

FIG. 1

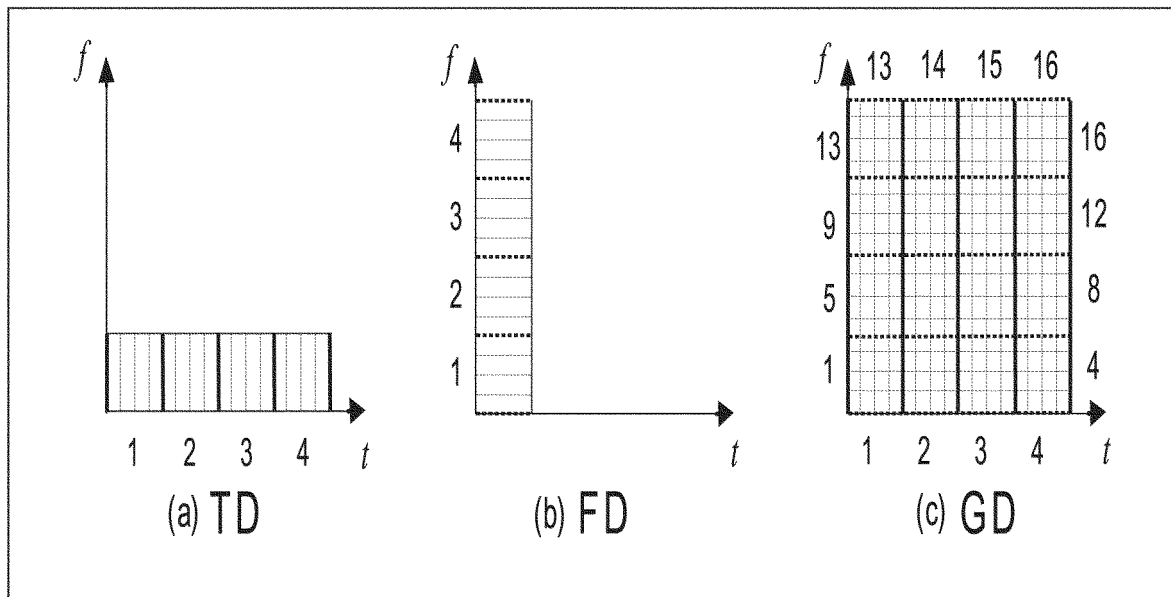


FIG. 2

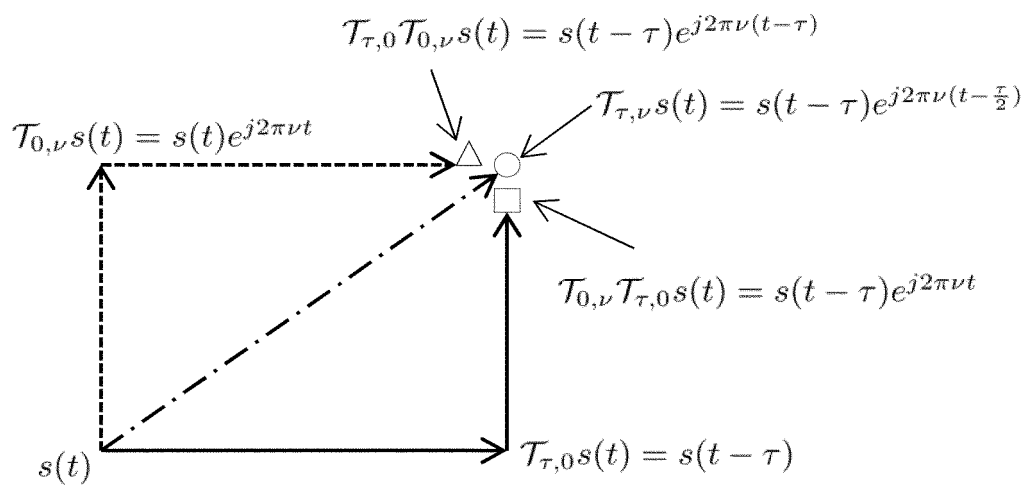


Figure 1 consists of three parts: (a), (b), and (c).

Part (a) illustrates the input signal processing. It shows two plots: "In-phase" and "Quadrature phase", both showing amplitude versus time (micro sec). Below these is a 2D time-frequency plot with frequency (MHz) on the vertical axis and time (micro sec) on the horizontal axis. The plot shows a signal with a frequency shift of $4W_c$ and a time shift of $4T_c$. The signal is represented as $g_{0,0}(f)$ and $g_{4,4}(f)$ in the frequency domain, and $g_{0,0}(t)$ and $g_{4,4}(t)$ in the time domain. The signal is processed by a summing junction Σ .

Part (b) shows the 2D array structure. It is a grid of $N' \times N$ elements. The row sum is $C_{pn}(u)$ and the column sum is $C_{pn}(v)$. The total sum is $C_{pn}(u, v)$. The array is labeled with $n' = 0, 1, \dots, N'-1$ and $n = 1, 2, \dots, N$. The row sum is $C_{pn}(u) \approx 1$ and the column sum is $C_{pn}(v) \approx 1$. The total sum is $C_{pn}(u, v) \approx 1$.

Part (c) shows the 3D beamforming structure. It is a 3D plot showing the steering vectors $(\hat{e}_{d,0}, \hat{e}_{d,0})$ and $(\hat{e}_{d,4}, \hat{e}_{d,4})$ in the frequency domain. The steering vectors are labeled with $(\hat{e}_{d,0}, \hat{e}_{d,0})$ and $(\hat{e}_{d,4}, \hat{e}_{d,4})$. The steering vectors are labeled with $(\hat{e}_{d,0}, \hat{e}_{d,0})$ and $(\hat{e}_{d,4}, \hat{e}_{d,4})$.

FIG. 4

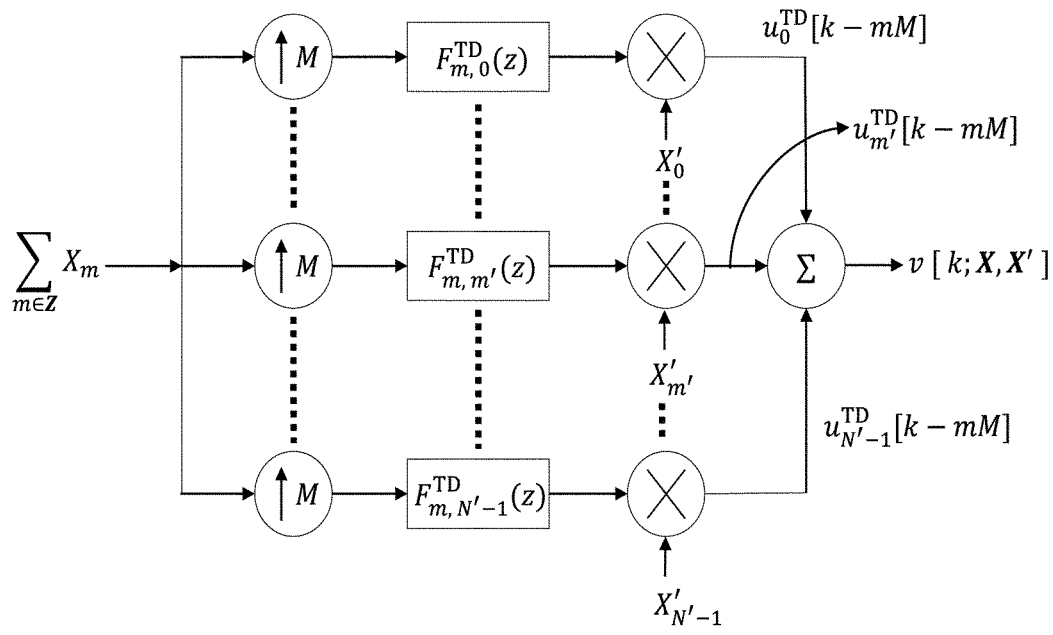
SFB for signature $v[k; \mathbf{X}, \mathbf{X}']$

FIG. 5

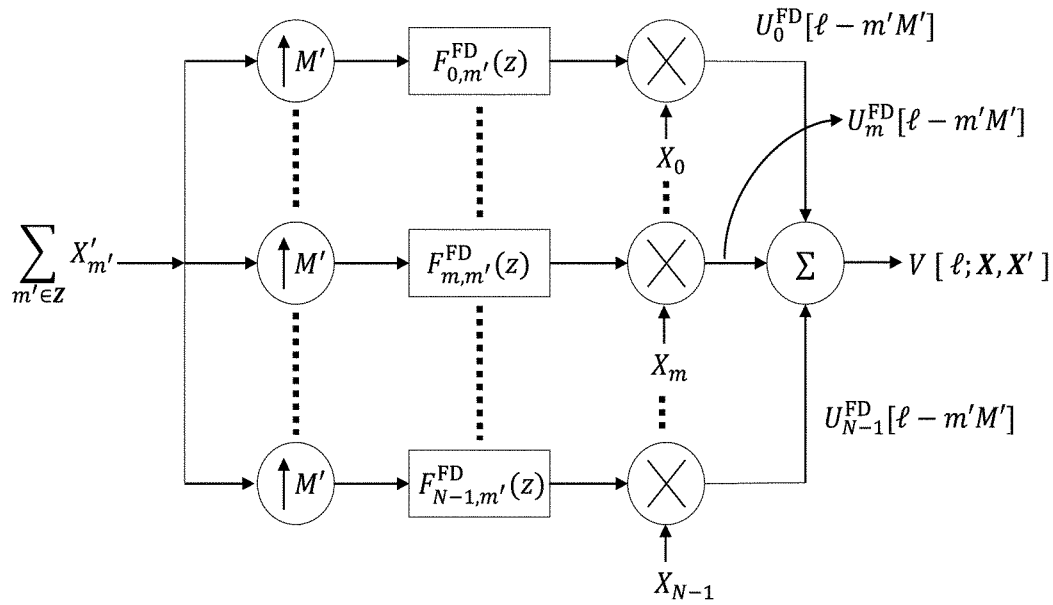
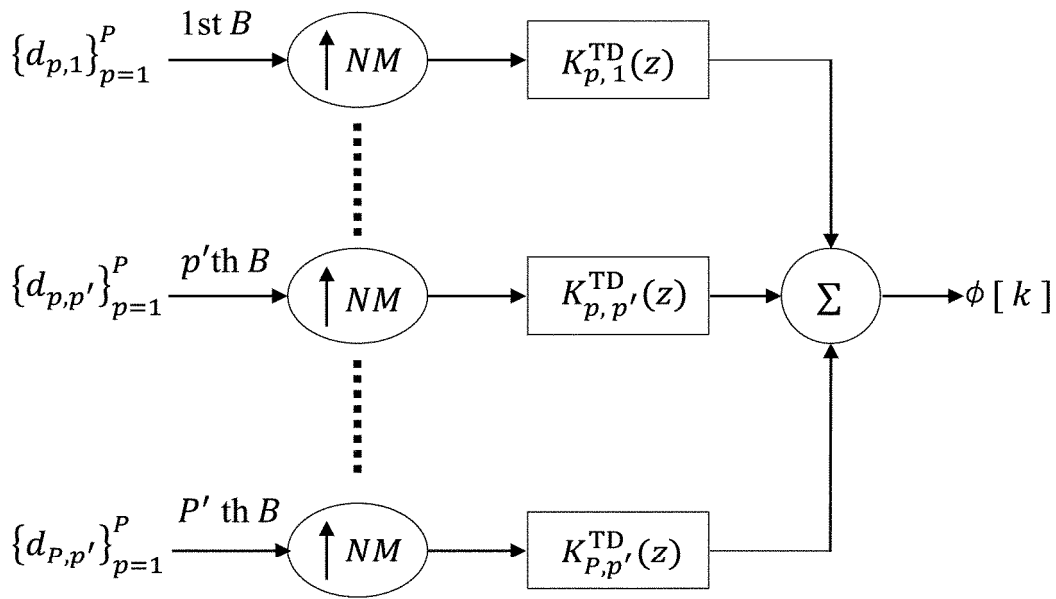
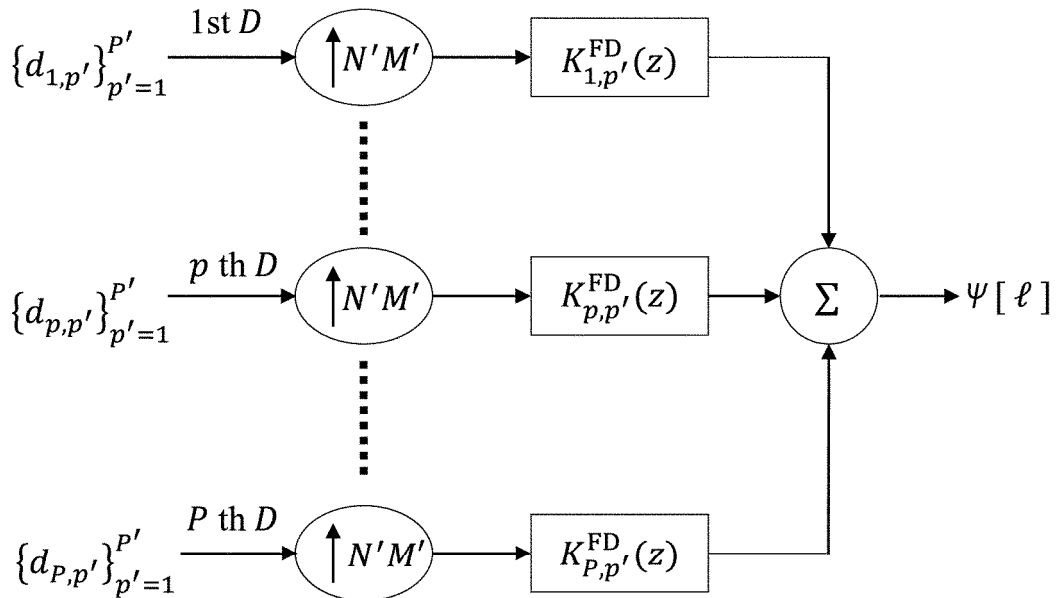
SFB for signature $V[\ell; \mathbf{X}, \mathbf{X}']$

FIG. 6



SFB for data embedded transmit TD signal

FIG. 7



SFB for data embedded transmit FD signal

FIG. 8

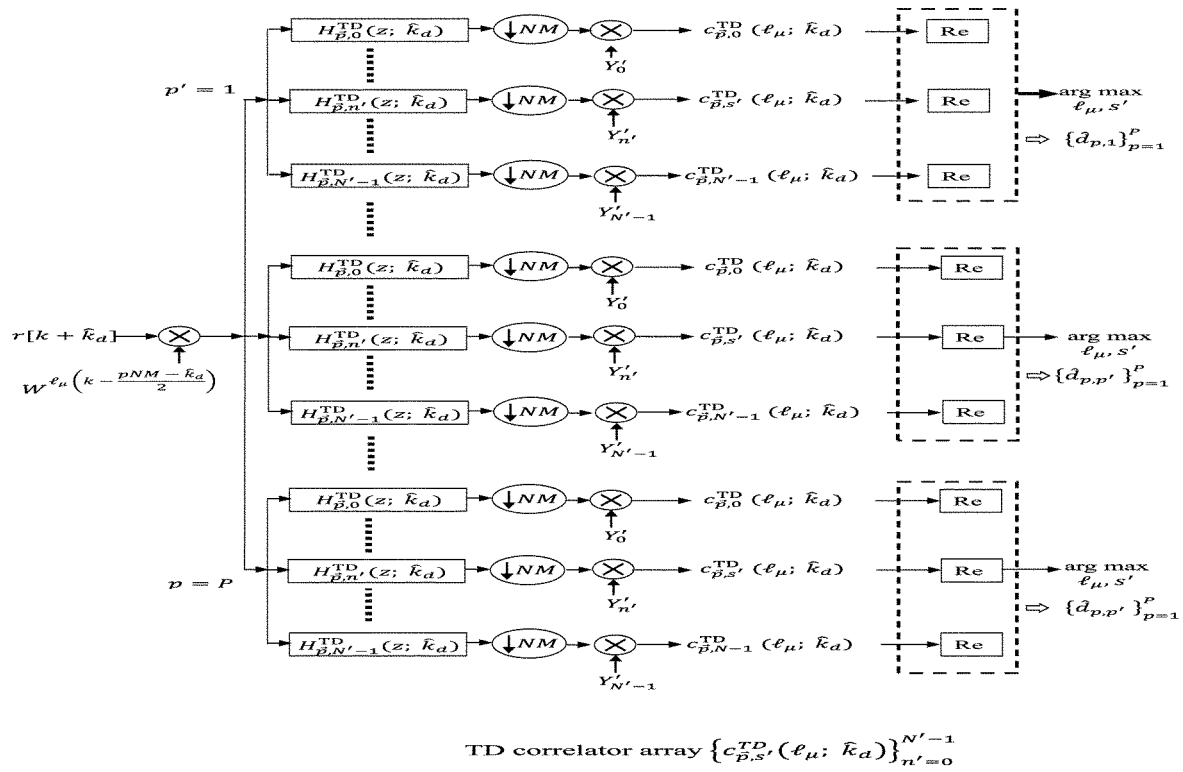


FIG. 9

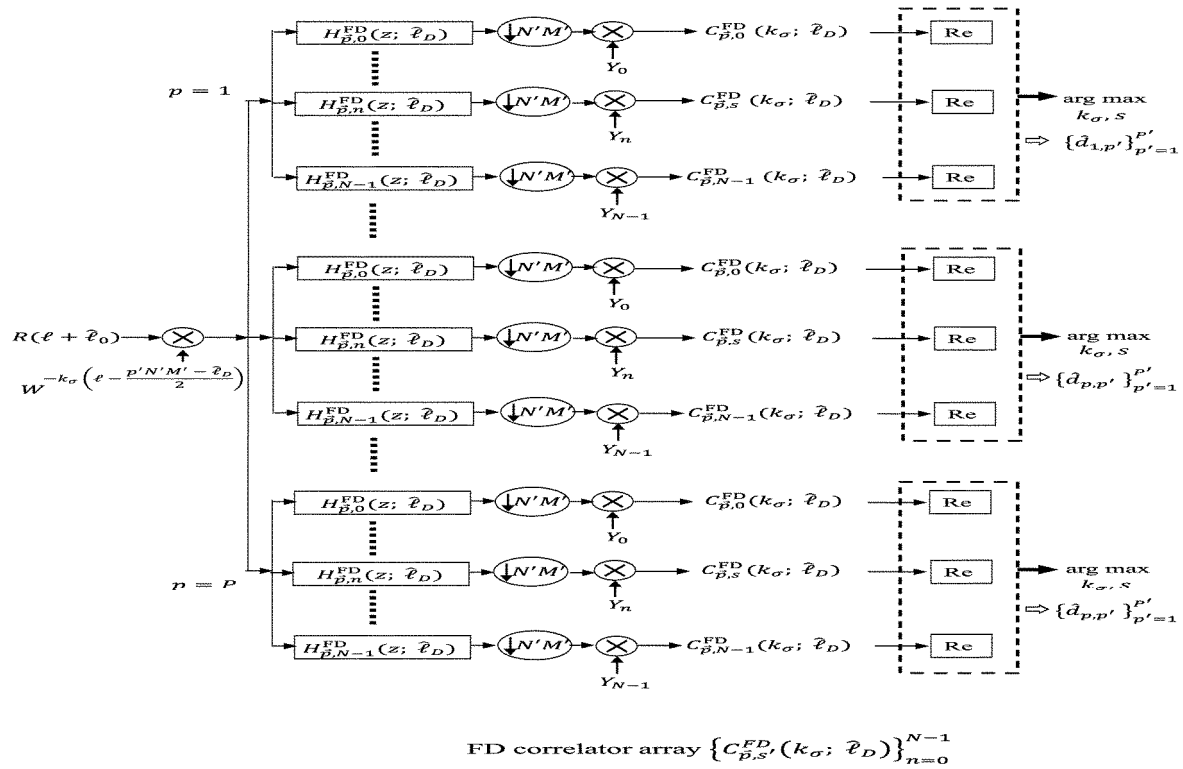


FIG. 10

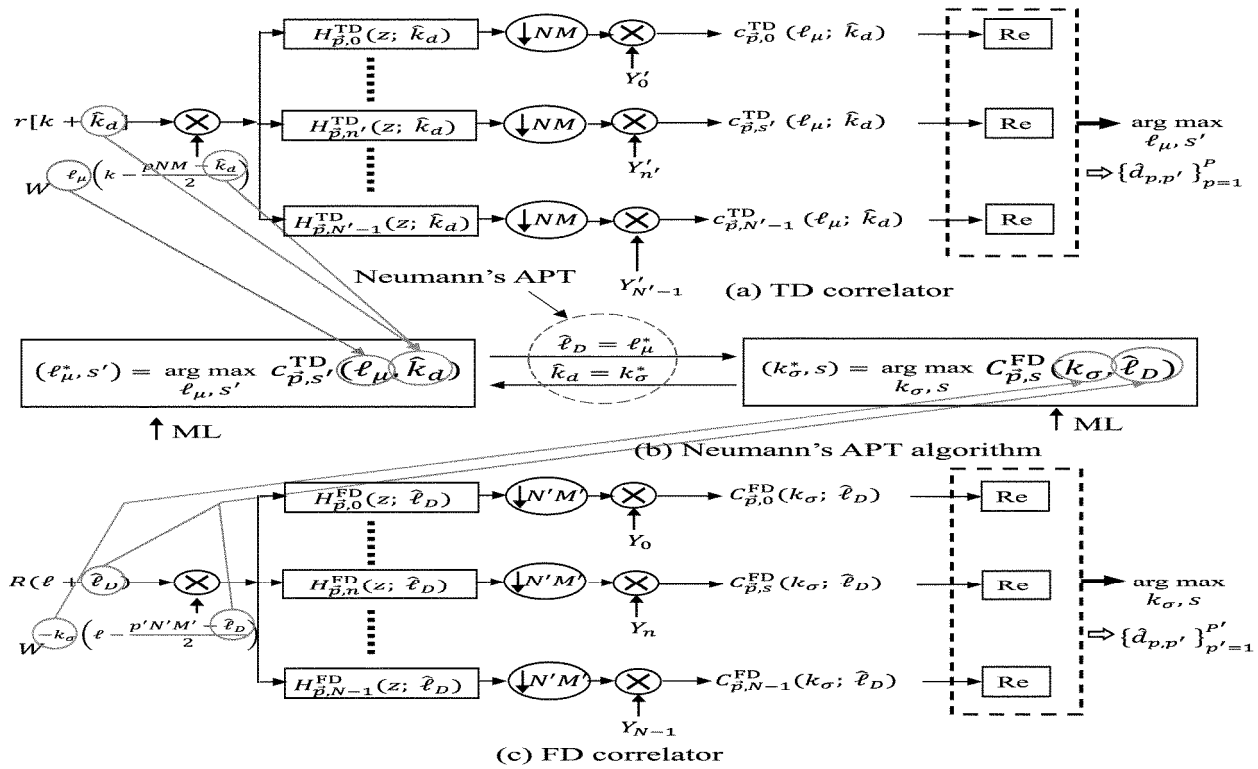
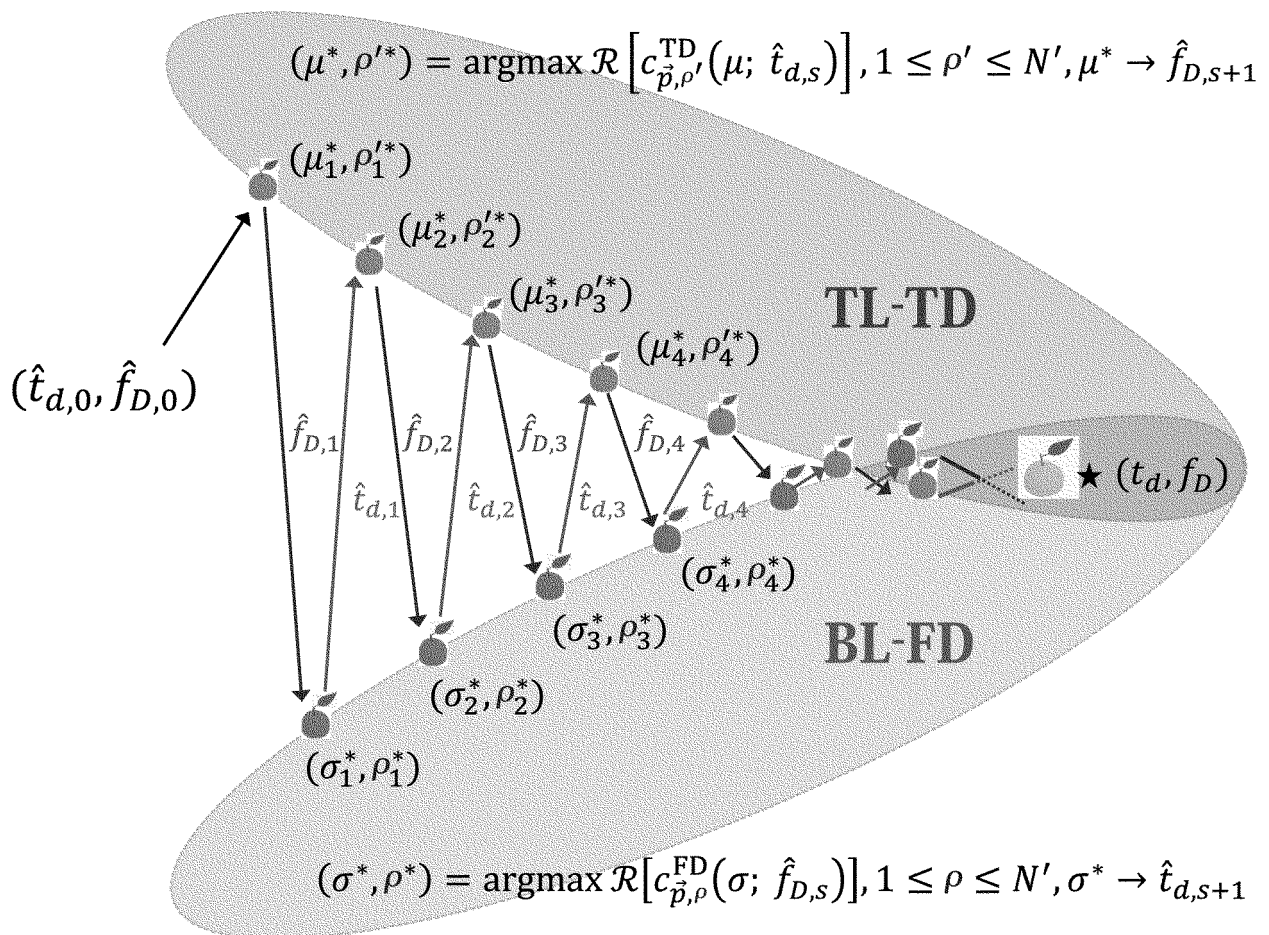


FIG. 11



TRANSMITTER

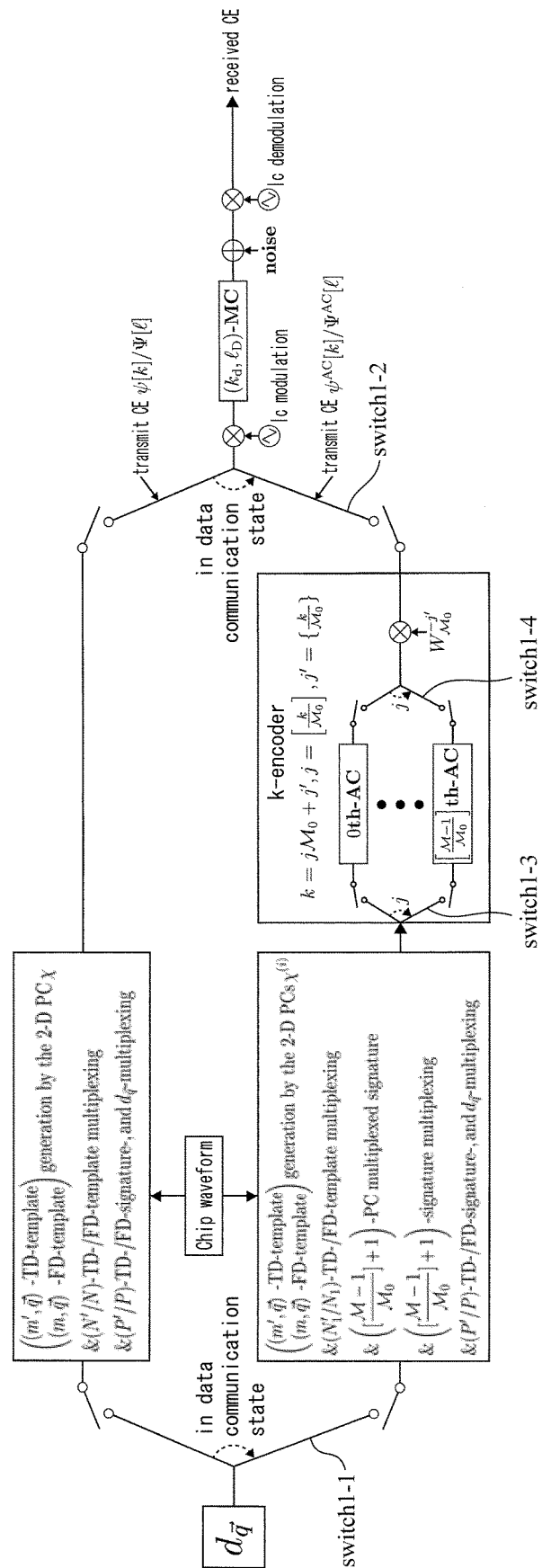


FIG. 13

RECEIVER

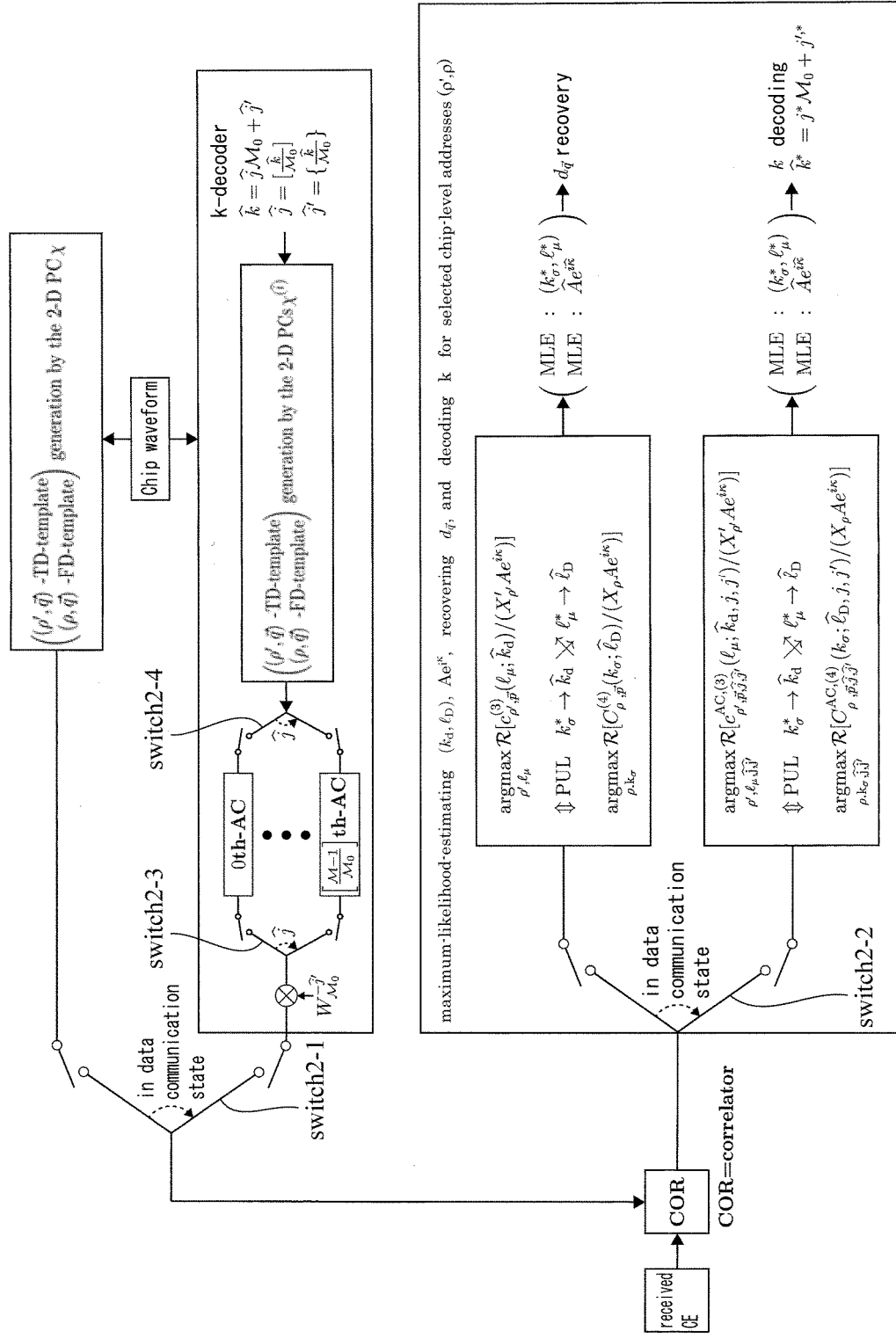


FIG. 14

magnitude of real part of CCF

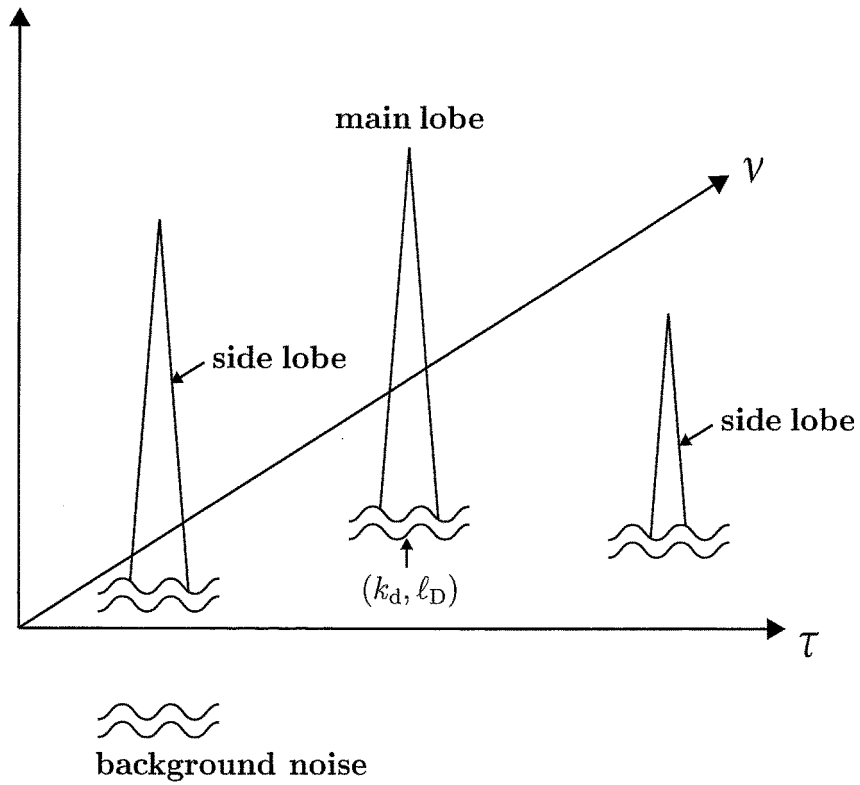


FIG. 15

magnitude of real part of CCF

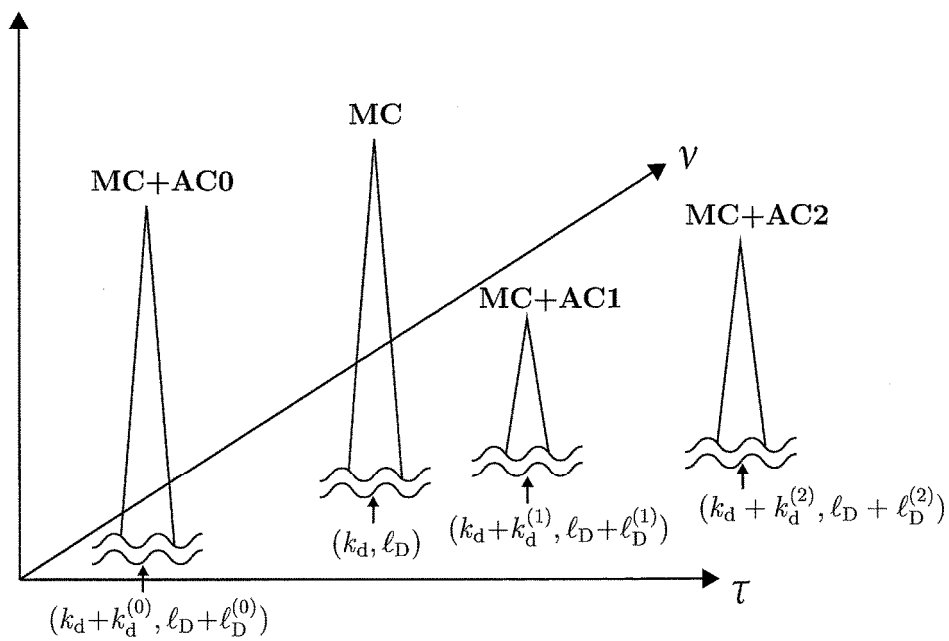


FIG. 16

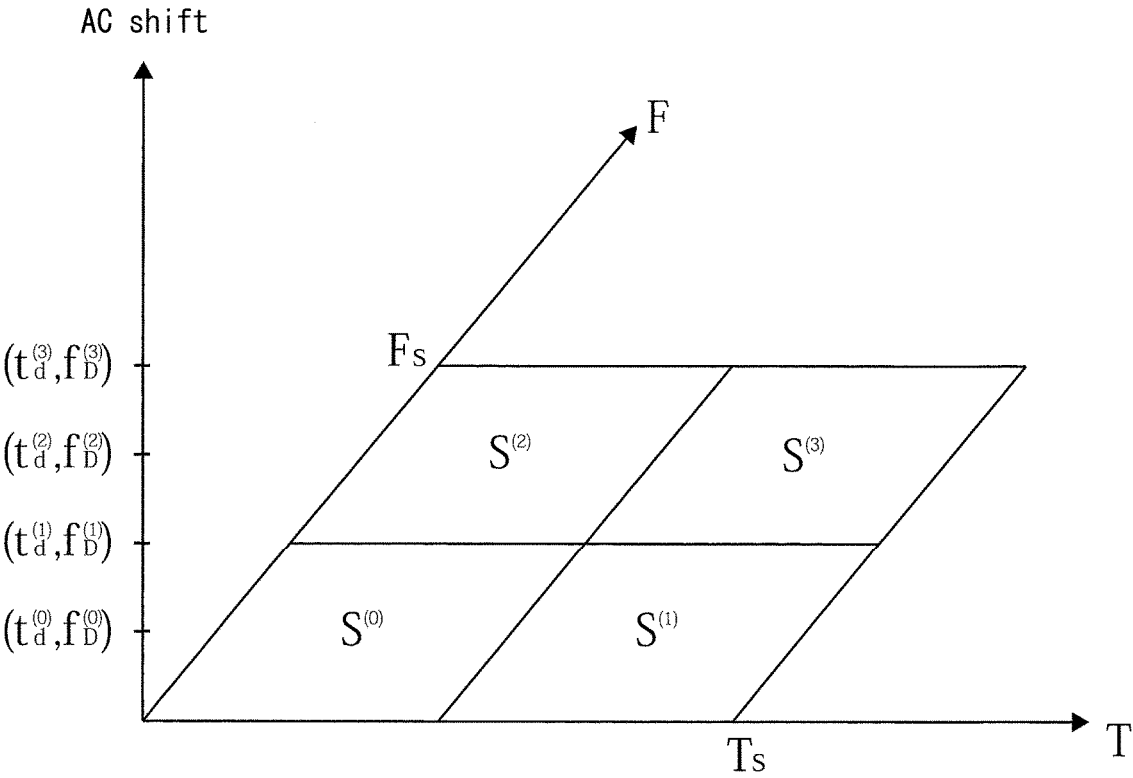


FIG. 17

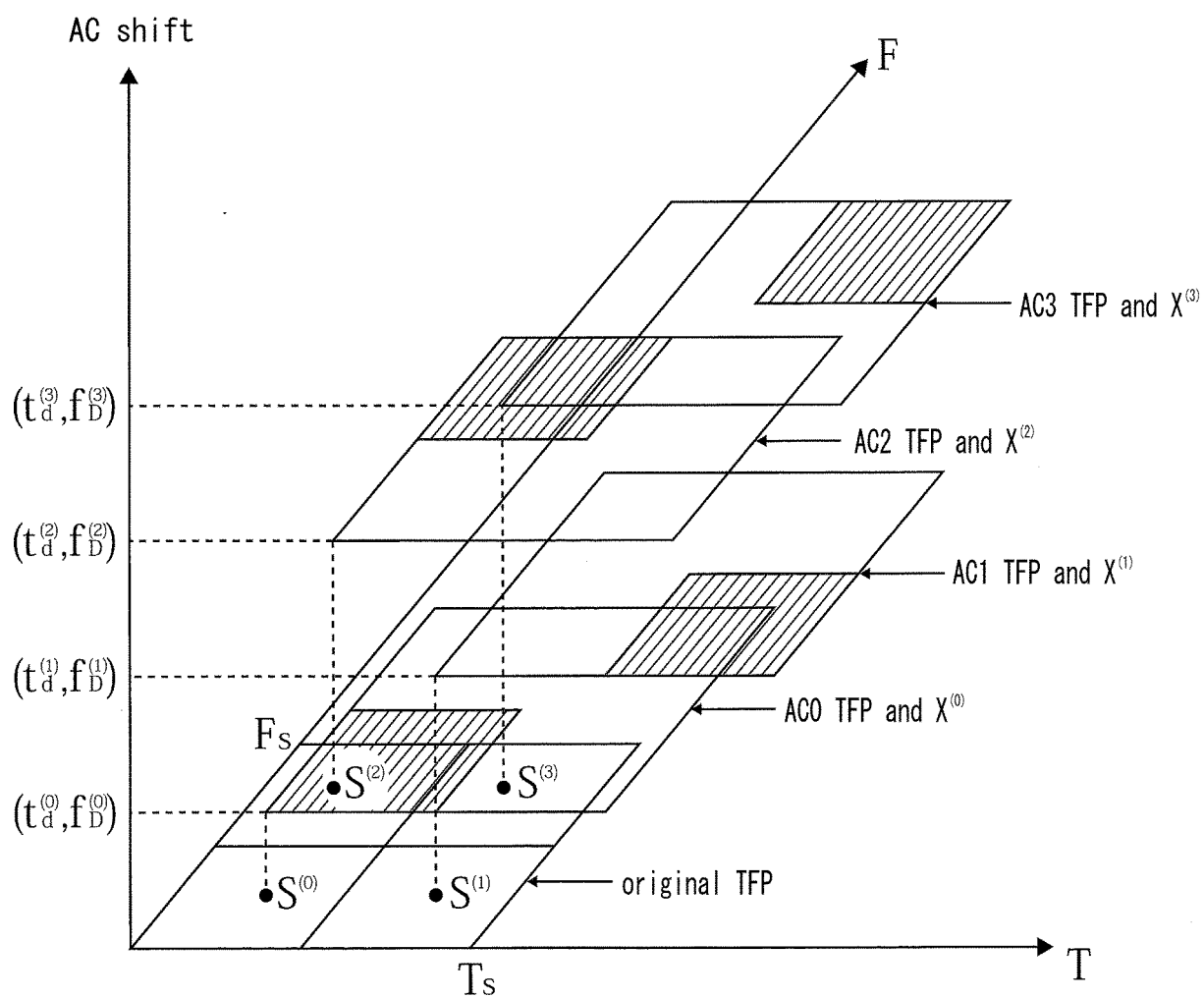


FIG. 18

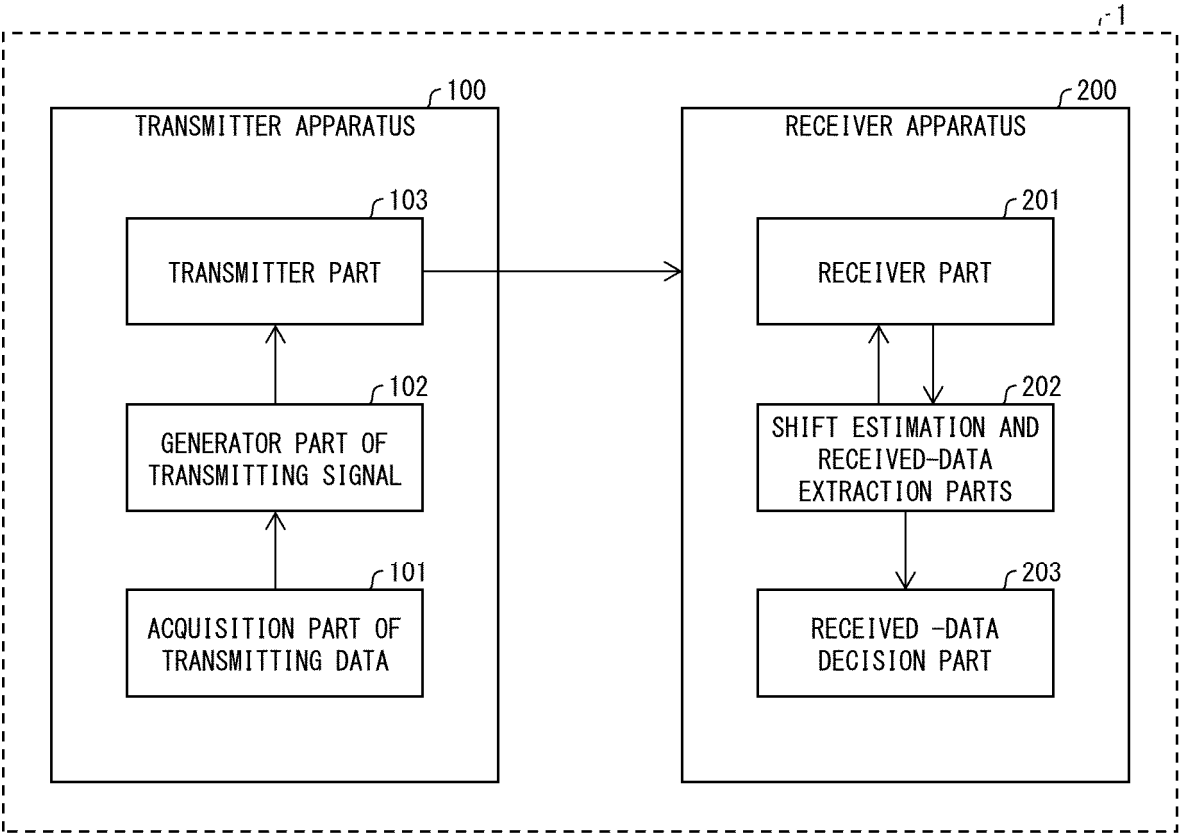


FIG. 19

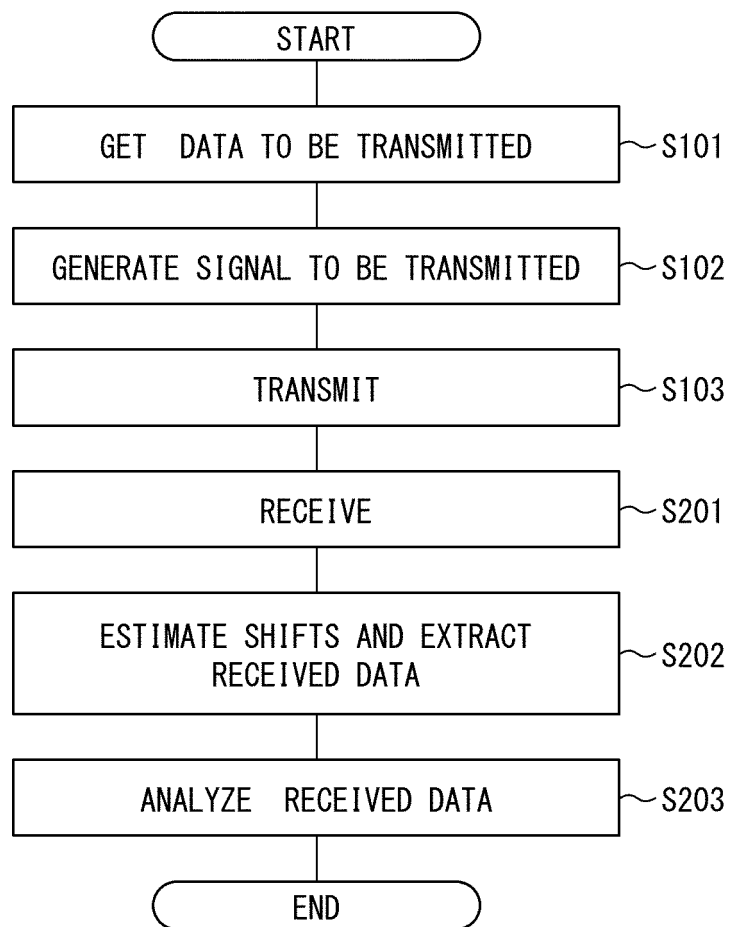


FIG. 20

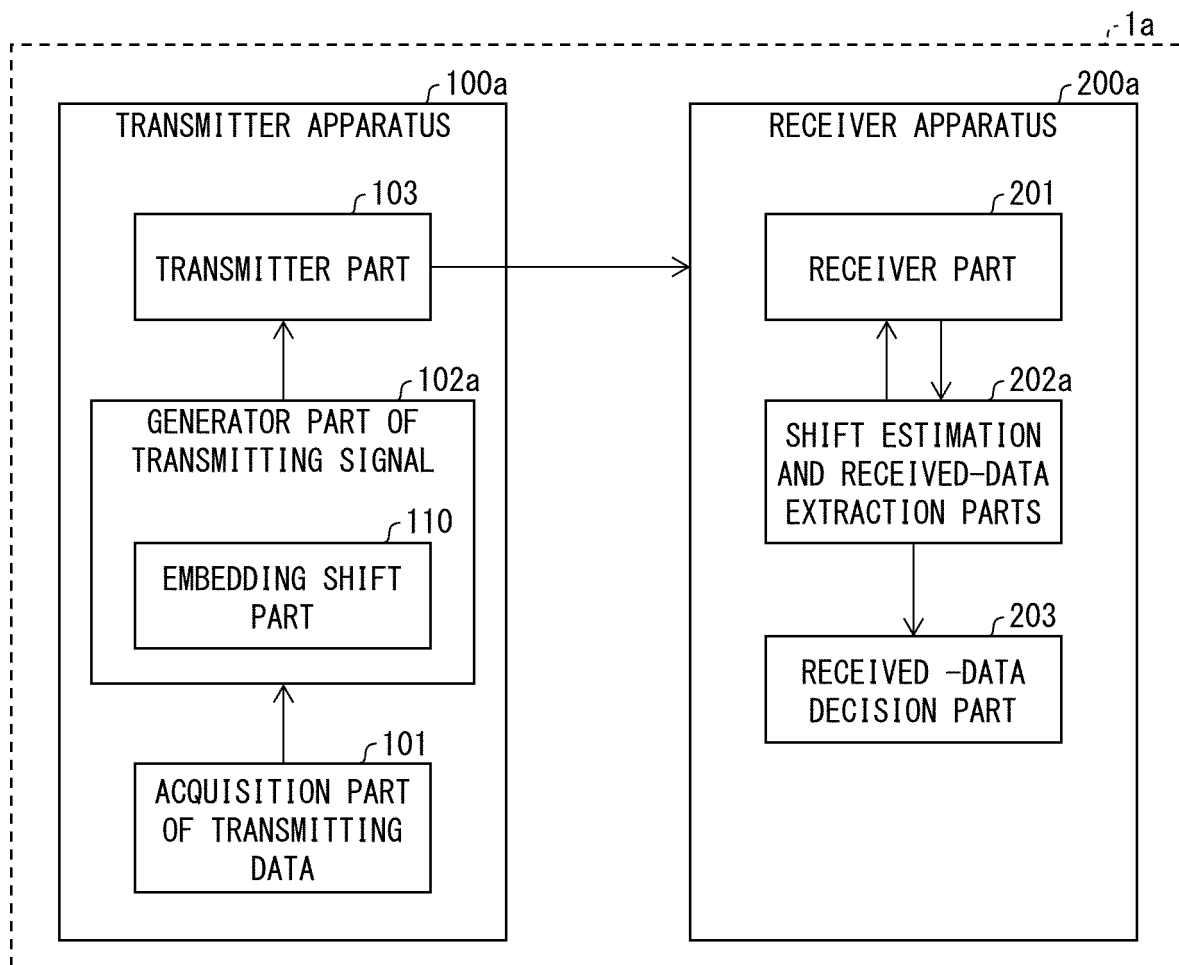


FIG. 21

