

CLAIMS



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[1] A paging signal transmission method in which a radio base station transmits a paging signal for notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the method comprising the steps of:

notifying, from the radio base station to the mobile station, a discontinuous reception interval and a total number of the groups, the discontinuous reception interval representing an interval at which discontinuous reception of the paging signal is performed;

determining, at the mobile station, a timing for receiving the paging signal on the basis of the notified discontinuous reception interval and the notified total number of the groups;

receiving, at the mobile station, the paging signal transmitted from the radio base station, at the determined timing; and

performing, at the mobile station, incoming call processing, when the received paging signal is a paging signal addressed to the mobile station.

[2] A mobile station configured to receive a paging signal from a radio base station, the paging signal being used for notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the mobile station comprising:

a reception timing determining unit configured to determine a timing for receiving the paging signal, on the basis



of an discontinuous reception interval and a total number of the groups notified by the radio base station, the discontinuous reception timing representing an interval at which discontinuous reception of the paging signal is performed;

- 5 a paging signal receiver unit configured to receive the paging signal transmitted from the radio base station, at the timing determined by the reception timing determining unit; and
- an incoming call processor unit configured to perform incoming call processing, when the received paging signal is
- 10 a paging signal addressed to the mobile station.

- [3] The mobile station according to claim 2, wherein
- the reception timing determining unit is configured to determine that the timing is a subframe which is selected from
- 15 among a plurality of subframes forming a radio frame to which the paging signal is mapped; and

 the paging signal is transmitted only in one subframe in a plurality of radio frames.

- 20 [4] The mobile station according to claim 2, wherein
- the reception timing determining unit is configured to determine that the timing is subframes which are selected from among a plurality of subframes forming a radio frame to which the paging signal is mapped; and
- 25 the paging signal is transmitted in two or more subframes in one radio frame.

- [5] The mobile station according to claim 3, wherein
- the reception timing determining unit is configured to

determine that the timing is a predetermined subframe in radio frames specified by SFN calculated from the following formula:
[Formula 1]

$$G = U \bmod N$$

$$SFN \bmod T = G \cdot \frac{T}{N}$$

5 where "T" represents the number of the radio frames included in the discontinuous reception interval, "N" represents the total number of the groups, "U" represents identification information on the mobile station, "G" represents identification information on the group to which the
10 mobile station belongs, and "T ≥ N" is satisfied.

[6] The mobile station according to claim 4, wherein the reception timing determining unit is configured to determine that the timing is subframes corresponding to SUBFN
15 in each of radio frames specified by SFN calculated from the following formula:

[Formula 2]

$$G = U \bmod N$$

$$SFN \bmod T = \left\lfloor \frac{G}{N} \cdot T \right\rfloor$$

$$SUBFN = G \bmod \left(\frac{N}{T} \right)$$

20 where "T" represents the number of the radio frames included in the discontinuous reception interval, "N" represents the total number of the groups, "U" represents identification information on the mobile station, "G" represents identification information on the group to which the

mobile station belongs, and " $T < N$ " is satisfied.

[7] The mobile station according to claim 4, wherein
the reception timing determining unit is configured to
5 determine the two or more subframes used to transmit the paging
signal in the one radio frame, on the basis of an offset from
a head subframe in the one radio frame, the offset being notified
of by the radio base station.

10 [8] The mobile station according to claim 4, wherein
the reception timing determining unit is configured to
determine the two or more subframes used to transmit the paging
signal in the one radio frame, on the basis of a bitmap indicating
the two or more subframes to which the paging signal is mapped,
15 the bitmap being notified of by the radio base station.

[9] The mobile station according to claim 4, wherein
the reception timing determining unit is configured to
determine the two or more subframes in the one radio frame, on
20 the basis of a mapping pattern indicating a pattern of the two
or more subframes to which the paging signal is mapped, the
mapping pattern being notified of by the radio base station.

[10] A radio base station configured to transmit a paging
25 signal for notification of an incoming call for a mobile station
belonging to any one of a plurality of groups, the radio base
station comprising:

a paging signal transmitter unit configured to transmit
the paging signal only in one subframe in a plurality of radio

frames; and

a notifier unit configured to notify, to the mobile station, an discontinuous reception interval and a total number of the groups, the discontinuous reception interval
5 representing an interval at which discontinuous reception of the paging signal is performed, wherein

a timing for the mobile station to receive the paging signal is determined based on the discontinuous reception interval and the total number of the groups.

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[11] A radio base station configured to transmit a paging signal for notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the radio base station comprising:

15 a paging signal transmitter unit configured to transmit the paging signal in two or more subframes in one radio frame;

a notifier unit configured to notify, to the mobile station, an discontinuous reception interval and a total number of the groups, the discontinuous reception interval
20 representing an interval at which discontinuous reception of the paging signal is performed; and

an adjuster unit configured to adjust the discontinuous reception interval and the total number of the groups, in accordance with the two or more subframes in which the paging
25 signal is transmitted, wherein

a timing for the mobile station to receive the paging signal is determined based on the discontinuous reception interval and the total number of the groups.

[12] The radio base station according to any one of claims 10 and 11, wherein

the adjuster unit is configured to adjust the discontinuous reception interval and the total number of the groups, in accordance with an amount of incoming call for each mobile station.

[13] The radio base station according to any one of claims 10 and 11, wherein

the adjuster unit is configured to adjust the discontinuous reception interval and the total number of the groups, in accordance with an available bandwidth in each cell.

[14] The radio base station according to any one of claims 10 and 11, wherein

the adjuster unit is configured to adjust the discontinuous reception interval and the total number of the groups, in accordance with a frequency of change in broadcast information in each cell.

[15] A paging signal transmission method in which a radio base station transmits a paging signal for notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the method comprising the steps of:

notifying, from the radio base station to the mobile station, an discontinuous reception interval and a mapping pattern, the discontinuous reception interval representing an interval at which discontinuous reception of the paging signal is performed, the mapping pattern indicating a pattern of a

plurality of subframes to which the paging signal is mapped;

determining, at the mobile station, a timing for receiving the paging signal, on the basis of the notified discontinuous reception interval and the notified mapping
5 pattern;

receiving, at the mobile station, the paging signal transmitted from the radio base station, at the determined timing; and

performing, at the mobile station, incoming call
10 processing, when the received paging signal is a paging signal addressed to the mobile station.

[16] A mobile station configured to receive a paging signal from a radio base station, the paging signal being used for
15 notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the mobile station comprising:

a reception timing determining unit configured to determine a timing for receiving the paging signal, on the basis
20 of an discontinuous reception interval and a mapping pattern notified by the radio base station, the discontinuous reception timing representing an interval at which discontinuous reception of the paging signal is performed, the mapping pattern being notified of by the radio base station and indicating a
25 pattern of a plurality of subframes to which the paging signal is mapped;

a paging signal receiver unit configured to receive the paging signal transmitted from the radio base station, at the timing determined by the reception timing determining unit; and

an incoming call processor unit configured to perform incoming call processing, when the received paging signal is a paging signal addressed to the mobile station.

5 [17] The mobile station according to claim 16, wherein

the reception timing determining unit is configured to determine that the timing is a subframe which is selected from among a plurality of subframes forming a radio frame to which the paging signal is mapped; and

10 the paging signal is transmitted only in one subframe in a plurality of radio frames.

[18] The mobile station according to claim 16, wherein

the reception timing determining unit is configured to
15 determine that the timing is subframes which are selected from among a plurality of subframes forming a radio frame to which the paging signal is mapped; and

the paging signal is transmitted in two or more subframes in one radio frame.

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[19] The mobile station according to claim 16, wherein

the reception timing determining unit is configured to determine that the timing is subframes corresponding to SUBFN in each of radio frames specified by SFN calculated from the
25 following formula:

[Formula 2A]

$$SFN \bmod T = \left\lfloor \frac{T}{N} \cdot (U \bmod N) \right\rfloor$$

$$SUBFN = U \bmod \left\lceil \frac{N}{T} \right\rceil$$

where "T" represents the number of the radio frames included in the discontinuous reception interval, "N" represents the total number of the groups, and "U" represents identification information on the mobile station.

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[20] A radio base station configured to transmit a paging signal for notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the radio base station comprising:

10 a paging signal transmitter unit configured to transmit the paging signal only in one subframe in a plurality of radio frames; and

 a notifier unit configured to notify, to the mobile station, an discontinuous reception interval and a mapping
15 pattern, the discontinuous reception interval representing an interval at which discontinuous reception of the paging signal is performed, the mapping pattern indicating a pattern of a plurality of subframes to which the paging signal is mapped, wherein

20 a timing for the mobile station to receive the paging signal is determined based on the discontinuous reception interval and the mapping pattern.

[21] A radio base station configured to transmit a paging
25 signal for notification of an incoming call for a mobile station belonging to any one of a plurality of groups, the radio base station comprising:

 a paging signal transmitter unit configured to transmit the paging signal in two or more subframes in one radio frame;

a notifier unit configured to notify the mobile station of an discontinuous reception interval and a mapping pattern, the discontinuous reception interval representing an interval at which discontinuous reception of the paging signal is performed, the mapping pattern indicating a pattern of a plurality of subframes to which the paging signal is mapped; and

an adjuster unit configured to adjust the discontinuous reception interval and the mapping pattern, in accordance with the two or more subframes in which the paging signal is transmitted, wherein

a timing for the mobile station to receive the paging signal is determined based on the discontinuous reception interval and the mapping pattern.

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[22] The radio base station according to claim 10, wherein the radio frames are each formed of 10 subframes; broadcast information is transmitted in the first and sixth subframes in each radio frame; and

20 the paging signal transmitter unit is configured to transmit the paging signal in the tenth subframe in each radio frame.

[23] The radio base station according to claim 11, wherein the radio frames are each formed of 10 subframes; broadcast information is transmitted in the first subframe in each radio frame; and

25 the paging signal transmitter unit is configured to preferentially use the tenth subframe and the fifth subframe

in each radio frame in this order, as subframes in which the paging signal is transmitted.

- [24] The radio base station according to claim 11, wherein
- 5 the radio frames are each formed of 10 subframes;
- broadcast information is transmitted in the first subframe in each radio frame; and
- the reception timing determining unit is configured to determine the tenth subframe in each radio frame as the
- 10 predetermined timing.