

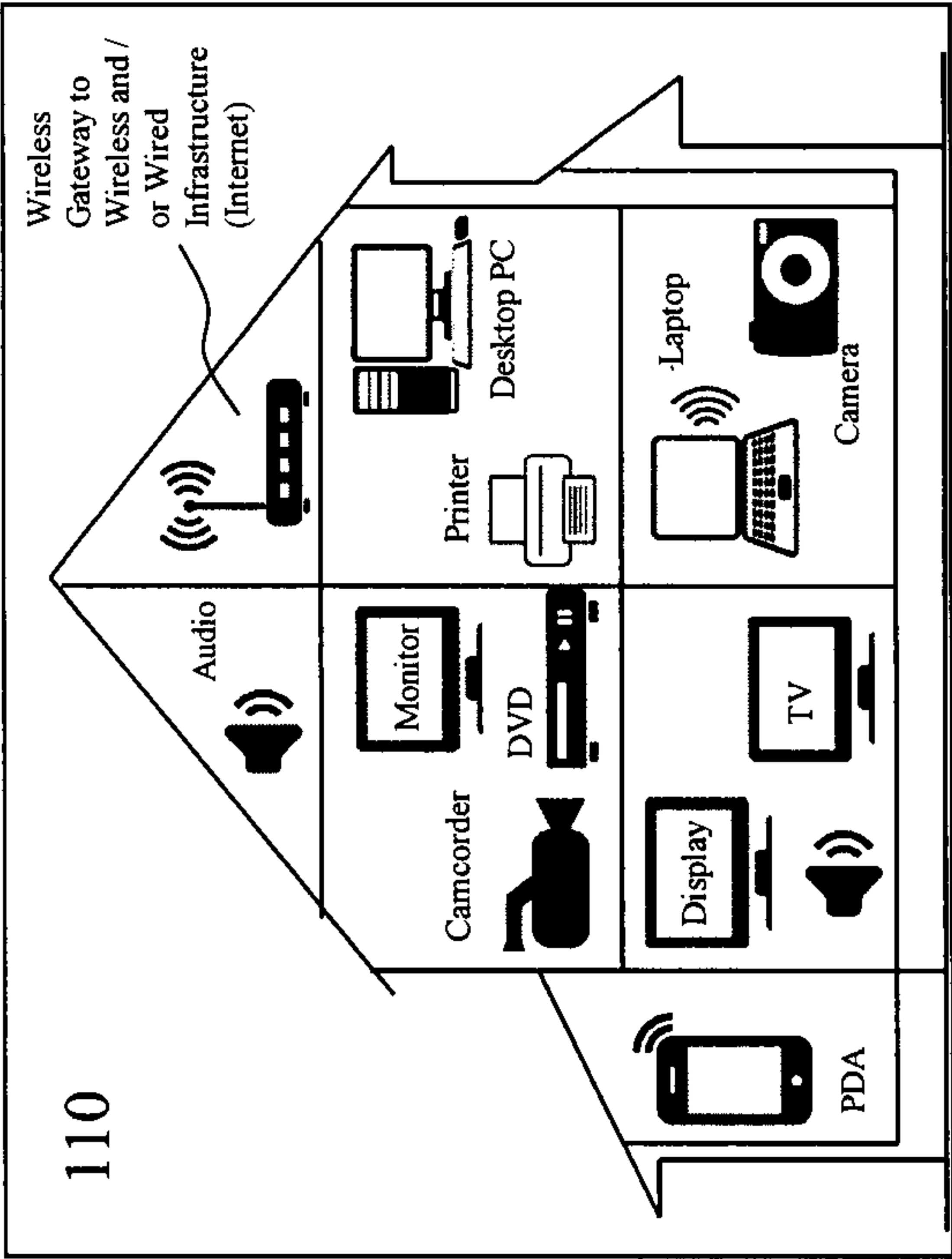
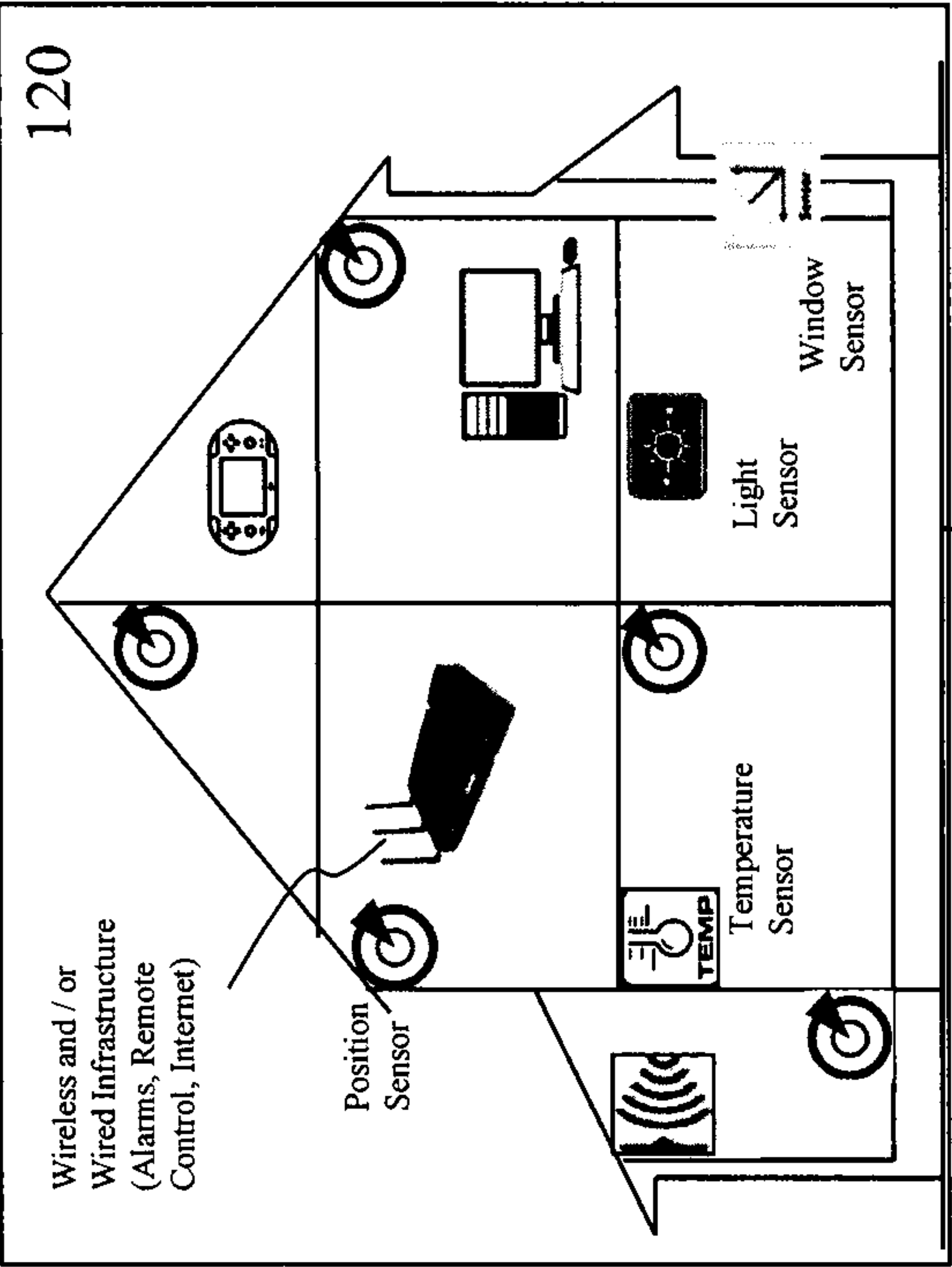


Figure 1

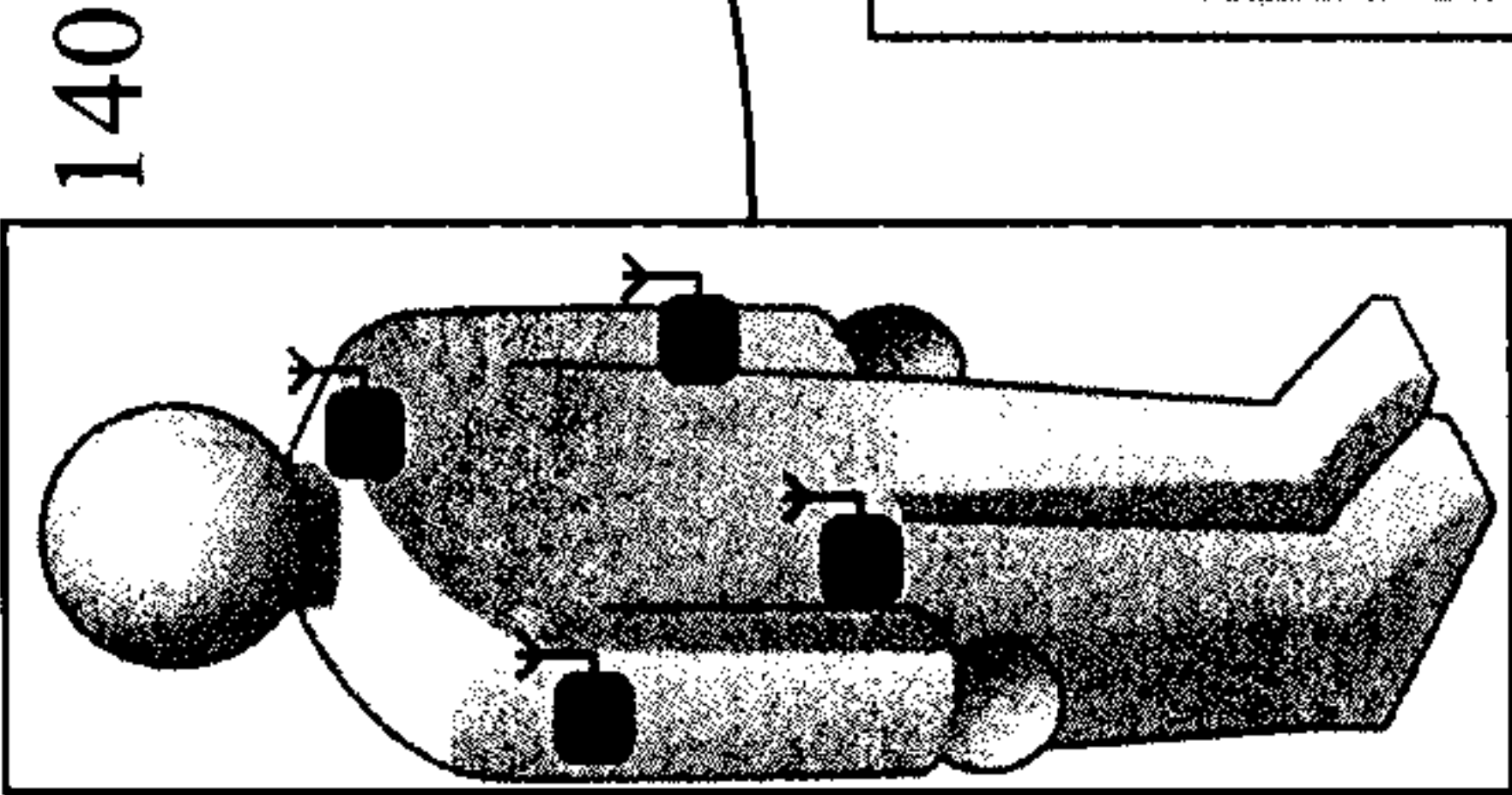
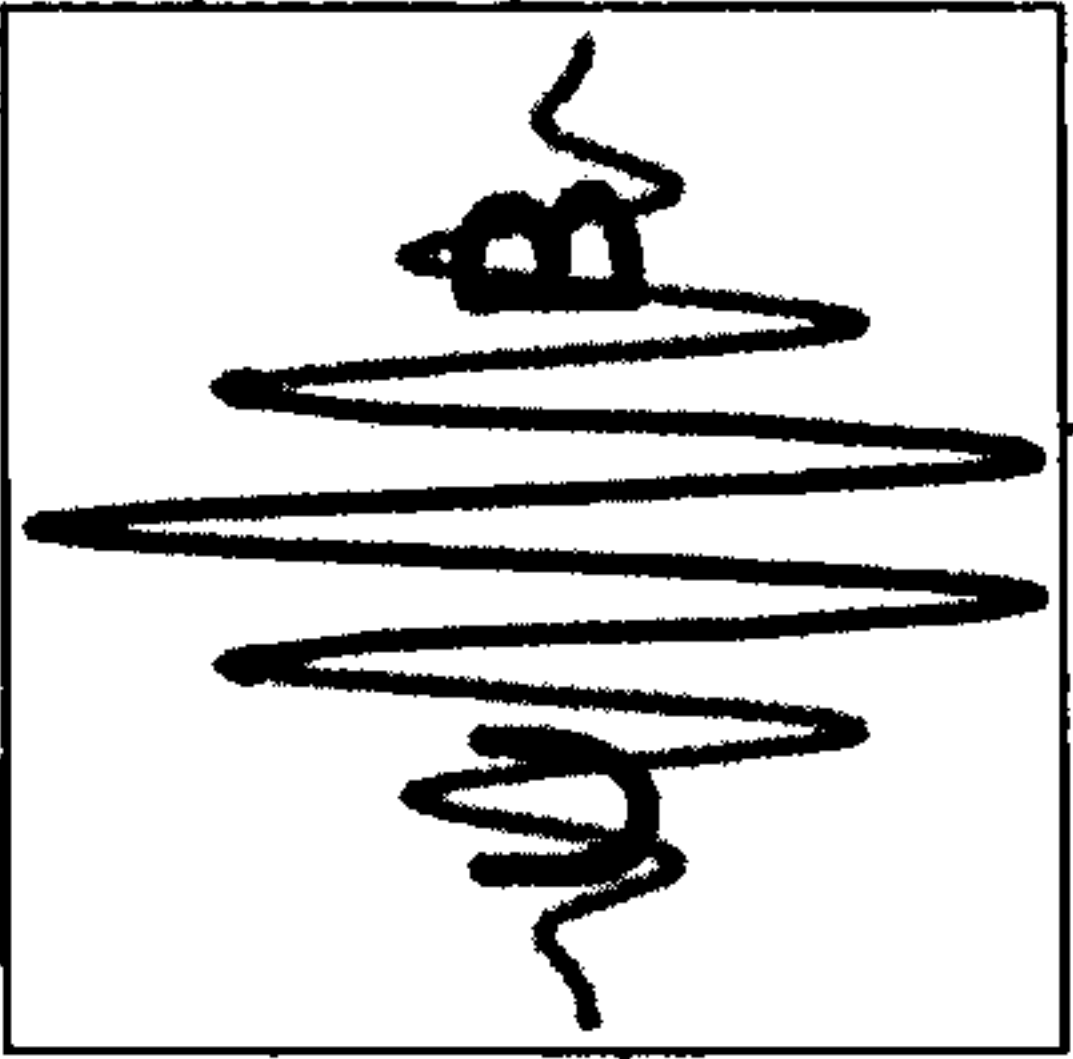
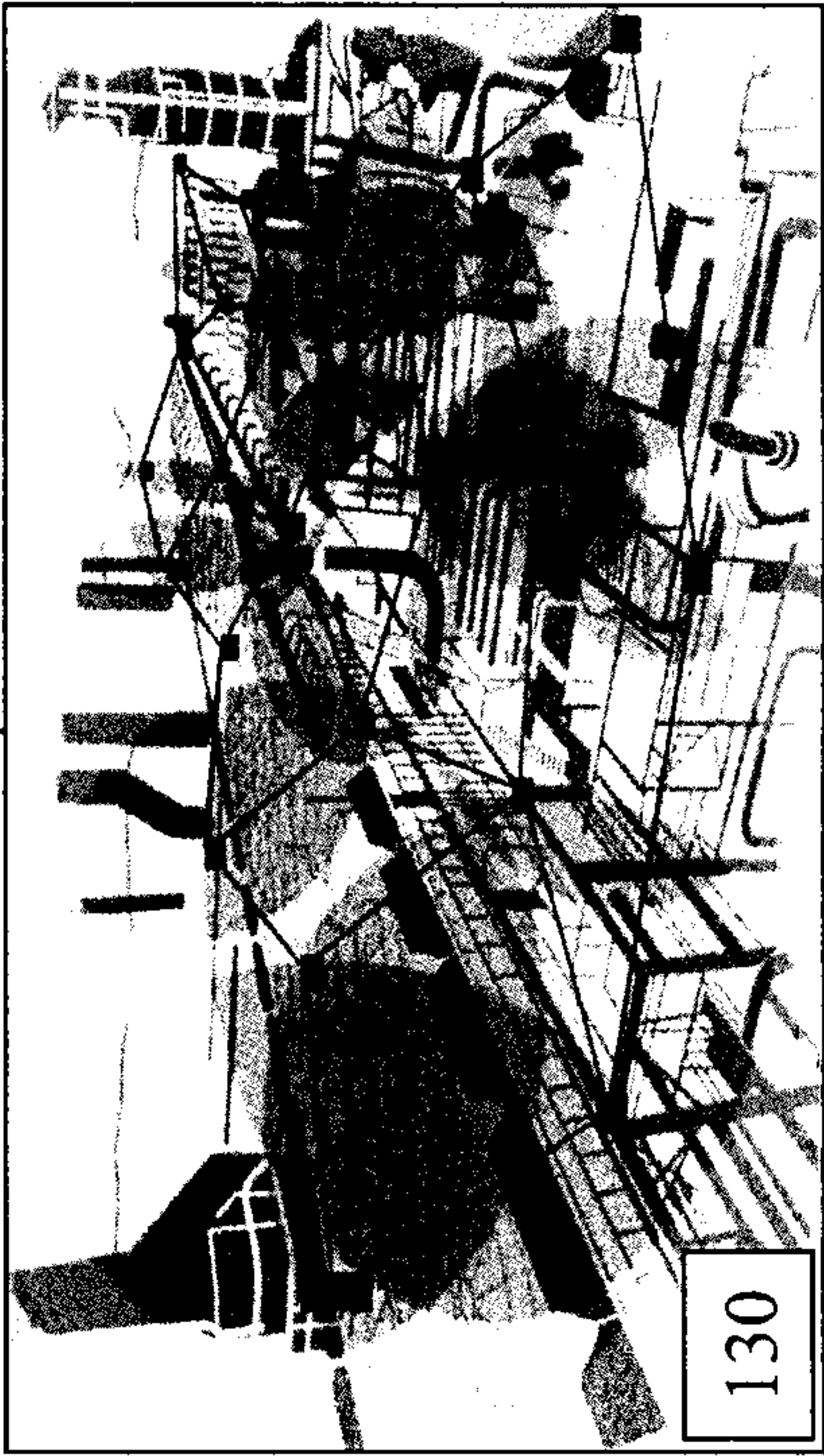
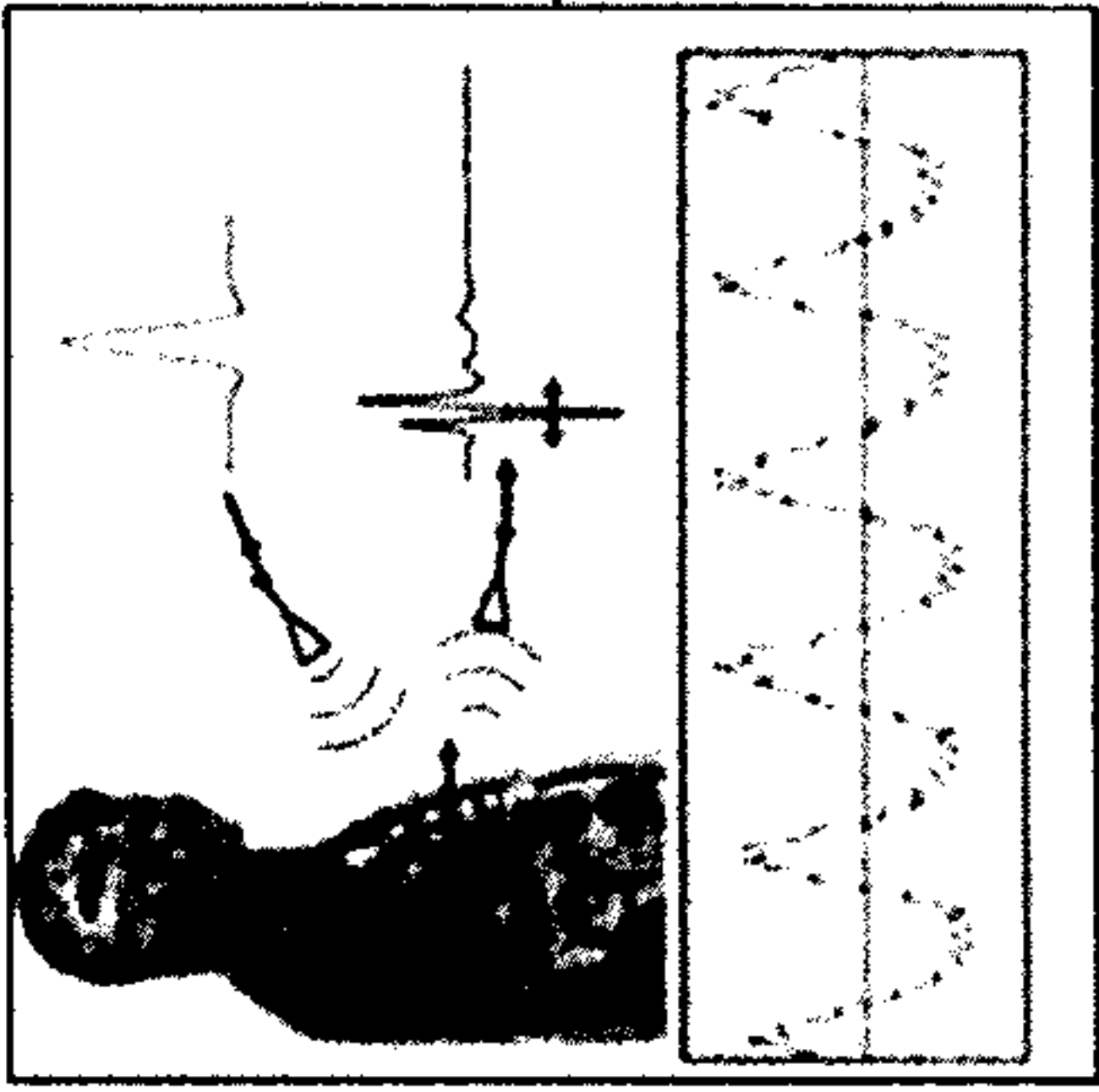


Figure 1



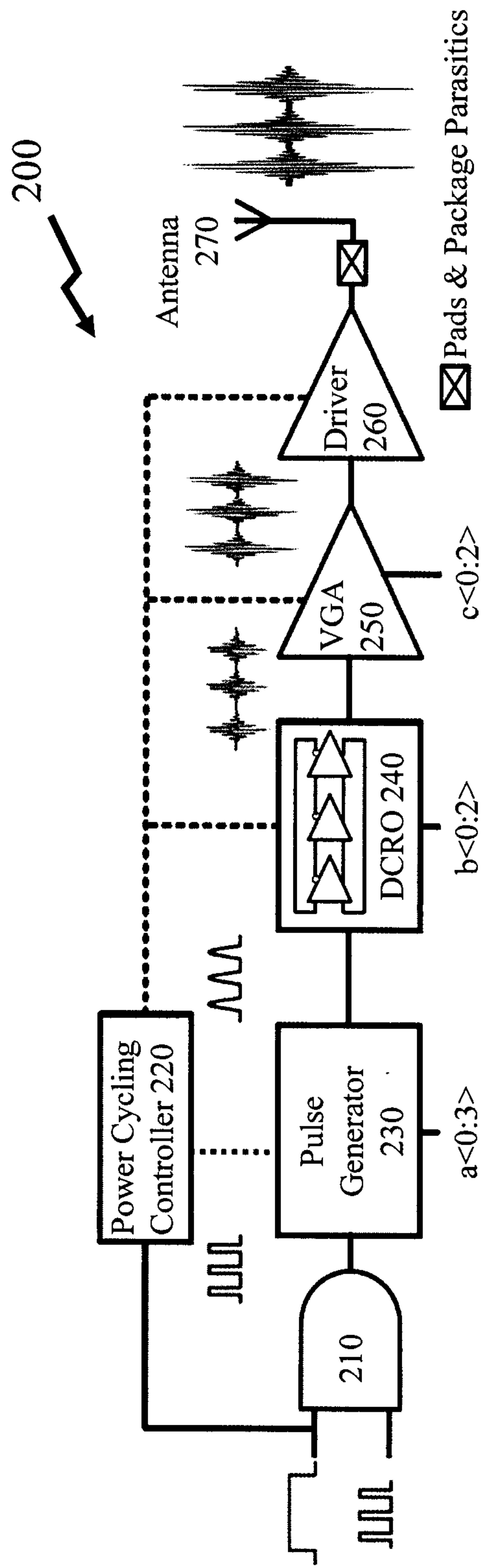


Figure 2

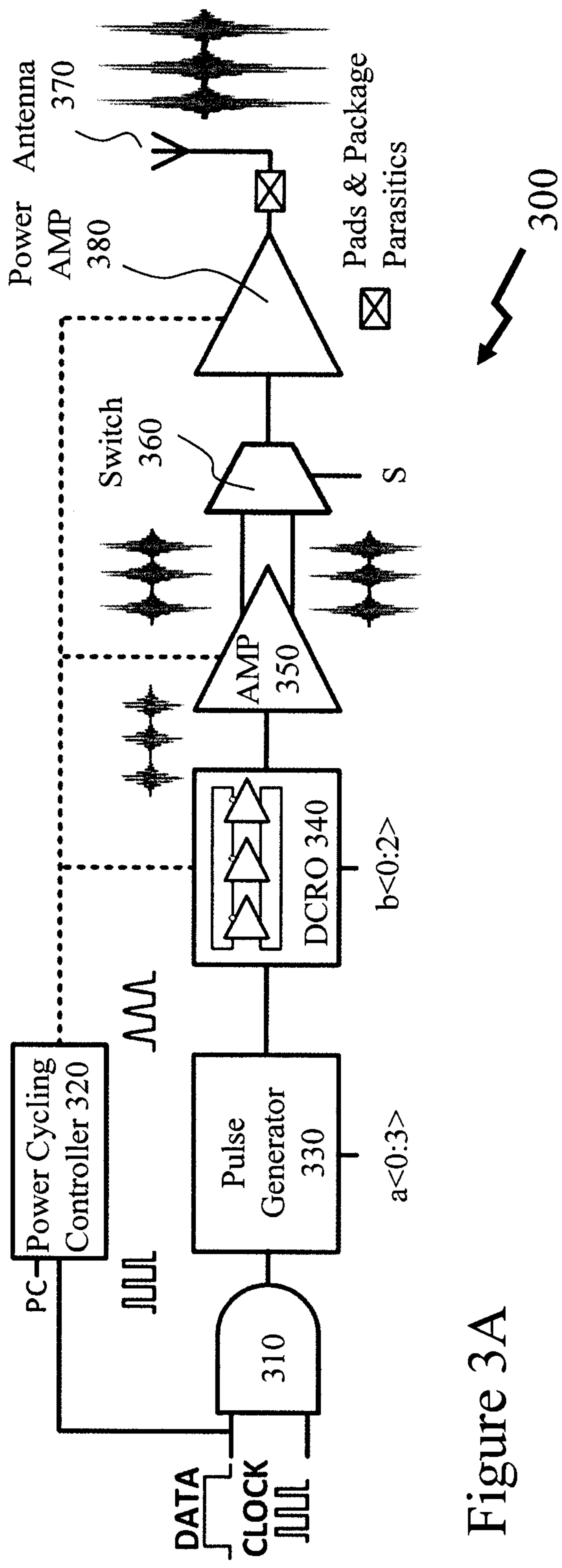


Figure 3A

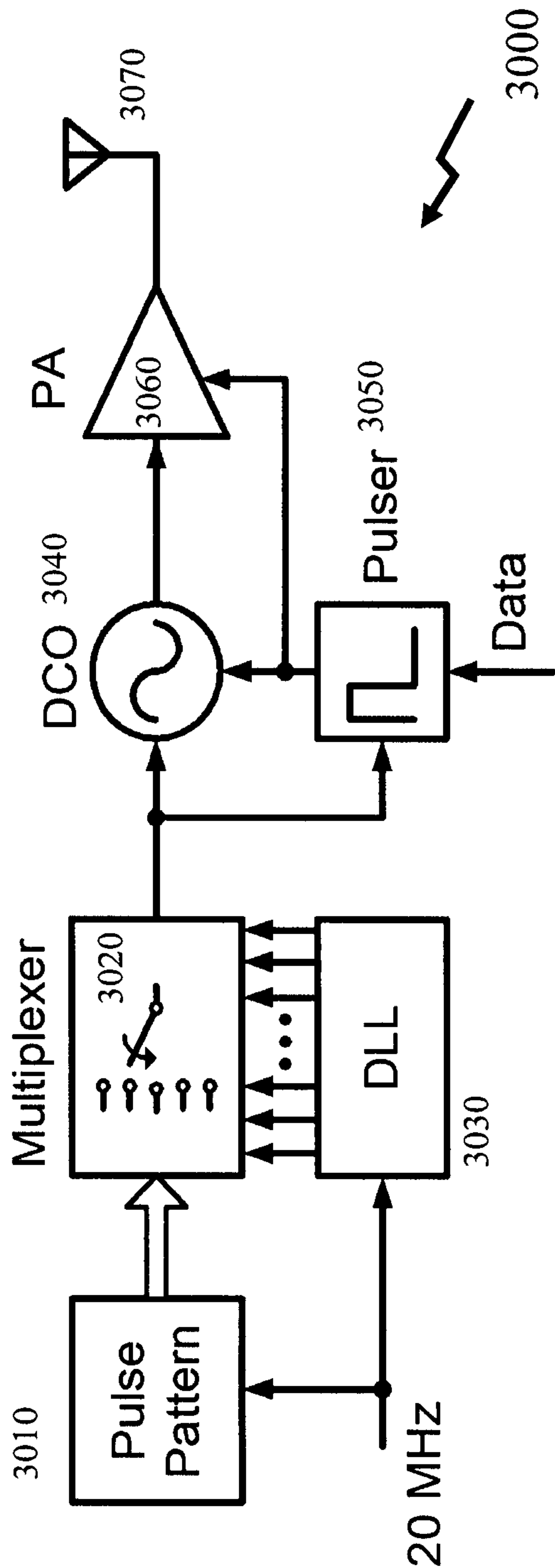


Figure 3B

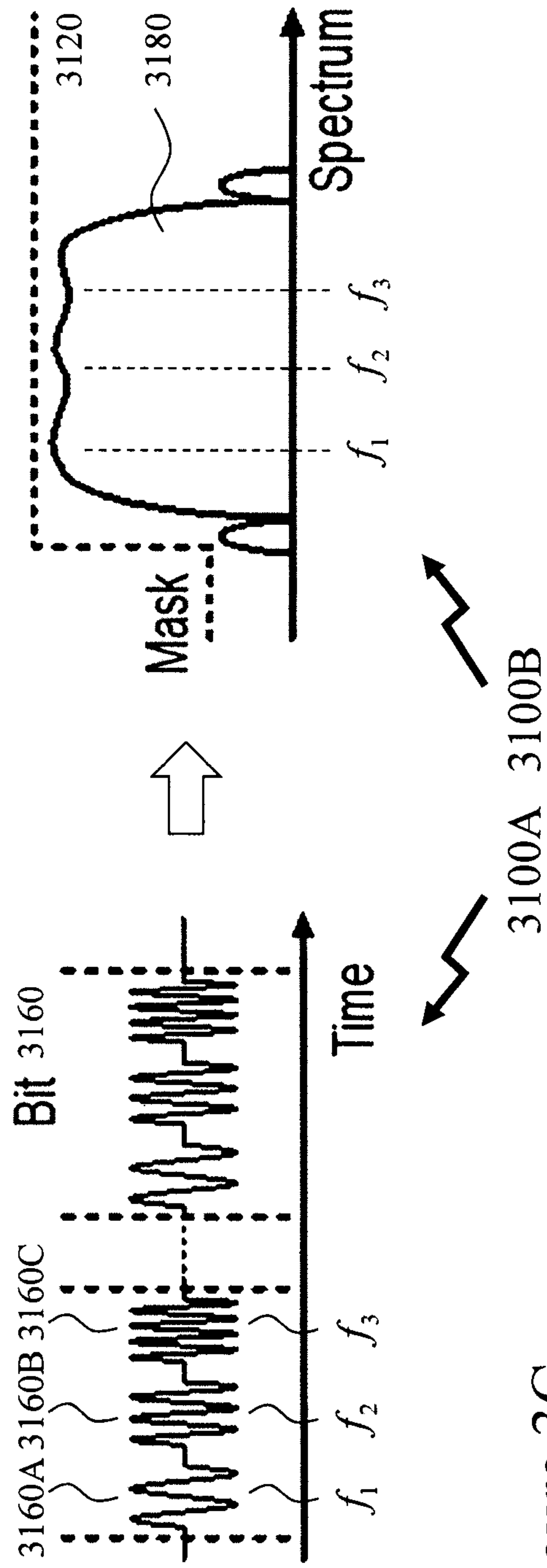
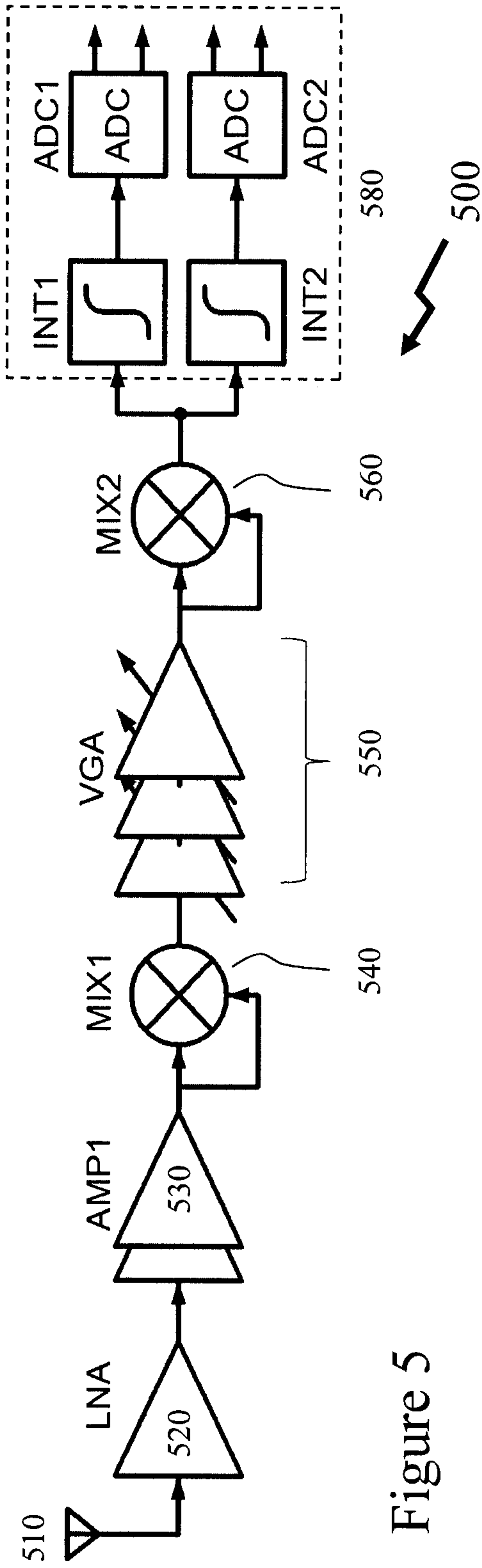
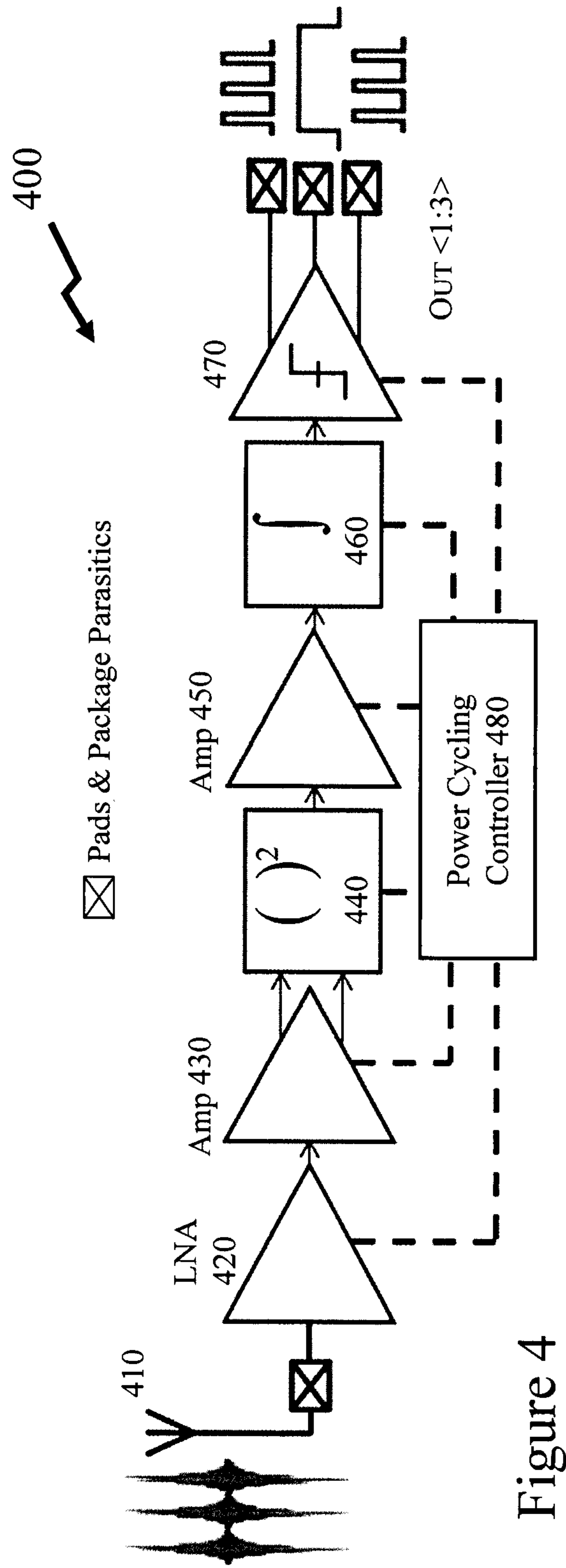
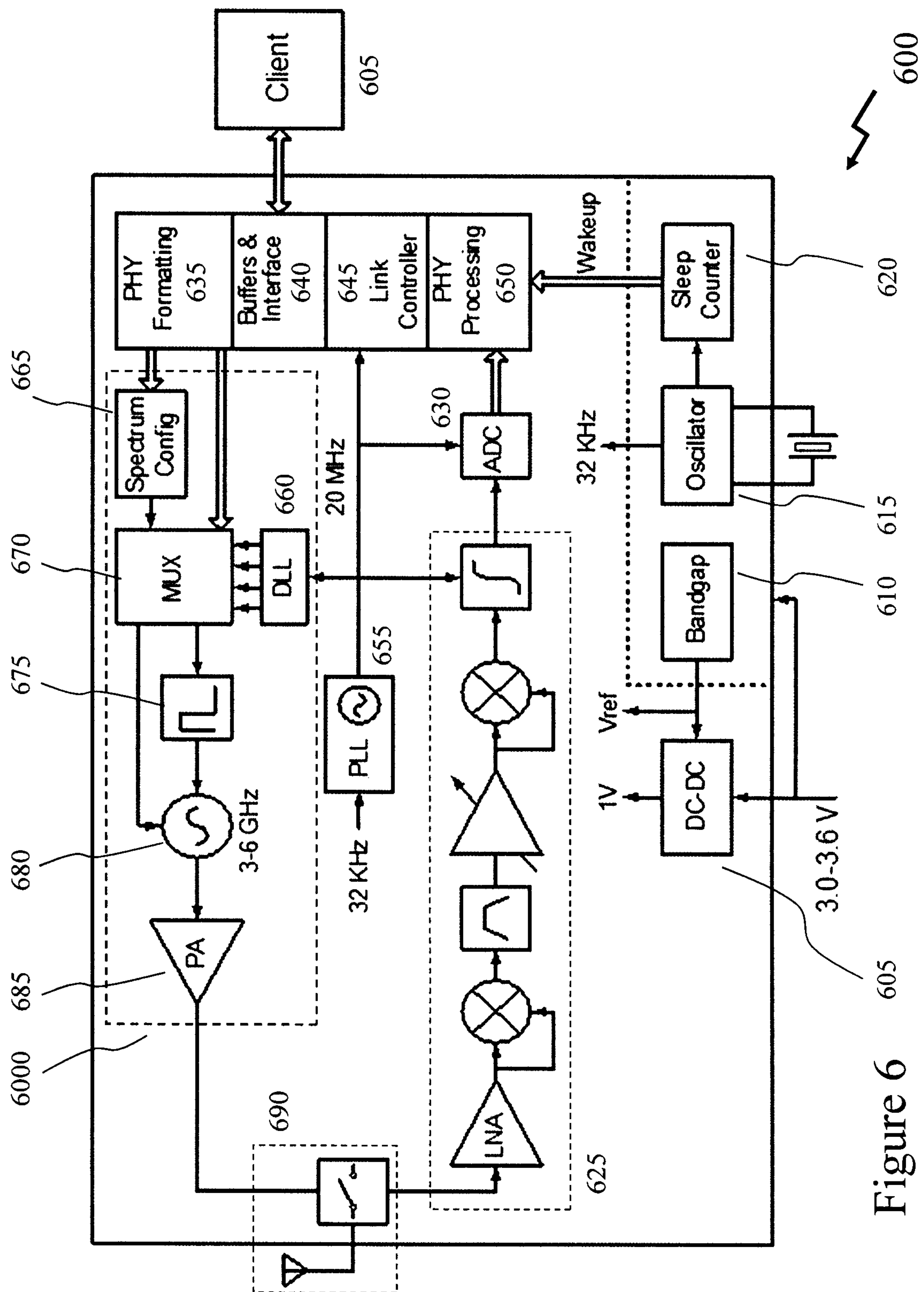


Figure 3C





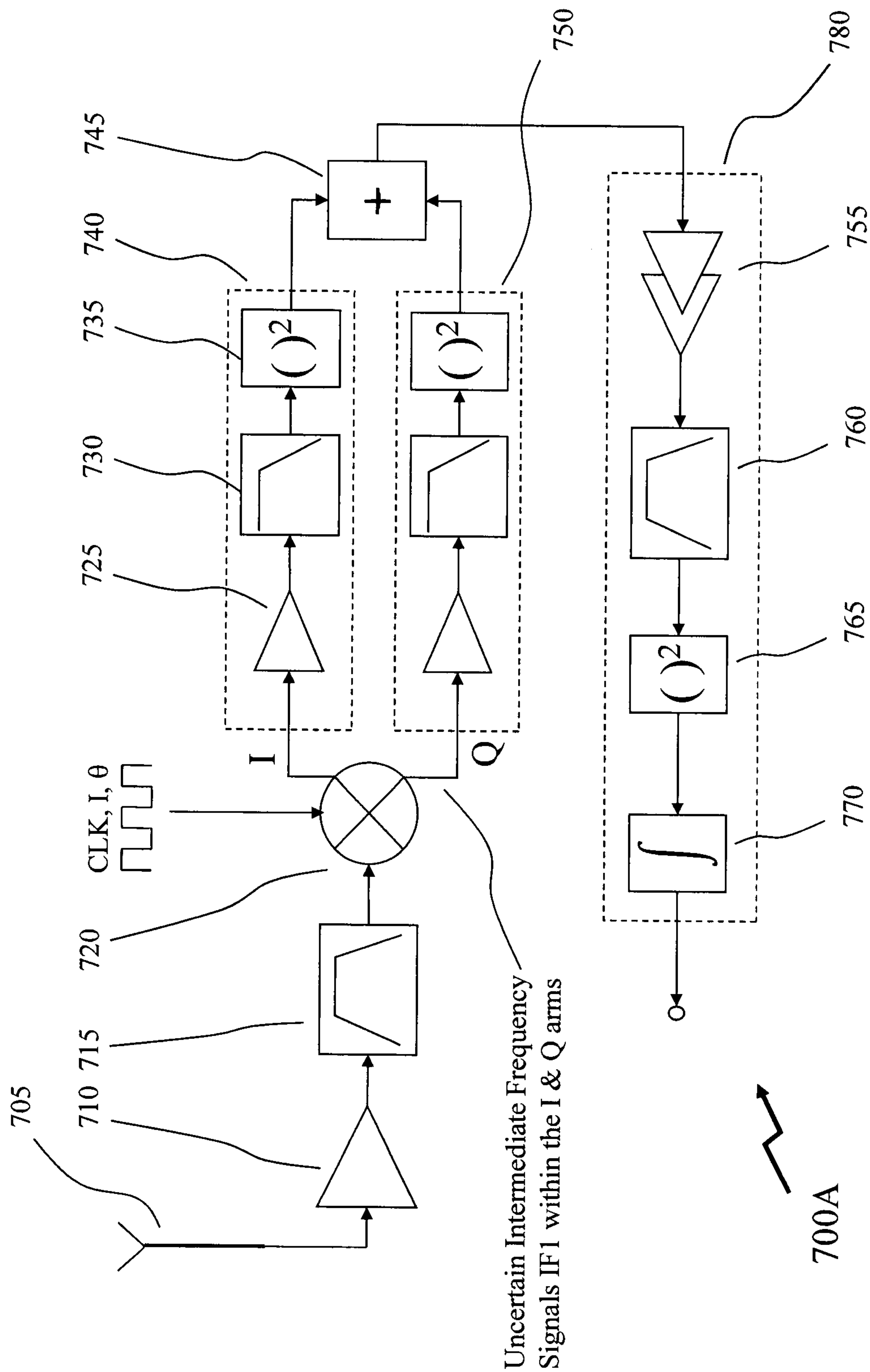


Figure 7A

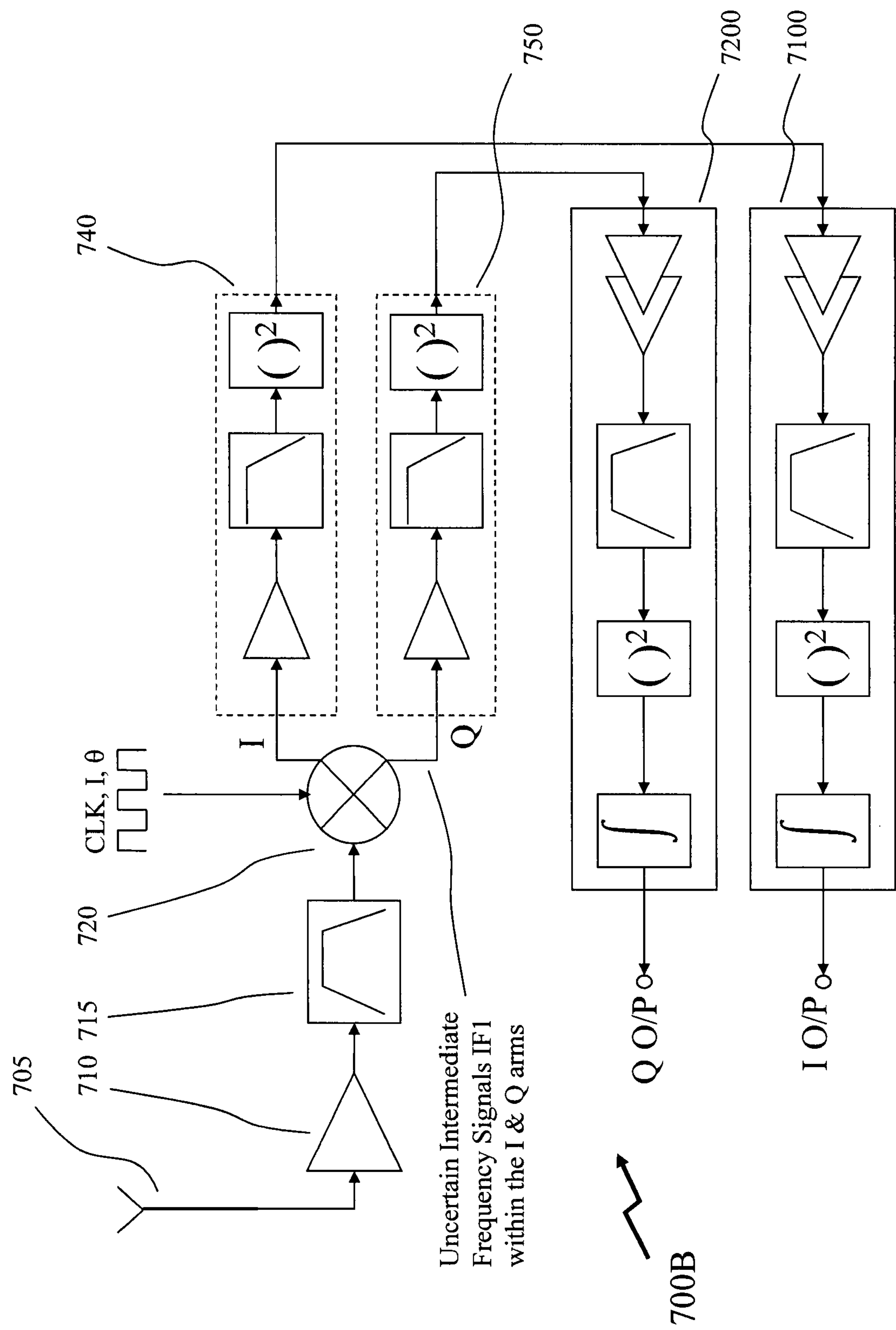


Figure 7B

| Decoded | Encoded | Decoded | Encoded |
|---------|---------|---------|---------|
| 0000    | 000000  | 1000    | 010001  |
| 0001    | 000011  | 1001    | 010010  |
| 0010    | 000101  | 1010    | 010100  |
| 0011    | 000110  | 1011    | 100010  |
| 0100    | 001001  | 1100    | 011000  |
| 0101    | 001010  | 1101    | 110000  |
| 0110    | 001100  | 1110    | 101000  |
| 0111    | 100100  | 1111    | 100001  |

Figure 8

| Modulation                     | OOK                                                                                   | 1-bit PPM                                                                             | 2-bit PPM                                                                             | 4-bit PPM                                                                             | Double PPM                                                                           | 'Invertable' OOK                                                                    |
|--------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Energy Cost (nJ/bit)           | 1                                                                                     | 2                                                                                     | 2                                                                                     | 4                                                                                     | 1.5                                                                                  | Between 1 and 1.1                                                                   |
| Worst-case Spectral Efficiency | 1 bit/pulse                                                                           | 1 bit/pulse                                                                           | 2 bit/pulse                                                                           | 4 bit/pulse                                                                           | 2 bit/pulse                                                                          | ~1.99... bit/pulse                                                                  |
| Link Robustness                |  |  |  |  |  |  |
| Design Complexity              | Ultra-low                                                                             | Low                                                                                   | Medium                                                                                | High                                                                                  | High                                                                                 | High                                                                                |

Figure 9

| Decoded | Encoded   | Decoded | Encoded   | Decoded | Encoded   | Decoded | Encoded   |
|---------|-----------|---------|-----------|---------|-----------|---------|-----------|
| 00000   | 000000001 | 01000   | 000100001 | 10000   | 001000001 | 11000   | 001100000 |
| 00001   | 000000011 | 01001   | 000100010 | 10001   | 001000010 | 11001   | 011000000 |
| 00010   | 000000101 | 01010   | 000101000 | 10010   | 001000100 | 11010   | 100000100 |
| 00011   | 000000110 | 01011   | 100100000 | 10011   | 010000010 | 11011   | 000100000 |
| 00100   | 000001001 | 01100   | 000110000 | 10100   | 001010000 | 11100   | 010100000 |
| 00101   | 000001010 | 01101   | 100000010 | 10101   | 100001000 | 11101   | 000001000 |
| 00110   | 000001100 | 01110   | 010001000 | 10110   | 101000000 | 11110   | 100000000 |
| 00111   | 010000100 | 01111   | 010000000 | 10111   | 001000000 | 11111   | 110000000 |

Figure 10

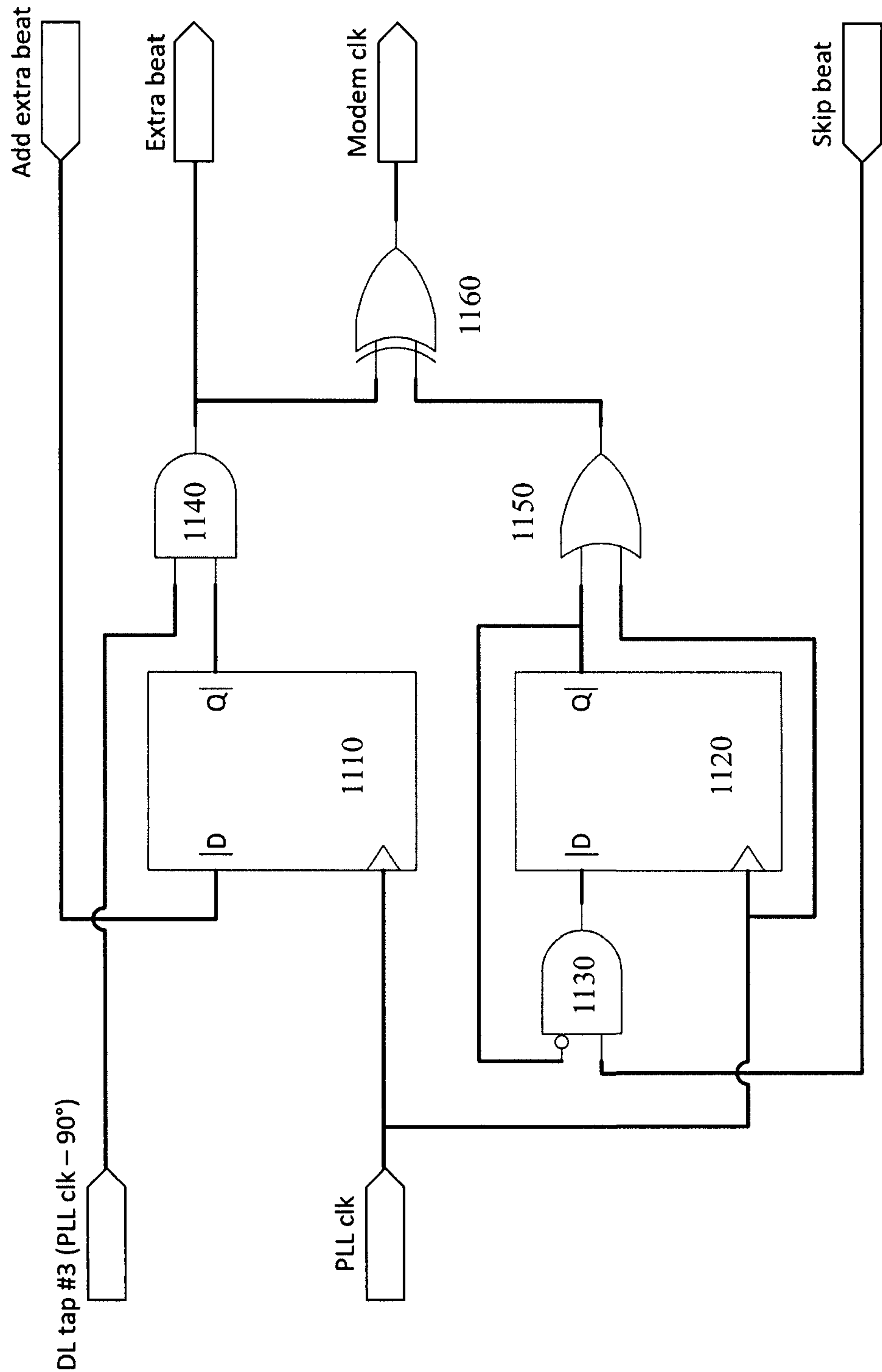


Figure 11

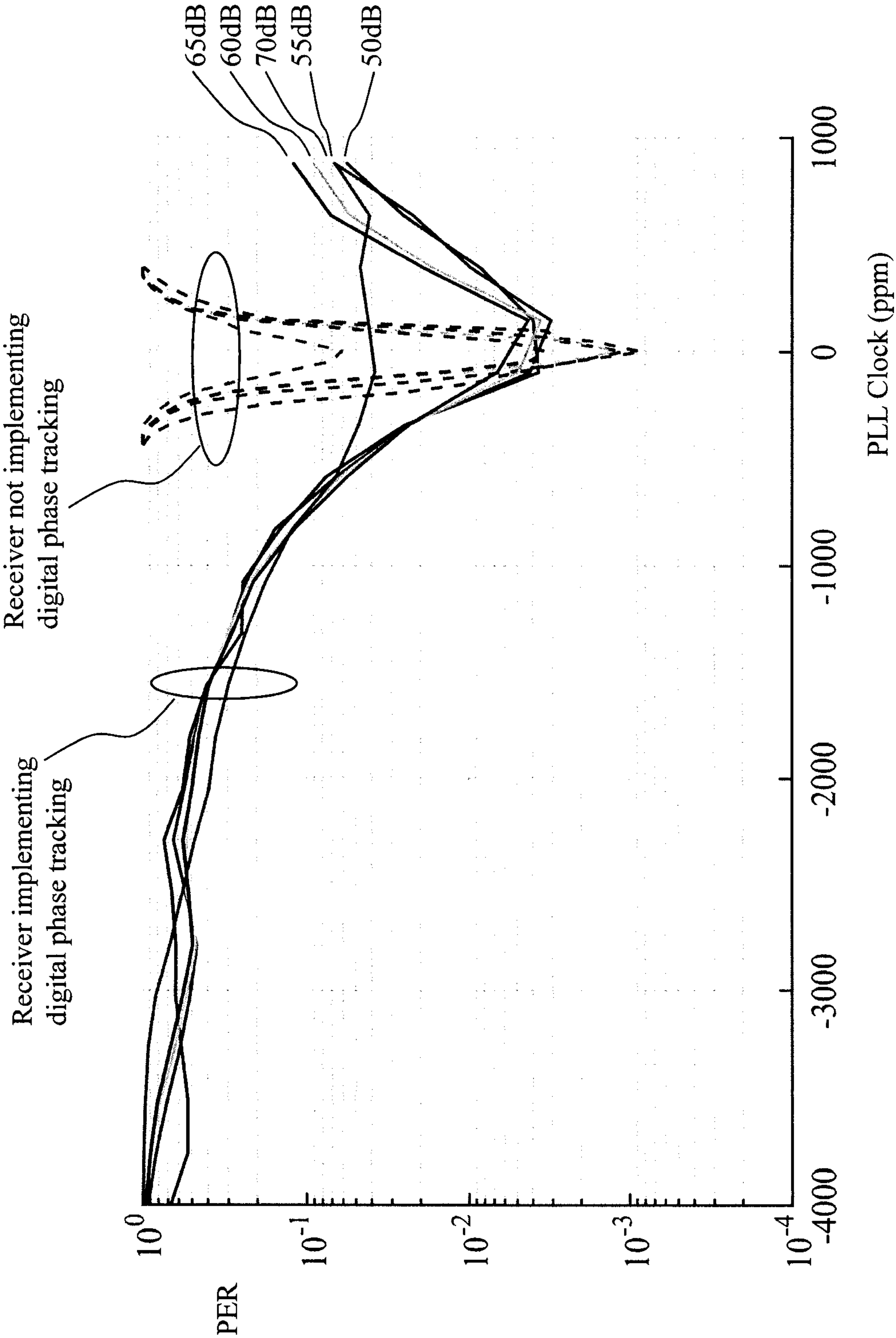


Figure 12

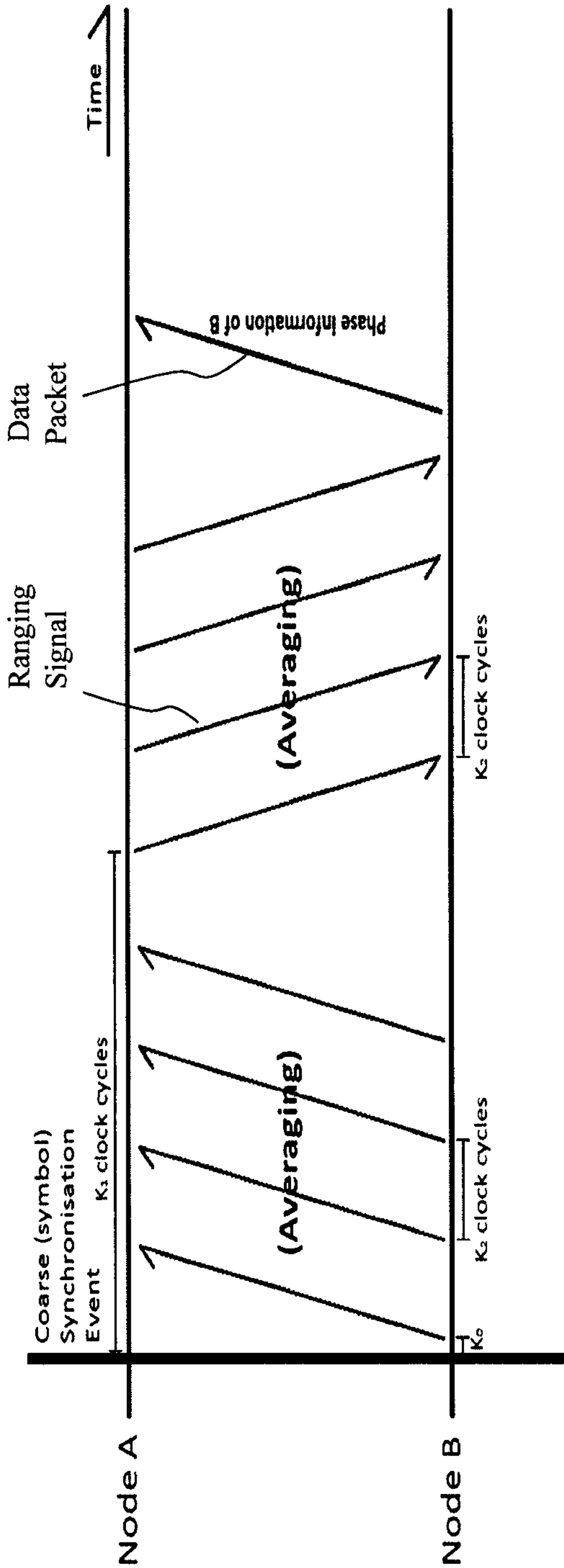


Figure 13

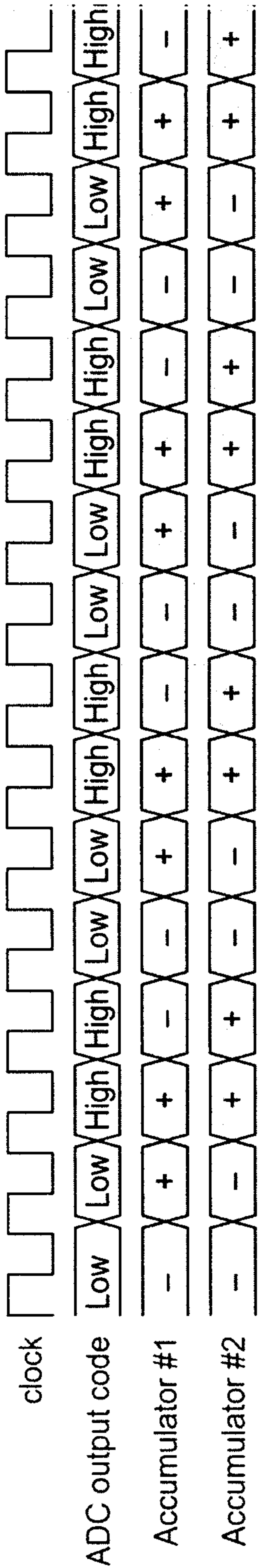


Figure 14

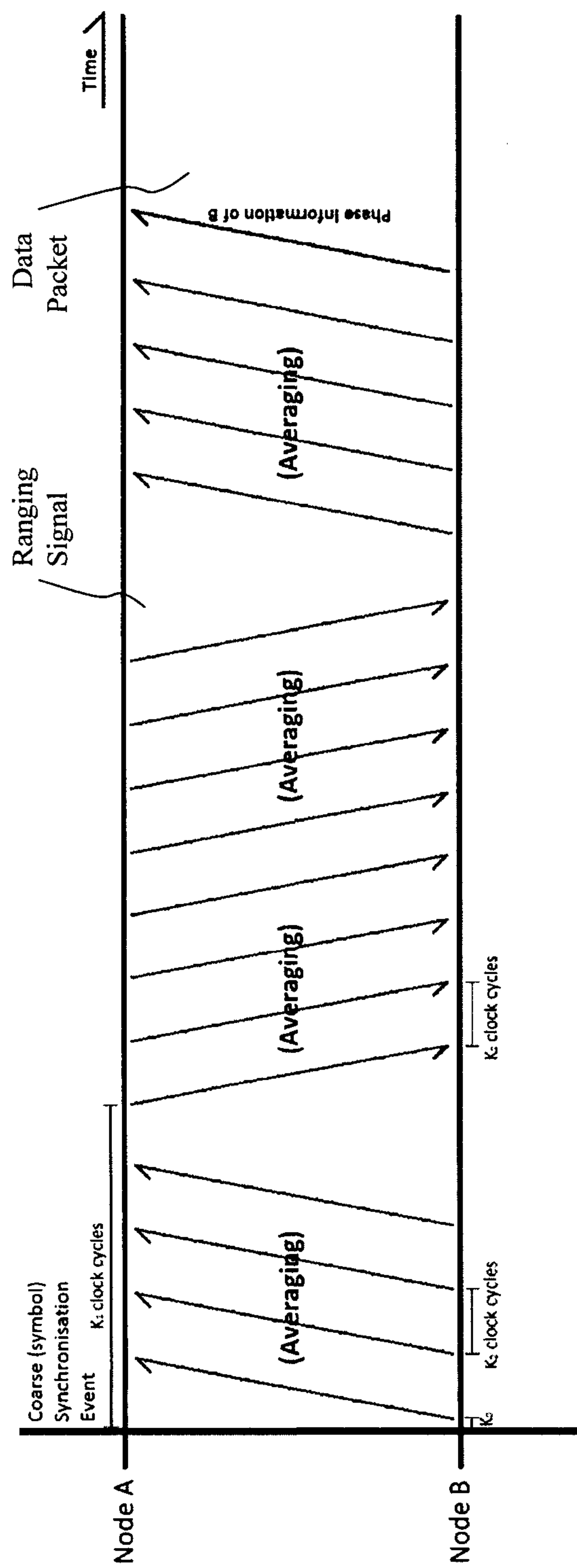


Figure 15

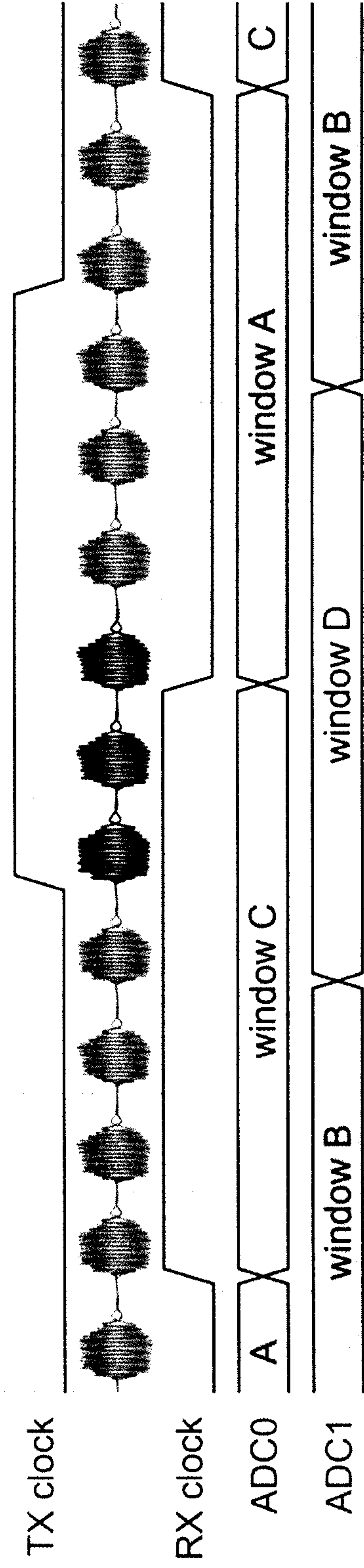


Figure 16

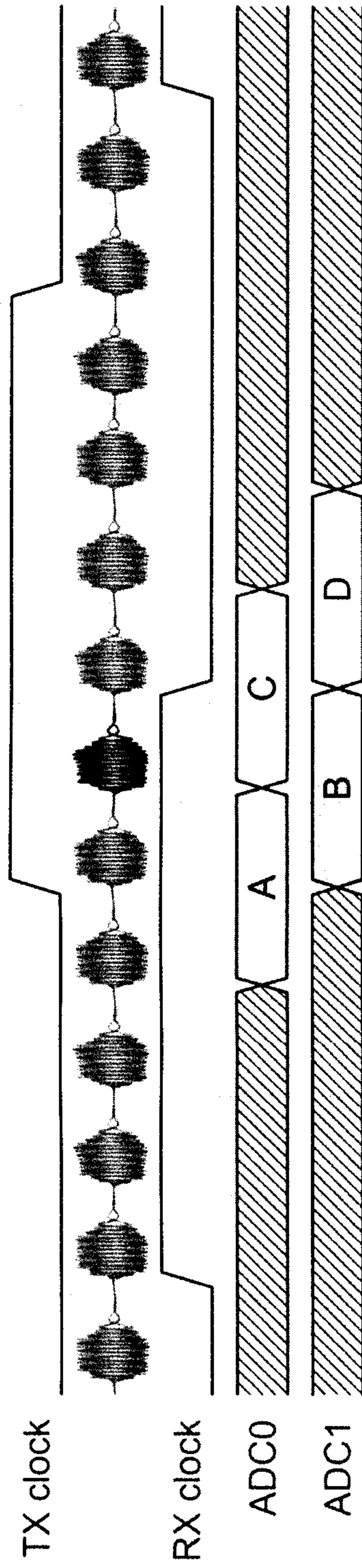
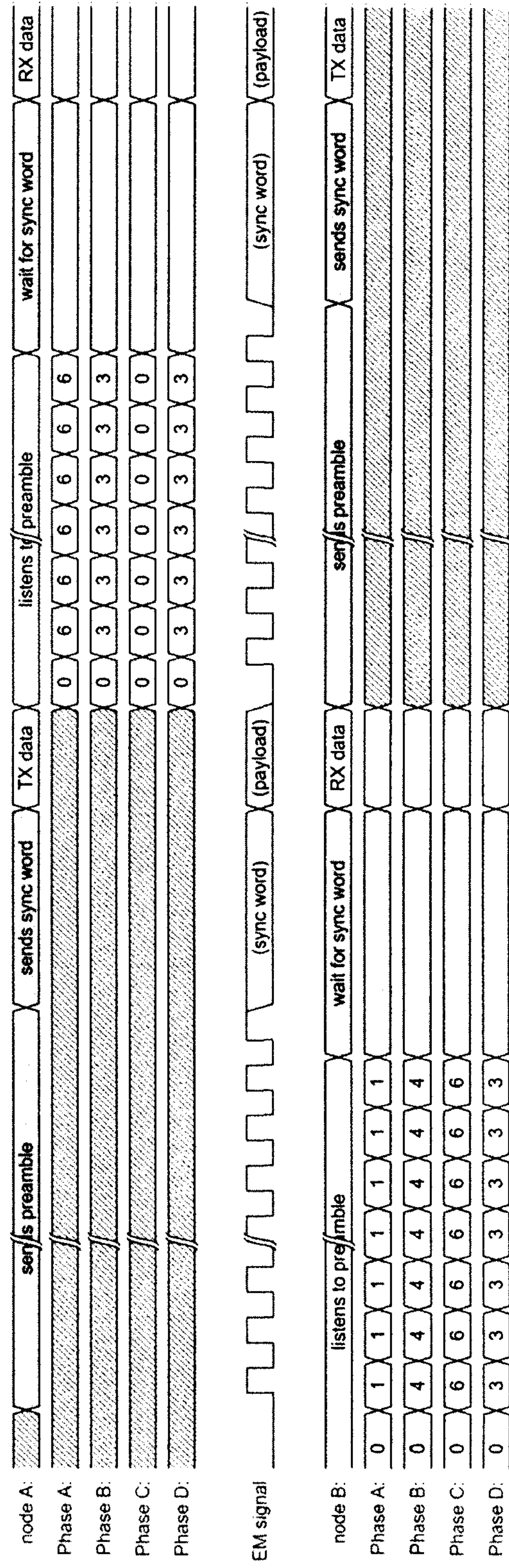


Figure 17



## Figure 18