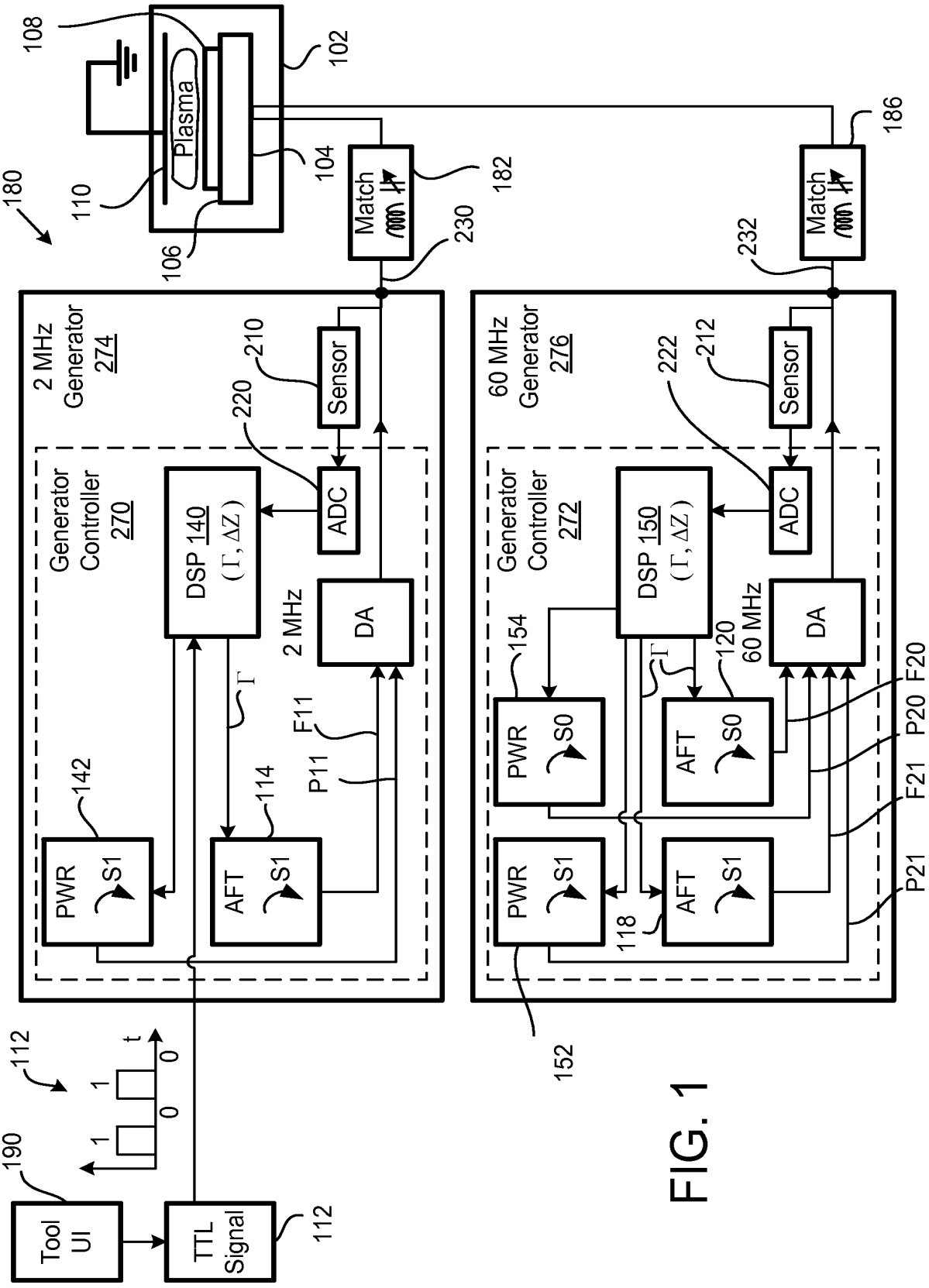

180
108
102
Plasma
110
106
104
Match
182
230
186
232
2 MHz Generator 274
60 MHz Generator 276
Generator Controller 270
Generator Controller 272
210
220
Sensor
ADC
DSP 140 (Γ, ΔZ)
DSP 150 (Γ, ΔZ)
DA
2 MHz
60 MHz
142
114
154
120
PWR
AFT
S1
S0
F11
P11
F20
P20
F21
P21
118
152
112
190
Tool UI
TTL Signal
t
1
0

FIG. 1

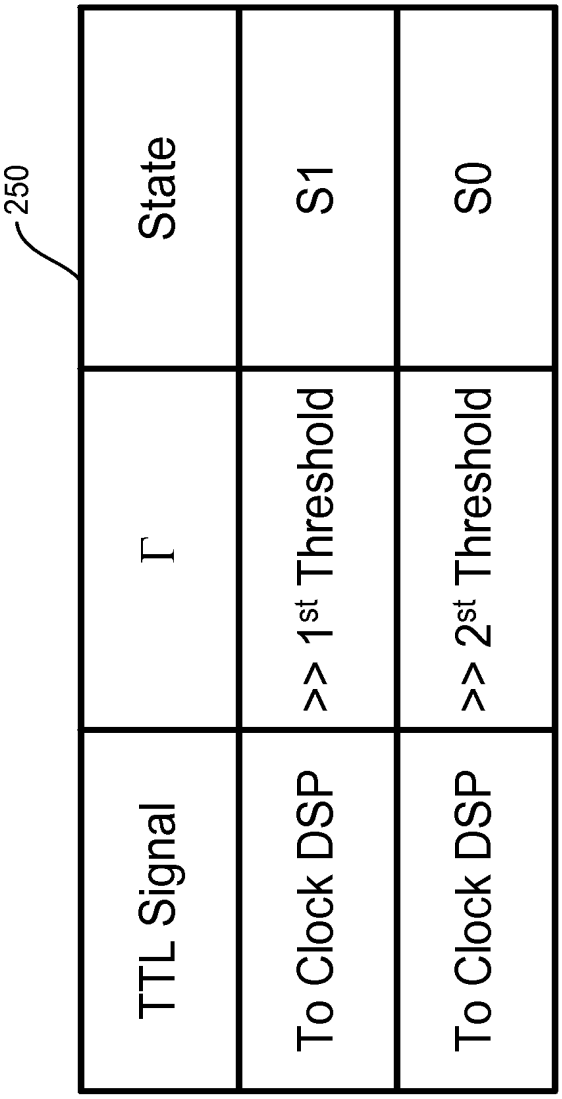

250
TTL Signal
Γ
State
To Clock DSP
>> 1st Threshold
S1
To Clock DSP
>> 2st Threshold
S0

FIG. 2

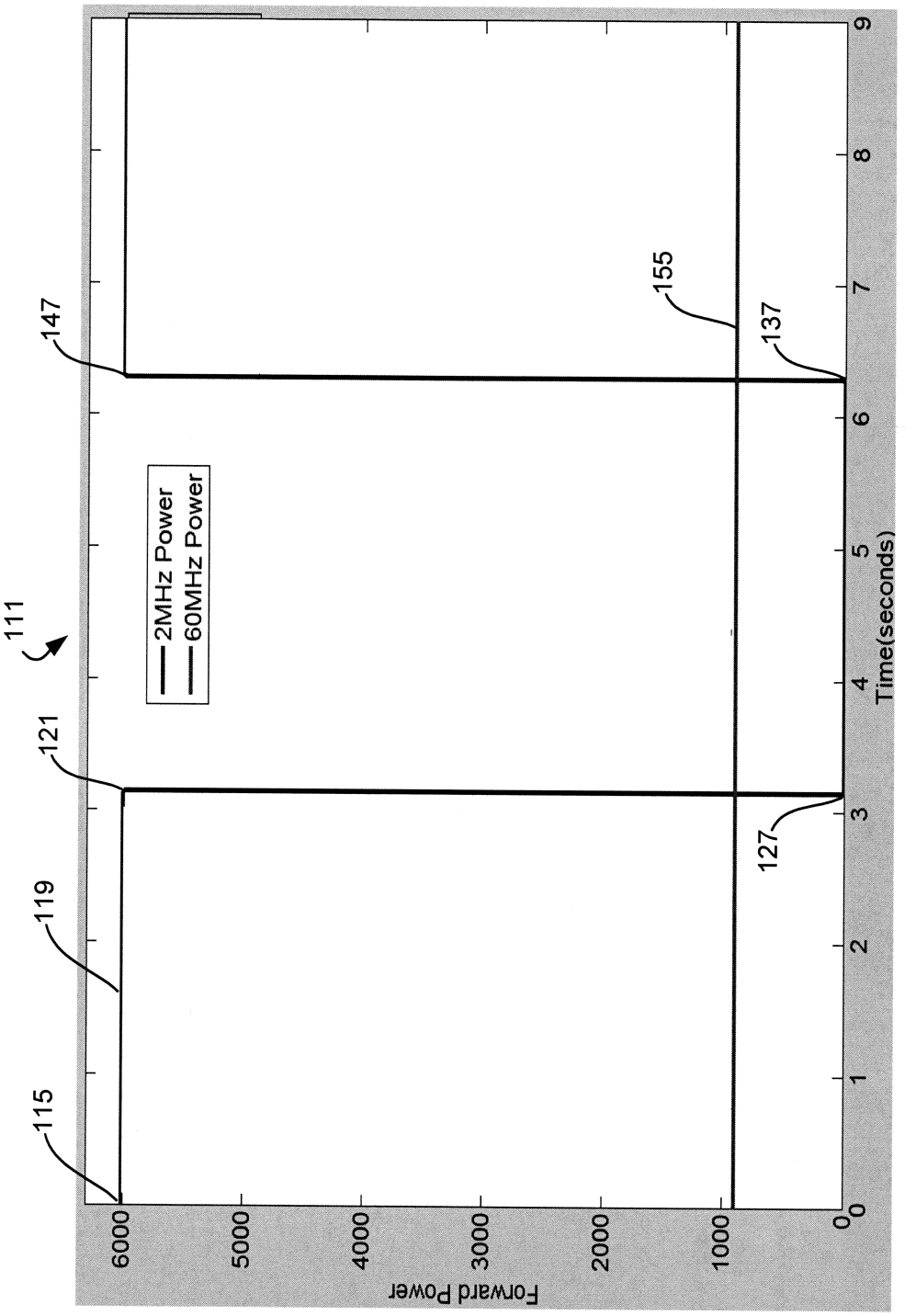

111
115
119
121
127
137
147
155
2MHz Power
60MHz Power
Forward Power
Time(seconds)
0
1000
2000
3000
4000
5000
6000
0
1
2
3
4
5
6
7
8
9

FIG. 3

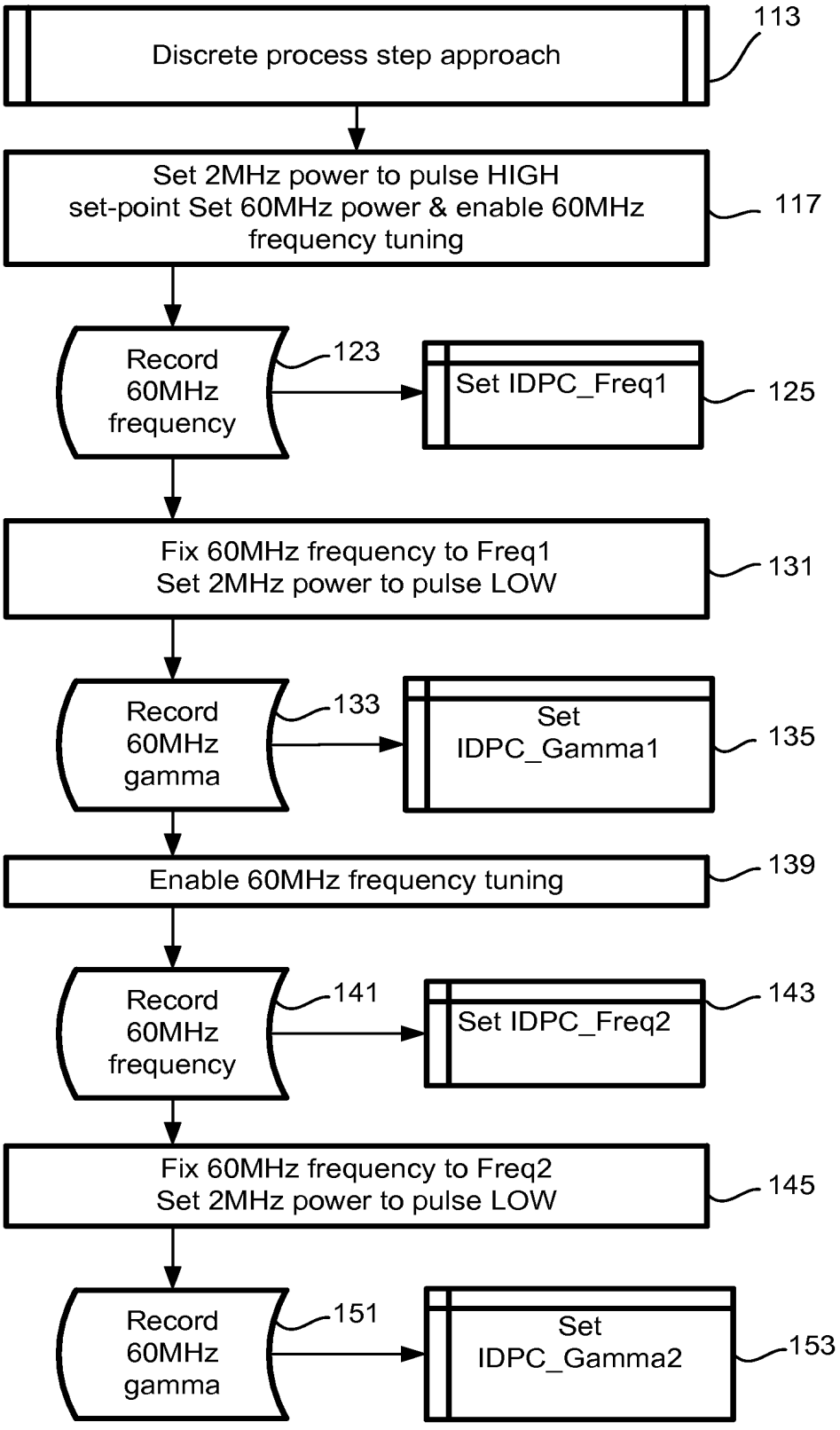

Discrete process step approach
113
Set 2MHz power to pulse HIGH
set-point Set 60MHz power & enable 60MHz
frequency tuning
117
Record
60MHz
frequency
123
Set IDPC_Freq1
125
Fix 60MHz frequency to Freq1
Set 2MHz power to pulse LOW
131
Record
60MHz
gamma
133
Set
IDPC_Gamma1
135
Enable 60MHz frequency tuning
139
Record
60MHz
frequency
141
Set IDPC_Freq2
143
Fix 60MHz frequency to Freq2
Set 2MHz power to pulse LOW
145
Record
60MHz
gamma
151
Set
IDPC_Gamma2
153

FIG. 4

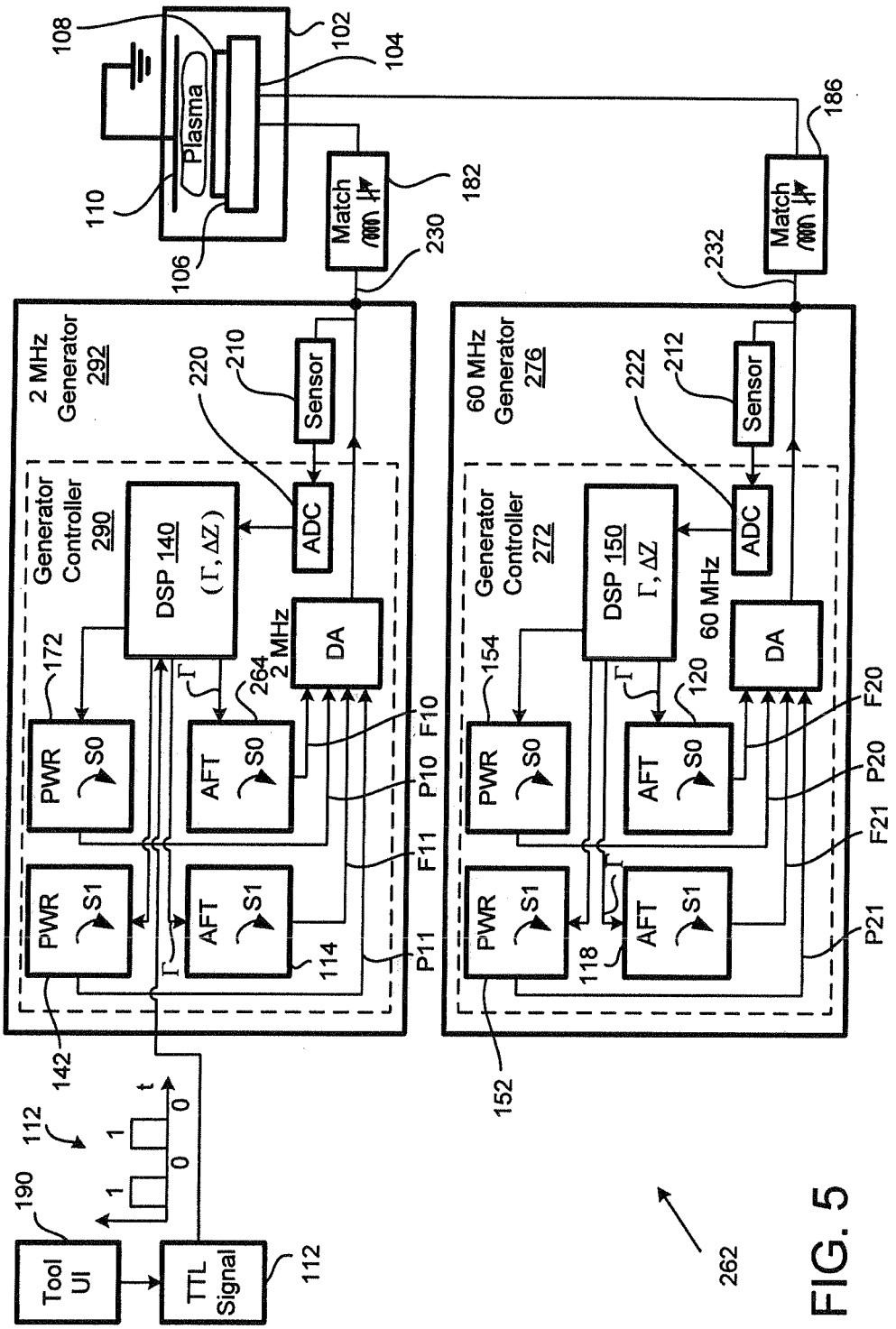

108
102
104
Plasma
110
106
Match
182
230
186
232
Match
2 MHz Generator 292
60 MHz Generator 276
Generator Controller 290
Generator Controller 272
220
210
222
212
Sensor
Sensor
DSP 140 (Γ, ΔZ)
DSP 150 Γ, ΔZ
ADC
ADC
172
154
PWR S0
PWR S1
AFT S0
AFT S1
264
2 MHz
DA
60 MHz
DA
120
F10
P10
F11
P11
F20
P20
F21
P21
114
118
142
152
112
190
Tool UI
TTL Signal
112
262

FIG. 5

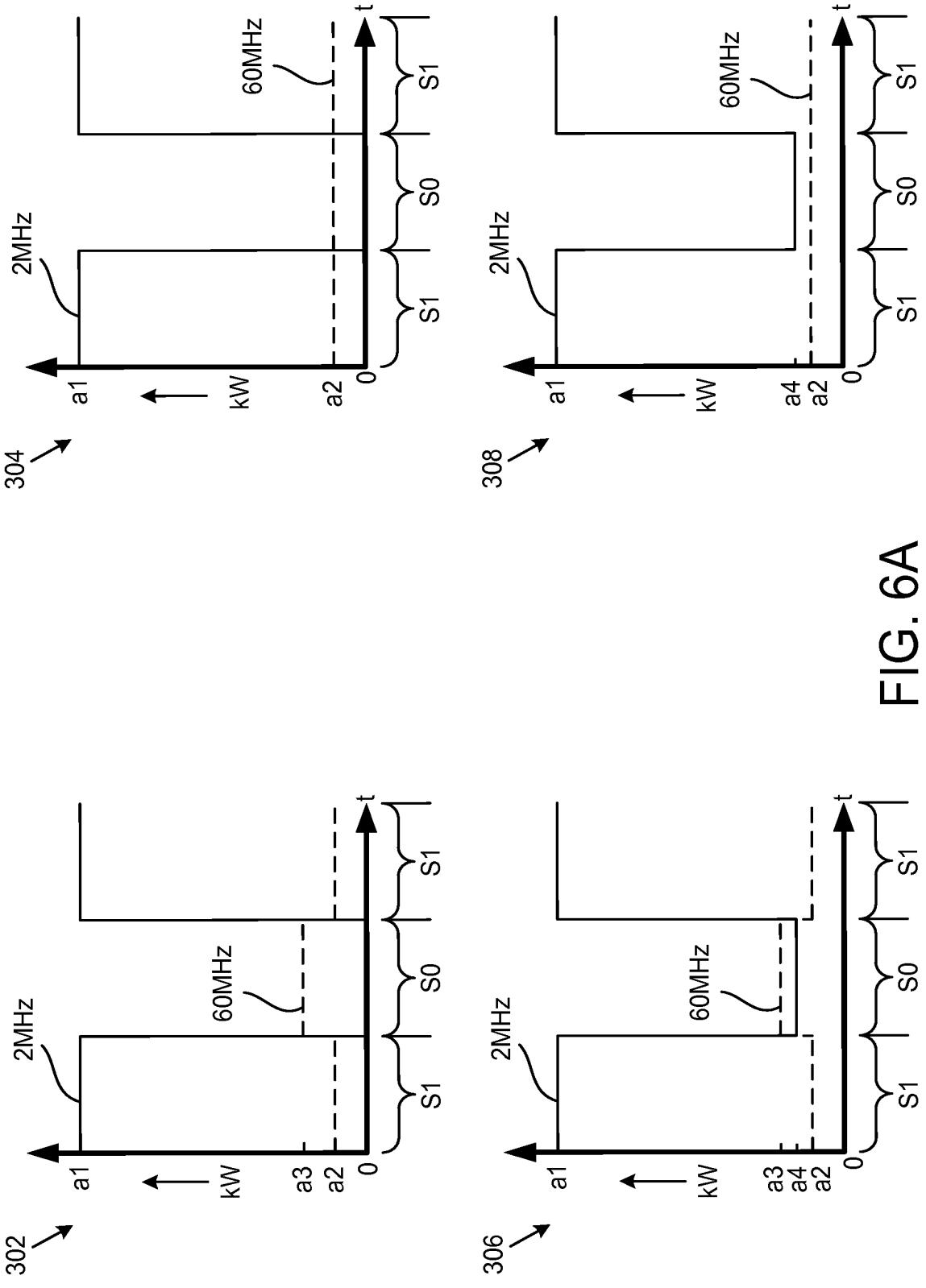


FIG. 6A

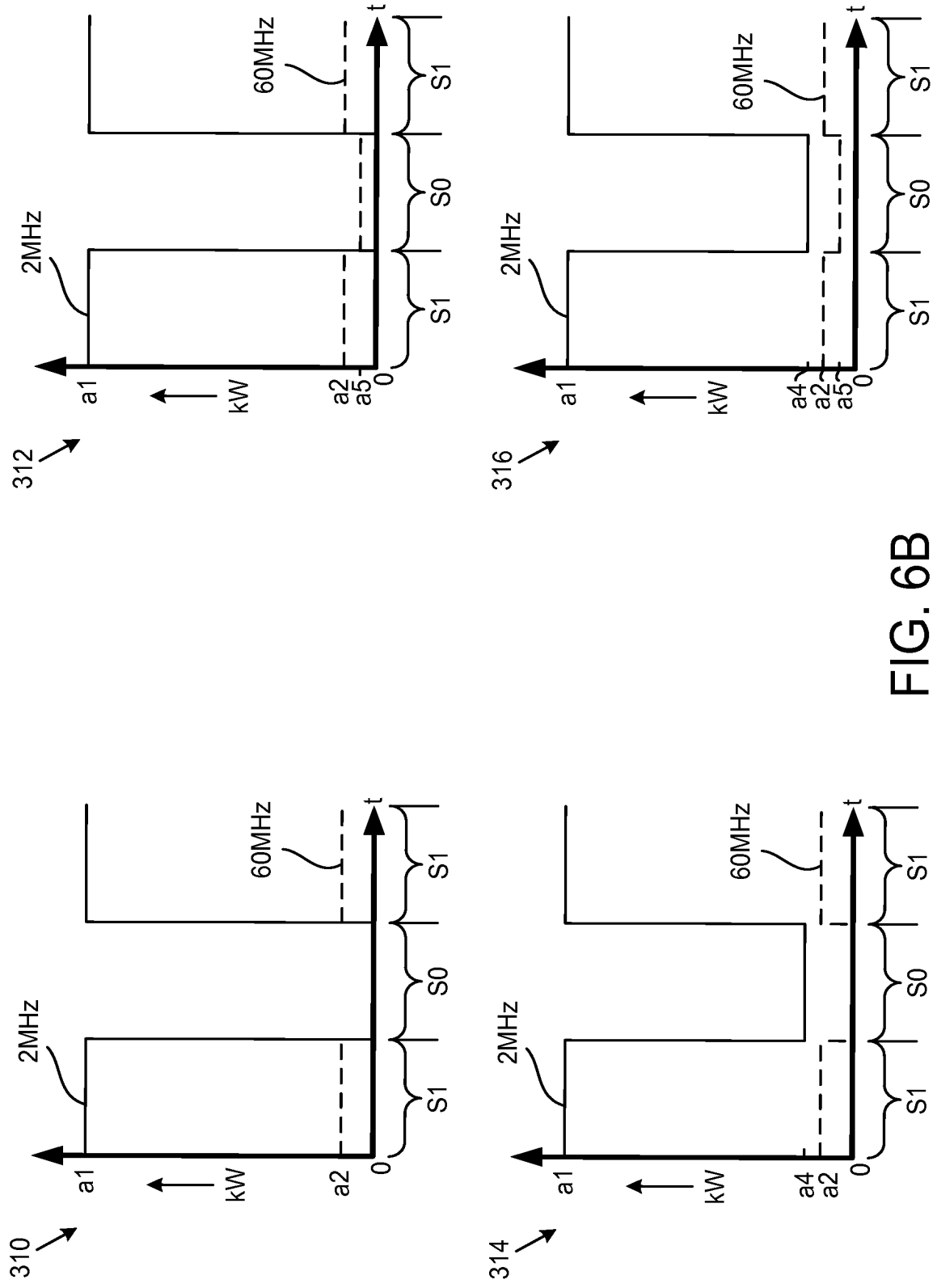


FIG. 6B

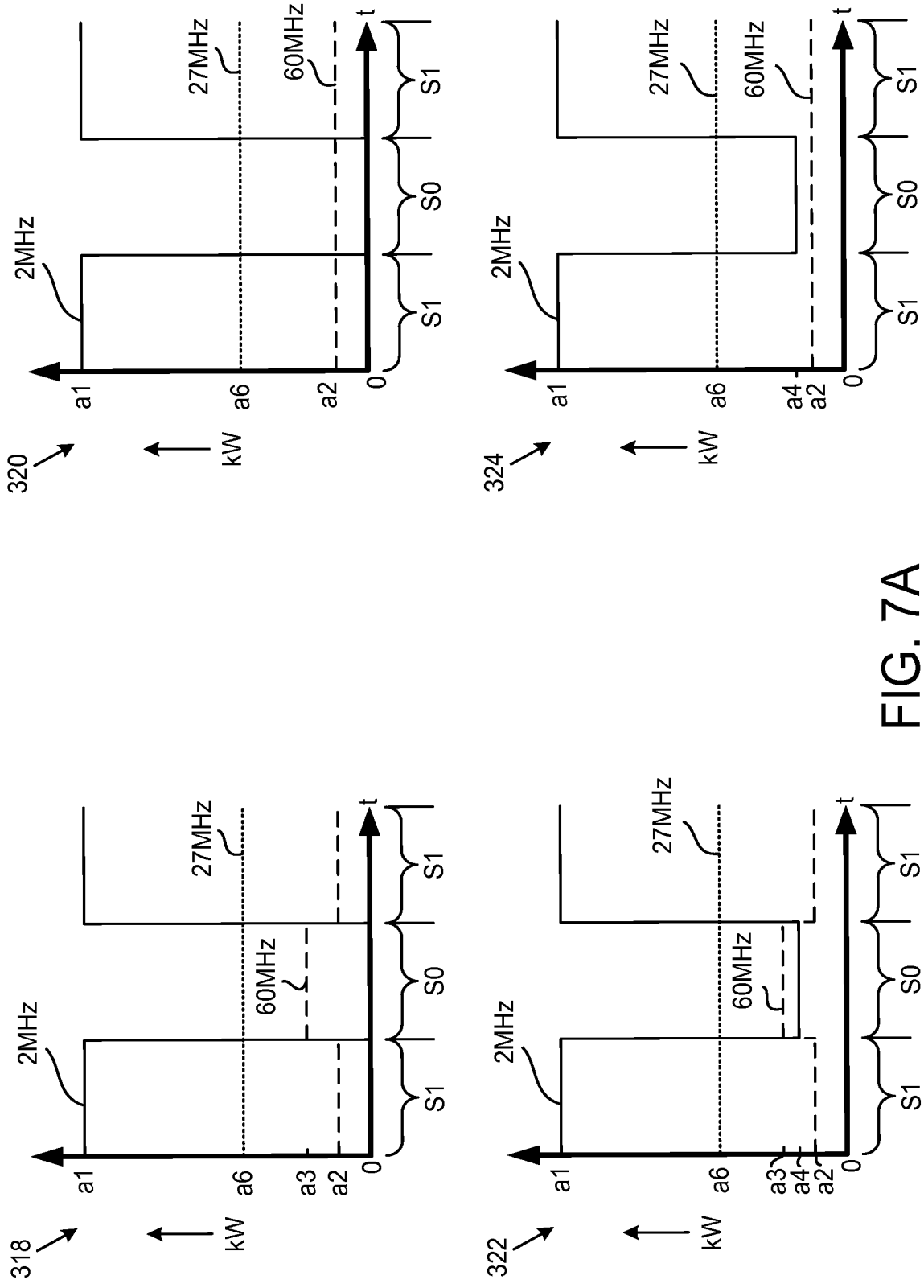


FIG. 7A

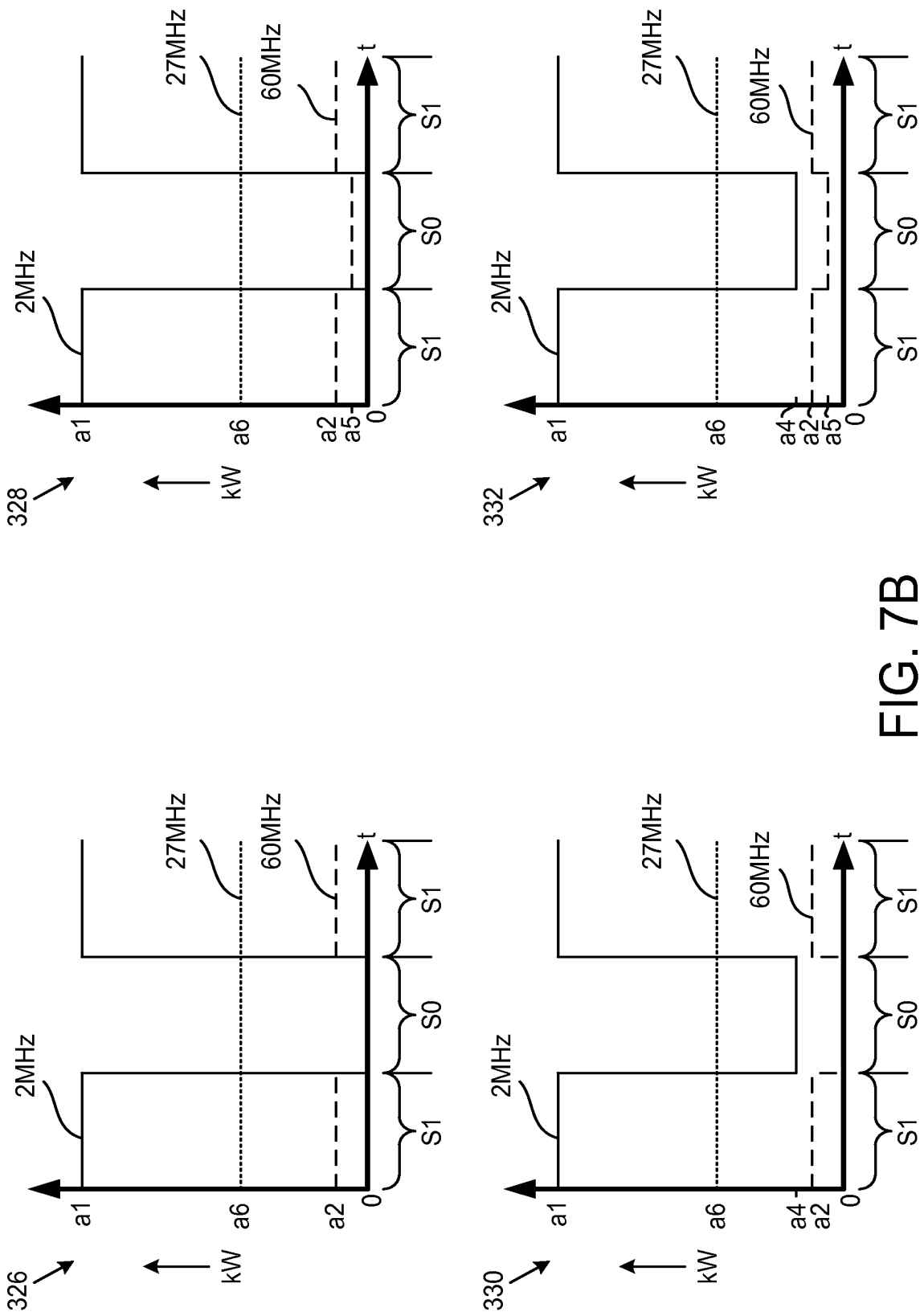


FIG. 7B

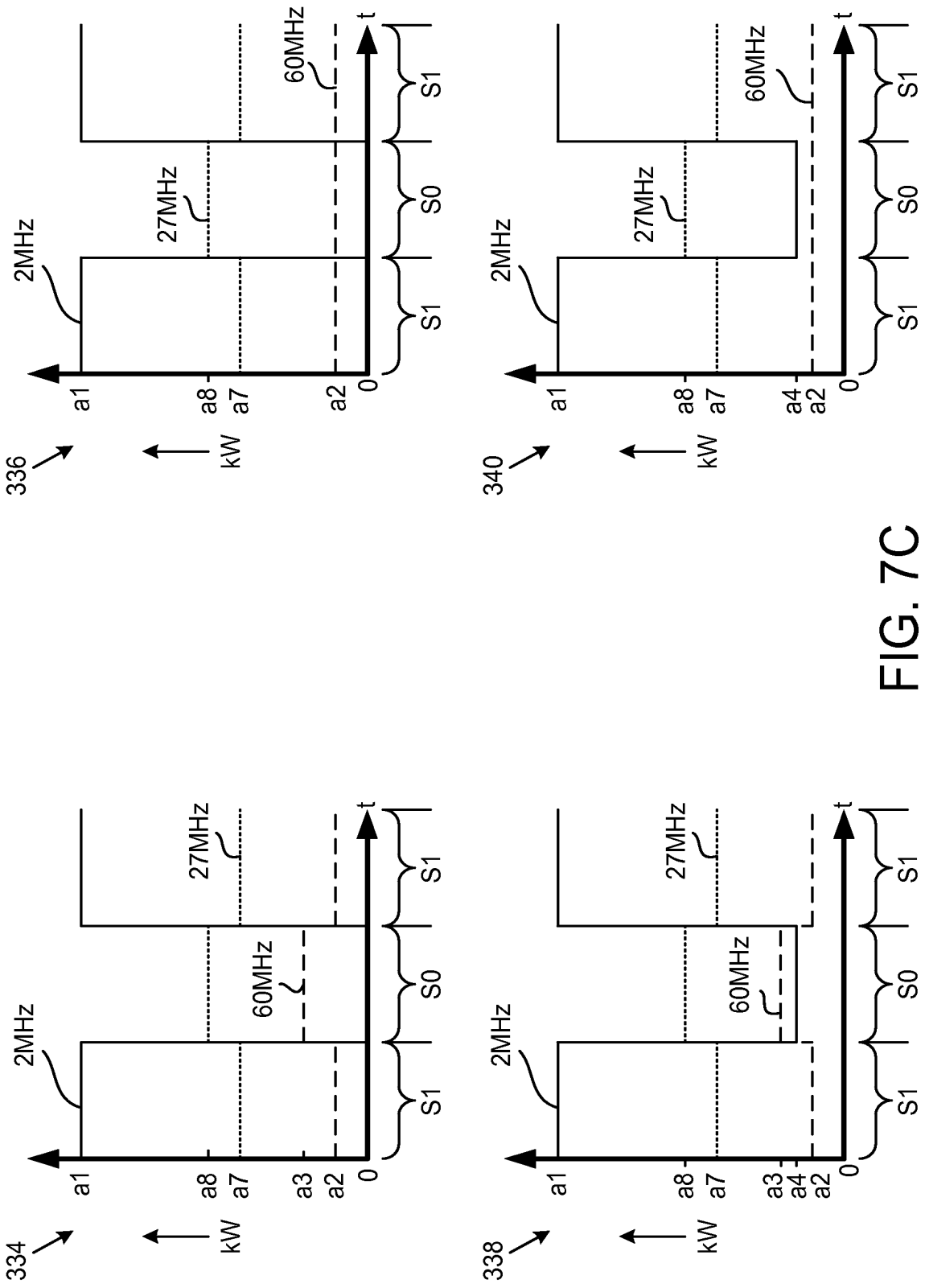


FIG. 7C

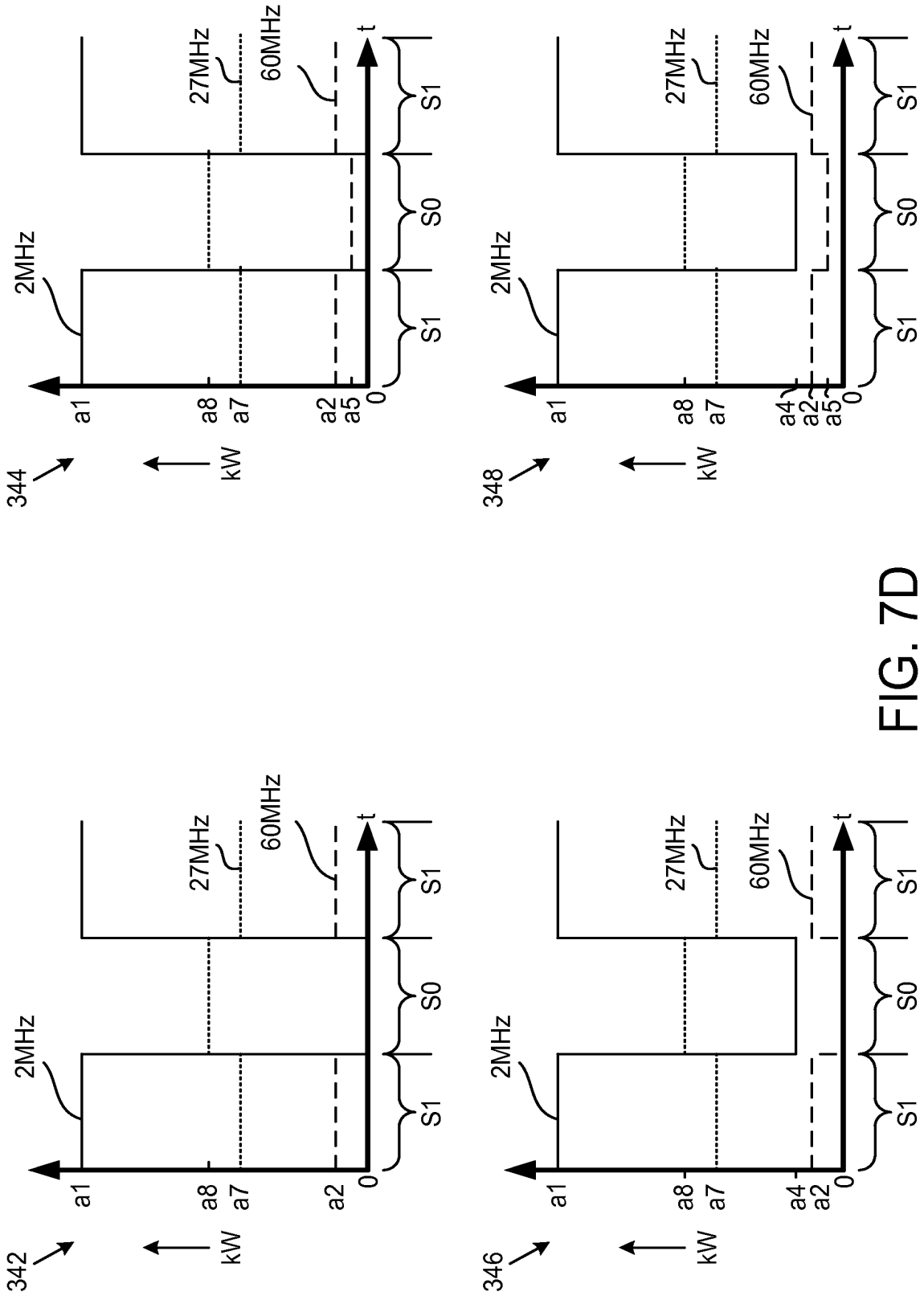


FIG. 7D

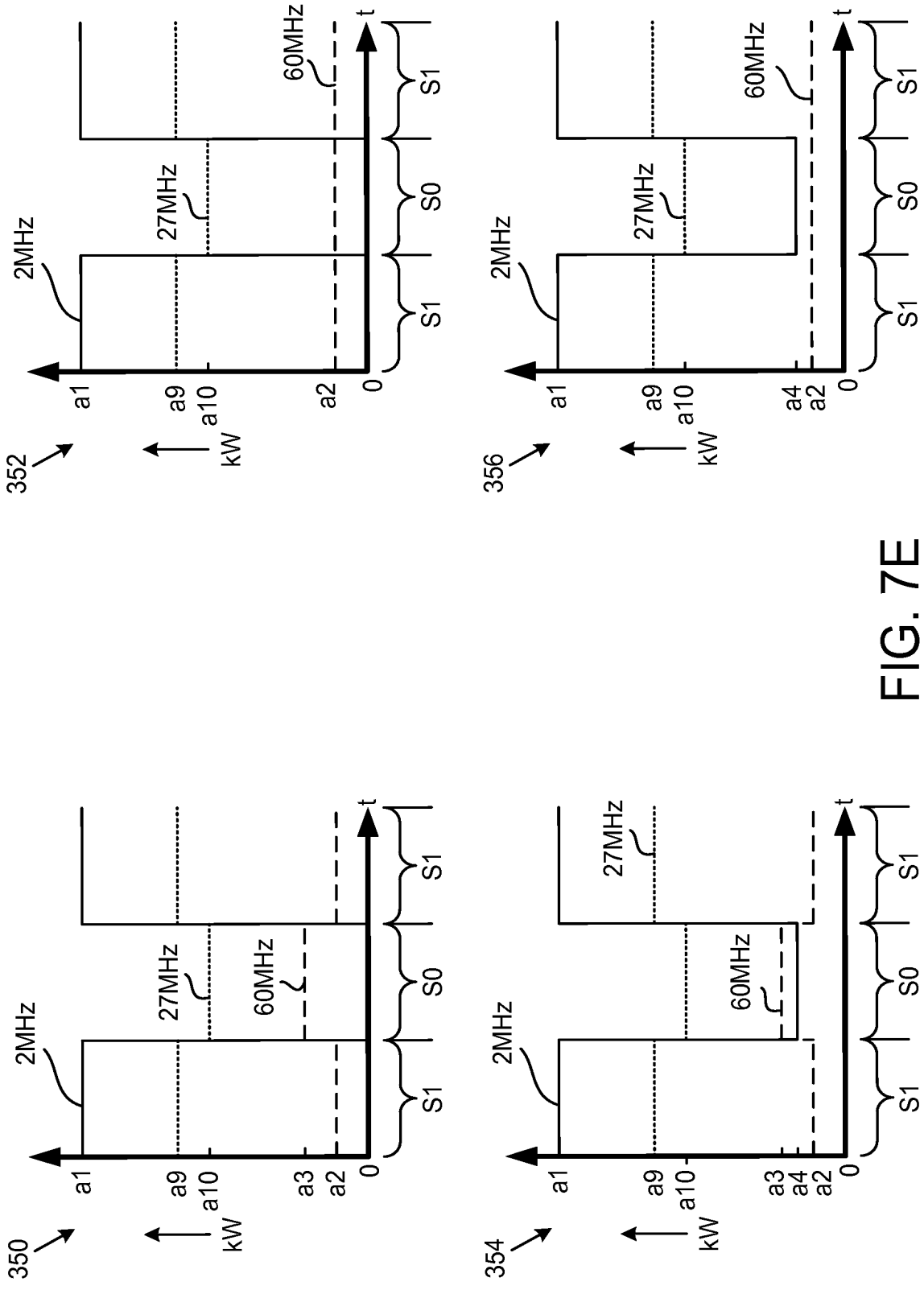


FIG. 7E

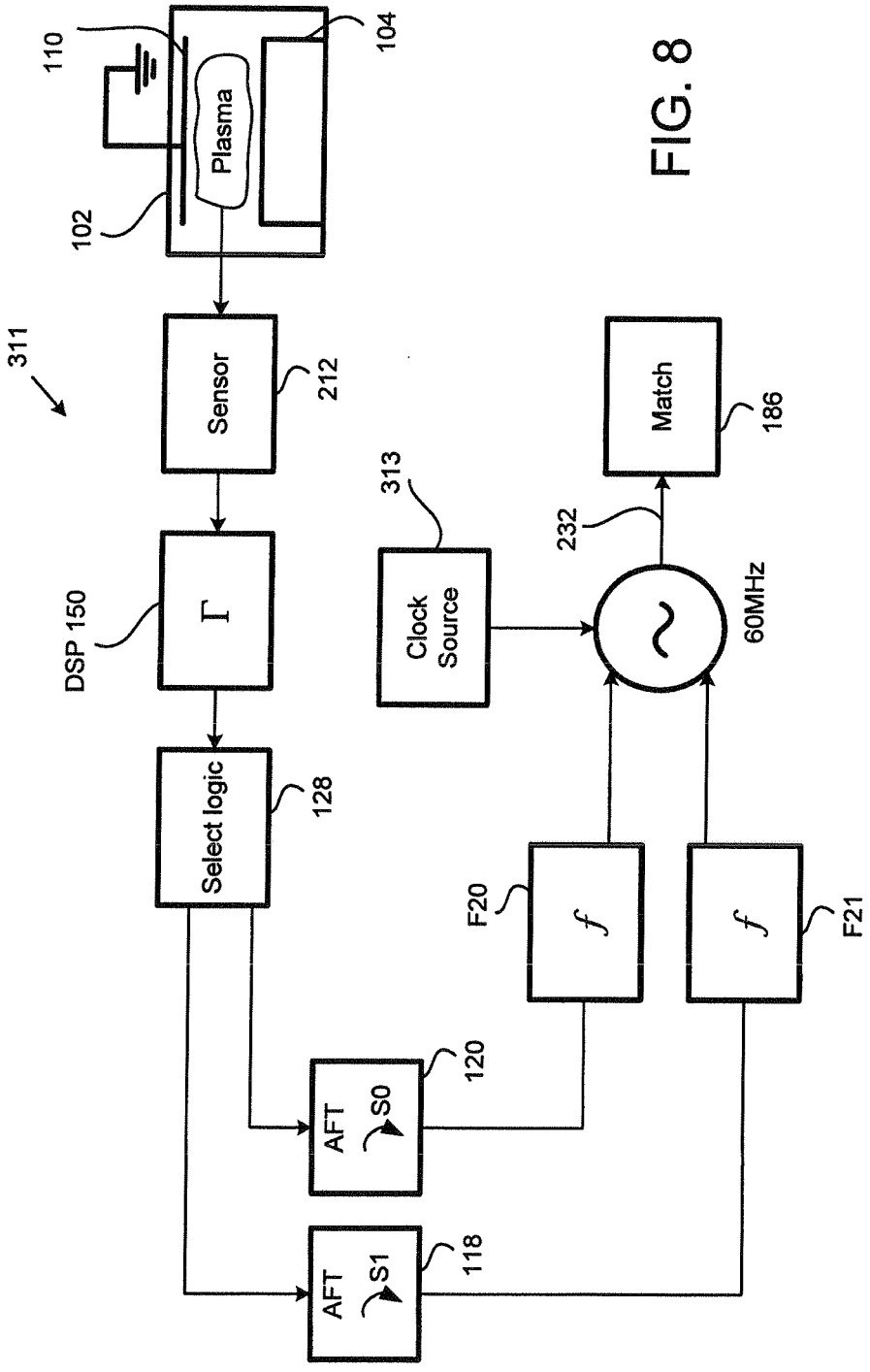

110
104
Plasma
102
311
Sensor
212
Match
186
313
232
DSP 150
Γ
Clock Source
60MHz
Select logic
128
F20
f
f
F21
AFT
S0
120
AFT
S1
118

FIG. 8

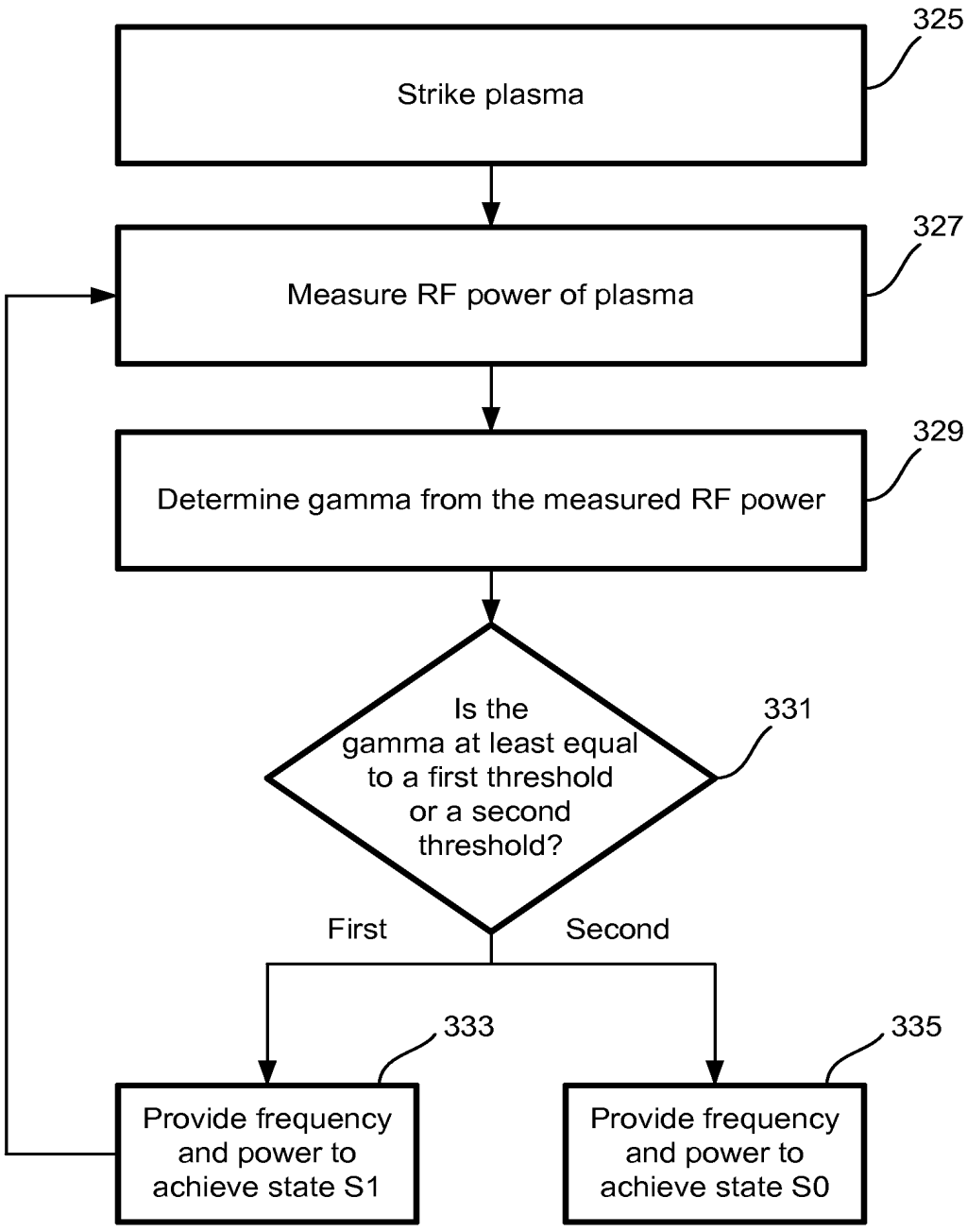

325
Strike plasma
327
Measure RF power of plasma
329
Determine gamma from the measured RF power
331
Is the gamma at least equal to a first threshold or a second threshold?
First
Second
333
Provide frequency and power to achieve state S1
335
Provide frequency and power to achieve state S0
321

FIG. 9

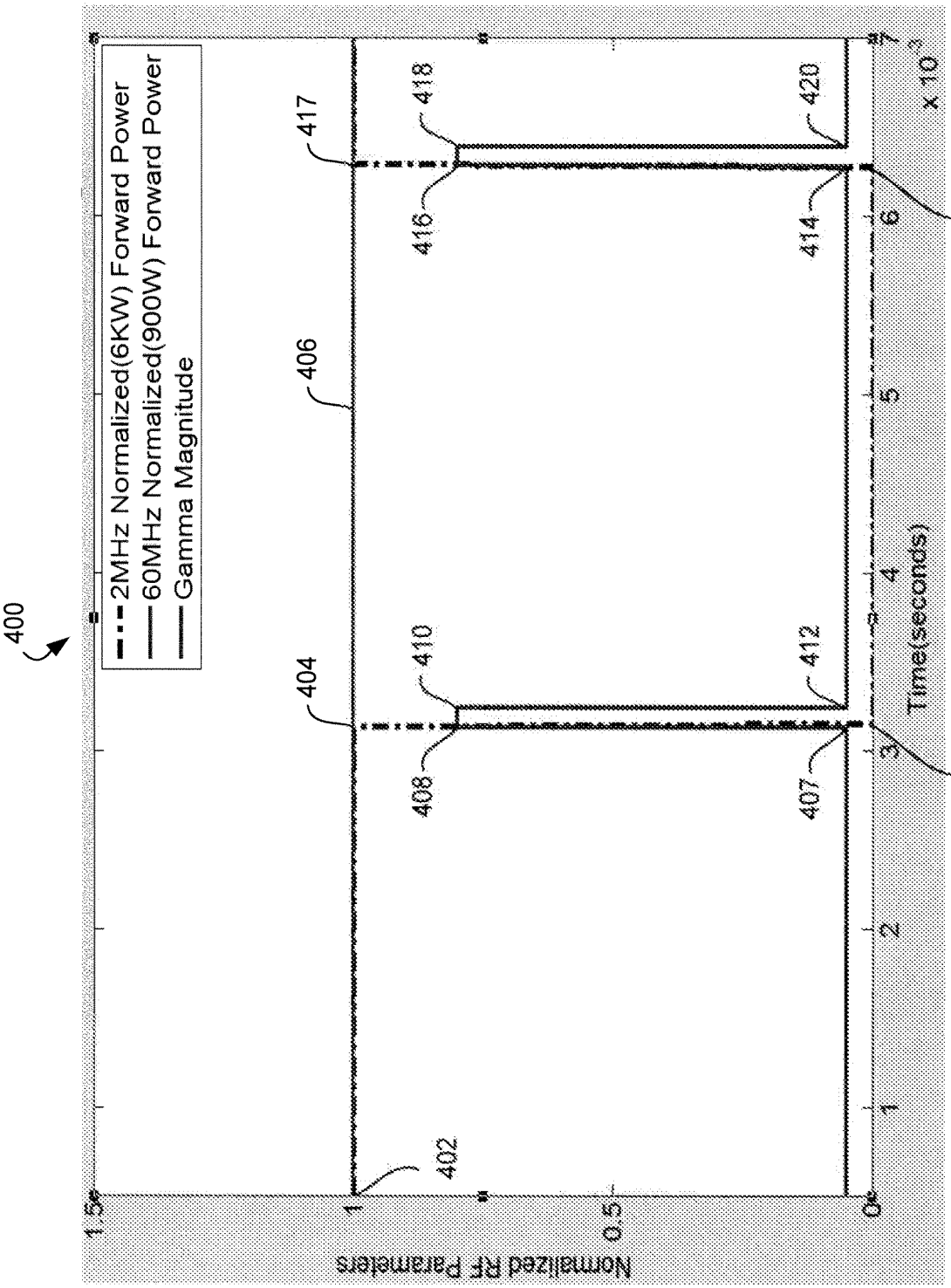

400
2MHz Normalized(6KW) Forward Power
60MHz Normalized(900W) Forward Power
Gamma Magnitude
Normalized RF Parameters
Time(seconds)
x 10^-3
402
404
406
407
408
409
410
412
414
415
416
417
418
420

FIG. 10

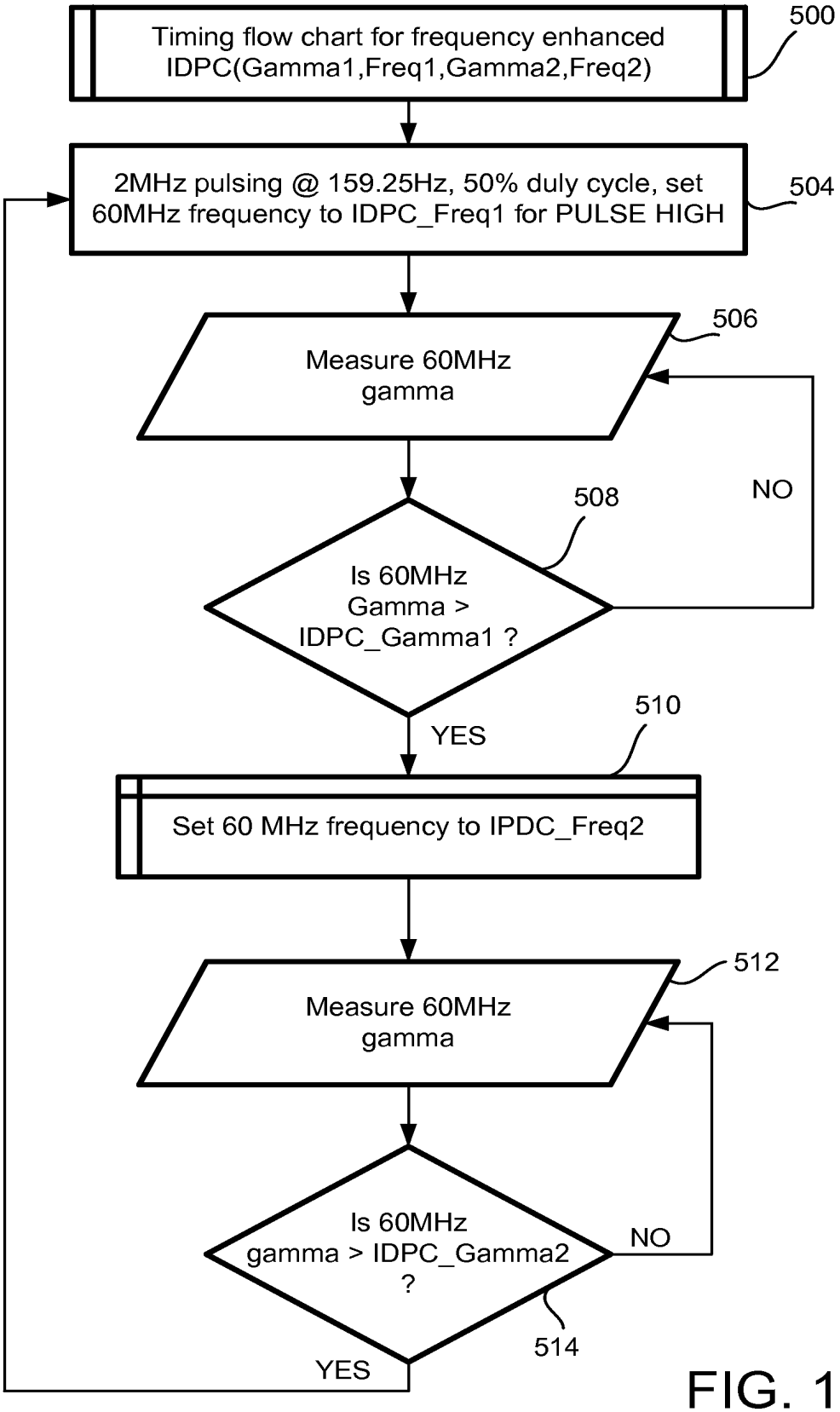

Timing flow chart for frequency enhanced IDPC(Gamma1,Freq1,Gamma2,Freq2)
500
2MHz pulsing @ 159.25Hz, 50% duly cycle, set 60MHz frequency to IDPC_Freq1 for PULSE HIGH
504
Measure 60MHz gamma
506
Is 60MHz Gamma > IDPC_Gamma1 ?
508
NO
YES
Set 60 MHz frequency to IPDC_Freq2
510
Measure 60MHz gamma
512
Is 60MHz gamma > IDPC_Gamma2 ?
514
NO
YES

FIG. 11

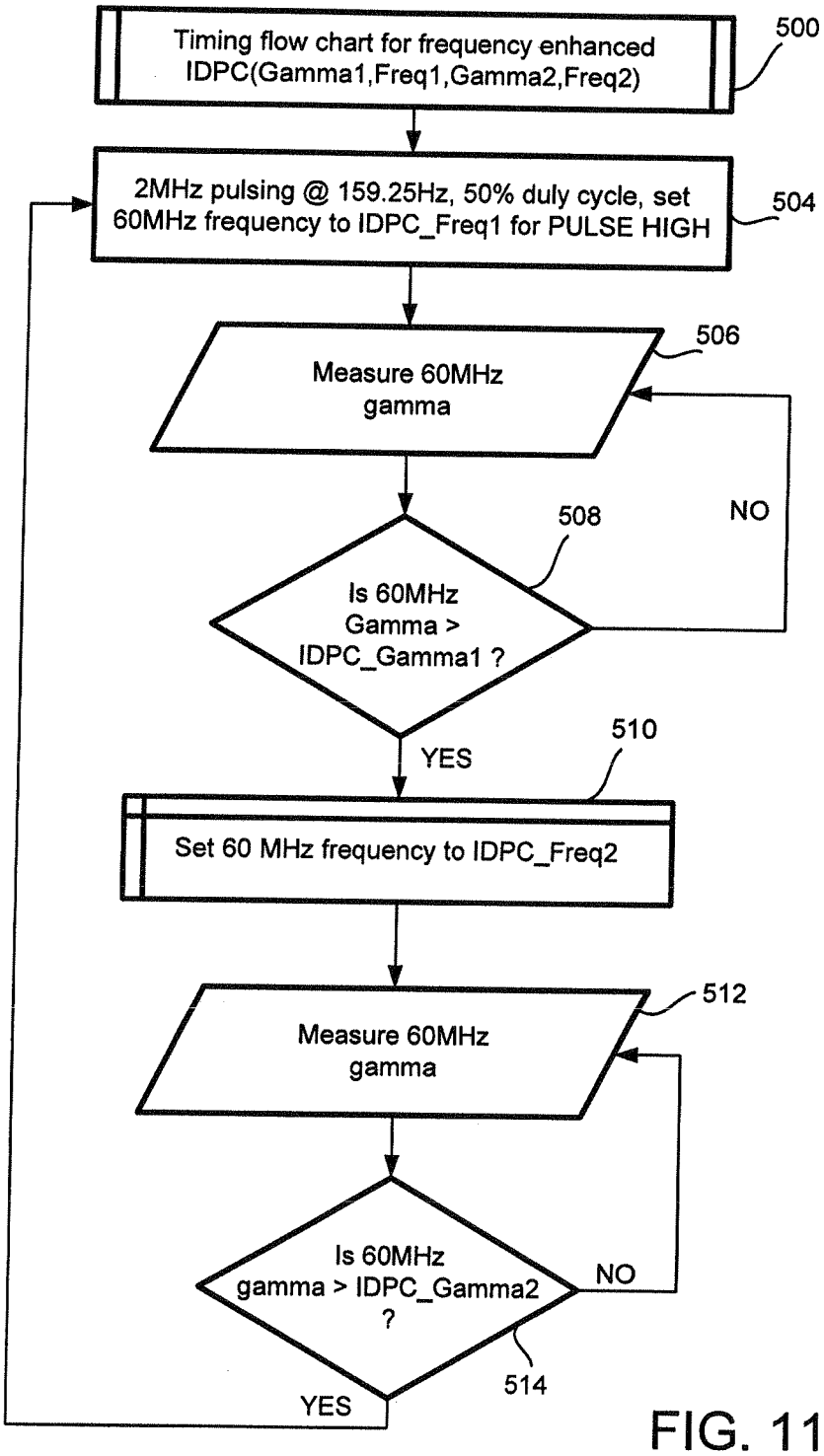

Timing flow chart for frequency enhanced IDPC(Gamma1,Freq1,Gamma2,Freq2)
500
2MHz pulsing @ 159.25Hz, 50% duly cycle, set 60MHz frequency to IDPC_Freq1 for PULSE HIGH
504
Measure 60MHz gamma
506
NO
508
Is 60MHz Gamma > IDPC_Gamma1 ?
YES
510
Set 60 MHz frequency to IDPC_Freq2
Measure 60MHz gamma
512
Is 60MHz gamma > IDPC_Gamma2 ?
NO
514
YES

FIG. 11