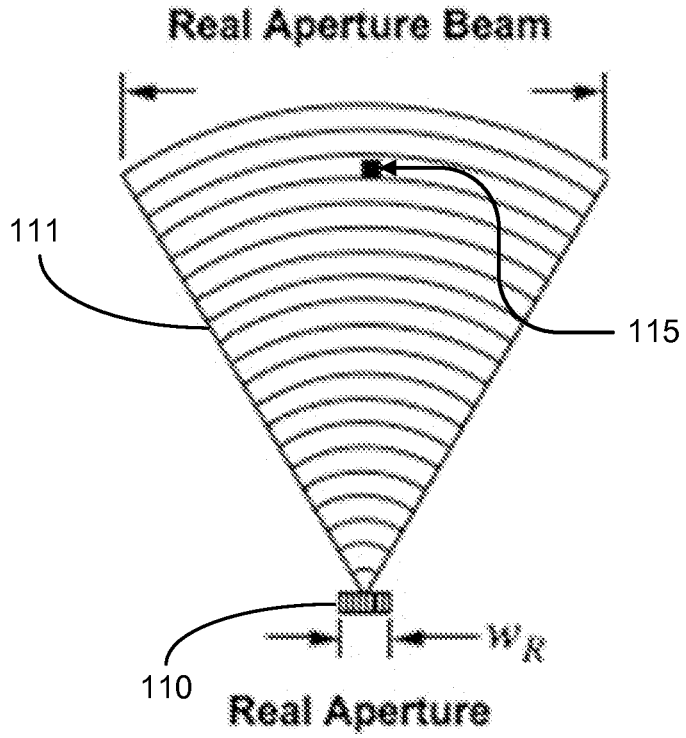

Real Aperture Beam
111
115
110
w_R
Real Aperture

FIG. 1A

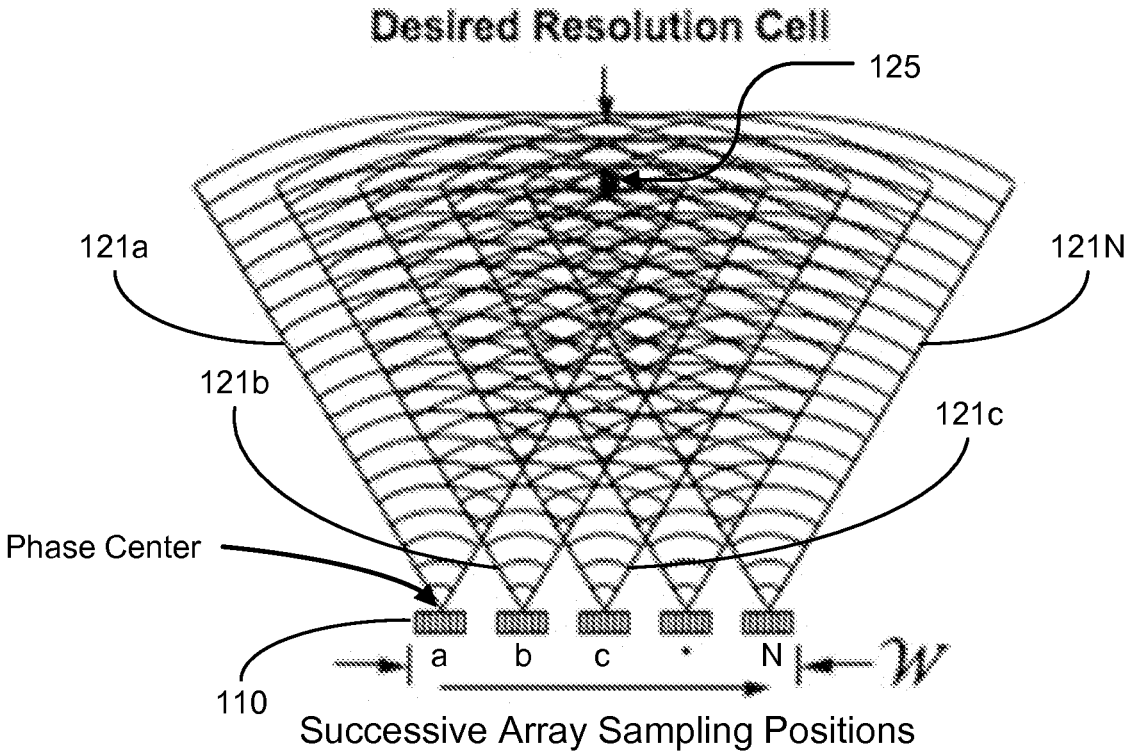

Desired Resolution Cell
125
121a
121N
121b
121c
Phase Center
a
b
c
N
110
w
Successive Array Sampling Positions

FIG. 1B

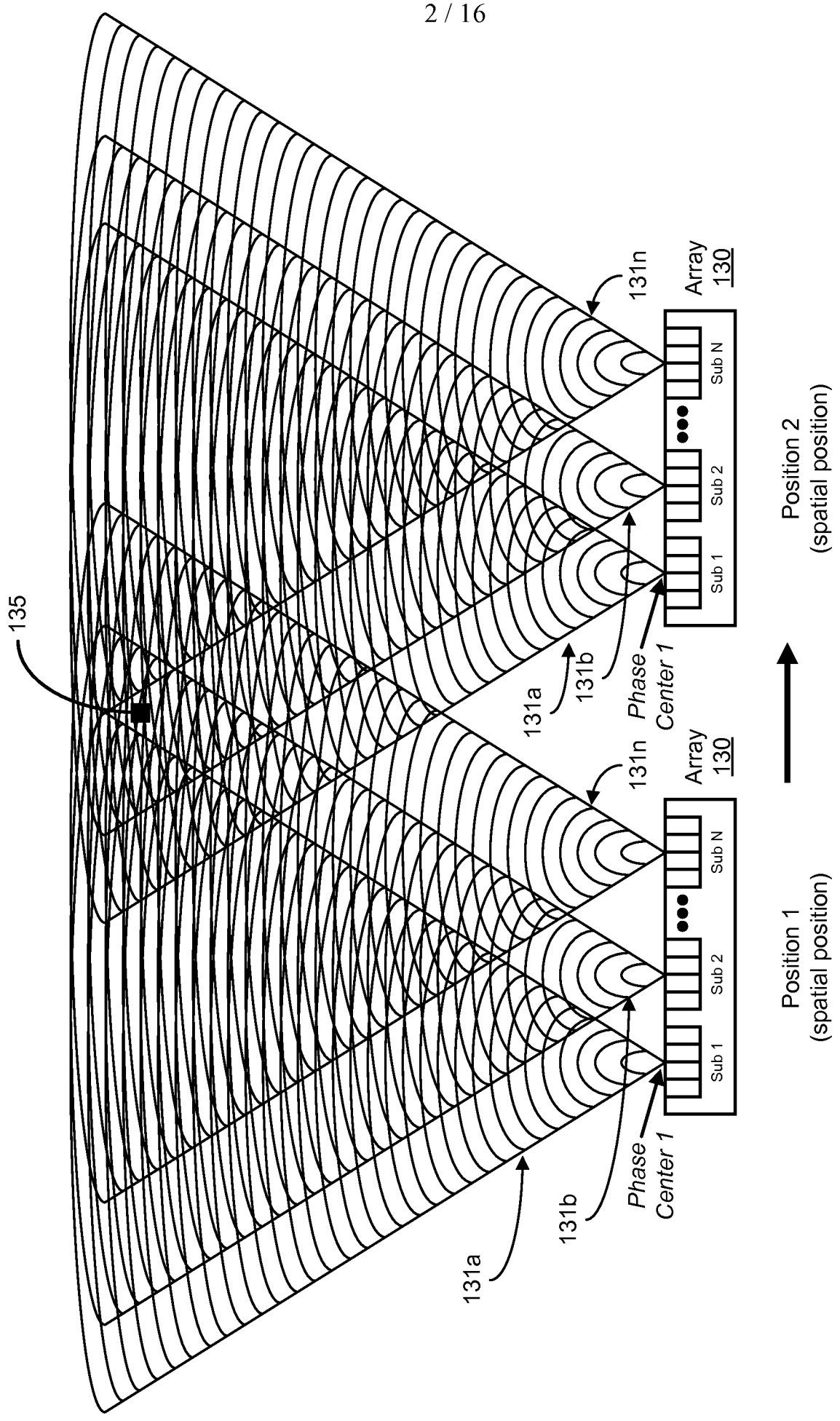
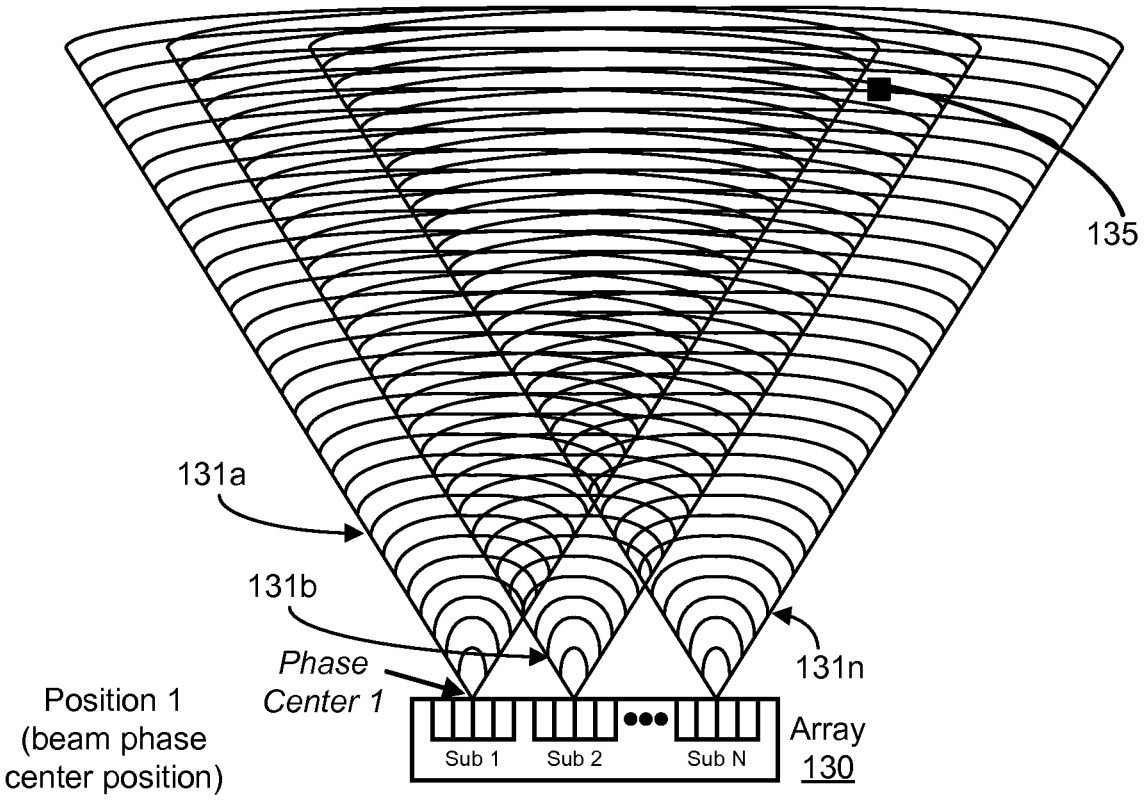

135
131a
131b
Phase Center 1
131n
Array 130
Sub 1
Sub 2
Sub N
Position 1 (spatial position)
Position 2 (spatial position)

FIG. 1C


135
131a
131b
Phase
Center 1
131n
Position 1
(beam phase
center position)
Sub 1
Sub 2
Sub N
Array
130

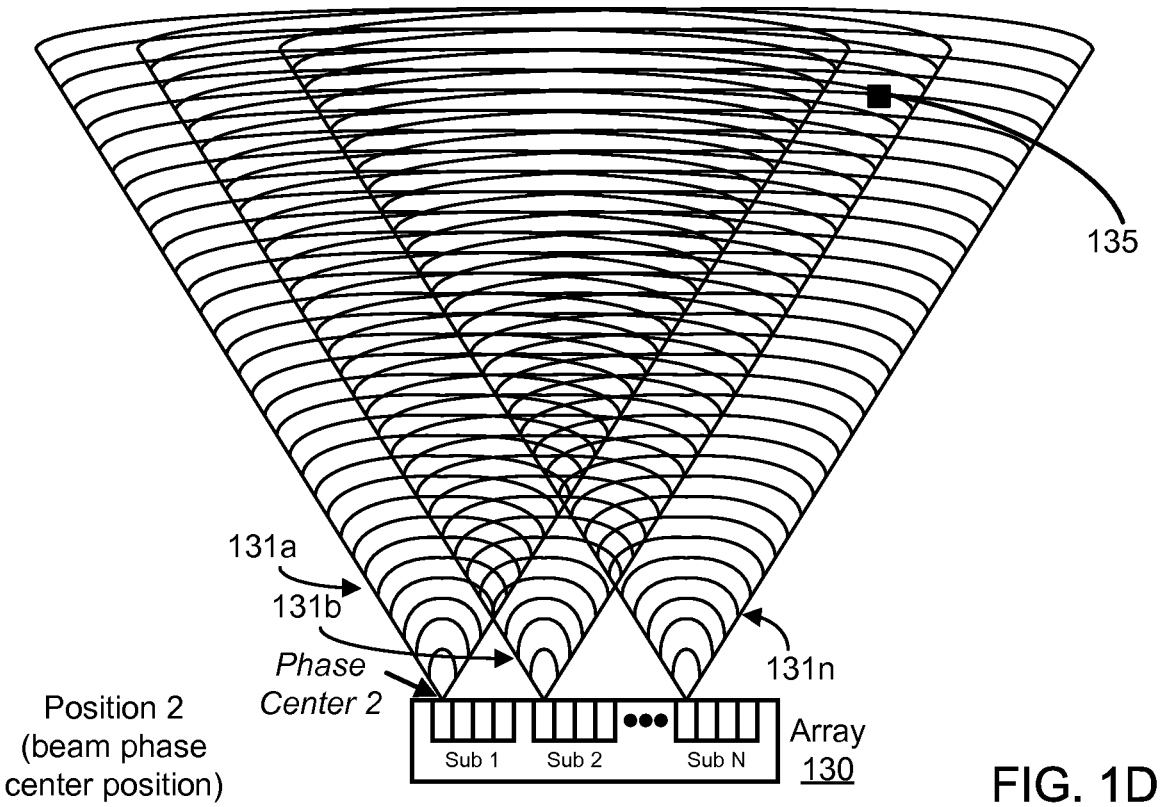

135
131a
131b
Phase
Center 2
131n
Position 2
(beam phase
center position)
Sub 1
Sub 2
Sub N
Array
130

FIG. 1D

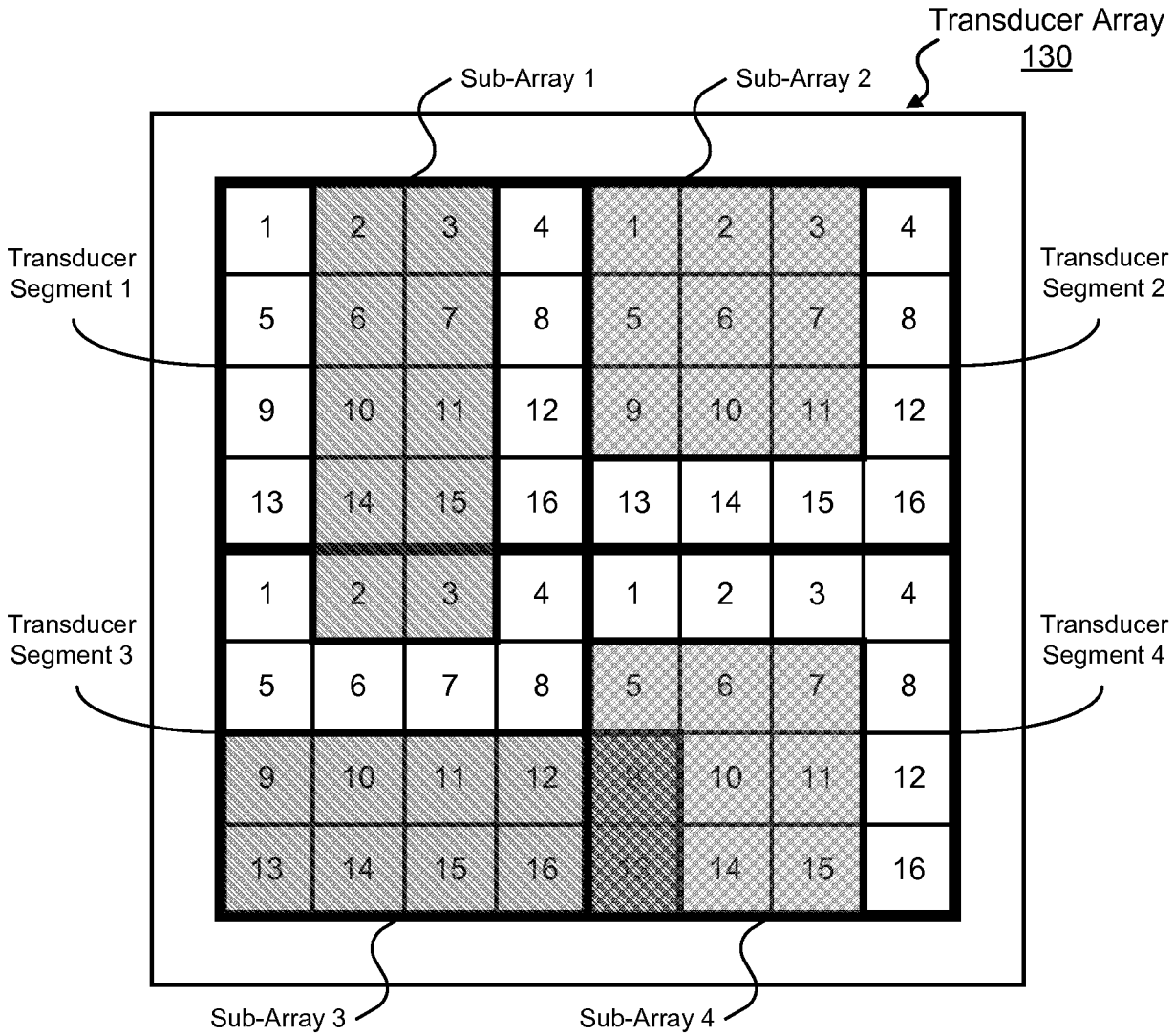

Transducer Array
130
Sub-Array 1
Sub-Array 2
Transducer Segment 1
Transducer Segment 2
Transducer Segment 3
Transducer Segment 4
Sub-Array 3
Sub-Array 4
1 2 3 4 1 2 3 4
5 6 7 8 5 6 7 8
9 10 11 12 9 10 11 12
13 14 15 16 13 14 15 16
1 2 3 4 1 2 3 4
5 6 7 8 5 6 7 8
9 10 11 12 10 11 12
13 14 15 16 14 15 16

FIG. 1E

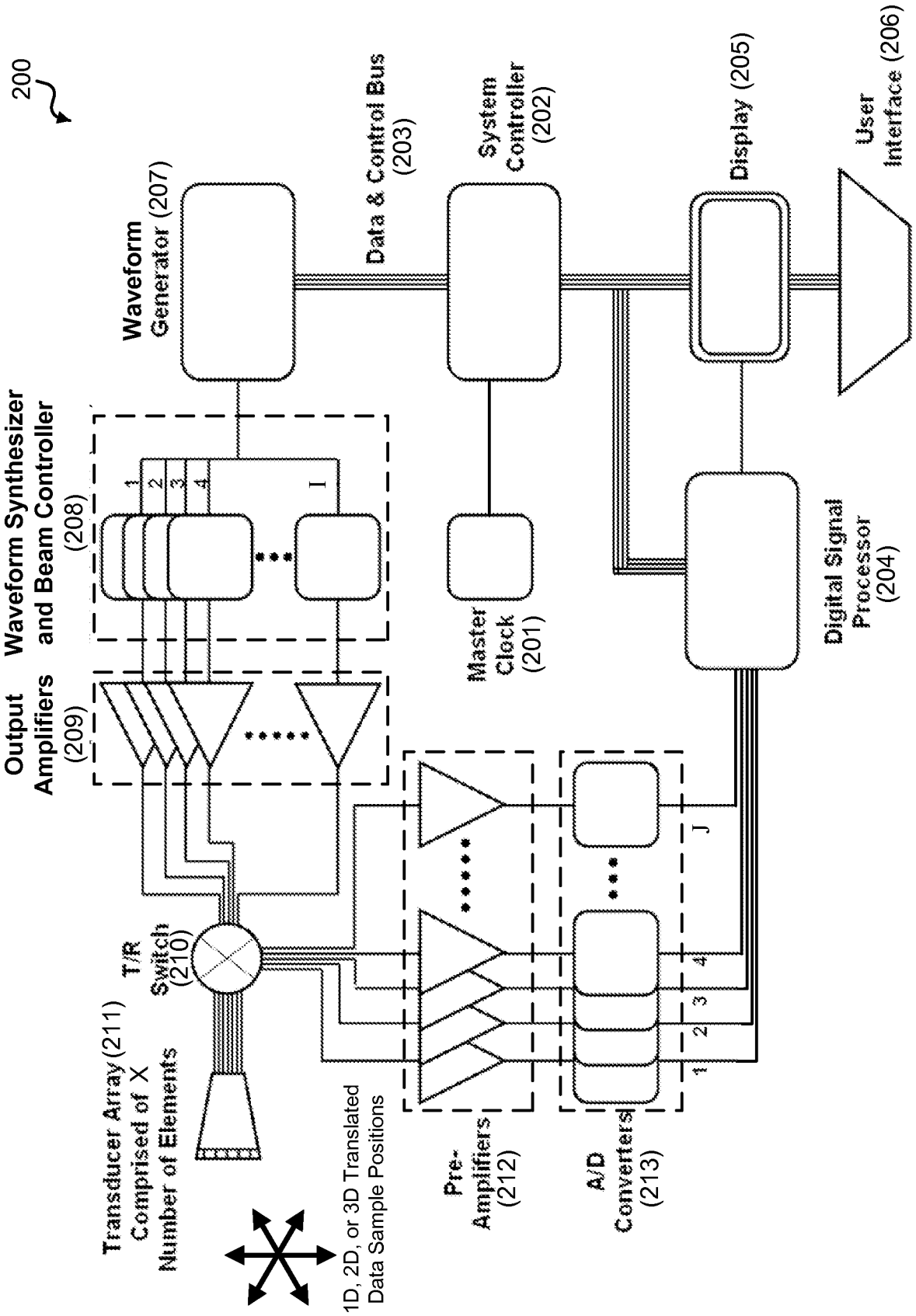

200
Waveform Generator (207)
Data & Control Bus (203)
System Controller (202)
Display (205)
User Interface (206)
Waveform Synthesizer and Beam Controller (208)
Output Amplifiers (209)
Master Clock (201)
Digital Signal Processor (204)
T/R Switch (210)
Transducer Array (211) Comprised of X Number of Elements
Pre-Amplifiers (212)
A/D Converters (213)
1D, 2D, or 3D Translated Data Sample Positions
1
2
3
4
I
J

FIG. 2A

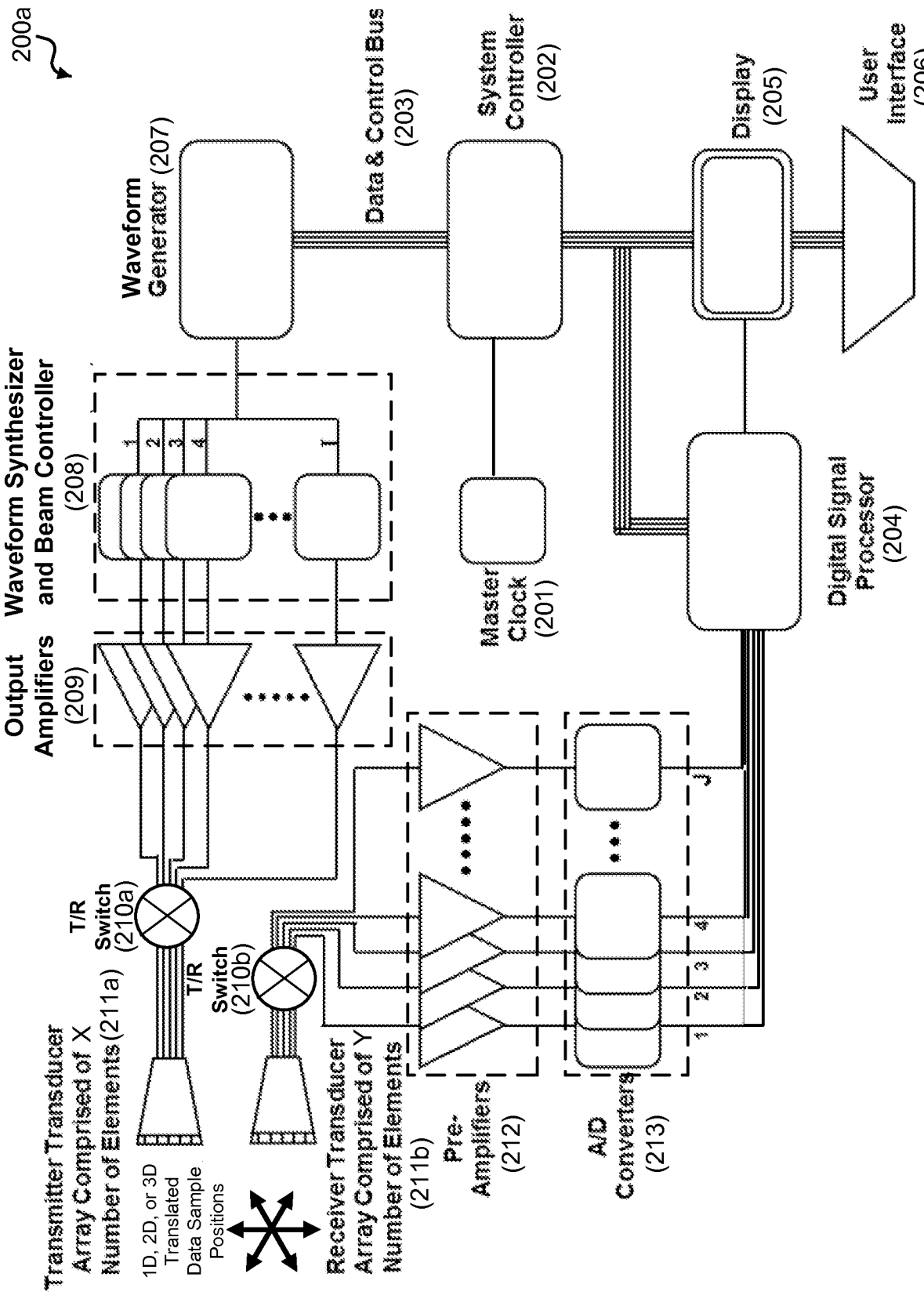

200a
Waveform Generator (207)
Data & Control Bus (203)
System Controller (202)
Display (205)
User Interface (206)
Output Amplifiers (209)
Waveform Synthesizer and Beam Controller (208)
Master Clock (201)
Digital Signal Processor (204)
T/R Switch (210a)
T/R Switch (210b)
Transmitter Transducer Array Comprised of X Number of Elements (211a)
Receiver Transducer Array Comprised of Y Number of Elements (211b)
Pre-Amplifiers (212)
A/D Converters (213)
1D, 2D, or 3D Translated Data Sample Positions
1
2
3
4
I
J

FIG. 2B

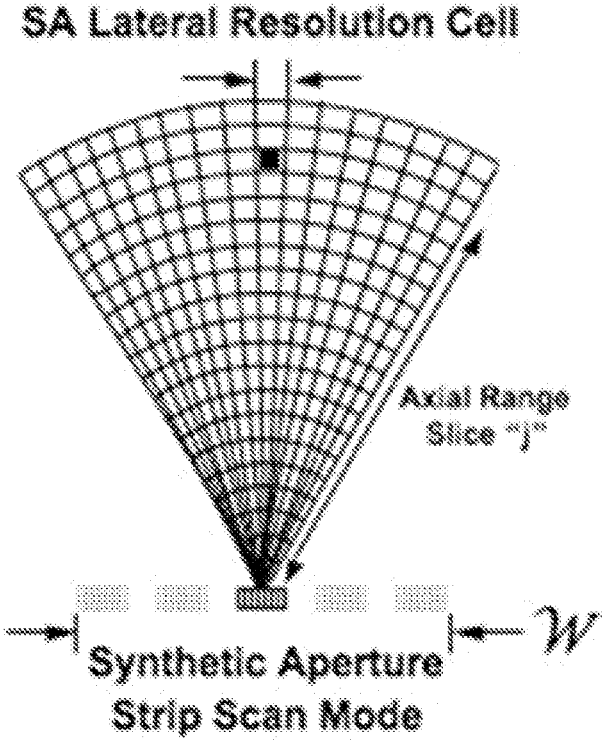

SA Lateral Resolution Cell
Axial Range
Slice "j"
W
Synthetic Aperture
Strip Scan Mode

FIG. 2C

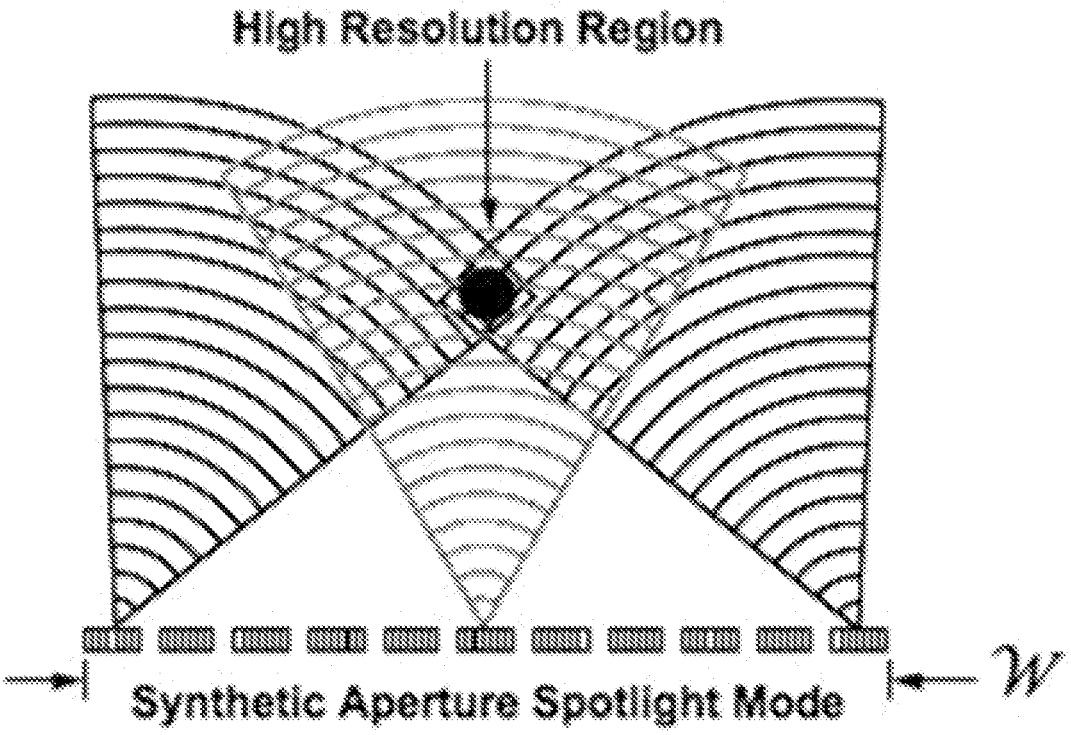

High Resolution Region
W
Synthetic Aperture Spotlight Mode

FIG. 2D

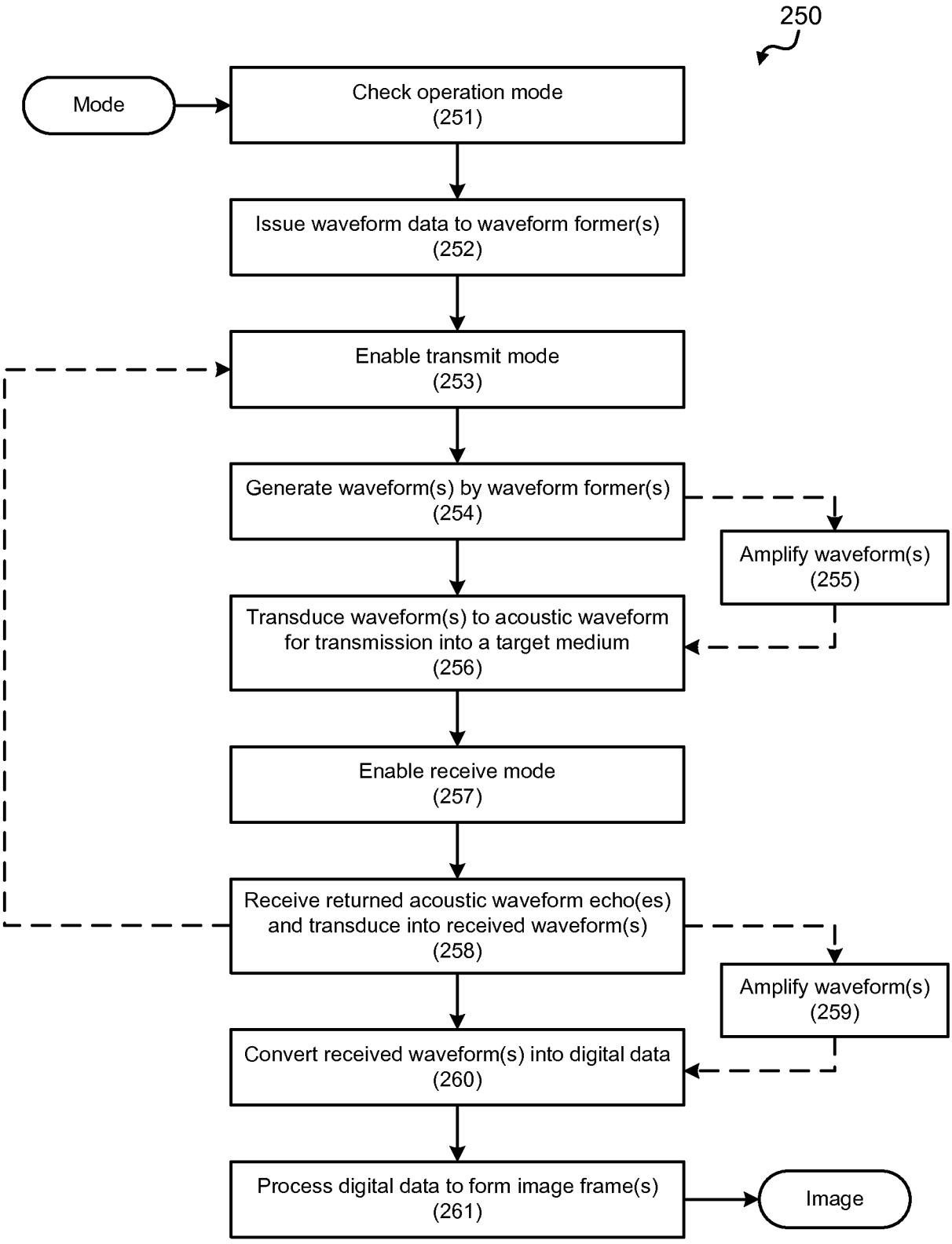

250
Mode
Check operation mode
(251)
Issue waveform data to waveform former(s)
(252)
Enable transmit mode
(253)
Generate waveform(s) by waveform former(s)
(254)
Amplify waveform(s)
(255)
Transduce waveform(s) to acoustic waveform
for transmission into a target medium
(256)
Enable receive mode
(257)
Receive returned acoustic waveform echo(es)
and transduce into received waveform(s)
(258)
Amplify waveform(s)
(259)
Convert received waveform(s) into digital data
(260)
Process digital data to form image frame(s)
(261)
Image

FIG. 2E

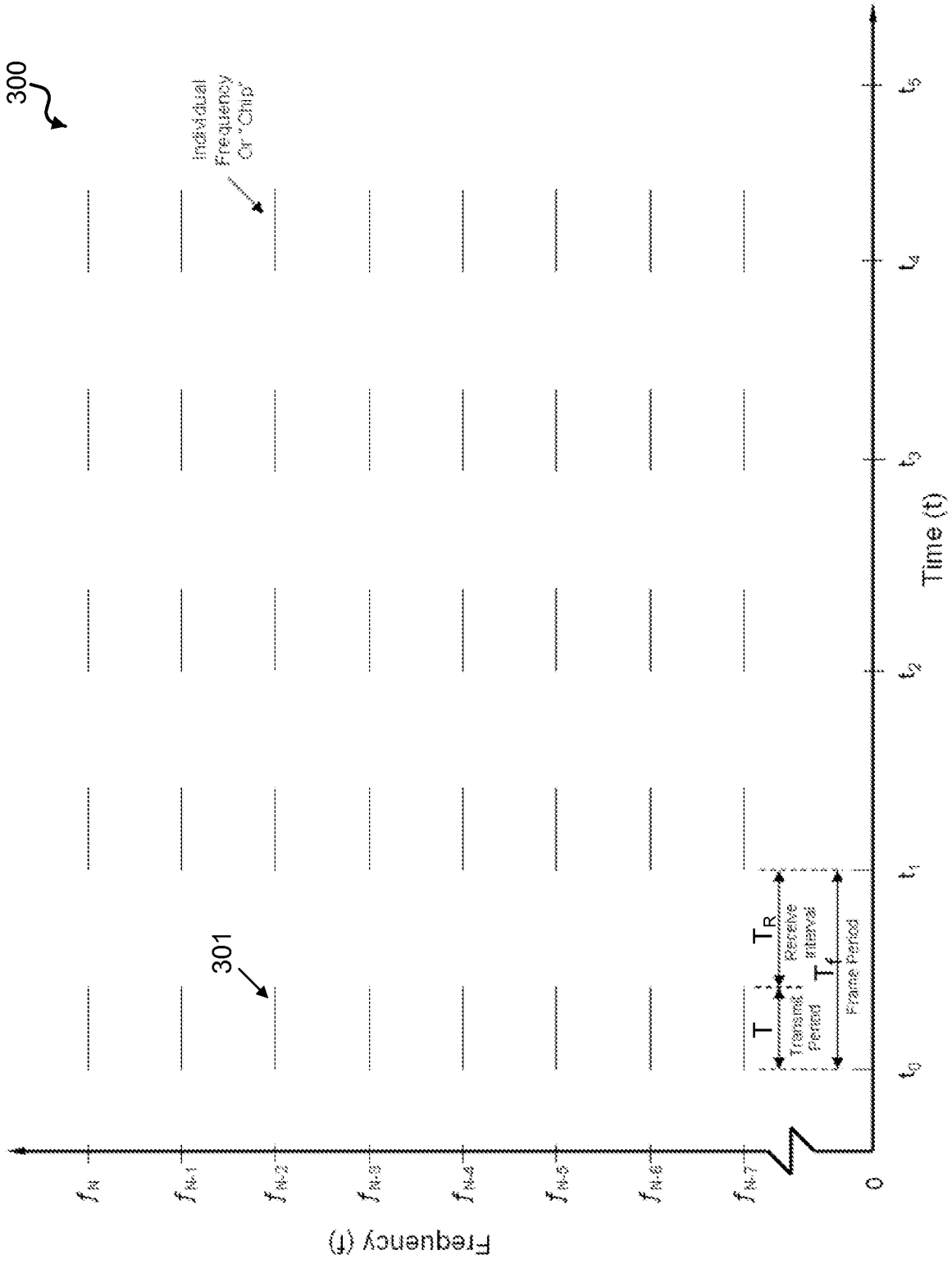

300
Individual Frequency Or "Chip"
301
Frequency (f)
Time (t)
0
t_0
t_1
t_2
t_3
t_4
t_5
f_N
f_{N-1}
f_{N-2}
f_{N-3}
f_{N-4}
f_{N-5}
f_{N-6}
f_{N-7}
T
Transmit Period
T_R
Receive Interval
T_f
Frame Period

FIG. 3

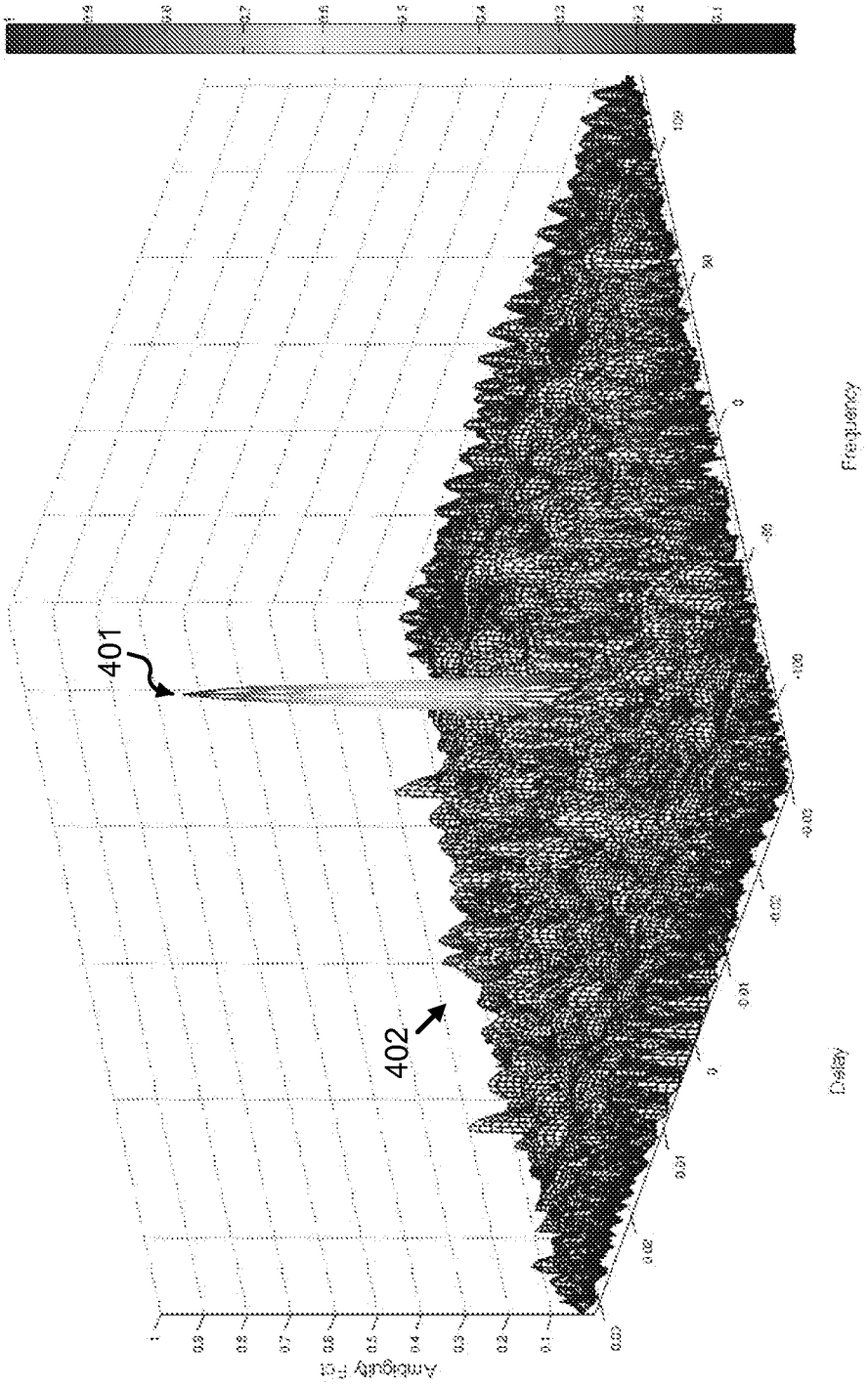


FIG. 4

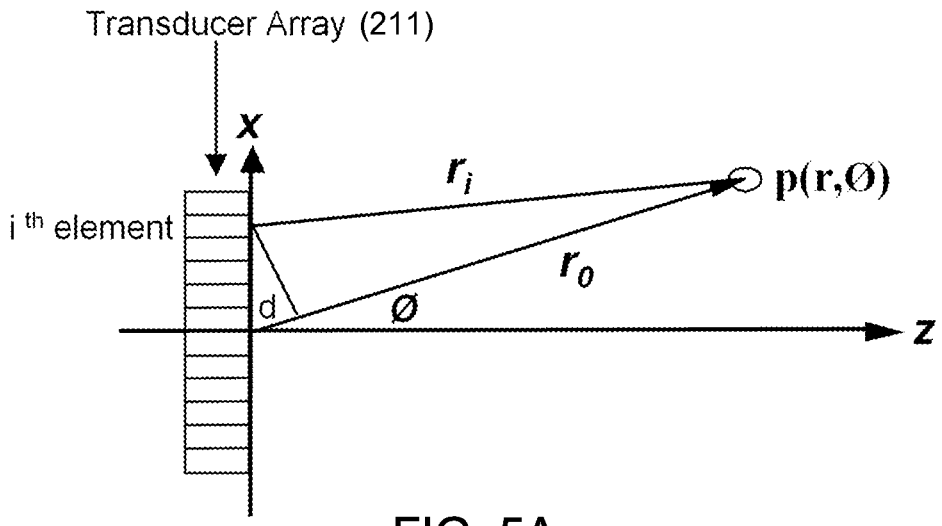


FIG. 5A

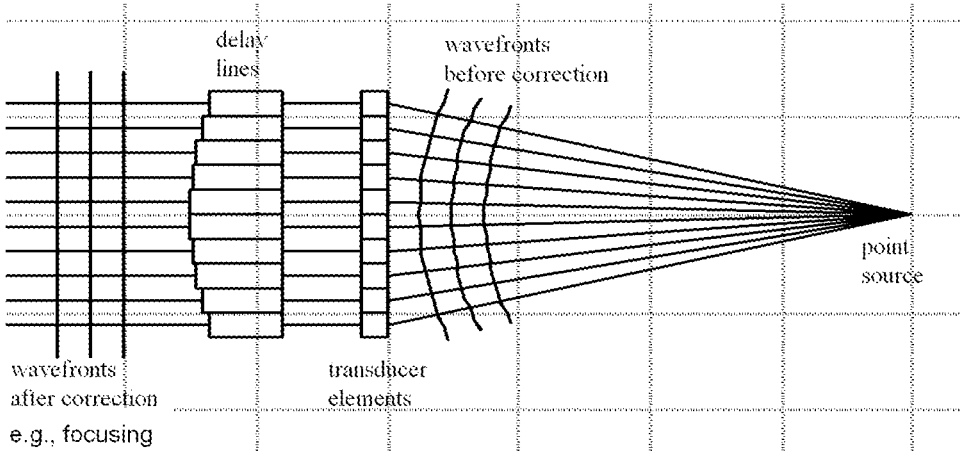


FIG. 5B

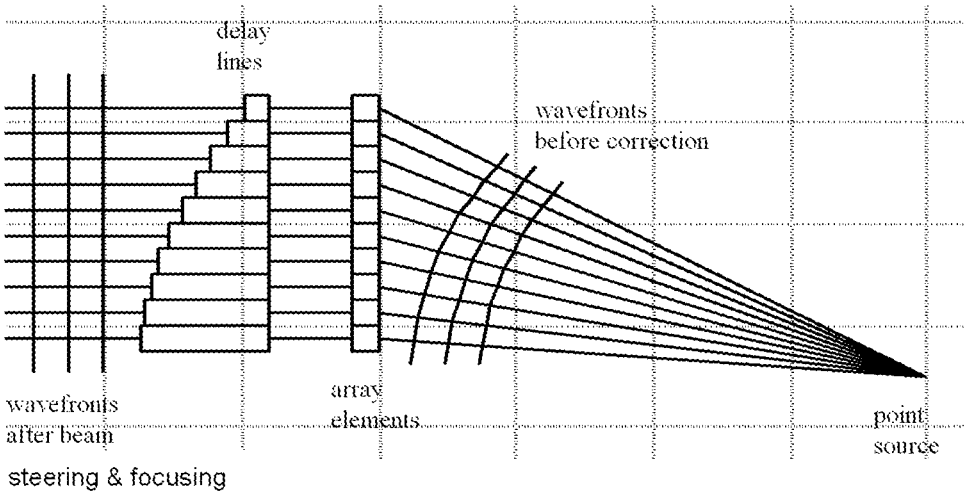


FIG. 5C

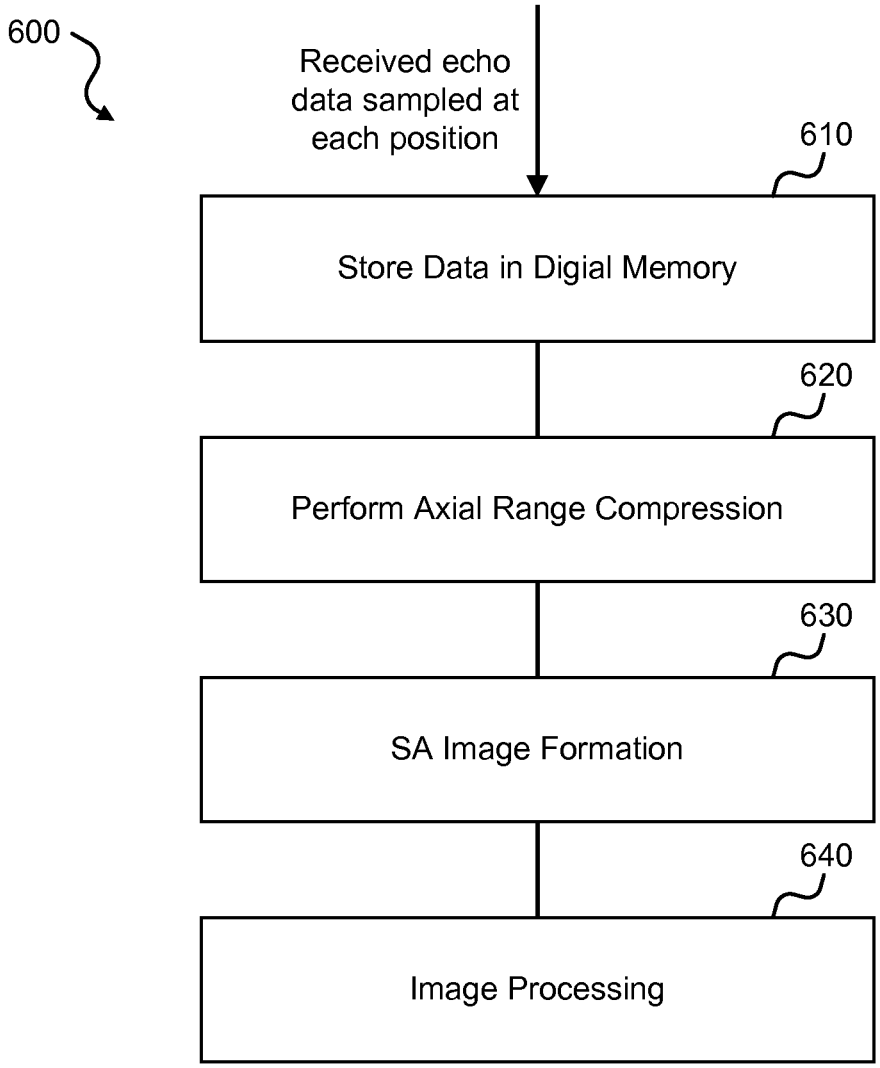

600
Received echo data sampled at each position
610
Store Data in Digial Memory
620
Perform Axial Range Compression
630
SA Image Formation
640
Image Processing

FIG. 6

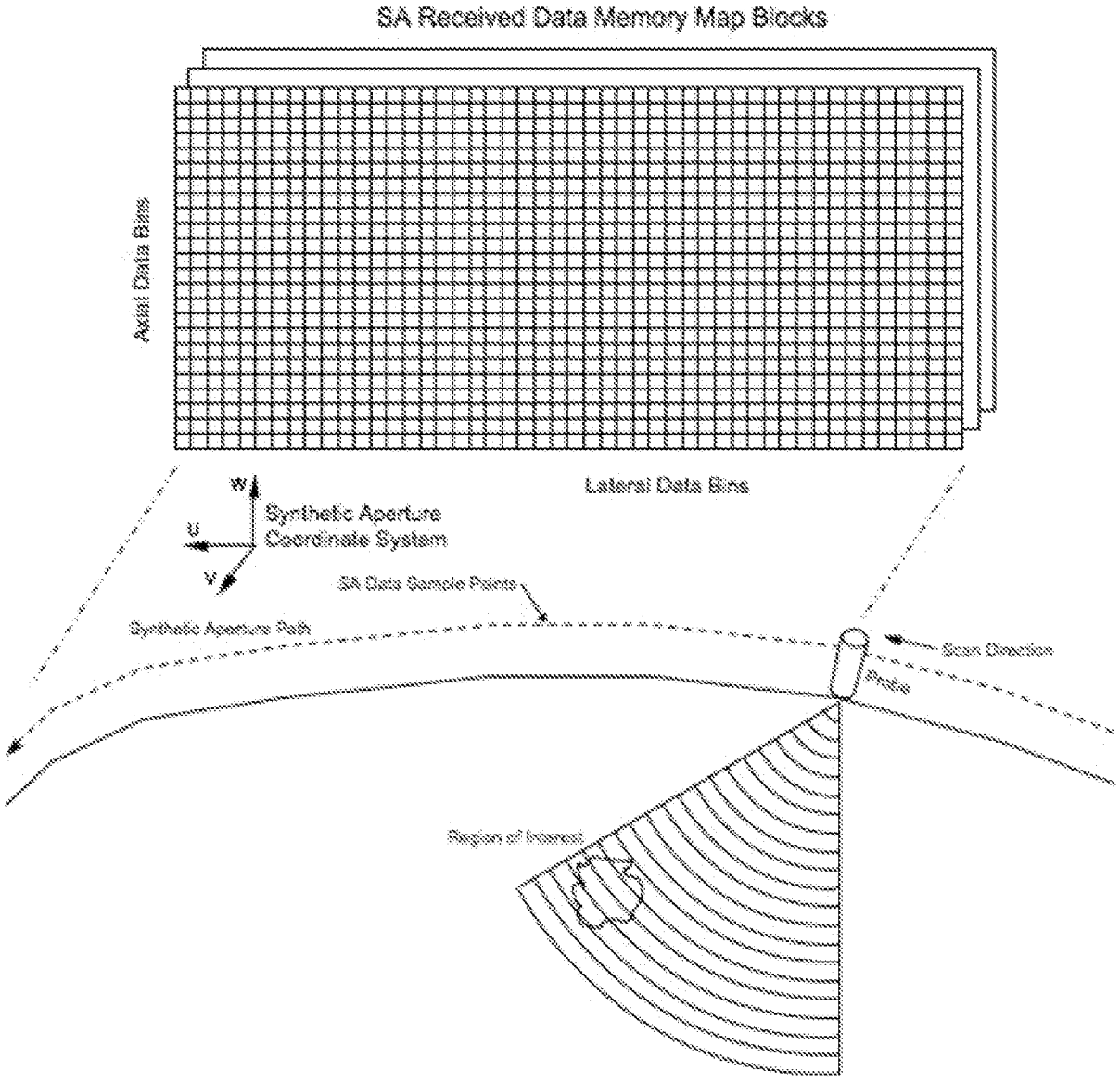

SA Received Data Memory Map Blocks
Axial Data Bins
Lateral Data Bins
W
U
V
Synthetic Aperture
Coordinate System
SA Data Sample Points
Synthetic Aperture Path
Scan Direction
Region of Interest

FIG. 7

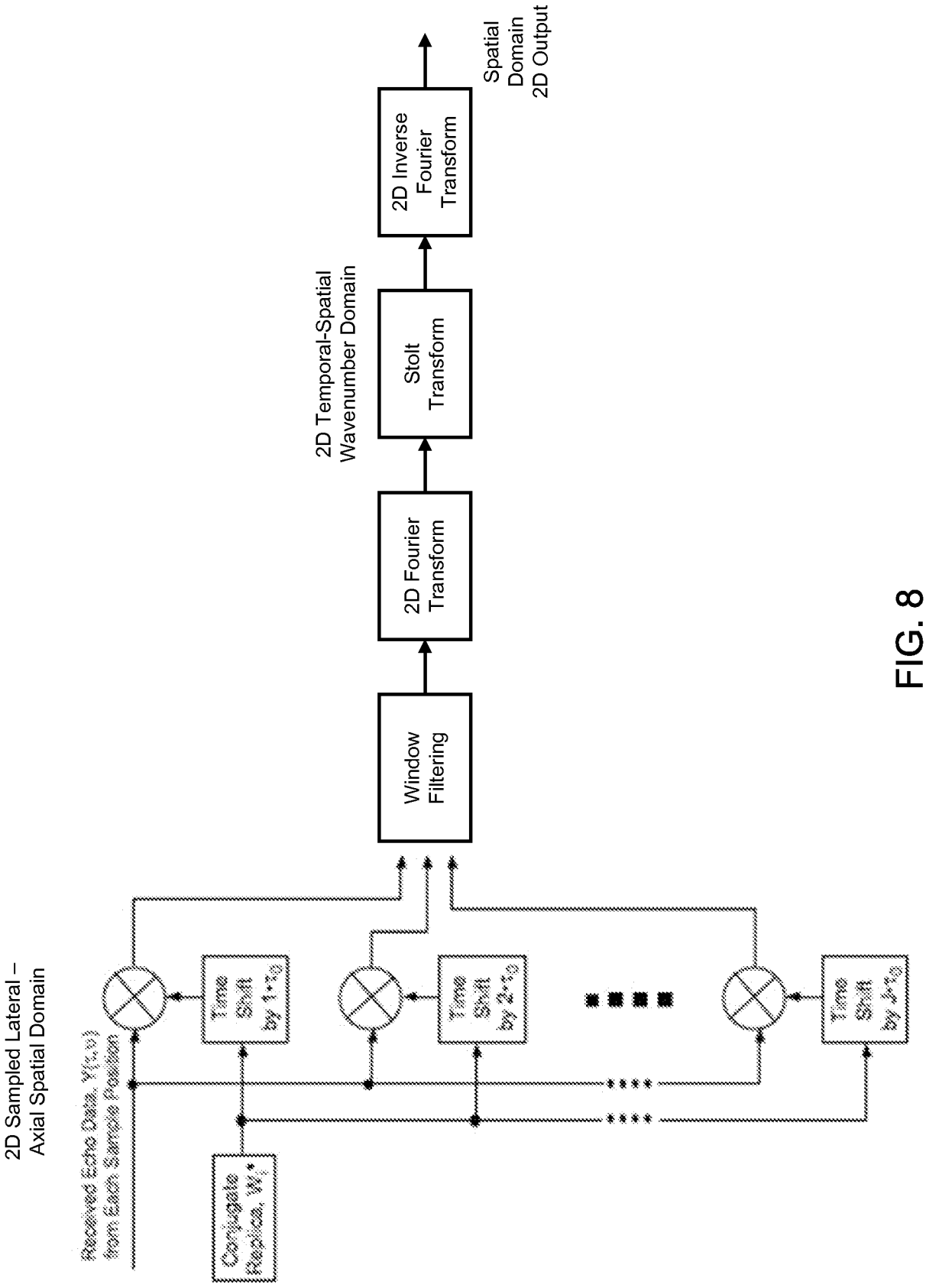

2D Sampled Lateral – Axial Spatial Domain
Received Echo Data, Y(x,v) from Each Sample Position
Conjugate Replica, W*
Time Shift by 1*τ0
Time Shift by 2*τ0
Time Shift by J*τ0
Window Filtering
2D Fourier Transform
2D Temporal-Spatial Wavenumber Domain
Stolt Transform
2D Inverse Fourier Transform
Spatial Domain 2D Output

FIG. 8

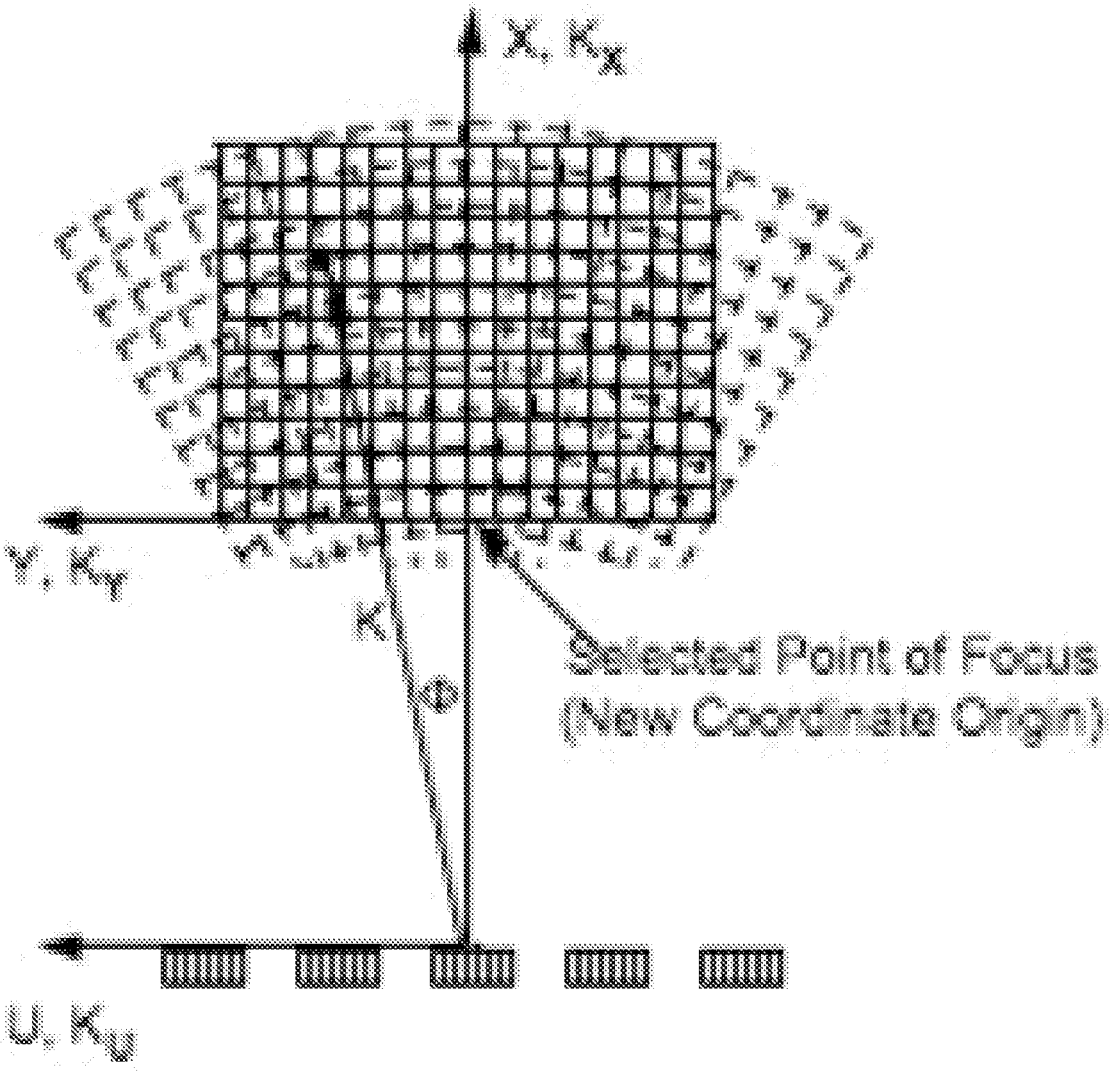


FIG. 9

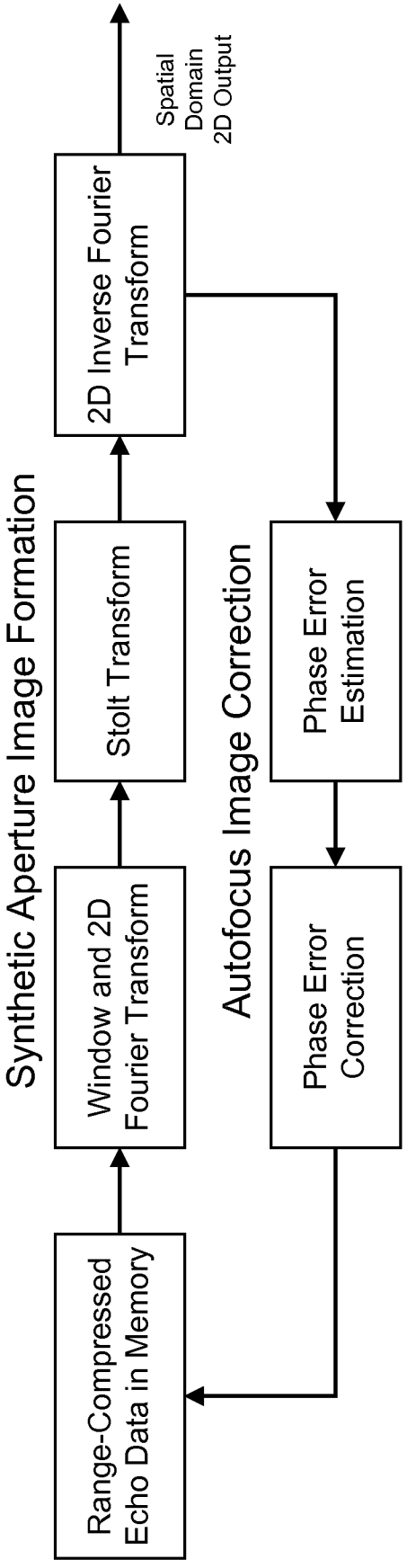

Synthetic Aperture Image Formation
Autofocus Image Correction
Range-Compressed Echo Data in Memory
Window and 2D Fourier Transform
Stolt Transform
2D Inverse Fourier Transform
Spatial Domain 2D Output
Phase Error Correction
Phase Error Estimation

FIG. 10