

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'759

Claims

1. — A sequence reporting apparatus characterized in that it comprises:

an allocating section (101) configured to allocate at least one of sequences with consecutive indices among a plurality of sequences, 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, the sequences being Zadoff-Chu sequences, $c_r(k)$, 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

a reporting section (109) configured to report the index of the allocated sequence to a user equipment.

2. — The sequence reporting apparatus 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 a user equipment moving at high speed.

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

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

5. — The sequence reporting apparatus 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 sequence reporting apparatus 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 sequence reporting apparatus 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 sequence reporting apparatus 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 sequence reporting apparatus 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 sequence reporting apparatus 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 sequence reporting apparatus according to any of claims 1-10, wherein the 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 sequence reporting apparatus according to any of claims 1-11, wherein said reporting section is configured to report a required cyclic shift amount to the user equipment.~~

~~13. The sequence reporting apparatus according to any of claims 1-12, wherein a random access preamble is generated from the sequence.~~

~~14. The sequence reporting apparatus according to any of claims 1-13, wherein said reporting section is configured to broadcast the index of the allocated sequence.~~

151. A sequence reporting method used 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 method comprises:

allocating at least one or more 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,

wherein the plurality of indices are correlated to the sequence numbers of the plurality of sequences via correspondence relationships, the plurality of sequences, which are being 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

reporting the index of the allocated sequence allocation sequence information to a user equipment having a storage section in which the correspondence relationships are stored, the allocation sequence information being indicative of the one or more allocated sequences and comprising:

a reported index; and

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

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,

whereby the user equipment is able, using 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 to transmit a preamble sequence generated from the selected Zadoff-Chu sequence.

2. The preamble sequence generating method 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 $\text{floor}(N/2)$ and in descending order for index numbers $\text{floor}(N/2)$ through $N-1$.