

CLAIMS

[Claim 1]

A terminal that communicates with a base station, the terminal comprising:

a downlink control channel detecting unit that monitors a physical downlink control channel allocated in a physical downlink control channel region and an enhanced physical downlink control channel allocated in a physical downlink shared channel region different from the physical downlink control channel region;

a data extracting unit that, if the downlink control channel detecting unit has detected the enhanced physical downlink control channel, extracts transmit data on a physical downlink shared channel associated with the detected enhanced physical downlink control channel;

a response information generating unit that generates response information for the extracted transmit data;

an uplink control channel generating unit that generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was detected; and

a response transmitting unit that transmits a signal including the physical uplink control channel.

[Claim 2]

The terminal according to claim 1, wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined based on an index of the enhanced physical downlink control channel resource and an individual shift value configured individually for each terminal.

[Claim 3]

The terminal according to claim 1, further comprising:
a higher layer control information acquiring unit that acquires control information including a parameter indicating an individual shift value configured individually for each terminal;

wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined by adding the individual shift value to an index of the enhanced physical downlink control channel resource.

[Claim 4]

The terminal according to claim 3,
wherein the higher layer control information acquiring unit acquires control information including a parameter indicating a common shift value configured in common for all

terminals, and

wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to the physical uplink control channel resource that has an index of a value obtained by adding the individual shift value and the common shift value to the index of the enhanced physical downlink control channel resource.

[Claim 5]

The terminal according to claim 1, wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined by adding an individual shift value configured for a slot in which the enhanced physical downlink control channel was detected to an index of the enhanced physical downlink control channel resource.

[Claim 6]

The terminal according to claim 1, further comprising:
a higher layer control information acquiring unit that acquires control information including a parameter indicating a plurality of individual shift values configured individually for each terminal;

wherein the downlink control channel detecting unit extracts one of the plurality of individual shift values

which is indicated by the detected enhanced physical downlink control channel, and

wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined by adding the extracted individual shift value to the index of the enhanced physical downlink control channel resource.

[Claim 7]

A base station that communicates with a terminal, the base station comprising:

a physical control information notification unit that notifies the terminal of an enhanced physical downlink control channel allocated in a physical downlink shared channel region; and

a response information receiving unit that extracts a physical uplink control channel to which response information for transmit data on a physical downlink shared channel associated with the enhanced physical downlink control channel is mapped, from a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was allocated.

[Claim 8]

The base station according to claim 7, wherein the

response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined based on an index of the enhanced physical downlink control channel resource and an individual shift value configured individually for each terminal.

[Claim 9]

The base station according to claim 7, further comprising:

a higher layer control information notification unit that notifies the terminal of control information including a parameter indicating an individual shift value configured individually for each terminal;

wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined by adding the individual shift value to an index of the enhanced physical downlink control channel resource.

[Claim 10]

The base station according to claim 9,

wherein the higher layer control information notification unit broadcasts control information including a parameter indicating a common shift value configured in common for all terminals, and

wherein the response information receiving unit

extracts the physical uplink control channel from a physical uplink control channel resource that has an index of a value obtained by adding the individual shift value and the common shift value to the index of the enhanced physical downlink control channel resource.

[Claim 11]

The base station according to claim 7, wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined by adding an individual shift value configured for a slot in which the enhanced physical downlink control channel was detected to an index of the enhanced physical downlink control channel resource.

[Claim 12]

The base station according to claim 7, further comprising:

a higher layer control information notification unit that notifies the terminal of control information including a parameter indicating a plurality of individual shift values configured individually for each terminal;

wherein the physical control information notification unit notifies the enhanced physical downlink control channel that indicates one of the plurality of individual shift values, and

wherein the response information receiving unit

extracts the physical uplink control channel from a physical uplink control channel resource which is determined by adding the individual shift value to an index of the enhanced physical downlink control channel resource.

[Claim 13]

A communications system in which communication is performed between a base station and a terminal,

wherein the terminal comprises:

a downlink control channel detecting unit that monitors an enhanced physical downlink control channel allocated in a physical downlink shared channel region,

a data extracting unit that, if the downlink control channel detecting unit has detected the enhanced physical downlink control channel, extracts transmit data on a physical downlink shared channel associated with the detected enhanced physical downlink control channel,

a response information generating unit that generates response information for the extracted transmit data,

an uplink control channel generating unit that generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was detected, and

a response transmitting unit that transmits a signal including the physical uplink control channel, and wherein the base station comprises:

a physical control information notification unit that notifies the terminal of the enhanced physical downlink control channel, and

a response information receiving unit that extracts a physical uplink control channel to which response information for the transmit data on the physical downlink shared channel associated with the enhanced physical downlink control channel is mapped, from a physical uplink control channel resource corresponding to the enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was allocated.

[Claim 14]

A communication method for a terminal that communicates with a base station, the method comprising:

a step of monitoring a physical downlink control channel allocated in a physical downlink control channel region and an enhanced physical downlink control channel allocated in a physical downlink shared channel region different from the physical downlink control channel region;

a step of, if the enhanced physical downlink control channel has been detected, extracting transmit data on a physical downlink shared channel associated with the

detected enhanced physical downlink control channel;

a step of generating response information for the extracted transmit data;

a step of generating a physical uplink control channel by mapping the response information to a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was detected; and

a step of transmitting a signal including the physical uplink control channel.

[Claim 15]

A communication method for a base station that communicates with a terminal, the method comprising:

a step of notifying the terminal of an enhanced physical downlink control channel allocated in a physical downlink shared channel region; and

a step of extracting a physical uplink control channel to which response information for transmit data on a physical downlink shared channel associated with the enhanced physical downlink control channel is mapped, from a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was allocated.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A terminal that communicates with a base station, the terminal comprising:

a downlink control channel detecting unit that monitors a physical downlink control channel allocated in a physical downlink control channel region and an enhanced physical downlink control channel allocated in a region different from the physical downlink control channel region;

a data extracting unit that, if the downlink control channel detecting unit has detected the enhanced physical downlink control channel, extracts transmit data on a physical downlink shared channel associated with the detected enhanced physical downlink control channel;

a response information generating unit that generates response information for the extracted transmit data;

an uplink control channel generating unit that generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was detected; and

a response transmitting unit that transmits a signal including the physical uplink control channel.

2. (Currently Amended) The terminal according to claim 1, wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined based on at least an index of an element constructing the enhanced physical downlink control channel resource and an individual shift value configured individually for each terminal.

3. (Currently Amended) The terminal according to claim 1, further comprising:

a higher layer control information acquiring unit that acquires control information including a parameter indicating an individual shift value configured individually for each terminal;

wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined by adding at least the individual shift value to an index of an element constructing the enhanced physical downlink control channel resource.

4. (Currently Amended) The terminal according to claim 1,

~~wherein the higher layer control information acquiring unit acquires control information including a parameter indicating a common shift value configured in common for all terminals, and~~

wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to the physical uplink control channel resource that has an index of a value obtained by adding an individual shift value which is terminal-specifically configured and a common shift value which is terminal-commonly configured to an index of an element constructing the enhanced physical downlink control channel resource.

5. (Currently Amended) The terminal according to claim 1, wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined from at least an index of an element the enhanced physical downlink control channel resource and an individual shift value configured for a transmission port at which the enhanced physical downlink control channel was detected.

6. (Currently Amended) The terminal according to claim 1, further comprising:

a higher layer control information acquiring unit that acquires control information including a parameter indicating a plurality of individual shift values configured individually for each terminal;

wherein the downlink control channel detecting unit extracts one of the plurality of individual shift values which is indicated by the detected enhanced physical downlink control channel, and

wherein the uplink control channel generating unit generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource which is determined by adding at least the extracted individual shift value to an index of an element constructing the enhanced physical downlink control channel resource.

7. (Currently Amended) A base station that communicates with a terminal, the base station comprising:

a physical control information notification unit that notifies the terminal of an enhanced physical downlink control channel allocated in a region different from a physical downlink control channel region in which a physical downlink control channel is allocated; and

a response information receiving unit that extracts a physical uplink control channel to which response

information for transmit data on a physical downlink shared channel associated with the enhanced physical downlink control channel is mapped, from a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was allocated.

8. (Currently Amended) The base station according to claim 7, wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined based on at least an index of an element constructing the enhanced physical downlink control channel resource and an individual shift value configured individually for each terminal.

9. (Currently Amended) The base station according to claim 7, further comprising:

a higher layer control information notification unit that notifies the terminal of control information including a parameter indicating an individual shift value configured individually for each terminal;

wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined by adding at least the individual shift value to an index of an

element constructing the enhanced physical downlink control channel resource.

10. (Currently Amended) The base station according to claim 7,

~~wherein the higher layer control information notification unit broadcasts control information including a parameter indicating a common shift value configured in common for all terminals, and~~

wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource that has an index of a value obtained by adding an individual shift value which is terminal-specifically configured and a common shift value which is terminal-commonly configured to an index of an element constructing the enhanced physical downlink control channel resource.

11. (Currently Amended) The base station according to claim 7, wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined from at least an index of an element constructing the enhanced physical downlink control channel resource and the an individual shift value configured for a transmission port at

which the enhanced physical downlink control channel was detected.

12. (Currently Amended) The base station according to claim 7, further comprising:

a higher layer control information notification unit that notifies the terminal of control information including a parameter indicating a plurality of individual shift values configured individually for each terminal;

wherein the physical control information notification unit notifies the enhanced physical downlink control channel that indicates one of the plurality of individual shift values, and

wherein the response information receiving unit extracts the physical uplink control channel from a physical uplink control channel resource which is determined by adding at least the individual shift value to an index of an element constructing the enhanced physical downlink control channel resource.

13. (Currently Amended) A communications system in which communication is performed between a base station and a terminal,

wherein the terminal comprises:

a downlink control channel detecting unit that

monitors an enhanced physical downlink control channel allocated in a region different from a physical downlink control channel region in which a physical downlink control channel is allocated;

a data extracting unit that, if the downlink control channel detecting unit has detected the enhanced physical downlink control channel, extracts transmit data on a physical downlink shared channel associated with the detected enhanced physical downlink control channel,

a response information generating unit that generates response information for the extracted transmit data,

an uplink control channel generating unit that generates a physical uplink control channel by mapping the response information to a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was detected, and

a response transmitting unit that transmits a signal including the physical uplink control channel, and

wherein the base station comprises:

a physical control information notification unit that notifies the terminal of the enhanced physical downlink control channel, and

a response information receiving unit that

extracts a physical uplink control channel to which response information for the transmit data on the physical downlink shared channel associated with the enhanced physical downlink control channel is mapped, from a physical uplink control channel resource corresponding to the enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was allocated.

14. (Currently Amended) A communication method for a terminal that communicates with a base station, the method comprising:

a step of monitoring a physical downlink control channel allocated in a physical downlink control channel region and an enhanced physical downlink control channel allocated in a region different from the physical downlink control channel region;

a step of, if the enhanced physical downlink control channel has been detected, extracting transmit data on a physical downlink shared channel associated with the detected enhanced physical downlink control channel;

a step of generating response information for the extracted transmit data;

a step of generating a physical uplink control channel by mapping the response information to a physical uplink control channel resource corresponding to an enhanced

physical downlink control channel resource in which the enhanced physical downlink control channel was detected; and
a step of transmitting a signal including the physical uplink control channel.

15. (Currently Amended) A communication method for a base station that communicates with a terminal, the method comprising:

a step of notifying the terminal of an enhanced physical downlink control channel allocated in a region different from a physical downlink control channel region in which a physical downlink control channel is allocated; and

a step of extracting a physical uplink control channel to which response information for transmit data on a physical downlink shared channel associated with the enhanced physical downlink control channel is mapped, from a physical uplink control channel resource corresponding to an enhanced physical downlink control channel resource in which the enhanced physical downlink control channel was allocated.

CLAIMS

1. A terminal apparatus configured to communicate with a base station apparatus, the terminal apparatus comprising:
 - a downlink control channel detecting unit configured to detect an enhanced physical downlink control channel (EPDCCH); and
 - a response transmitting unit configured to transmit HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission indicated by a detection of the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH and a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH.
2. A terminal apparatus configured to communicate with a base station apparatus, the terminal apparatus comprising:
 - a downlink control channel detecting unit configured to detect an enhanced physical downlink control channel (EPDCCH); and
 - a response transmitting unit configured to transmit HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission indicated by a detection of the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH, a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH, and a value which is configured for each terminal by dedicated RRC signaling.
3. The terminal apparatus according to claim 1, wherein
 - the PUCCH resource is determined further on the basis of at least a value which is determined from an antenna port used for the EPDCCH transmission.
4. The terminal apparatus according to claim 1, wherein
 - the PUCCH resource is determined further on the basis of at least a value which is configured by dedicated RRC signaling and a value which is determined from an antenna port used for the EPDCCH transmission.

5. The terminal apparatus according to claim 1, wherein

the downlink control channel detecting unit is configured to detect a PDCCH, and

the response transmitting unit is configured to transmit HARQ response information using a PUCCH resource for a PDSCH transmission indicated by a detection of the PDCCH, the PUCCH resource being determined on the basis of at least a lowest index of an element constructing the PDCCH and a value which is common in a cell.

6. The terminal apparatus according to claim 1, wherein

the lowest index of the element constructing the EPDCCH is an index of an initial element among elements constructing the EPDCCH.

7. A base station apparatus configured to communicate with a terminal apparatus, the base station apparatus comprising:

a physical control information notification unit configured to transmit an enhanced physical downlink control channel (EPDCCH); and

a response information receiving unit configured to receive HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission associated with the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH and a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH.

8. A base station apparatus configured to communicate with a terminal apparatus, the base station apparatus comprising:

a physical control information notification unit configured to transmit an enhanced physical downlink control channel (EPDCCH); and

a response information receiving unit configured to receive HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission associated with the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH, a value which is determined, within a plurality of values, from a field in downlink control

information of the EPDCCH, and a value which is configured for each terminal by dedicated RRC signaling.

9. The base station apparatus according to claim 7, wherein

the PUCCH resource is determined further on the basis of at least a value which is determined from an antenna port used for the EPDCCH transmission.

10. The base station apparatus according to claim 7, wherein

the PUCCH resource is determined further on the basis of at least a value which is configured by dedicated RRC signaling and a value which is determined from an antenna port used for the EPDCCH transmission.

11. The base station apparatus according to claim 7, wherein

the physical control information notification unit is configured to transmit a PDCCH, and the response information receiving unit is configured to receive HARQ response information using a PUCCH resource for a PDSCH transmission associated with the PDCCH, the PUCCH resource being determined on the basis of at least a lowest index of an element constructing the PDCCH and a value which is common in a cell.

12. The base station apparatus according to claim 7, wherein

the lowest index of the element constructing the EPDCCH is an index of an initial element among elements constructing the EPDCCH.

13. An integrated circuit used in a terminal apparatus communicating with a base station apparatus, the integrated circuit comprising:

detecting an enhanced physical downlink control channel (EPDCCH); and transmitting HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission indicated by a detection of the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH and a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH.

14. An integrated circuit used in a base station apparatus communicating with a terminal apparatus, the integrated circuit comprising:

- transmitting an enhanced physical downlink control channel (EPDCCH); and
- receiving HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission associated with the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH and a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH.

15. A communication method used in a terminal apparatus communicating with a base station apparatus, the communication method comprising:

- detecting an enhanced physical downlink control channel (EPDCCH); and
- transmitting HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission indicated by a detection of the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH and a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH.

16. A communication method used in a base station apparatus communicating with a terminal apparatus, the communication method comprising:

- transmitting an enhanced physical downlink control channel (EPDCCH); and
- receiving HARQ response information using a physical uplink control channel (PUCCH) resource for a physical downlink shared channel (PDSCH) transmission associated with the EPDCCH, the PUCCH resource being determined on the basis of at least the sum of a value based on a lowest index of an element constructing the EPDCCH, a value which is determined, within a plurality of values, from a field in downlink control information of the EPDCCH, and a value which is configured for each terminal by dedicated RRC signaling.