

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:

GODO KAISHA IP BRIDGE 1

(a company incorporated under the laws of Japan)

Claimant

- and -

(1) HUAWEI TECHNOLOGIES CO., LIMITED

(a company incorporated under the laws of the People's Republic of China)

(2) HUAWEI DEVICE CO., LIMITED

(a company incorporated under the laws of the People's Republic of China)

(3) HUAWEI TECHNOLOGIES (UK) CO., LIMITED

Defendants

ANNEX A TO THE STATEMENT OF GROUNDS FOR AMENDMENT OF EP'463

Claims

1. A user equipment for use in a wireless communications system which allocates sequences to base stations for use by user equipments to transmit random access connection requests in cells of the wireless communications system, the random access connection requests comprising preamble sequences having cyclic shifts applied to the allocated sequences, wherein a required cyclic shift amount is configurable in accordance with cell radius and wherein a known number of preamble sequences are used in each cell, characterized in that ~~it~~ the user equipment comprises:

a receiving section (0152) configured to receive, from a base station of the wireless communication system, allocation sequence information indicative of one or more allocated sequences, the allocation sequence information comprising:

a ~~reported~~ index of at least one of sequences with consecutive indices among a plurality of sequences each with a different sequence number, the consecutive indices being among a plurality of indices having consecutive numbers; and

a reported required cyclic shift amount that is indicative of the number of allocated sequences given the known number of preamble sequences;

a storage section (161) configured to store correspondence relationships that correlate the plurality of indices to the sequence numbers of the plurality of sequences, the plurality of sequences, ~~which are being indexed,~~ by the plurality of indices having consecutive numbers, in order of increasing to a maximum value and then decreasing, from the maximum value, a cyclic shift amount corresponding to a Doppler shift according to a sequence number ~~or in order of increasing to a maximum value and then decreasing, from the maximum value,~~ a required cyclic shift amount according to the sequence number,

wherein the required cyclic shift amount according to the sequence number, in order of which the plurality of sequences are indexed, is a maximum applicable cyclic shift amount for user equipments that move at high speed and for which high-speed-movement related Doppler spread and frequency offset are involved in a signal received at the base station,

wherein the plurality of sequences being are Zadoff-Chu sequences, $c_r(k)$, defined in the time domain, the Zadoff-Chu sequences being defined by equation

$$c_r(k) = \exp\left\{-j \frac{2\pi r}{N} \left(\frac{k(k+1)}{2} + qk\right)\right\}$$

where r is the sequence number, N is a length of the Zadoff-Chu sequence and is odd, k is an integer changing from 0 to $N-1$, and q is an arbitrary integer,

wherein the one or more allocated sequences consist of:

a Zadoff-Chu sequence corresponding to the reported index; and

in the case that there is more than one allocated sequence, a Zadoff-Chu sequence corresponding to each respective other of the consecutive indices, and

wherein the user equipment is configured to use the storage section to select a Zadoff-Chu sequence which is one of the one or more allocated sequences, based on the allocation sequence information; and

a transmitting section (167) configured to:

transmit a preamble sequence generated from the Zadoff-Chu sequence corresponding to the reported index—that is—received, when the Zadoff-Chu sequence corresponding to the reported index is selected; and

transmit a preamble sequence generated from the Zadoff-Chu sequence corresponding to one other of the consecutive indices, when the Zadoff-Chu sequence corresponding to that one other of the consecutive indices is selected.

~~2.—The user equipment according to claim 1, wherein the cyclic shift amount corresponding to the Doppler shift is a cyclic shift amount corresponding to a Doppler shift for an user equipment moving at high speed.~~

~~3.—The user equipment according to claim 1 or 2, wherein the cyclic shift amount depends on the sequence number.~~

~~4.—The user equipment according to any of claims 1-3, wherein the required cyclic shift amount is a required cyclic shift amount for an user equipment moving at high speed.~~

5. — The user equipment according to any of claims 1-4, wherein the required cyclic shift amount is equal to or less than a cyclic shift amount corresponding to a Doppler shift.

6. — The user equipment according to any of claims 1-5, wherein the required cyclic shift amount is a maximum cyclic shift amount that is equal to or less than a cyclic shift amount corresponding to a Doppler shift.

7. — The user equipment according to any of claims 1-6, wherein the required cyclic shift amount is a maximum cyclic shift amount available for a Doppler shift.

8. — The user equipment according to any of claims 1-7, wherein the plurality of sequences are indexed by the indices having consecutive numbers in the sequence number order of a and $N-a$, wherein N is a sequence length and a is an integer whose value ranges between 1 and $N-1$.

9. — The user equipment according to claim 8, wherein the plurality of sequences are indexed by the indices having consecutive numbers in the sequence number order of a and $N-a$, and wherein the integers a are not in consecutive order.

10. — The user equipment according to any of claims 1-9, wherein the plurality of sequences are indexed by the indices having consecutive numbers in order of increasing to a maximum value and then decreasing, from the maximum value, an available cell radius.

11. — The user equipment according to any of claims 1-10, wherein the plurality of sequences are indexed by the indices having consecutive numbers in order of increasing to a maximum value and then decreasing, from the maximum value, a cell radius for an user equipment moving at high speed.

~~12. The user equipment according to any of claims 1-11, wherein the preamble sequence is generated by cyclically shifting at least one of sequences with consecutive indices, the at least one of sequences corresponding to the index that is received.~~

~~13. The user equipment according to any of claims 1-12, wherein a random access preamble including the preamble sequence is generated, and said transmitting section transmits the random access preamble.~~

~~14. The user equipment according to claim 1, wherein said receiving section is configured to receive the index that is broadcasted.~~

2. The user equipment according to claim 1, wherein the maximum applicable cyclic shift amounts are arranged, in the order in which the plurality of sequences are indexed, in ascending order for index numbers 1 through floor(N/2) and in descending order for index numbers floor(N/2) through N-1.

153. A preamble sequence generating method for use in a user equipment for use in a wireless communications system which allocates sequences to base stations for use by user equipments to transmit random access connection requests in cells of the wireless communications system, the random access connection requests comprising preamble sequences having cyclic shifts applied to the allocated sequences, wherein a required cyclic shift amount is configurable in accordance with cell radius and wherein a known number of preamble sequences are used in each cell, characterized in that the method comprises:

receiving by the user equipment, from a base station of the wireless communication system, allocation sequence information indicative of one or more allocated sequences, the allocation sequence information comprising:

a reported index of at least one of sequences with consecutive indices among a plurality of sequences each with a different sequence number, the consecutive indices being among a plurality of indices having consecutive numbers; and

a reported required cyclic shift amount that is indicative of the number of allocated sequences given the known number of preamble sequences;

storing by the user equipment correspondence relationships that correlate the plurality of indices to the sequence numbers of the plurality of sequences, the plurality of sequences being, which are indexed, by the indices having consecutive numbers, in order of increasing to a maximum value and then decreasing, from the maximum value, a cyclic shift amount corresponding to a Doppler shift according to a sequence number or in order of increasing to a maximum value and then decreasing, from the maximum value, a required cyclic shift amount according to the sequence number,

wherein the required cyclic shift amount according to the sequence number, in order of which the plurality of sequences are indexed, is a maximum applicable cyclic shift amount for user equipments that move at high speed and for which high-speed-movement related Doppler spread and frequency offset are involved in a signal received at the base station,

wherein the plurality of sequences being are Zadoff-Chu sequences, $c_r(k)$, defined in the time domain, the Zadoff-Chu sequences being defined by equation

$$c_r(k) = \exp\left\{-j \frac{2\pi r}{N} \left(\frac{k(k+1)}{2} + qk\right)\right\},$$

where r is the sequence number, N is a length of the Zadoff-Chu sequence and is odd, k is an integer changing from 0 to $N-1$, and q is an arbitrary integer, and

wherein the one or more allocated sequences consist of:

a Zadoff-Chu sequence corresponding to the reported index; and

in the case that there is more than one allocated sequence, a Zadoff-Chu sequence corresponding to each respective other of the consecutive indices;

using the stored correspondence relationships, selecting by the user equipment the Zadoff-Chu sequence corresponding to the reported index, based on the allocation sequence information; and

transmitting by the user equipment a preamble sequence generated from a the Zadoff-Chu sequence corresponding to the reported index that is received.

4. The preamble sequence generating method according to claim 3, wherein the maximum applicable cyclic shift amounts are arranged, in the order in which the plurality of sequences are indexed, in ascending order for index numbers 1 through floor(N/2) and in descending order for index numbers floor(N/2) through N-1.