Claim No. HP-2019-000006

IN THE HIGH COURT OF JUSTICE
BUSINESS AND PROPERTY COURTS OF ENGLAND AND WALES
INTELLECTUAL PROPERTY LIST (ChD)
PATENTS COURT

B E T W E E N:

(1) OPTIS CELLULAR TECHNOLOGY LLC

(A company incorporated under the laws of the State of Delaware)

(2) OPTIS WIRELESS TECHNOLOGY LLC

(A company incorporated under the laws of the State of Delaware)

(3) UNWIRED PLANET INTERNATIONAL LIMITED

(A company incorporated under the laws of the Republic of Ireland)

Claimants

-and-

(1) APPLE RETAIL UK LIMITED

(2) APPLE DISTRIBUTION INTERNATIONAL LIMITED

(A company incorporated under the laws of the Republic of Ireland)

(3) APPLE INC

(A company incorporates under the laws of the State of California)

Defendants

ANNEX A
TO THE STATEMENT OF GROUNDS FOR
AMENDMENT OF EP(UK) 2,690,810

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810 Patent unconditional amendments

1. A mobile station (200) adapted to spread and transmit an ACK/NACK signal or a CQI signal in accordance with a code-multiplexing structure for code-multiplexing ACK/NACK signals and CQI signals from a plurality of mobile stations, comprising:

a receiver (202) configured to receive control information on a control channel element, CCE;

a first spreading unit (214) adapted to spread the ACK/NACK signal with a sequence defined by one of a plurality of cyclic shift values, the sequence being one of a plurality of sequences that are mutually separable because of mutually different cyclic shift values of the plurality of cyclic shift values;

a second spreading unit (219) adapted to spread the CQI signal with a sequence defined by another one of the plurality of cyclic shift values, the sequence being another of the plurality of sequences;

a third spreading unit (216) adapted to spread the ACK/NACK signal, after the ACK/NACK signal has been spread with the sequence defined by one of a plurality of cyclic shift values, with a sequence that is one of a plurality of orthogonal sequences that each have a different respective orthogonal sequence number of a plurality of orthogonal sequence numbers;

a control section adapted to:

control the spreading of the ACK/NACK signal by the first spreading unit (214) by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading ACK/NACK signals in the plurality of cyclic shift values, in accordance with the code-multiplexing structure;

control the spreading of the CQI signal by the second spreading unit (219) by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading CQI signals in the plurality of cyclic shift values, in accordance with the code-multiplexing structure; and

control the spreading of the ACK/NACK signal by the third spreading unit (216) by setting a code-multiplexing orthogonal sequence number, of the plurality of orthogonal sequence numbers, in accordance with the code-multiplexing structure; and

a transmitter (223) configured to transmit ~~a~~ the CQI signal using ~~a~~ the code-multiplexing cyclic shift value of ~~a~~ the set of cyclic shift values for spreading CQI signals; and

the transmitter being further configured to transmit ~~an~~ the ACK/NACK signal using the code-multiplexing~~a~~ cyclic shift value of the~~a~~ set of cyclic shift values for spreading ACK/NACK signals, and the code-multiplexing orthogonal sequence number of the plurality of orthogonal sequence numbers,

characterized in that

the CCE is associated with a physical uplink control channel, PUCCH, and the PUCCH is determinative of a cyclic shift value among ~~a~~the plurality of cyclic shift values comprising the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals, with one or more unused cyclic shift values separating the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals,

the set of cyclic shift values for spreading ACK/NACK signals and the plurality of orthogonal sequence numbers are arranged in a 2-cyclic shift interval mesh structure in the code-multiplexing structure, and

an unused cyclic shift value, of the one or more unused cyclic shift values, is positioned after an immediately preceding cyclic shift value for spreading CQI signals, and before an immediately subsequent cyclic shift value for spreading ACK/NACK signals, in the code-multiplexing structure,

so that a minimum value of a difference in cyclic shift values between the CQI signals and the ACK/NACK signals, after said immediately preceding cyclic shift value in the code-multiplexing structure, is equal to the 2-cyclic-shift interval in cyclic shift values between the ACK/NACK signals in the mesh structure.

~~2. The mobile station (200) of claim 1 wherein an unused cyclic shift value is positioned after a cyclic shift value for spreading CQI signals and before a cyclic shift value for spreading ACK/NACK signals.~~

~~3~~2. The mobile station (200) of claim 1 ~~or 2~~ wherein a second~~n~~ unused cyclic shift value is positioned after an immediately preceding cyclic shift value for spreading ACK/NACK signals, and before an immediately subsequent cyclic shift value for spreading CQI signals, in the code-multiplexing structure.

~~4. The mobile station (200) of any of claims 1 to 3 wherein an unused cyclic shift value is positioned before the set of cyclic shift values for spreading CQI signals and a second unused cyclic shift value is positioned after the set of cyclic shift values for spreading CQI signals.~~

~~5. The mobile station (200) of any of claims 1 to 4 wherein an unused cyclic shift value is positioned after a cyclic shift value for spreading ACK/NACK signals and a second unused cyclic shift value is positioned before a second cyclic shift value for spreading ACK/NACK signals.~~

~~6. The mobile station (200) of any of claims 1 to 5 wherein an unused cyclic shift value is positioned after a cyclic shift value for spreading ACK/NACK signals and a second unused cyclic shift value is positioned before a second cyclic shift value for spreading ACK/NACK signals, and a cyclic shift value for spreading CQI signals is positioned between the unused cyclic shift value and the second unused cyclic shift value.~~

~~7. The mobile station (200) of any of claims 1 to 6 wherein an unused cyclic shift value is positioned before the set of cyclic shift values for spreading CQI signals and after a cyclic shift value for spreading ACK/NACK signals, and a second unused cyclic shift value is positioned before a second cyclic shift value for spreading ACK/NACK signals and after the set of cyclic shift values for spreading CQI signals.~~

~~8~~3. The mobile station (200) of ~~any of claims 1 to 7~~claim 1 or 2 wherein the set of cyclic shift values for spreading CQI signals consists of a single cyclic shift value.

~~9. The mobile station (200) of any of claims 1 to 8 wherein the unused cyclic shift values consists of a single cyclic shift value.~~

~~10. The mobile station (200) of any of claims 1 to 9 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading CQI signals.~~

~~11. The mobile station (200) of any of claims 1 to 10 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading ACK/NACK signals.~~

~~12. The mobile station (200) of any of claims 1 to 11 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading ACK/NACK signals, and a second unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading CQI signals.~~

~~13. The mobile station (200) of any of claims 1 to 12 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading ACK/NACK signals, and a second unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading CQI signals, and the set of cyclic shift values for spreading CQI signals is positioned between the unused cyclic shift value and the second unused cyclic shift value.~~

~~14. The mobile station (200) of any of claims 1 to 13 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading CQI signals by a unit of one cyclic shift value and decrementally shifted from a cyclic shift value for spreading ACK/NACK signals by the same unit.~~

~~15. The mobile station (200) of any of claims 1 to 14 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading ACK/NACK signals by a unit of one cyclic shift value and decrementally shifted from a cyclic shift value for spreading CQI signals by the same unit.~~

~~16. The mobile station (200) of any of claims 1 to 15 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading ACK/NACK signals by a unit of one cyclic shift value and an second unused cyclic shift value is decrementally shifted from an second cyclic shift value for spreading ACK/NACK signals by the same unit.~~

~~17. The mobile station (200) of any of claims 1 to 16 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading ACK/NACK signals by a unit of one cyclic shift value and decrementally shifted from a cyclic shift value for spreading CQI signals by the same unit, and an second unused cyclic shift value is decrementally shifted from a second cyclic shift value for spreading ACK/NACK signals by the same unit and decrementally shifted from a cyclic shift value for spreading CQI signals by the same unit.~~

~~18. The mobile station (200) of any of claims 1 to 17, further comprising a spreader (214, 219) configured to spread a selected one of:~~

~~a CQI signal with a sequence defined by one of the set of cyclic shift values for spreading CQI signals; and~~

~~an ACK/NACK signal with a sequence defined by one of the set of cyclic shift values for spreading ACK/NACK signals,~~

~~wherein said transmitter (223) is configured to transmit the selected one of the spread CQI signal and the spread ACK/NACK signal.~~

~~19. The mobile station (200) of any of claims 1 to 18 wherein the transmitter (223) transmits said one of the CQI signal and the ACK/NACK signal on a PUCCH, an index of which is specified from the control information.~~

~~20. The mobile station (200) of any of claims 1 to 19 wherein the set of cyclic shift values for spreading CQI signals, the set of cyclic shift values for spreading ACK/NACK signals, and the one or more unused cyclic shift values are mutually exclusive for each symbol.~~

~~21. The mobile station (200) of any of claims 1 to 20 wherein the control information includes mobile station identification information indicating a mobile station to which the control information is addressed.~~

4. The mobile station (200) of any of claims 1 to 3 wherein the set of cyclic shift values for spreading ACK/NACK signals consists of a single set of consecutive cyclic shift values.

~~22~~5. A method of spreading and transmitting an ACK/NACK signal and a CQI signal in accordance with a code-multiplexing structure for code-multiplexing ACK/NACK signals and CQI signals from a plurality of mobile stations, comprising:

receiving control information on a control channel element, CCE;

spreading the ACK/NACK signal with a sequence defined by one of a plurality of cyclic shift values, the sequence being one of a plurality of sequences that are mutually separable because of mutually different cyclic shift values of the plurality of cyclic shift values;

spreading the CQI signal with a sequence defined by another one of the plurality of cyclic shift values, the sequence being another of the plurality of sequences;

spreading the ACK/NACK signal, after the ACK/NACK signal has been spread with the sequence defined by one of a plurality of cyclic shift values, with a sequence that is one of a plurality of orthogonal sequences that each have a different respective orthogonal sequence number of a plurality of orthogonal sequence numbers;

controlling the spreading of the ACK/NACK signal by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading ACK/NACK signals in the plurality of cyclic shift values, in accordance with the code-multiplexing structure;

controlling the spreading of the CQI signal by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading CQI signals in the plurality of cyclic shift values, in accordance with the code-multiplexing structure;

controlling the spreading of the ACK/NACK signal by setting a code-multiplexing orthogonal sequence number, of the plurality of orthogonal sequence numbers, in accordance with the code-multiplexing structure;

transmitting ~~a~~ the CQI signal using ~~a~~ the code-multiplexing cyclic shift value of ~~a~~ the set of CQI cyclic shift values for spreading CQI signals; and

the method further comprising transmitting ~~an~~ the ACK/NACK signal using ~~a~~ the code-multiplexing cyclic shift value of ~~a~~ the set of cyclic shift values for spreading ACK/NACK signals, and the code-multiplexing orthogonal sequence number of the plurality of orthogonal sequence numbers,

characterized in that

the CCE is associated with a physical uplink control channel, PUCCH, and the PUCCH is determinative of a cyclic shift value among ~~a~~the plurality of cyclic shift values comprising the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals, with one or more unused cyclic shift values separating the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals,

the set of cyclic shift values for spreading ACK/NACK signals and the plurality of orthogonal sequence numbers are arranged in a 2-cyclic shift interval mesh structure in the code-multiplexing structure, and

an unused cyclic shift value, of the one or more unused cyclic shift values, is positioned after an immediately preceding cyclic shift value for spreading CQI signals, and before an immediately subsequent cyclic shift value for spreading ACK/NACK signals, in the code-multiplexing structure,

so that a minimum value of a difference in cyclic shift values between the CQI signals and the ACK/NACK signals, after said immediately preceding cyclic shift value in the code-multiplexing structure, is equal to the 2-cyclic-shift interval in cyclic shift values between the ACK/NACK signals in the mesh structure.

6. The method of claim 5 wherein a second unused cyclic shift value is positioned after an immediately preceding cyclic shift value for spreading ACK/NACK signals, and before an immediately subsequent cyclic shift value for spreading CQI signals, in the code-multiplexing structure.

7. The method of claim 5 or 6 wherein the set of cyclic shift values for spreading ACK/NACK signals consists of a single set of consecutive cyclic shift values.

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ANNEX B
TO THE STATEMENT OF GROUNDS FOR
AMENDMENT OF EP(UK) 2,690,810

Part 1 - 810 Patent Unconditional Amendment

Claim (granted)	Claim (amended)	Reference in application for 810
1	1	[0005], [0009], [0010], [0011], [0013], [0019], [0021], [0049], [0050], [0057], [0089] Figures 6, 7, 9 to 13
2	deleted	
3	2	Figure 13
4, 5, 6, 7	deleted	
8	3	
9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21	deleted	
-	4	Figures 10 to 13
22	5	[0005], [0009], [0010], [0011], [0013], [0019], [0021], [0049], [0050], [0057], [0089] Figures 6, 7, 9 to 13
-	6	Figure 13
-	7	Figures 10 to 13

Part 2 - 810 Patent Conditional Amendment

Claim (granted)	Claim (amended)	Reference in application for 810
1	1	[0005], [0007], [0009], [0010], [0011], [0013], [0019], [0021], [0049], [0050], [0057], [0089] Figures 6, 7, 9 to 13
2	deleted	
3	2	Figure 13
4, 5, 6, 7	deleted	
8	3	
9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21	deleted	
-	4	Figures 10 to 13
22	5	[0005], [0007], [0009], [0010], [0011], [0013], [0019], [0021], [0049], [0050], [0057], [0089] Figures 6, 7, 9 to 13
-	6	Figure 13
-	7	Figures 10 to 13

Claim No. HP-2019-000006

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Defendants

ANNEX C
TO THE STATEMENT OF GROUNDS FOR
AMENDMENT OF EP(UK) 2,690,810

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810 Patent conditional amendments

1. A mobile station (200) adapted to spread and transmit an ACK/NACK signal or a CQI signal in accordance with a code-multiplexing structure for code-multiplexing ACK/NACK signals and CQI signals from a plurality of mobile stations, comprising:

a receiver (202) configured to receive control information on a control channel element, CCE;

a first spreading unit (214) adapted to spread the ACK/NACK signal with a sequence defined by one of twelve cyclic shift values, the sequence being one of twelve sequences that are mutually separable because of mutually different cyclic shift values of the twelve cyclic shift values;

a second spreading unit (219) adapted to spread the CQI signal with a sequence defined by another one of the twelve cyclic shift values, the sequence being another of the twelve sequences;

a third spreading unit (216) adapted to spread the ACK/NACK signal, after the ACK/NACK signal has been spread with the sequence defined by one of twelve cyclic shift values, with a sequence that is one of three orthogonal sequences that each have a different respective orthogonal sequence number of first, second and third orthogonal sequence numbers;

a control section adapted to:

control the spreading of the ACK/NACK signal by the first spreading unit (214) by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading ACK/NACK signals in the twelve cyclic shift values, in accordance with the code-multiplexing structure;

control the spreading of the CQI signal by the second spreading unit (219) by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading CQI signals in the twelve cyclic shift values, in accordance with the code-multiplexing structure; and

control the spreading of the ACK/NACK signal by the third spreading unit (216) by setting a code-multiplexing orthogonal sequence number, of the first, second and

third orthogonal sequence numbers, in accordance with the code-multiplexing structure; and

a transmitter (223) configured to transmit ~~a~~ the CQI signal using ~~a~~ the code-multiplexing cyclic shift value of ~~a~~ the set of cyclic shift values for spreading CQI signals; and

the transmitter being further configured to transmit ~~an~~ the ACK/NACK signal using the code-multiplexing~~a~~ cyclic shift value of the~~a~~ set of cyclic shift values for spreading ACK/NACK signals, and the code-multiplexing orthogonal sequence number of the first, second and third orthogonal sequence numbers,

characterized in that

the CCE is associated with a physical uplink control channel, PUCCH, and the PUCCH is determinative of a cyclic shift value among ~~a plurality of~~the twelve cyclic shift values comprising the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals, with one or more unused cyclic shift values separating the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals,

the set of cyclic shift values for spreading ACK/NACK signals and the first, second and third orthogonal sequence numbers are arranged in a 2-cyclic shift interval mesh structure in the code-multiplexing structure, according to which ACK/NACK signals for which the second orthogonal sequence number is set have 2-cyclic-shift-interval cyclic shift values set that are offset by one cyclic shift value with respect to 2-cyclic-shift-interval cyclic shift values that are set for the ACK/NACK signals for which the first and third orthogonal sequence numbers are set,

the CQI signals in the code-multiplexing structure are not spread with any of the orthogonal sequences, and

an unused cyclic shift value, of the one or more unused cyclic shift values, is positioned after an immediately preceding cyclic shift value for spreading CQI signals, and before an immediately subsequent cyclic shift value for spreading ACK/NACK signals, in the code-multiplexing structure,

so that a minimum value of a difference in cyclic shift values between the CQI signals and the ACK/NACK signals, after said immediately preceding cyclic shift value in the code-

multiplexing structure, is equal to the 2-cyclic-shift interval in cyclic shift values between the ACK/NACK signals in the mesh structure.

~~2. The mobile station (200) of claim 1 wherein an unused cyclic shift value is positioned after a cyclic shift value for spreading CQI signals and before a cyclic shift value for spreading ACK/NACK signals.~~

~~3~~2. The mobile station (200) of claim 1 ~~or 2~~ wherein a second~~n~~ unused cyclic shift value is positioned after an immediately preceding cyclic shift value for spreading ACK/NACK signals, and before an immediately subsequent cyclic shift value for spreading CQI signals, in the code-multiplexing structure.

~~4. The mobile station (200) of any of claims 1 to 3 wherein an unused cyclic shift value is positioned before the set of cyclic shift values for spreading CQI signals and a second unused cyclic shift value is positioned after the set of cyclic shift values for spreading CQI signals.~~

~~5. The mobile station (200) of any of claims 1 to 4 wherein an unused cyclic shift value is positioned after a cyclic shift value for spreading ACK/NACK signals and a second unused cyclic shift value is positioned before a second cyclic shift value for spreading ACK/NACK signals.~~

~~6. The mobile station (200) of any of claims 1 to 5 wherein an unused cyclic shift value is positioned after a cyclic shift value for spreading ACK/NACK signals and a second unused cyclic shift value is positioned before a second cyclic shift value for spreading ACK/NACK signals, and a cyclic shift value for spreading CQI signals is positioned between the unused cyclic shift value and the second unused cyclic shift value.~~

~~7. The mobile station (200) of any of claims 1 to 6 wherein an unused cyclic shift value is positioned before the set of cyclic shift values for spreading CQI signals and after a cyclic shift~~

~~value for spreading ACK/NACK signals, and a second unused cyclic shift value is positioned before a second cyclic shift value for spreading ACK/NACK signals and after the set of cyclic shift values for spreading CQI signals.~~

~~8~~3. The mobile station (200) of ~~any of claims 1 to 7~~claim 1 or 2 wherein the set of cyclic shift values for spreading CQI signals consists of a single cyclic shift value.

~~9. The mobile station (200) of any of claims 1 to 8 wherein the unused cyclic shift values consists of a single cyclic shift value.~~

~~10. The mobile station (200) of any of claims 1 to 9 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading CQI signals.~~

~~11. The mobile station (200) of any of claims 1 to 10 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading ACK/NACK signals.~~

~~12. The mobile station (200) of any of claims 1 to 11 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading ACK/NACK signals, and a second unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading CQI signals.~~

~~13. The mobile station (200) of any of claims 1 to 12 wherein an unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading ACK/NACK signals, and a second unused cyclic shift value is cyclically subsequent to a cyclic shift value for spreading CQI signals, and the set of cyclic shift values for spreading CQI signals is positioned between the unused cyclic shift value and the second unused cyclic shift value.~~

~~14. The mobile station (200) of any of claims 1 to 13 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading CQI signals by a unit of one cyclic shift value and decrementally shifted from a cyclic shift value for spreading ACK/NACK signals by the same unit.~~

~~15. The mobile station (200) of any of claims 1 to 14 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading ACK/NACK signals by a unit of one cyclic shift value and decrementally shifted from a cyclic shift value for spreading CQI signals by the same unit.~~

~~16. The mobile station (200) of any of claims 1 to 15 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading ACK/NACK signals by a unit of one cyclic shift value and an second unused cyclic shift value is decrementally shifted from an second cyclic shift value for spreading ACK/NACK signals by the same unit.~~

~~17. The mobile station (200) of any of claims 1 to 16 wherein an unused cyclic shift value is incrementally shifted from a cyclic shift value for spreading ACK/NACK signals by a unit of one cyclic shift value and decrementally shifted from a cyclic shift value for spreading CQI signals by the same unit, and an second unused cyclic shift value is decrementally shifted from a second cyclic shift value for spreading ACK/NACK signals by the same unit and decrementally shifted from a cyclic shift value for spreading CQI signals by the same unit.~~

~~18. The mobile station (200) of any of claims 1 to 17, further comprising a spreader (214, 219) configured to spread a selected one of:~~

~~a CQI signal with a sequence defined by one of the set of cyclic shift values for spreading CQI signals; and~~

~~an ACK/NACK signal with a sequence defined by one of the set of cyclic shift values for spreading ACK/NACK signals,~~

~~wherein said transmitter (223) is configured to transmit the selected one of the spread CQI signal and the spread ACK/NACK signal.~~

~~19. The mobile station (200) of any of claims 1 to 18 wherein the transmitter (223) transmits said one of the CQI signal and the ACK/NACK signal on a PUCCH, an index of which is specified from the control information.~~

~~20. The mobile station (200) of any of claims 1 to 19 wherein the set of cyclic shift values for spreading CQI signals, the set of cyclic shift values for spreading ACK/NACK signals, and the one or more unused cyclic shift values are mutually exclusive for each symbol.~~

~~21. The mobile station (200) of any of claims 1 to 20 wherein the control information includes mobile station identification information indicating a mobile station to which the control information is addressed.~~

4. The mobile station (200) of any of claims 1 to 3 wherein the set of cyclic shift values for spreading ACK/NACK signals consists of a single set of consecutive cyclic shift values.

~~22~~5. A method of spreading and transmitting an ACK/NACK signal and a CQI signal in accordance with a code-multiplexing structure for code-multiplexing ACK/NACK signals and CQI signals from a plurality of mobile stations, comprising:

receiving control information on a control channel element, CCE;

spreading the ACK/NACK signal with a sequence defined by one of twelve of cyclic shift values, the sequence being one of twelve sequences that are mutually separable because of mutually different cyclic shift values of the twelve cyclic shift values;

spreading the CQI signal with a sequence defined by another one of the twelve cyclic shift values, the sequence being another of the twelve sequences;

spreading the ACK/NACK signal, after the ACK/NACK signal has been spread with the sequence defined by one of a twelve cyclic shift values, with a sequence that is one of three orthogonal sequences that each have a different respective orthogonal sequence number of first, second and third orthogonal sequence numbers;

controlling the spreading of the ACK/NACK signal by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading ACK/NACK signals in the twelve cyclic shift values, in accordance with the code-multiplexing structure;

controlling the spreading of the CQI signal by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading CQI signals in the twelve cyclic shift values, in accordance with the code-multiplexing structure;

controlling the spreading of the ACK/NACK signal by setting a code-multiplexing orthogonal sequence number, of the first, second and third orthogonal sequence numbers, in accordance with the code-multiplexing structure;

transmitting ~~a~~ the CQI signal using ~~a~~ the code-multiplexing cyclic shift value of ~~a~~ the set of CQI cyclic shift values for spreading CQI signals; and

the method further comprising transmitting ~~an~~ the ACK/NACK signal using ~~a~~ the code-multiplexing cyclic shift value of ~~a~~ the set of cyclic shift values for spreading ACK/NACK signals, and the code-multiplexing orthogonal sequence number of the first, second and third orthogonal sequence numbers,

characterized in that

the CCE is associated with a physical uplink control channel, PUCCH, and the PUCCH is determinative of a cyclic shift value among ~~a plurality of~~the twelve cyclic shift values comprising the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals, with one or more unused cyclic shift values separating the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals,

the set of cyclic shift values for spreading ACK/NACK signals and the first, second and third orthogonal sequence numbers are arranged in a 2-cyclic shift interval mesh structure in the code-multiplexing structure, according to which ACK/NACK signals for which the second orthogonal sequence number is set have 2-cyclic-shift-interval cyclic shift values set that are

offset by one cyclic shift value with respect to 2-cyclic-shift-interval cyclic shift values that are set for the ACK/NACK signals for which the first and third orthogonal sequence numbers are set,

the CQI signals in the code-multiplexing structure are not spread with any of the orthogonal sequences, and

an unused cyclic shift value, of the one or more unused cyclic shift values, is positioned after an immediately preceding cyclic shift value for spreading CQI signals, and before an immediately subsequent cyclic shift value for spreading ACK/NACK signals, in the code-multiplexing structure,

so that a minimum value of a difference in cyclic shift values between the CQI signals and the ACK/NACK signals, after said immediately preceding cyclic shift value in the code-multiplexing structure, is equal to the 2-cyclic-shift interval in cyclic shift values between the ACK/NACK signals in the mesh structure.

6. The method of claim 5 wherein a second unused cyclic shift value is positioned after an immediately preceding cyclic shift value for spreading ACK/NACK signals, and before an immediately subsequent cyclic shift value for spreading CQI signals, in the code-multiplexing structure.

7. The method of claim 5 or 6 wherein the set of cyclic shift values for spreading ACK/NACK signals consists of a single set of consecutive cyclic shift values.

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ANNEX D
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---

810 Patent – comparison of unconditional and conditional amendments

1. A mobile station (200) adapted to spread and transmit an ACK/NACK signal or a CQI signal in accordance with a code-multiplexing structure for code-multiplexing ACK/NACK signals and CQI signals from a plurality of mobile stations, comprising:

a receiver (202) configured to receive control information on a control channel element, CCE;

a first spreading unit (214) adapted to spread the ACK/NACK signal with a sequence defined by one of ~~a plurality of~~ twelve cyclic shift values, the sequence being one of ~~a plurality of~~ twelve sequences that are mutually separable because of mutually different cyclic shift values of the ~~plurality of~~ twelve cyclic shift values;

a second spreading unit (219) adapted to spread the CQI signal with a sequence defined by another one of the ~~plurality of~~ twelve cyclic shift values, the sequence being another of the ~~plurality of~~ twelve sequences;

a third spreading unit (216) adapted to spread the ACK/NACK signal, after the ACK/NACK signal has been spread with the sequence defined by one of ~~a plurality of~~ twelve cyclic shift values, with a sequence that is one of ~~a plurality of~~ three orthogonal sequences that each have a different respective orthogonal sequence number of ~~a plurality of~~ first, second and third orthogonal sequence numbers;

a control section adapted to:

control the spreading of the ACK/NACK signal by the first spreading unit (214) by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading ACK/NACK signals in the ~~plurality of~~ twelve cyclic shift values, in accordance with the code-multiplexing structure;

control the spreading of the CQI signal by the second spreading unit (219) by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading CQI signals in the ~~plurality of~~ twelve cyclic shift values, in accordance with the code-multiplexing structure; and

control the spreading of the ACK/NACK signal by the third spreading unit (216) by setting a code-multiplexing orthogonal sequence number, of the ~~plurality of~~ first,

second and third orthogonal sequence numbers, in accordance with the code-multiplexing structure; and

a transmitter (223) configured to transmit the CQI signal using the code-multiplexing cyclic shift value of the set of cyclic shift values for spreading CQI signals; and

the transmitter being further configured to transmit the ACK/NACK signal using the code-multiplexing cyclic shift value of the set of cyclic shift values for spreading ACK/NACK signals, and the code-multiplexing orthogonal sequence number of the ~~plurality of~~ first, second and third orthogonal sequence numbers,

characterized in that

the CCE is associated with a physical uplink control channel, PUCCH, and the PUCCH is determinative of a cyclic shift value among the ~~plurality of~~ twelve cyclic shift values comprising the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals, with one or more unused cyclic shift values separating the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals,

the set of cyclic shift values for spreading ACK/NACK signals and the ~~plurality of~~ first, second and third orthogonal sequence numbers are arranged in a 2-cyclic shift interval mesh structure in the code-multiplexing structure, ~~and~~according to which ACK/NACK signals for which the second orthogonal sequence number is set have 2-cyclic-shift-interval cyclic shift values set that are offset by one cyclic shift value with respect to 2-cyclic-shift-interval cyclic shift values that are set for the ACK/NACK signals for which the first and third orthogonal sequence numbers are set,

the CQI signals in the code-multiplexing structure are not spread with any of the orthogonal sequences, and

an unused cyclic shift value, of the one or more unused cyclic shift values, is positioned after an immediately preceding cyclic shift value for spreading CQI signals, and before an immediately subsequent cyclic shift value for spreading ACK/NACK signals, in the code-multiplexing structure,

so that a minimum value of a difference in cyclic shift values between the CQI signals and the ACK/NACK signals, after said immediately preceding cyclic shift value in the code-

multiplexing structure, is equal to the 2-cyclic-shift interval in cyclic shift values between the ACK/NACK signals in the mesh structure.

2. The mobile station (200) of claim 1 wherein a second unused cyclic shift value is positioned after an immediately preceding cyclic shift value for spreading ACK/NACK signals, and before an immediately subsequent cyclic shift value for spreading CQI signals, in the code-multiplexing structure.

3. The mobile station (200) of claim 1 or 2 wherein the set of cyclic shift values for spreading CQI signals consists of a single cyclic shift value.

4. The mobile station (200) of any of claims 1 to 3 wherein the set of cyclic shift values for spreading ACK/NACK signals consists of a single set of consecutive cyclic shift values.

5. A method of spreading and transmitting an ACK/NACK signal and a CQI signal in accordance with a code-multiplexing structure for code-multiplexing ACK/NACK signals and CQI signals from a plurality of mobile stations, comprising:

receiving control information on a control channel element, CCE;

spreading the ACK/NACK signal with a sequence defined by one of ~~a plurality~~ twelve of cyclic shift values, the sequence being one of ~~a plurality of~~ twelve sequences that are mutually separable because of mutually different cyclic shift values of the ~~plurality of~~ twelve cyclic shift values;

spreading the CQI signal with a sequence defined by another one of the ~~plurality of~~ twelve cyclic shift values, the sequence being another of the ~~plurality of~~ twelve sequences;

spreading the ACK/NACK signal, after the ACK/NACK signal has been spread with the sequence defined by one of a ~~plurality of~~ twelve cyclic shift values, with a sequence that is one of ~~a plurality of~~ three orthogonal sequences that each have a different respective orthogonal sequence number of ~~a plurality of~~ first, second and third orthogonal sequence numbers;

controlling the spreading of the ACK/NACK signal by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading ACK/NACK signals in the ~~plurality of~~ twelve cyclic shift values, in accordance with the code-multiplexing structure;

controlling the spreading of the CQI signal by setting a code-multiplexing cyclic shift value, of a set of cyclic shift values for spreading CQI signals in the ~~plurality of~~ twelve cyclic shift values, in accordance with the code-multiplexing structure;

controlling the spreading of the ACK/NACK signal by setting a code-multiplexing orthogonal sequence number, of the ~~plurality of~~ first, second and third orthogonal sequence numbers, in accordance with the code-multiplexing structure;

transmitting the CQI signal using the code-multiplexing cyclic shift value of the set of CQI cyclic shift values for spreading CQI signals; and

the method further comprising transmitting the ACK/NACK signal using the code-multiplexing cyclic shift value of the set of cyclic shift values for spreading ACK/NACK signals, and the code-multiplexing orthogonal sequence number of the ~~plurality of~~ first, second and third orthogonal sequence numbers,

characterized in that

the CCE is associated with a physical uplink control channel, PUCCH, and the PUCCH is determinative of a cyclic shift value among the ~~plurality of~~ twelve cyclic shift values comprising the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals, with one or more unused cyclic shift values separating the set of cyclic shift values for spreading CQI signals and the set of cyclic shift values for spreading ACK/NACK signals,

the set of cyclic shift values for spreading ACK/NACK signals and the ~~plurality of~~ first, second and third orthogonal sequence numbers are arranged in a 2-cyclic shift interval mesh structure in the code-multiplexing structure, ~~and~~according to which ACK/NACK signals for which the second orthogonal sequence number is set have 2-cyclic-shift-interval cyclic shift values set that are offset by one cyclic shift value with respect to 2-cyclic-shift-interval cyclic shift values that are set for the ACK/NACK signals for which the first and third orthogonal sequence numbers are set,

the CQI signals in the code-multiplexing structure are not spread with any of the orthogonal sequences, and

an unused cyclic shift value, of the one or more unused cyclic shift values, is positioned after an immediately preceding cyclic shift value for spreading CQI signals, and before an immediately subsequent cyclic shift value for spreading ACK/NACK signals, in the code-multiplexing structure,

so that a minimum value of a difference in cyclic shift values between the CQI signals and the ACK/NACK signals, after said immediately preceding cyclic shift value in the code-multiplexing structure, is equal to the 2-cyclic-shift interval in cyclic shift values between the ACK/NACK signals in the mesh structure.

6. The method of claim 5 wherein a second unused cyclic shift value is positioned after an immediately preceding cyclic shift value for spreading ACK/NACK signals, and before an immediately subsequent cyclic shift value for spreading CQI signals, in the code-multiplexing structure.

7. The method of claim 5 or 6 wherein the set of cyclic shift values for spreading ACK/NACK signals consists of a single set of consecutive cyclic shift values.