in a lower reception quality than that required for all the CWs (i.e., reception quality required for control information in the LTE system).

[0019] ~~Accordingly, it is an object~~ Embodiments of the present invention ~~to~~ provide a terminal capable of preventing the degradation of reception quality of control information even in a case of adopting the SU-MIMO transmission method, and also to provide a communication method thereof.

Solution to Problem

~~[0020] A first aspect of the present invention provides a terminal apparatus that transmits two code words to which control information is allocated, in a plurality of different layers, the apparatus including: a determination section that determines the amount of resource of the control information in each of the plurality of layers; and a transmission signal generating section that generates a transmission signal through modulation of the control information using the amount of the resource and allocation of the modulated control information to the two code words, in which the determination section determines the amount of the resource based on a lower coding rate of the coding rates of the two code words, or the average of the inverses of the coding rates of the two code words.~~

[0020] According to a first aspect of the present invention, there is provided a terminal apparatus that transmits control information on a plurality of layers, the apparatus comprising: a determining section that determines an amount of resource of the control information for each of the plurality of layers by multiplying a reciprocal of a total number of transmittable bits per resource element for all of the plurality of layers with a number of bits of the control information and with an offset amount; and a transmission section that transmits the control information using the determined amount of resource of the control information, wherein the total number of transmittable bits is calculated by adding a multiplying result of a first coding rate with a number of layers allocated to a first code word to a multiplying result of a second coding rate with a number of layers allocated to a second code word, the first coding rate being acquired by dividing a number of bits of the first code word by a first amount of resource of data signals for transmitting the first code word, and the second coding rate being acquired by dividing a number of bits of the second code word by a second amount of resource of data signals for transmitting the second code word.

[0220a] According to a second aspect of the present invention, there is provided a base station apparatus that receives control information on a plurality of layers, the apparatus comprising: a reception section that receives a signal including the control information; and a control information extracting section that determines an amount of resource of the control information for each of the plurality of layers by multiplying a reciprocal of a total number of transmittable bits per resource element for all of the plurality of layers with a number of bits of the control information and with an offset amount and extracts the control information from the received signal based on the determined amount of resource of the control information, wherein the total number of transmittable bits is calculated by adding a multiplying result of a first coding rate with a number of layers allocated to a first code word to a multiplying result of a second coding rate with a number of layers allocated to a second code word, the first coding rate being acquired by dividing a number of bits of the first code word by a first amount of resource of data signals for transmitting the first code word, and the second coding rate being acquired by dividing a number of bits of the second code word by a second amount of resource of data signals for transmitting the second code word.

~~[0021] A second aspect of the present invention provides a communication method including: determining an amount of resource of control information in each of a plurality of different layers in which two code words are transmitted, the control~~

~~information being allocated in the two code words; modulating the control information using the amount of the resource; and allocating the modulated control information in the two code words to generate a transmission signal, in which the amount of the resource is determined based on a lower coding rate of the coding rates of the two code words, or the average of the inverses of the coding rates of the two code words.~~

[0021] According to a third aspect of the present invention, there is provided a transmission method for transmitting control information on a plurality of layers, the method comprising: determining an amount of resource of the control information for each of the plurality of layers by multiplying a reciprocal of a total number of transmittable bits per resource element for all of the plurality of layers with a number of bits of the control information and with an offset amount; and transmitting the control information based on the amount of the resource of the control information, wherein the total number of transmittable bits is calculated by adding a multiplying result of a first coding rate with a number of layers allocated to a first code word to a multiplying result of a second coding rate with a number of layers allocated to a second code word, the first coding rate being acquired by dividing a number of bits of the first code word by a first amount of resource of data signals for transmitting the first code word, and the second coding rate being acquired by dividing a number of bits of the second code word by a second amount of resource of data signals for transmitting the second code word.

[0021a] According to a fourth aspect of the present invention, there is provided a reception method for receiving control information on a plurality of layers, the method comprising: receiving a signal including the control information; determining an amount of resource of the control information for each of the plurality of layers by multiplying a reciprocal of a total number of transmittable bits per resource element for all of the plurality of layers with a number of bits of the control information and with an offset amount; and extracting the control information from the received signal based on the determined amount of resource of the control information, wherein the total number of transmittable bits is calculated by adding a multiplying result of a first coding rate with a number of layers allocated to a first code word to a multiplying result of a second coding rate with a number of layers allocated to a second code word, the first coding rate being acquired by dividing a number of bits of the first code word by a first amount of resource of data signals for transmitting the first code word, and the second coding rate being acquired by dividing a number of bits of the second code word by a second amount of resource

of data signals for transmitting the second code word.

[0021b] According to a fifth aspect of the present invention, there is provided an integrated circuit for controlling a process comprising: determining an amount of resource of control information for each of a plurality of layers by multiplying a reciprocal of a total number of transmittable bits per resource element for all of the plurality of layers with a number of bits of the control information and with an offset amount; and transmitting the control information based on the amount of the resource of the control information, wherein the total number of transmittable bits is calculated by adding a multiplying result of a first coding rate with a number of layers allocated to a first code word to a multiplying result of a second coding rate with a number of layers allocated to a second code word, the first coding rate being acquired by dividing a number of bits of the first code word by a first amount of resource of data signals for transmitting the first code word, and the second coding rate being acquired by dividing a number of bits of the second code word by a second amount of resource of data signals for transmitting the second code word.

[0021c] According to a sixth aspect of the present invention, there is provided an integrated circuit for controlling a process comprising: receiving a signal including control information on a plurality of layers; determining an amount of resource of the control information for each of the plurality of layers by multiplying a reciprocal of a total number of transmittable bits per resource element for all of the plurality of layers with a number of bits of the control information and with an offset amount; and extracting the control information from the received signal based on the determined amount of resource of the control information, wherein the total number of transmittable bits is calculated by adding a multiplying result of a first coding rate with a number of layers allocated to a first code word to a multiplying result of a second coding rate with a number of layers allocated to a second code word, the first coding rate being acquired by dividing a number of bits of the first code word by a first amount of resource of data signals for transmitting the first code word, and the second coding rate being acquired by dividing a number of bits of the second code word by a second amount of resource of data signals for transmitting the second code word.

Advantageous Effects of Invention

[0022] ~~The~~Embodiments of the present invention can prevent the degradation of reception quality of control information even in a case of adopting the SU-MIMO transmission method.

Brief Description of Drawings

[0023]

FIG.1 shows a conventional allocation of ACKs/NACKs and CQIs;

FIG.2 is a diagram provided for describing a table containing candidates for an offset amount in the conventional case;

FIG.3 is a diagram provided for describing a technical problem;

FIG.4 is a block diagram showing the configuration of a base station according to Embodiment 1 of the present invention;

FIG.5 is a block diagram showing the configuration of a terminal according to Embodiment 1 of the present invention;

FIG.6 shows exemplary correction factors according to