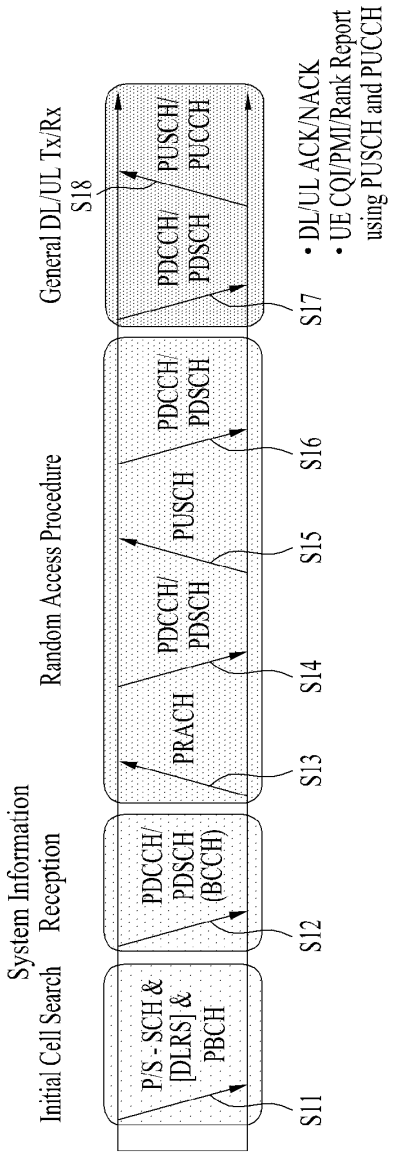
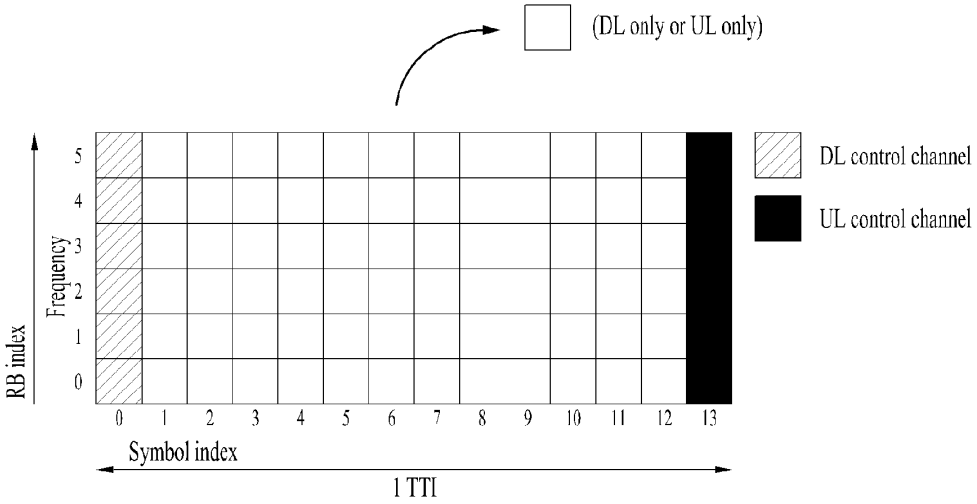
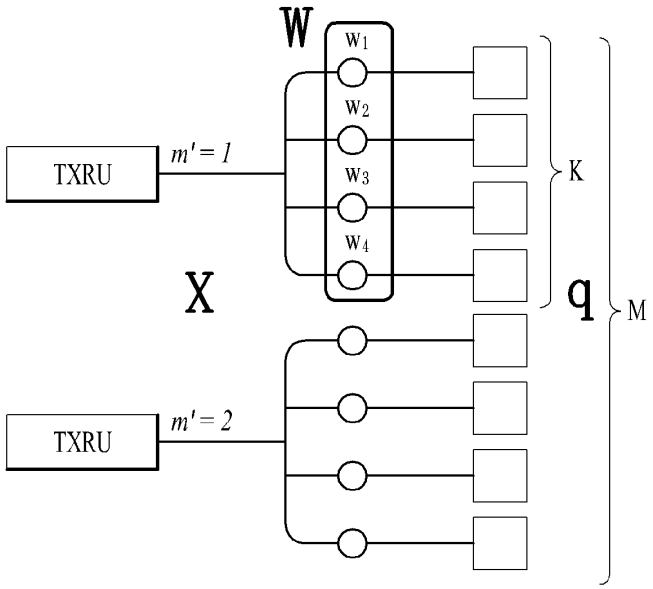
[Fig. 1]


Initial Cell Search
System Information Reception
Random Access Procedure
General DL/UL Tx/Rx
S18
P/S - SCH & [DLRS] & PBCH
PDCCH/ PDSCH (BCCH)
PRACH
PDCCH/ PDSCH
PUSCH
PDCCH/ PDSCH
PDCCH/ PDSCH
PUSCH/ PUCCH
S11
S12
S13
S14
S15
S16
S17
• DL/UL ACK/NACK
• UE CQI/PMI/Rank Report using PUSCH and PUCCH

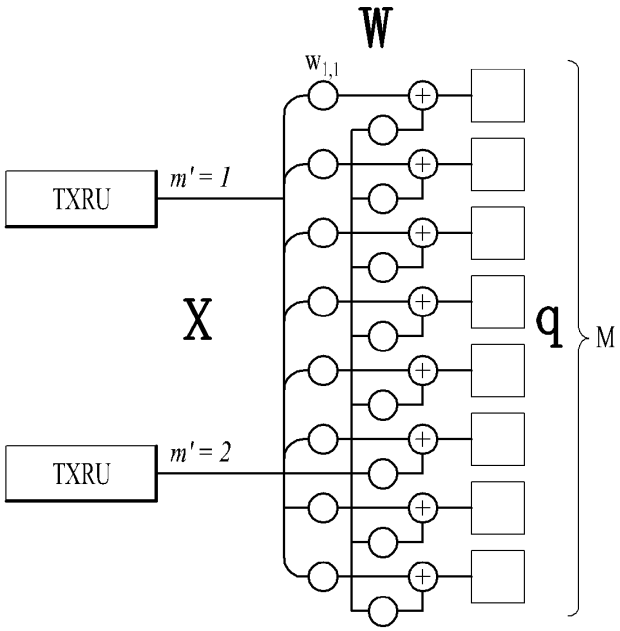
[Fig. 2]


(DL only or UL only)
DL control channel
UL control channel
RB index
Frequency
0
1
2
3
4
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Symbol index
1 TTI

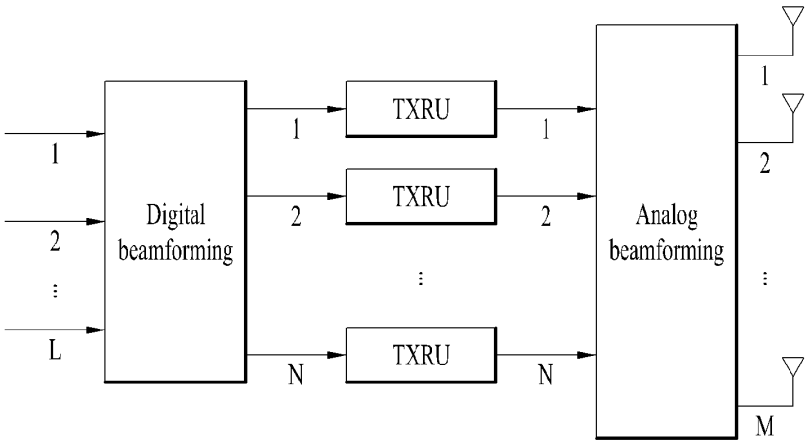
[Fig. 3]


W
W1
W2
W3
W4
TXRU
m' = 1
X
TXRU
m' = 2
K
q
M

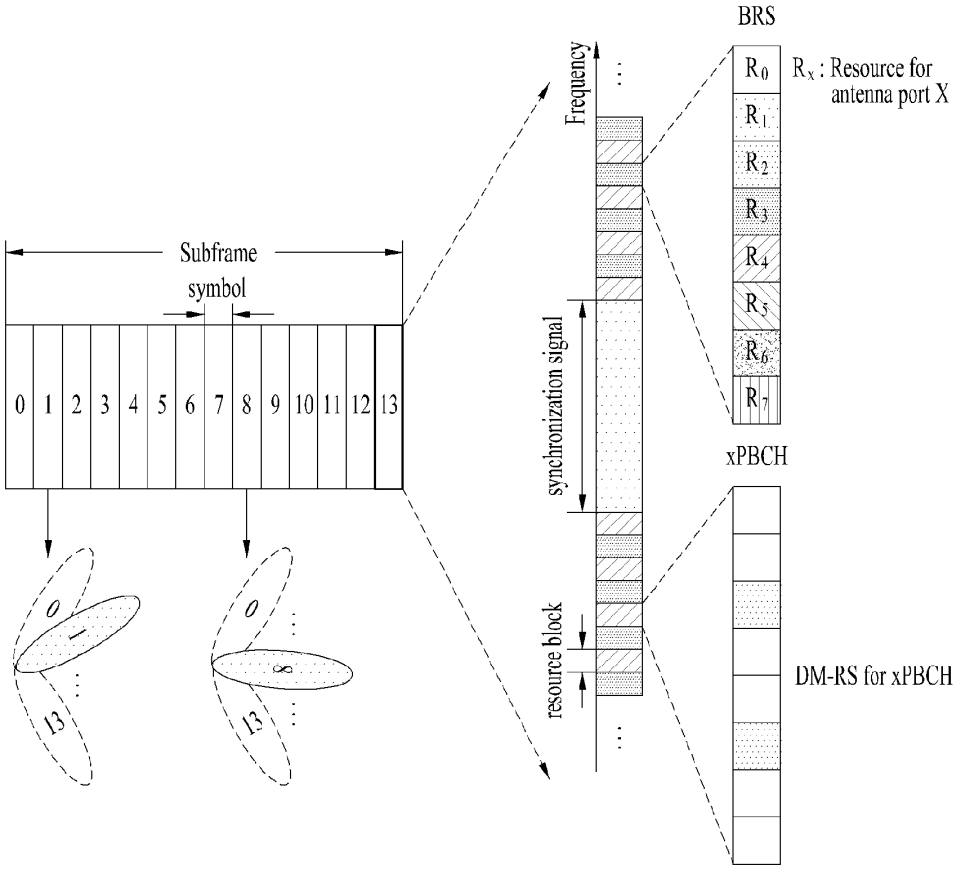
[Fig. 4]


W
$W_{1,1}$
TXRU
m' = 1
X
q
M
TXRU
m' = 2

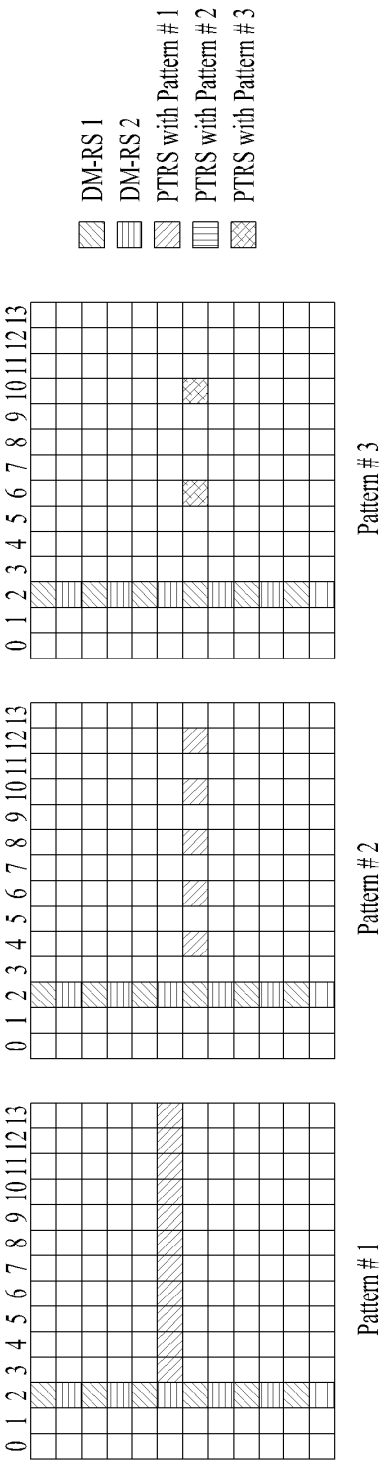
[Fig. 5]


1
2
L
Digital beamforming
1
2
N
TXRU
TXRU
TXRU
1
2
N
Analog beamforming
1
2
M

[Fig. 6]


BRS
Frequency
R_0
R_1
R_2
R_3
R_4
R_5
R_6
R_7
R_x : Resource for antenna port X
Subframe
symbol
0 1 2 3 4 5 6 7 8 9 10 11 12 13
synchronization signal
xPBCH
resource block
DM-RS for xPBCH

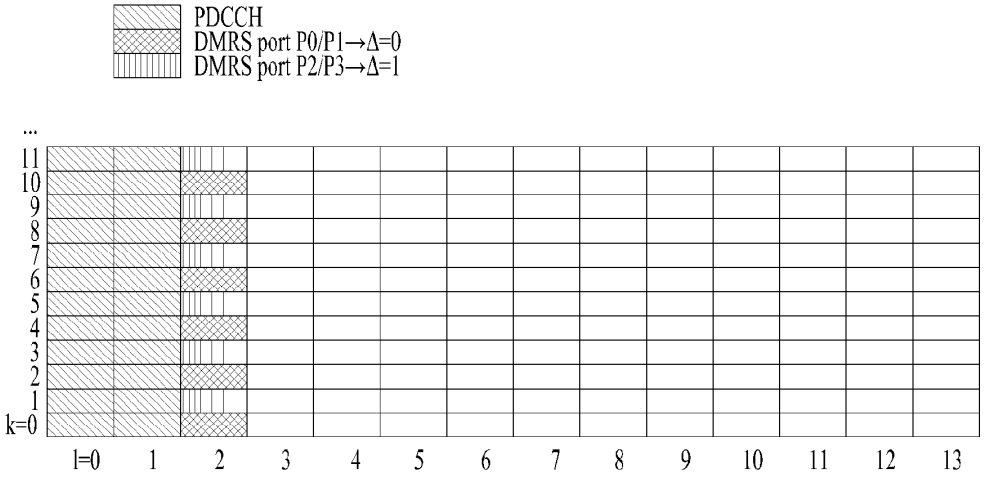
[Fig. 7]


DM-RS 1
DM-RS 2
PTRS with Pattern # 1
PTRS with Pattern # 2
PTRS with Pattern # 3
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Pattern # 3
Pattern # 2
Pattern # 1

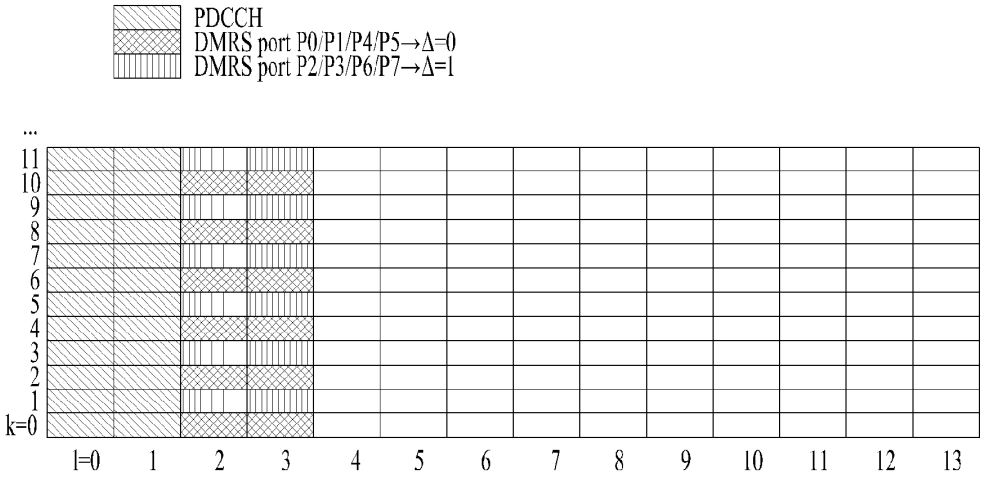
[Fig. 8]

Configuration type 1 CDM-T & CDM-F	Configuration type 2 CDM-T & CDM-F
P2/P3/P6/P7	P4/P5/P10/P11
P0/P1/P4/P5	P4/P5/P10/P11
P2/P3/P6/P7	P2/P3/P8/P9
P0/P1/P4/P5	P2/P3/P8/P9
P2/P3/P6/P7	P0/P1/P6/P7
P0/P1/P4/P5	P0/P1/P6/P7
P2/P3/P6/P7	P4/P5/P10/P11
P0/P1/P4/P5	P4/P5/P10/P11
P2/P3/P6/P7	P2/P3/P8/P9
P0/P1/P4/P5	P2/P3/P8/P9
P2/P3/P6/P7	P0/P1/P6/P7
P0/P1/P4/P5	P0/P1/P6/P7

[Fig. 9]

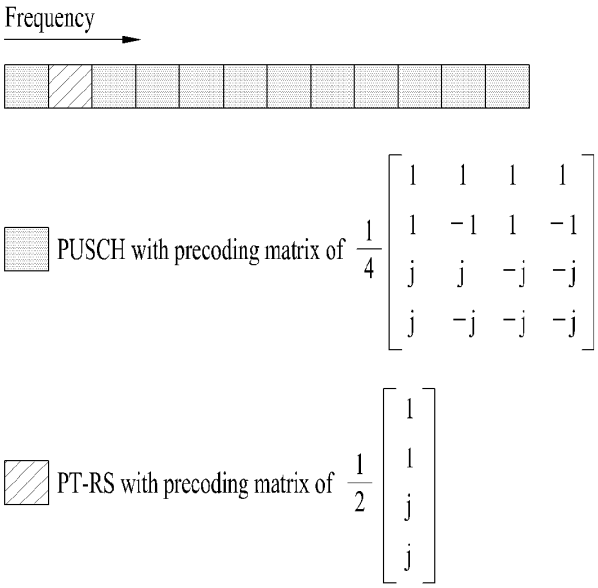

PDCCH
DMRS port P0/P1→Δ=0
DMRS port P2/P3→Δ=1
...
11
10
9
8
7
6
5
4
3
2
1
k=0
l=0 1 2 3 4 5 6 7 8 9 10 11 12 13

(a)

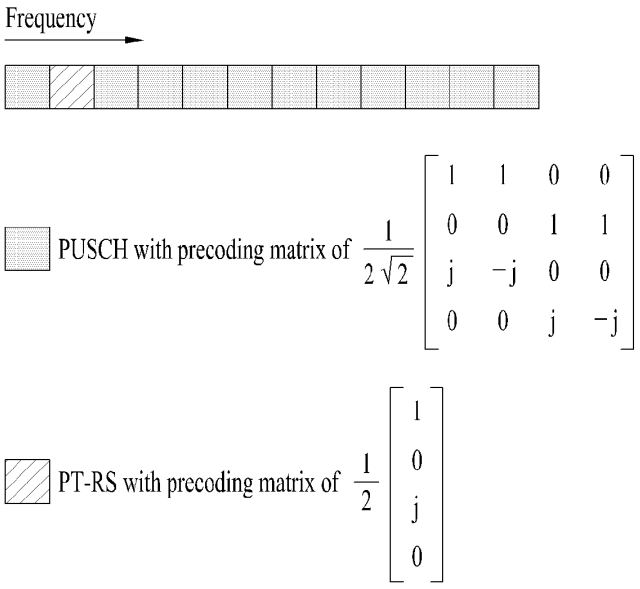

PDCCH
DMRS port P0/P1/P4/P5→Δ=0
DMRS port P2/P3/P6/P7→Δ=1
...
11
10
9
8
7
6
5
4
3
2
1
k=0
l=0 1 2 3 4 5 6 7 8 9 10 11 12 13

(b)

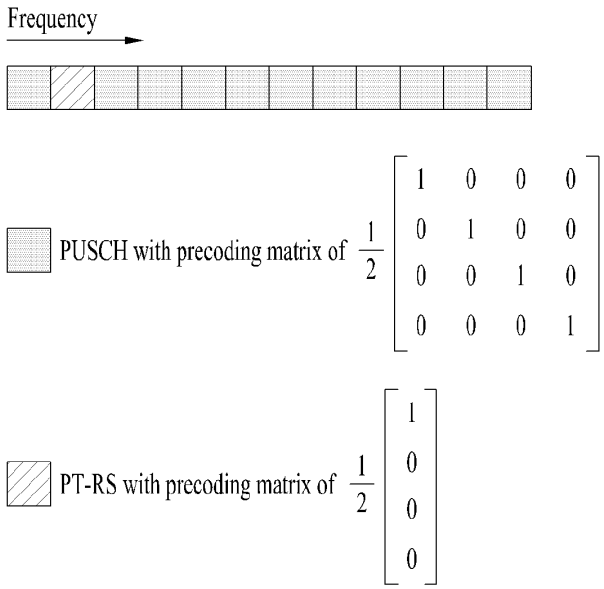
[Fig. 10]


Frequency
PUSCH with precoding matrix of $\frac{1}{4}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ j & j & -j & -j \\ j & -j & -j & -j \end{bmatrix}$
PT-RS with precoding matrix of $\frac{1}{2}\begin{bmatrix} 1 \\ 1 \\ j \\ j \end{bmatrix}$

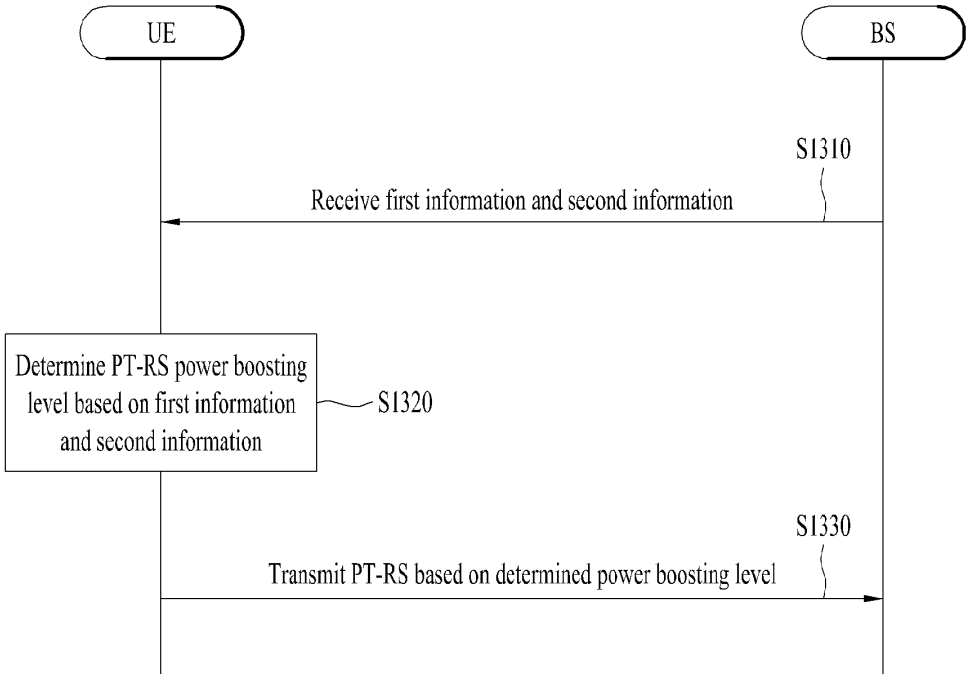
[Fig. 11]


Frequency
PUSCH with precoding matrix of $\frac{1}{2\sqrt{2}}\begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ j & -j & 0 & 0 \\ 0 & 0 & j & -j \end{bmatrix}$
PT-RS with precoding matrix of $\frac{1}{2}\begin{bmatrix} 1 \\ 0 \\ j \\ 0 \end{bmatrix}$

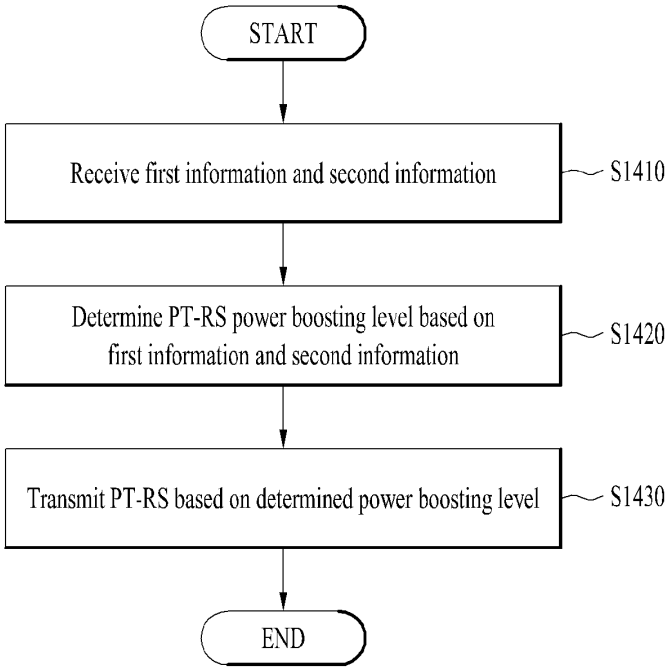
[Fig. 12]


Frequency
PUSCH with precoding matrix of $\frac{1}{2}\begin{bmatrix}1&0&0&0\\0&1&0&0\\0&0&1&0\\0&0&0&1\end{bmatrix}$
PT-RS with precoding matrix of $\frac{1}{2}\begin{bmatrix}1\\0\\0\\0\end{bmatrix}$

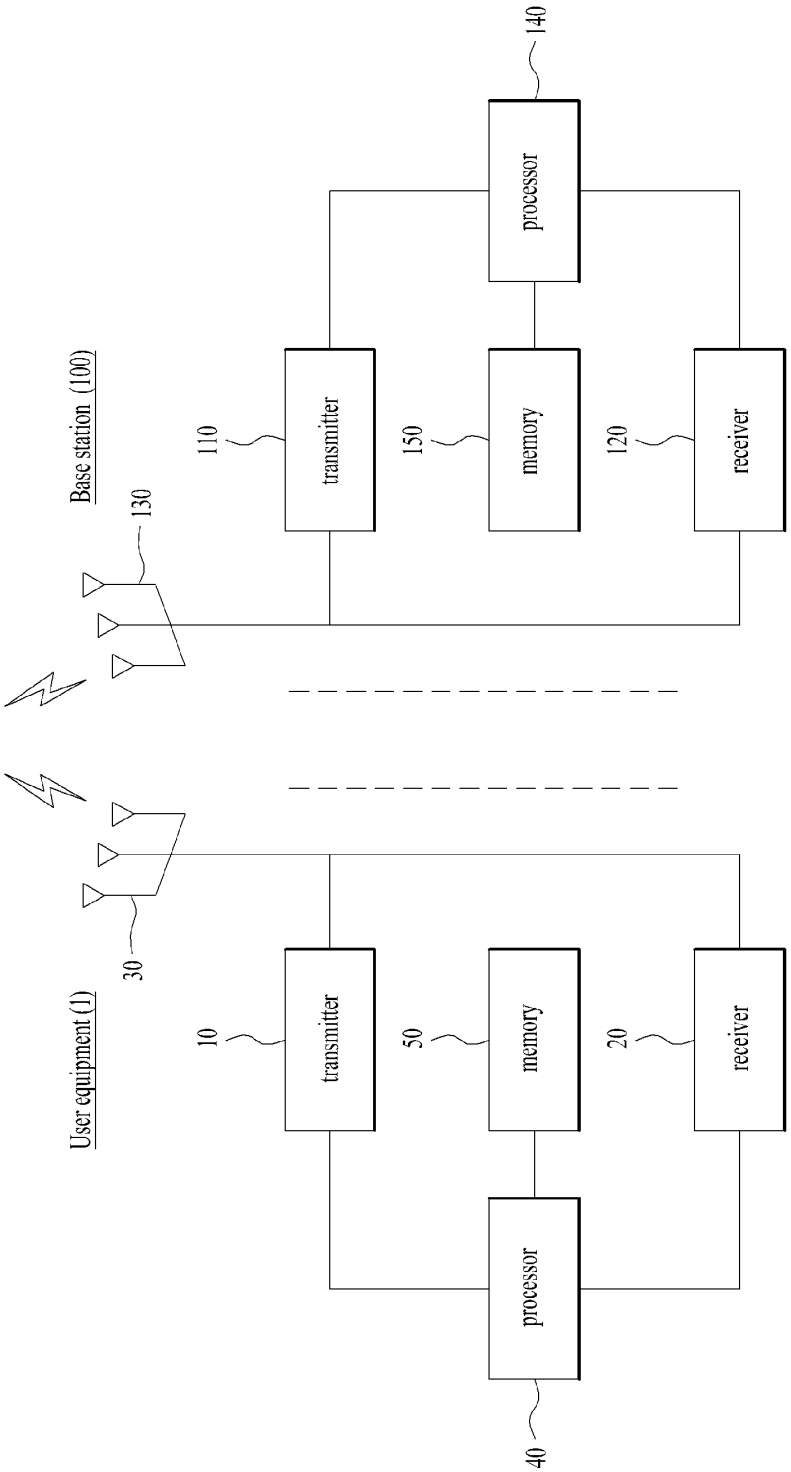
[Fig. 13]


UE
BS
S1310
Receive first information and second information
Determine PT-RS power boosting level based on first information and second information
S1320
S1330
Transmit PT-RS based on determined power boosting level

[Fig. 14]


START
Receive first information and second information
S1410
Determine PT-RS power boosting level based on first information and second information
S1420
Transmit PT-RS based on determined power boosting level
S1430
END

[Fig. 15]


Base station (100)
User equipment (1)
processor
transmitter
memory
receiver
140
110
150
120
130
30
10
50
20
40