

CLAIMS

1. A bit interleaving method for interleaving bits of a codeword generated based on a quasi-cyclic low-density parity check coding scheme, including a repeat-accumulate quasi-cyclic low-density parity check coding scheme, the bit interleaving method comprising:

a cyclic block permutation step of applying a cyclic block permutation process to an $N \times Q$ -bit codeword made up of N cyclic blocks each consisting of Q bits, to reorder the cyclic blocks in accordance with a cyclic block permutation rule defining a reordering of the cyclic blocks;

a bit permutation step of applying a bit permutation process to the codeword after the cyclic block permutation process, to reorder the bits of the codeword in accordance with a bit permutation rule defining a reordering of the bits; and

a dividing step of dividing the codeword after the bit permutation process into a plurality of constellation words, each of the constellation words being made up of M bits, wherein

N is not a multiple of M , and

the bit permutation rule is equivalent to writing Q bits in each of $N' = N - X$ cyclic block row-wise into a matrix having M rows and then reading the Q bits column-wise, where X is a remainder of N divided by M .

2. A bit interleaver for interleaving bits of a codeword generated based on a quasi-cyclic low-density parity check coding scheme, including a repeat-accumulate quasi-cyclic low-density parity check coding scheme, the bit interleaver comprising:

a cyclic block permutator applying a cyclic block permutation process to an $N \times Q$ -bit codeword made up of N cyclic blocks each consisting of Q bits, to reorder the cyclic blocks in accordance with a cyclic block permutation rule defining a reordering of the cyclic blocks;

a bit permutator applying a bit permutation process to the codeword after the cyclic block permutation process, to reorder the bits of the codeword in accordance with a bit permutation rule defining a reordering of the bits; and

5 a divider dividing the codeword after the bit permutation process into a plurality of constellation words, each of the constellation words being made up of M bits, wherein

N is not a multiple of M, and

the bit permutation rule is equivalent to writing Q bits in each of $N' = N - X$ cyclic block row-wise into a matrix having M rows and then reading the Q bits
10 column-wise, where X is a remainder of N divided by M.

3. A signal processing method for processing a signal transmitted by modulating $N \times Q/M$ constellation words, the constellation words being generated by applying a bit reordering process to a codeword generated based on a quasi-cyclic low-density parity
15 check coding scheme, including a repeat-accumulate quasi-cyclic low-density parity check coding scheme, and dividing bits of the codeword for each M bits, the codeword being made up of N cyclic blocks each including Q bits,

the bit reordering process comprising:

a cyclic block permutation process of reordering the cyclic blocks of the
20 codeword in accordance with a cyclic block permutation rule defining a reordering of the cyclic blocks; and

a bit permutation process of reordering the bits of the codeword after the cyclic block permutation process in accordance with a bit permutation rule defining a reordering of the bits, wherein

25 N is not a multiple of M,

the bit permutation rule is equivalent to writing Q bits in each of $N' = N - X$

cyclic block row-wise into a matrix having M rows and then reading the Q bits column-wise, where X is a remainder of N divided by M , and

the signal processing method comprising:

5 a demodulating step of generating a demodulated signal by demodulating the signal, which has been transmitted by modulating the $N \times Q/M$ constellation words; and

a decoding step of decoding the demodulated signal in accordance with the cyclic block permutation rule and the bit permutation rule to generate data before coding according to the quasi-cyclic low-density parity check coding scheme.

10 4. A signal processor for processing a signal transmitted by modulating $N \times Q/M$ constellation words, the constellation words being generated by applying a bit reordering process to a codeword generated based on a quasi-cyclic low-density parity check coding scheme, including a repeat-accumulate quasi-cyclic low-density parity check coding scheme, and dividing bits of the codeword for each M bits, the codeword
15 being made up of N cyclic blocks each including Q bits,

the bit reordering process comprising:

a cyclic block permutation process of reordering the cyclic blocks of the codeword in accordance with a cyclic block permutation rule defining a reordering of the cyclic blocks; and

20 a bit permutation process of reordering the bits of the codeword after the cyclic block permutation process in accordance with a bit permutation rule defining a reordering of the bits, wherein

N is not a multiple of M ,

25 the bit permutation rule is equivalent to writing Q bits in each of $N' = N - X$ cyclic block row-wise into a matrix having M rows and then reading the Q bits column-wise, where X is a remainder of N divided by M , and

the signal processor comprising:

a demodulator generating a demodulated signal by demodulating the signal, which has been transmitted by modulating the $N \times Q/M$ constellation words; and

a decoder decoding the demodulated signal in accordance with the cyclic block permutation rule and the bit permutation rule to generate data before coding according to the quasi-cyclic low-density parity check coding scheme.

5