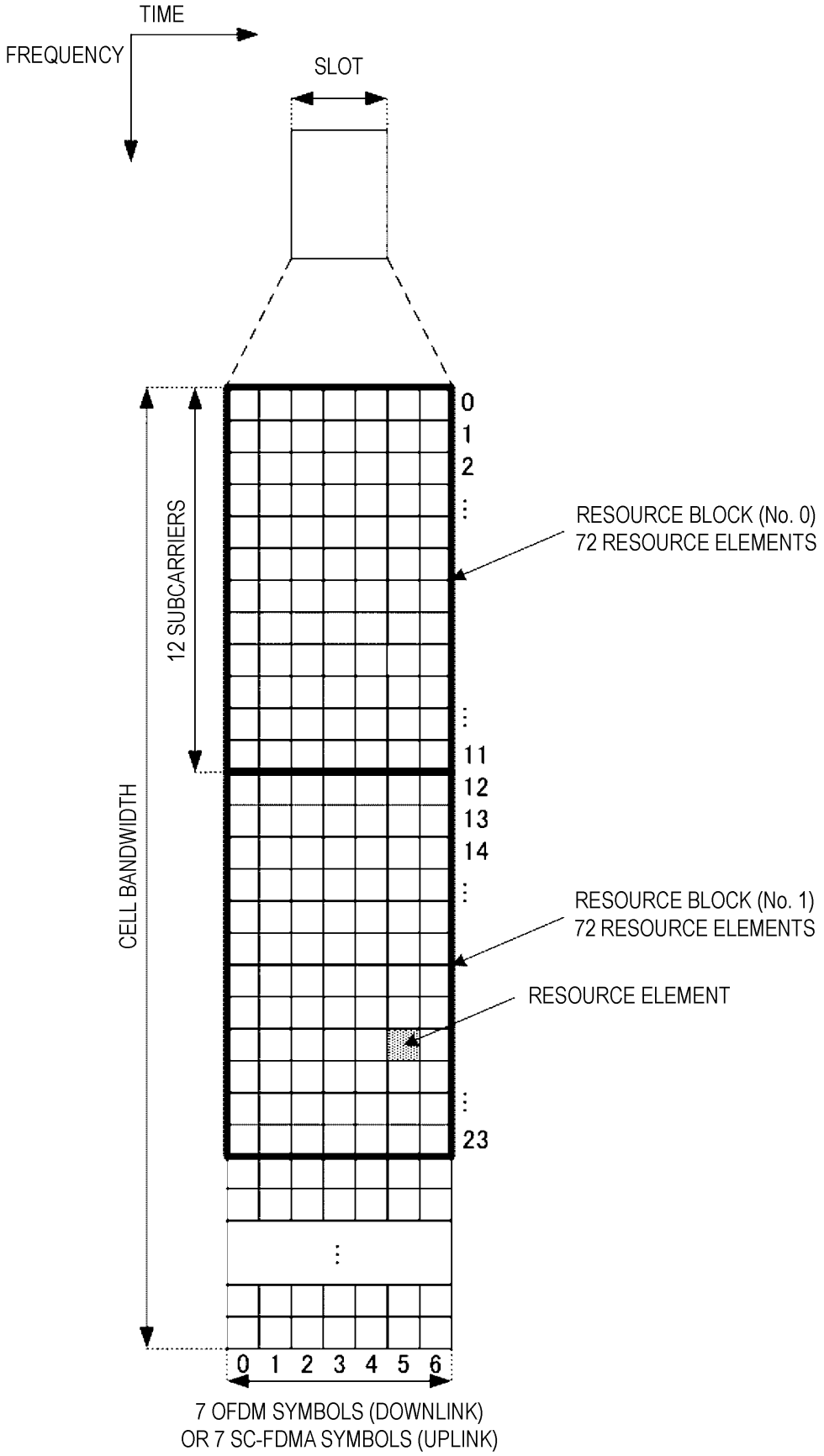

TIME
FREQUENCY
SLOT
0
1
2
11
12
13
14
23
12 SUBCARRIERS
CELL BANDWIDTH
RESOURCE BLOCK (No. 0)
72 RESOURCE ELEMENTS
RESOURCE BLOCK (No. 1)
72 RESOURCE ELEMENTS
RESOURCE ELEMENT
0 1 2 3 4 5 6
7 OFDM SYMBOLS (DOWNLINK)
OR 7 SC-FDMA SYMBOLS (UPLINK)

FIG. 2

FIG. 3A Example 1

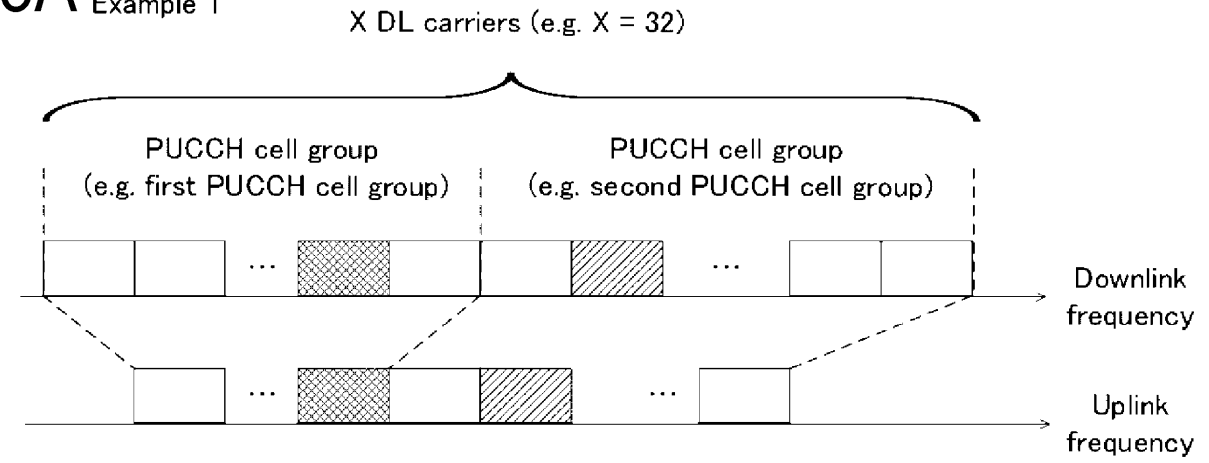


FIG. 3B Example 2

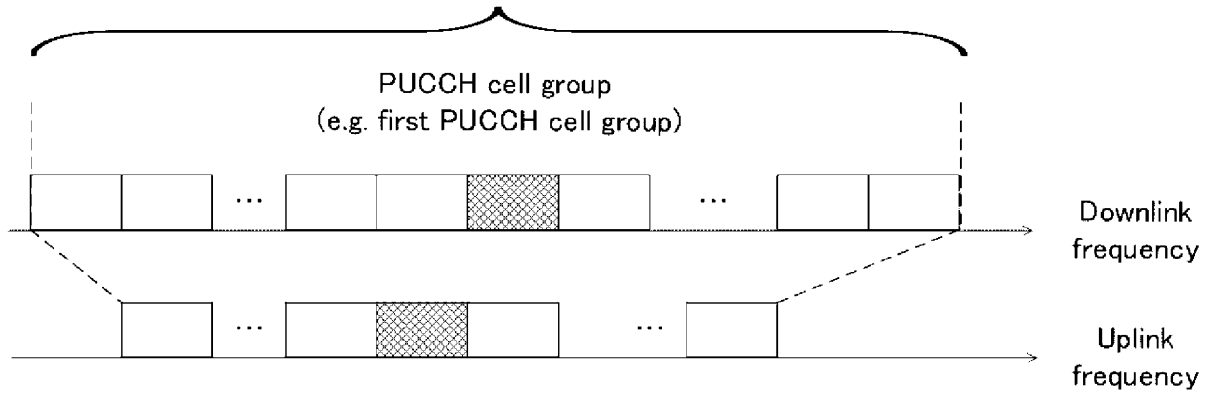
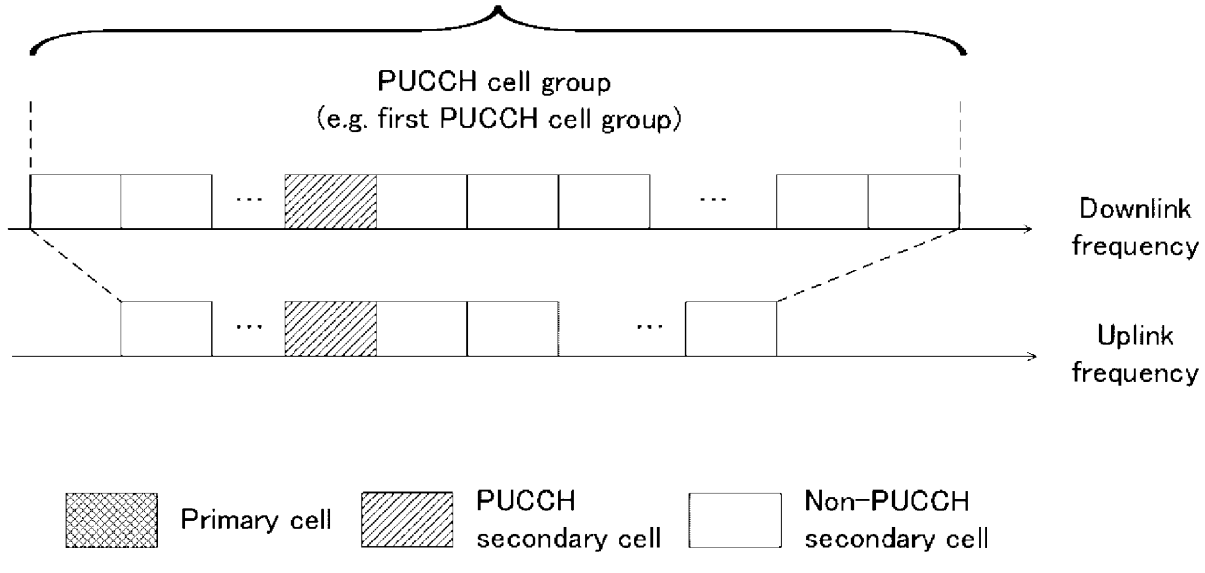


FIG. 3C Example 3



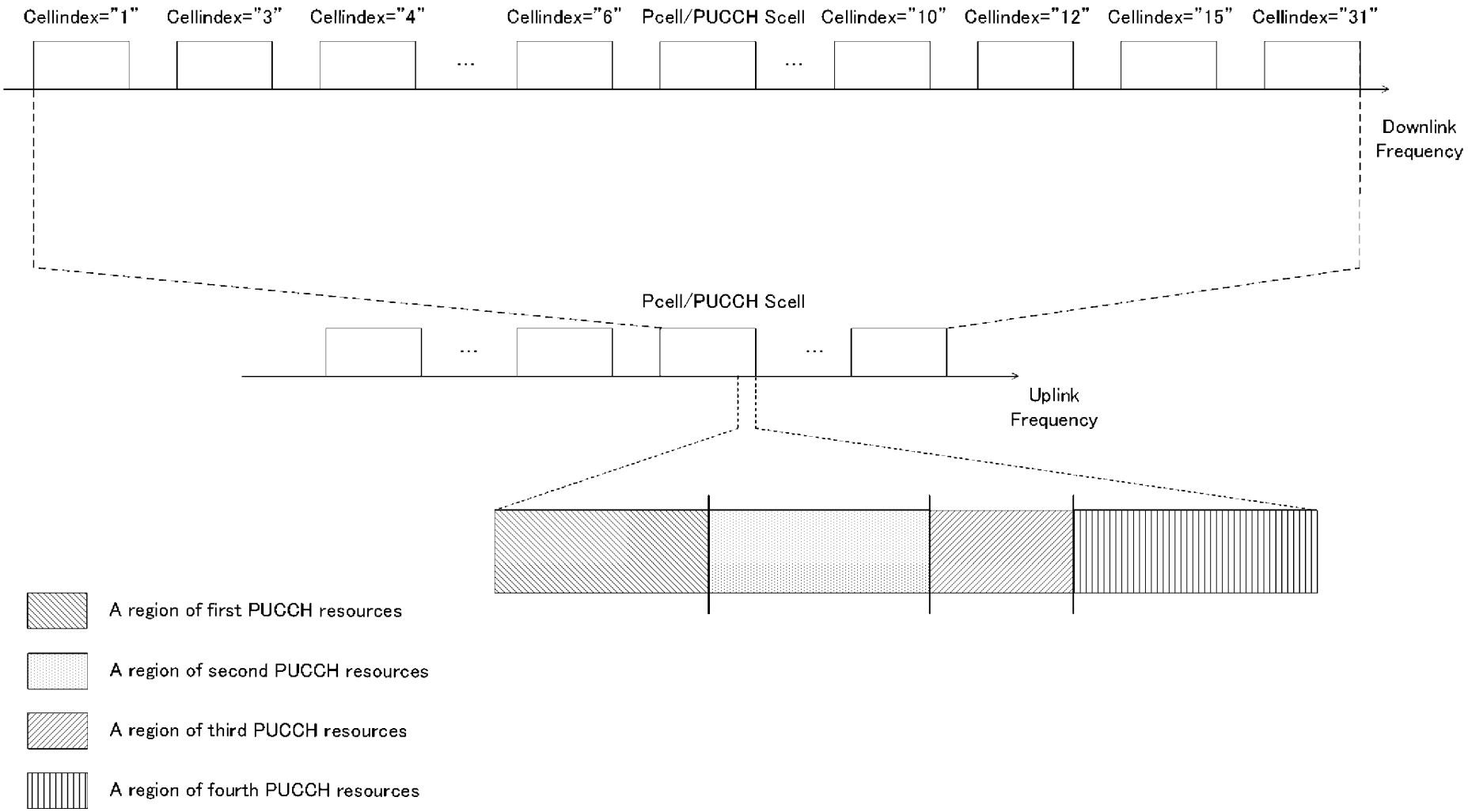
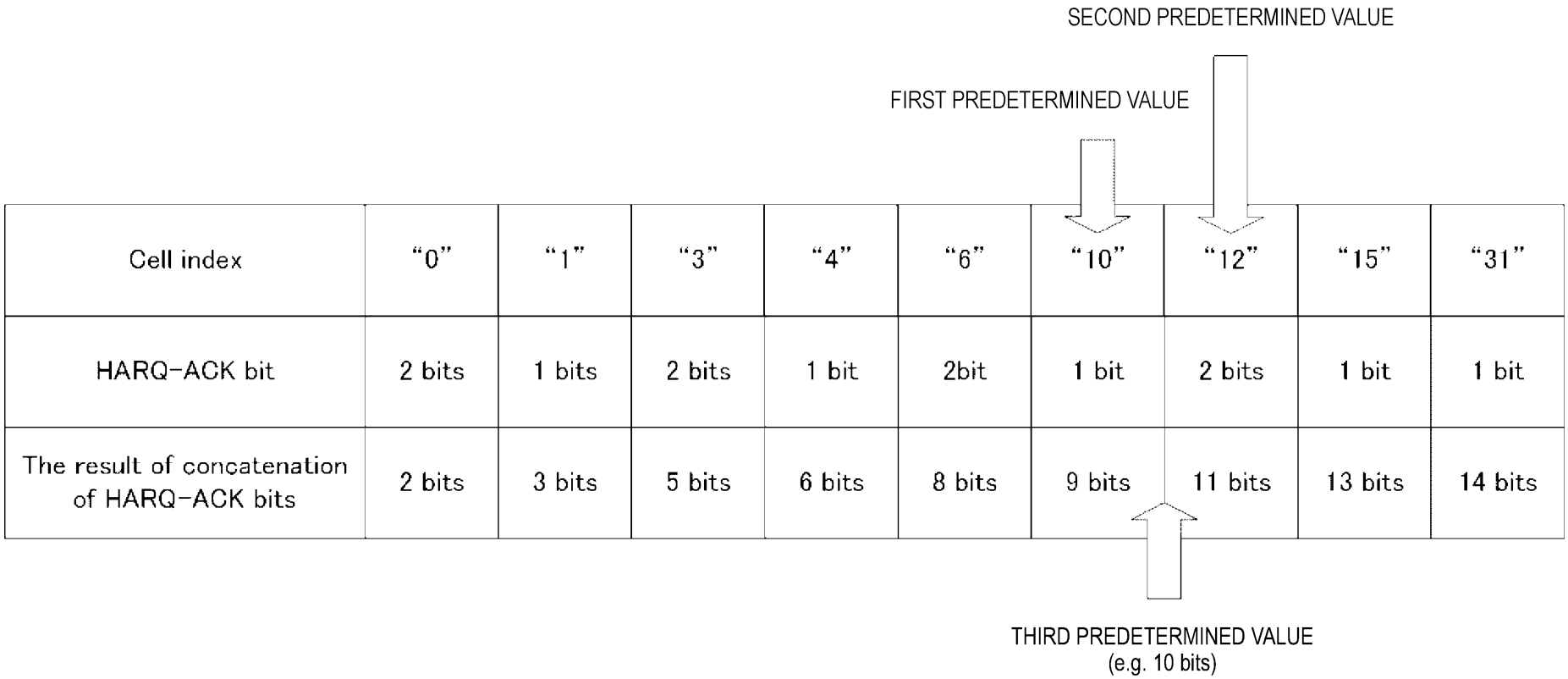

Cellindex="1"
Cellindex="3"
Cellindex="4"
Cellindex="6"
Pcell/PUCCH Scell
Cellindex="10"
Cellindex="12"
Cellindex="15"
Cellindex="31"
Downlink Frequency
Pcell/PUCCH Scell
Uplink Frequency
A region of first PUCCH resources
A region of second PUCCH resources
A region of third PUCCH resources
A region of fourth PUCCH resources

FIG. 4



Cell index	"0"	"1"	"3"	"4"	"6"	"10"	"12"	"15"	"31"
HARQ-ACK bit	2 bits	1 bits	2 bits	1 bit	2bit	1 bit	2 bits	1 bit	1 bit
The result of concatenation of HARQ-ACK bits	2 bits	3 bits	5 bits	6 bits	8 bits	9 bits	11 bits	13 bits	14 bits

FIG. 5

The sequence of bits $\tilde{o}_0^{ACK}, \tilde{o}_1^{ACK}, \ldots, \tilde{o}_{O^{ACK}-1}^{ACK}$ is the result of the concatenation of HARQ-ACK bits for different cells according to the following pseudo-code:

Set $c = 0$ – cell index: lower indices correspond to lower RRC indices of corresponding cell

Set $j = 0$ – HARQ-ACK bit index

Set N_{cells}^{DL} to the number of cells configured by higher layers for the UE

while $c < N_{cells}^{DL}$

    if transmission mode configured in cell $c \in \{1,2,5,6,7\}$ -- 1 bit HARQ-ACK feedback for this cell

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit of this cell

        $j = j + 1$

    else

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit corresponding to the first codeword of this cell

        $j = j + 1$

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit corresponding to the second codeword of this cell

        $j = j + 1$

    end if

  $c = c + 1$

end while

FIG. 6

The sequence of bits $\tilde{o}_0^{ACK}, \tilde{o}_1^{ACK}, \ldots, \tilde{o}_{O^{ACK}-1}^{ACK}$ is the result of the concatenation of HARQ-ACK bits for different cells according to the following pseudo-code:

Set $c = 0$ – cell index: lower indices correspond to lower RRC indices of corresponding cell

Set $j = 0$ – HARQ-ACK bit index

Set N_{cells}^{DL} to the number of cells configured by higher layers for the UE

Set X to min $\{ N_{cells}^{DL}$, a first value (e.g. 5 or 10)$\}$

while $c <$ X

    if transmission mode configured in cell $c \in \{1,2,5,6,7\}$ -- 1 bit HARQ-ACK feedback for this cell

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit of this cell

        $j = j + 1$

    else

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit corresponding to the first codeword of this cell

        $j = j + 1$

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit corresponding to the second codeword of this cell

        $j = j + 1$

    end if

  $c = c + 1$

end while

FIG. 7

The sequence of bits $\tilde{o}_0^{ACK}, \tilde{o}_1^{ACK}, \ldots, \tilde{o}_{O^{ACK}-1}^{ACK}$ is the result of the concatenation of HARQ-ACK bits for different cells according to the following pseudo-code:

Set $c = 0$ – cell index: lower indices correspond to lower RRC indices of corresponding cell

Set $j = 0$ – HARQ-ACK bit index

Set N_{cells}^{DL} to the number of cells configured by higher layers for the UE

Set Y to a second value (e.g. 10, or 20)

while $c <$ Y

    if transmission mode configured in cell $c \in \{1,2,5,6,7\}$ -- 1 bit HARQ-ACK feedback for this cell

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit of this cell

        $j = j + 1$

    else

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit corresponding to the first codeword of this cell

        $j = j + 1$

        $\tilde{o}_j^{ACK}$ = HARQ-ACK bit corresponding to the second codeword of this cell

        $j = j + 1$

    end if

  $c = c + 1$

end while

FIG. 8

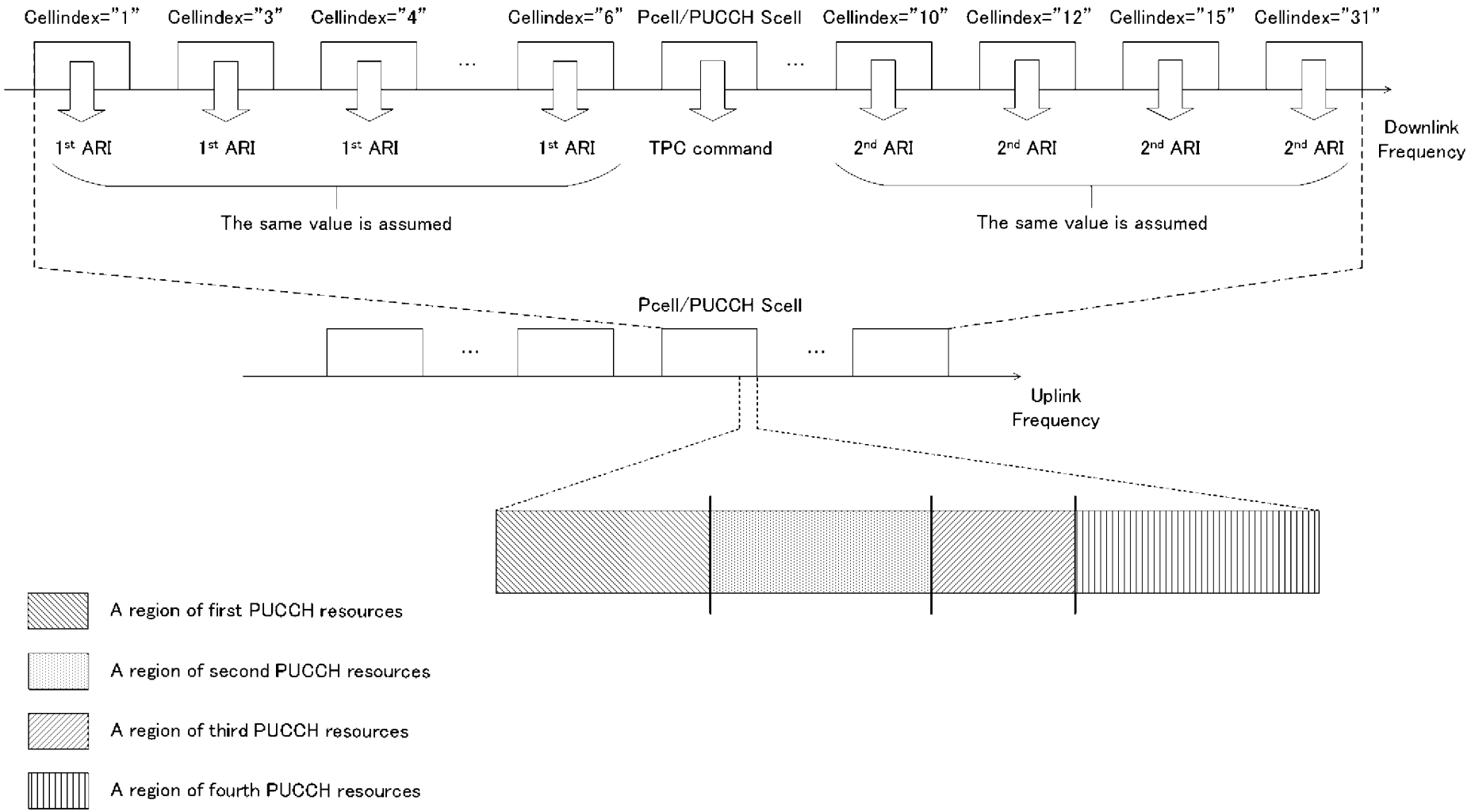

Cellindex="1"
Cellindex="3"
Cellindex="4"
Cellindex="6"
Pcell/PUCCH Scell
Cellindex="10"
Cellindex="12"
Cellindex="15"
Cellindex="31"
1st ARI
1st ARI
1st ARI
1st ARI
TPC command
2nd ARI
2nd ARI
2nd ARI
2nd ARI
Downlink Frequency
The same value is assumed
The same value is assumed
Pcell/PUCCH Scell
Uplink Frequency
A region of first PUCCH resources
A region of second PUCCH resources
A region of third PUCCH resources
A region of fourth PUCCH resources

FIG. 9

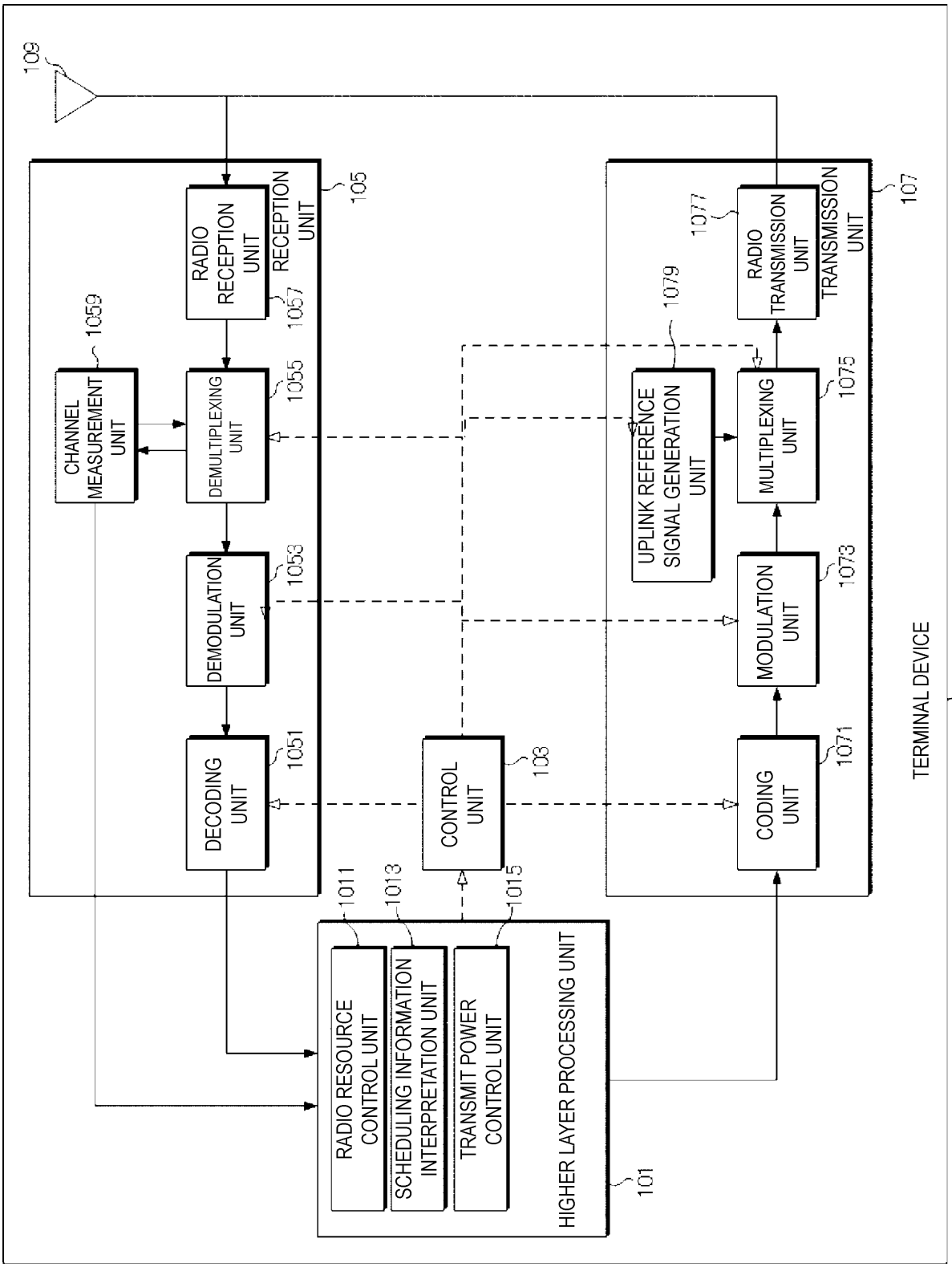

109
RECEPTION UNIT
105
RADIO RECEPTION UNIT
1057
CHANNEL MEASUREMENT UNIT
1059
DEMULTIPLEXING UNIT
1055
DEMODULATION UNIT
1053
DECODING UNIT
1051
TRANSMISSION UNIT
107
RADIO TRANSMISSION UNIT
1077
UPLINK REFERENCE SIGNAL GENERATION UNIT
1079
MULTIPLEXING UNIT
1075
MODULATION UNIT
1073
CODING UNIT
1071
CONTROL UNIT
103
HIGHER LAYER PROCESSING UNIT
101
RADIO RESOURCE CONTROL UNIT
1011
SCHEDULING INFORMATION INTERPRETATION UNIT
1013
TRANSMIT POWER CONTROL UNIT
1015
TERMINAL DEVICE
1

FIG. 10

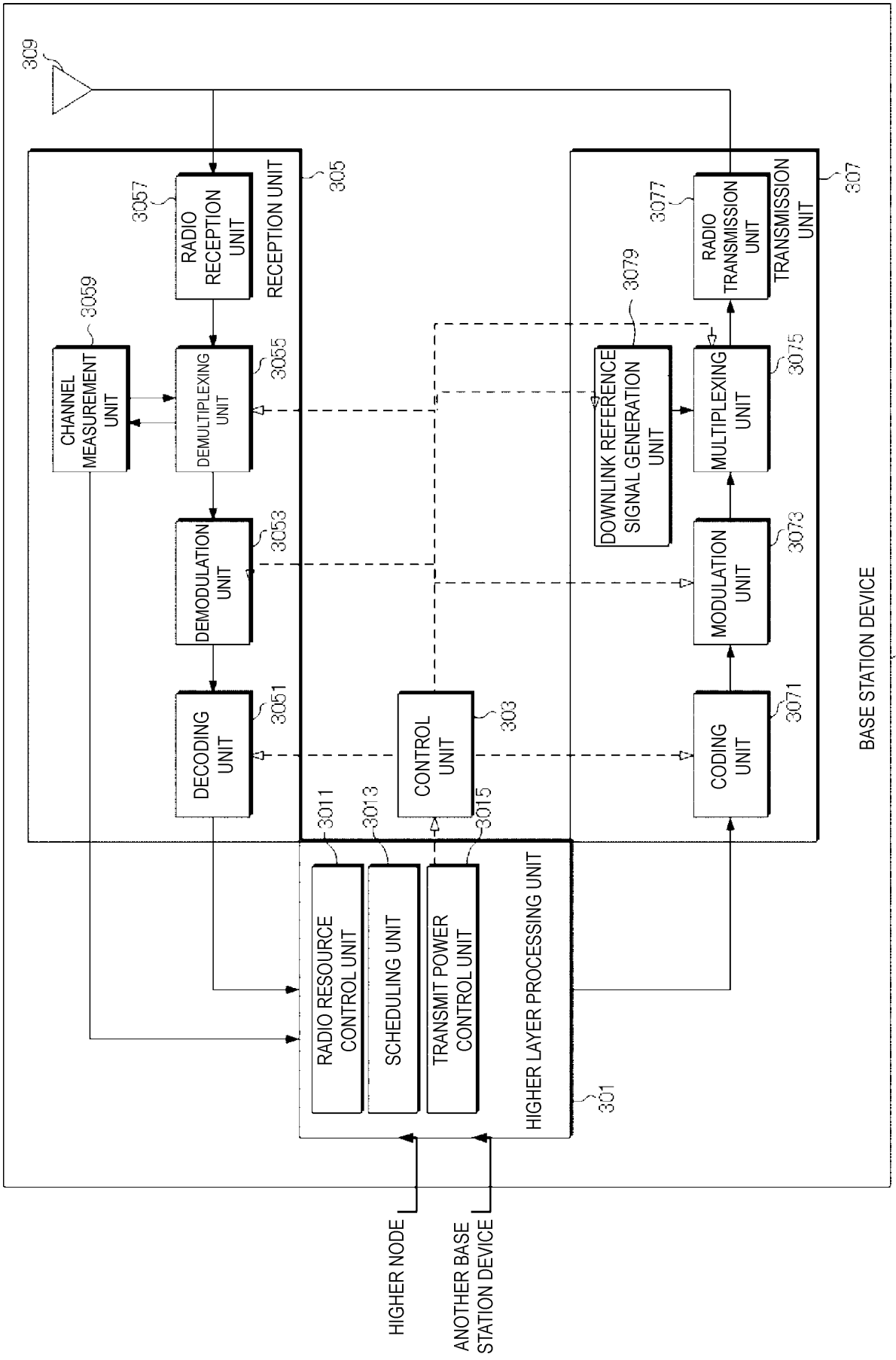

309
RADIO RECEPTION UNIT
3057
RECEPTION UNIT
305
CHANNEL MEASUREMENT UNIT
3059
DEMULTIPLEXING UNIT
3055
DEMODULATION UNIT
3053
DECODING UNIT
3051
CONTROL UNIT
303
RADIO RESOURCE CONTROL UNIT
3011
SCHEDULING UNIT
3013
TRANSMIT POWER CONTROL UNIT
3015
HIGHER LAYER PROCESSING UNIT
301
RADIO TRANSMISSION UNIT
3077
TRANSMISSION UNIT
307
DOWNLINK REFERENCE SIGNAL GENERATION UNIT
3079
MULTIPLEXING UNIT
3075
MODULATION UNIT
3073
CODING UNIT
3071
BASE STATION DEVICE
3
HIGHER NODE
ANOTHER BASE STATION DEVICE

FIG. 11