

Claims

1. A method comprising:

5 receiving common physical uplink control channel configuration information at a user device from a base station, said common physical uplink control channel configuration information being associated with a subset of acknowledgement resources in a cell;

10 determining in dependence on said common physical uplink control channel configuration information which of the acknowledgement resources is to be used in association with an ACK/NACK resource indicator; and

causing transmission by the user device of an acknowledgement on an acknowledgement resource being associated with a received ACK/NACK resource indicator value;

15 wherein the common physical uplink control channel configuration information is received at the user device during initial access when radio resource control connection has not yet been established.

2. A method as claimed in claim 1, wherein the common physical uplink control channel configuration information is received via system information.

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3. A method as claimed in claim 1 or 2, wherein the method further comprises receiving a physical downlink control channel assignment for downlink transmission including the ACK/NACK resource indicator value.

25 4. A method as claimed in any preceding claim, wherein the acknowledgement is transmitted in response to a contention resolution message of a random access procedure.

30 5. A method as claimed in any preceding claim, comprising subsequently receiving dedicated acknowledgment resource information and causing transmission by the user device of an acknowledgment in a resource associated with said dedicated acknowledgement resource information.

6. A method as claimed in any preceding claim, wherein acknowledgement resource information of the common physical uplink control channel configuration information comprises one or more of:

- 5 - physical uplink control channel channelization structure defining one or more sets of parallel HARQ-ACK resources;
- index of a first resource to be used for HARQ-ACK;
- first physical uplink control channel interlace to be used for HARQ-ACK;
- 10 - number of physical uplink control channel interlaces to be used for HARQ-ACK;
- a supported physical uplink control channel format;
- a HARQ-ACK bundling scheme to be applied.

15 7. A method as claimed in any preceding claim, wherein the acknowledgement comprises a hybrid automatic repeat request acknowledgement on a physical uplink control channel.

20 8. A method as claimed in any preceding claim, wherein said subset of acknowledgement resources comprises at least one resource index in an orthogonal resource space.

9. A method comprising:

causing common physical uplink control channel configuration information

25 to be transmitted from a base station to a user device, said common physical uplink control channel configuration information being associated with a subset of acknowledgement resources in a cell; and

receiving at said base station from said user device in the subset of acknowledgement resources an acknowledgement on an acknowledgement

30 resource being associated with an ACK/NACK resource indicator value;

wherein the common physical uplink control channel configuration information is transmitted to the user device during initial access when radio resource control connection has not yet been established.

5 10. A method as claimed in claim 9, wherein the common physical uplink control channel configuration information is transmitted via system information.

11. A method as claimed in claim 9 or 10, wherein the acknowledgement is received in response to a physical downlink control channel assignment for
10 downlink transmission including the ACK/NACK resource indicator value to the user device.

12. A method as claimed in any one of claims 9 to 11, wherein the acknowledgement on said acknowledgement resource is received in response to
15 a contention resolution message of a random access procedure to the user device.

13. A method as claimed in claim 11 or 12, comprising subsequently transmitting dedicated acknowledgment resource information to the user device
20 and receiving of an acknowledgment in a resource associated with said dedicated acknowledgment resource information from the user device.

14. A method as claimed in any of claims 9 to 13, wherein acknowledgement resource information of the common physical uplink control channel configuration
25 information comprises one or more of:

- physical uplink control channel channelization structure defining one or more sets of parallel HARQ-ACK resources;
- index of a first resource to be used for HARQ-ACK;
- first physical uplink control channel interlace to be used for HARQ-
30 ACK;
- number of physical uplink control channel interlaces to be used for HARQ-ACK;

- a supported physical uplink control channel format;
- a HARQ-ACK bundling scheme to be applied.

15. A method as claimed in any one of claims 9 to 14, wherein the
5 acknowledgment comprises a hybrid automatic repeat request acknowledgement
on a physical uplink control channel.

16. A method as claimed in any one of claims 9 to 15, wherein the subset
acknowledgement resources comprises at least one resource index in an
10 orthogonal resource space.

17. An apparatus in a user device, the apparatus comprising at least one
processor, and at least one memory including computer program code, wherein
the at least one memory and the computer program code are configured, with the
15 at least one processor, to:

receive common physical uplink control channel configuration information
from a base station, said common physical uplink control channel configuration
information being associated with a subset of acknowledgement resources in a
cell;

20 determine in dependence on said common physical uplink control channel
configuration information which of the common acknowledgement resources is to
be used in association with an ACK/NACK resource indicator; and

cause transmission of an acknowledgement on an acknowledgement
resource associated with a received ACK/NACK indicator value;

25 wherein the common physical uplink control channel configuration
information is received at the user device during initial access when radio
resource control connection has not yet been established.

18. An apparatus as claimed in claim 17, wherein the common physical uplink
30 control channel configuration information is received via system information.

19. An apparatus as claimed in claim 17 or 18, wherein the at least one memory and the computer program code are further configured, with the at least one processor, to receive a physical downlink control channel assignment for downlink transmission including the ACK/NACK resource indicator value.

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20. An apparatus as claimed in any one of claims 17 to 19, wherein the acknowledgement is transmitted in response to a contention resolution message of a random access procedure.

10 21. An apparatus as claimed in any one of claims 17 to 20, wherein the at least one memory and the computer program code are further configured, with the at least one processor to subsequently receive dedicated acknowledgment resource information and cause transmission by the user device of an acknowledgment in a resource associated with said dedicated acknowledgment resource information.

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22. An apparatus as claimed in any one of claims 17 to 21, wherein acknowledgement resource information of the common physical uplink control channel configuration information comprises one or more of:

- 20 - physical uplink control channel channelization structure defining one or more sets of parallel HARQ-ACK resources;
- index of a first resource to be used for HARQ-ACK;
- first physical uplink control channel interlace to be used for HARQ-ACK;
- 25 - number of physical uplink control channel interlaces to be used for HARQ-ACK;
- a supported physical uplink control channel format;
- a HARQ-ACK bundling scheme to be applied.

30 23. An apparatus as claimed in any one of claims 17 to 22, wherein the acknowledgement comprises a hybrid automatic repeat request acknowledgement on a physical uplink control channel.

24. An apparatus as claimed in any one of claims 17 to 23, wherein said subset of acknowledgement resources comprises at least one resource index in an orthogonal resource space.

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25. An apparatus in a base station, the apparatus comprising at least one processor, and at least one memory including computer program code, wherein the at least one memory and the computer program code are configured, with the at least one processor, to:

10 cause common physical uplink control channel configuration information to be transmitted to a user device, said common physical uplink control channel configuration information being associated with a subset of acknowledgement resources in a cell; and

 receive from said user device in the subset of acknowledgement resources
15 an acknowledgement on an acknowledgement resource being associated with an ACK/NACK resource indicator value;

 wherein the common physical uplink control channel configuration information is transmitted to the user device during initial access when radio resource control connection has not yet been established.

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26. An apparatus as claimed in claim 25, wherein the common physical uplink control channel configuration information is transmitted via system information.

27. An apparatus as claimed in claim 25 or 26, wherein the acknowledgement
25 is received in response to a physical downlink control channel assignment for downlink transmission including the ACK/NACK resource indicator value to the user device.

28. An apparatus as claimed in any one of claims 25 to 27, wherein the
30 acknowledgement on said acknowledgement resource is received in response to a contention resolution message of a random access procedure to the user device.

29. An apparatus as claimed in claim 27 or 28, wherein the at least one memory and the computer program code are further configured, with the at least one processor to subsequently transmit dedicated acknowledgment resource information to the user device and receive an acknowledgment in a resource associated with said dedicated acknowledgement resource information from the user device.
30. An apparatus as claimed in any of claims 25 to 29, wherein acknowledgment resource information of the common physical uplink control channel configuration information comprises one or more of:
- physical uplink control channel channelization structure defining one or more sets of parallel HARQ-ACK resources;
 - index of a first resource to be used for HARQ-ACK;
 - first physical uplink control channel interlace to be used for HARQ-ACK;
 - number of physical uplink control channel interlaces to be used for HARQ-ACK;
 - a supported physical uplink control channel format;
 - a HARQ-ACK bundling scheme to be applied.
31. An apparatus as claimed in any one of claims 25 to 30, wherein the acknowledgment comprises a hybrid automatic repeat request acknowledgement on a physical uplink control channel.
32. An apparatus as claimed in any one of claims 25 to 31, wherein the subset acknowledgement resources comprises at least one resource index in an orthogonal resource space.
33. A computer program comprising program code means adapted to perform the steps of any of claims 1 to 16 when the program is run on a data processing apparatus.