42 in the interleaver buffer M,

8 bits (bit rows 0 to 7 in blocks) are sequentially read from top to bottom in the blocks in row 43 in the interleaver buffer M,

8 bits (bit rows 8 to 15 in the blocks) are sequentially read from top to bottom in the blocks in row 0 in the interleaver buffer M,

8 bits (bit rows 8 to 15 in the blocks) are sequentially read from top to bottom in the blocks in row 1 in the interleaver buffer M,

8 bits (bit rows 8 to 15 in the blocks) are sequentially read from top to bottom in the blocks in row 42 in the interleaver buffer M,

8 bits (bit rows 8 to 15 in the blocks) are sequentially read from top to bottom in the blocks in row 43 in the interleaver buffer M,

then, 8 bits (bit rows 0 to 7 in blocks) are sequentially read from top to bottom in the blocks in row 2 in the interleaver buffer M, and

..., until a total of 1344 bits in a current bit column in the interleaver buffer M are completely read out.

(4) Symbol mapping and polarization distribution:

Bit data output through OFEC interleaving is sent to the symbol mapping and polarization distribution to obtain a dual-polarization symbol. As shown in FIG. 4, two OFEC interleavers, OFEC interleaver 0 and OFEC interleaver 1, send, in a round-robin fashion, bits to symbol mapping by using 8 bits as a group. When dual-polarization 16QAM modulation (DP-16QAM) is used, every 8 bits $(b_0, b_1, b_2, b_3, b_4, b_5, b_6, b_7)$ are mapped to one DP-16QAM symbol in symbol mapping and polarization distribution. The following first symbol mapping scheme is considered: (b_0, b_2) is mapped to an I in-phase component (in-phase component) of X-polarization of the DP-16QAM symbol, denoted as XI; (b_4, b_6) is mapped to a Q component (quadrature-phase component) of the X-polarization of the DP-16QAM symbol, denoted as XQ; (b_1, b_3) is mapped to an I component (in-phase component) of Y-polarization of the DP-16QAM symbol, denoted as YI; and (b_5, b_7) is mapped to a Q component (quadrature-phase component) of the Y-polarization of the DP-16QAM symbol, denoted as YQ. In each signaling dimension (signaling dimension) XI/XQ/YI/YQ, 2 bits are mapped to corresponding symbol amplitude (symbol amplitude) in the following mapping manner:

$$(0,0) \rightarrow -3, \qquad (0,1) \rightarrow -1, \qquad (1,1) \rightarrow +1, \qquad (1,0) \rightarrow +3$$

In this case, b_0 and b_4 in the 8 bits $(b_0, b_1, b_2, b_3, b_4, b_5, b_6, b_7)$ are two sign bits (sign bits) in 16QAM in the X polarization direction, and b_2 and b_6 are two amplitude bits (amplitude bits) in 16QAM in the X polarization direction; and b_1 and b_5 are two sign bits (sign bits) in 16QAM in the Y polarization direction, and b_3 and b_7 are two amplitude bits (amplitude bits) in 16QAM

polarization symbol and Y polarization symbols to obtain one super-frame including 175104 dual-polarization symbols. A total of three super-frames are obtained, and then sent. Typically, the super-frame includes 74 RES reserved symbols.

It should be noted that, $d_{scr} \neq 336 \times k$, and $d_{scr} \times F_{Frame} = 336 \times k \times F_{DSP}$ is considered, where $F_{Frame} = 1$ and $F_{DSP} = 3$, the $F_{DSP} = 3$ super-frames may be used as a combination, so that the F_{DSP} super-frames correspond to $d_{scr} \times F_{Frame} = 4128768$ bits output through $F_{Frame} = 1$ first data processing. RES reserved symbols inserted into each super-frame are designed, so that a receiver can identify the $F_{DSP} = 3$ super-frames, to identify a boundary corresponding to the $d_{scr} \times F_{Frame} = 4128768$ bits output through the $F_{Frame} = 1$ first data processing.

It should be noted that a specific implementation of the "RES reserved symbols inserted into each super-frame are designed" is as follows: For the $F_{DSP} = 3$ super-frames, 22 consecutive RES reserved symbols in super-frame 0 are a specific first marker sequence (which may also be referred to as a first marker symbol), 22 consecutive RES reserved symbols in super-frame 1 and super-frame 2 are a specific second marker sequence (which may also be referred to as a second marker symbol), and the first marker sequence is different from the second marker sequence. After performing DSP super-frame alignment, a receiver may obtain a boundary of a combination of the $F_{DSP} = 3$ super-frames by identifying the first marker sequence and the second marker sequence. The first marker and the second marker may also be referred to as F_{DSP} super-frame alignment signals (F_{DSP} super-frame alignment signals). In this case, a remaining RES reserved symbol after the first marker or the second marker is removed is also referred to as a fixed stuff (Fixed Stuff, FS). In some specific implementations, specific values of the first marker sequence and the second marker sequence are shown in Table 4, and 16QAM symbols in two polarization directions corresponding to the first marker sequence and the second marker sequence may be obtained through 16QAM symbol mapping on the sequences.

Table 4

No.	First marker sequence		Second marker sequence	
	X polarization	Y polarization	X polarization	Y polarization
0	1000	0110	0001	0000
1	1101	1110	1010	1111
2	1011	1100	0110	1100
3	1000	1101	1100	0100
4	1111	1110	0100	0111