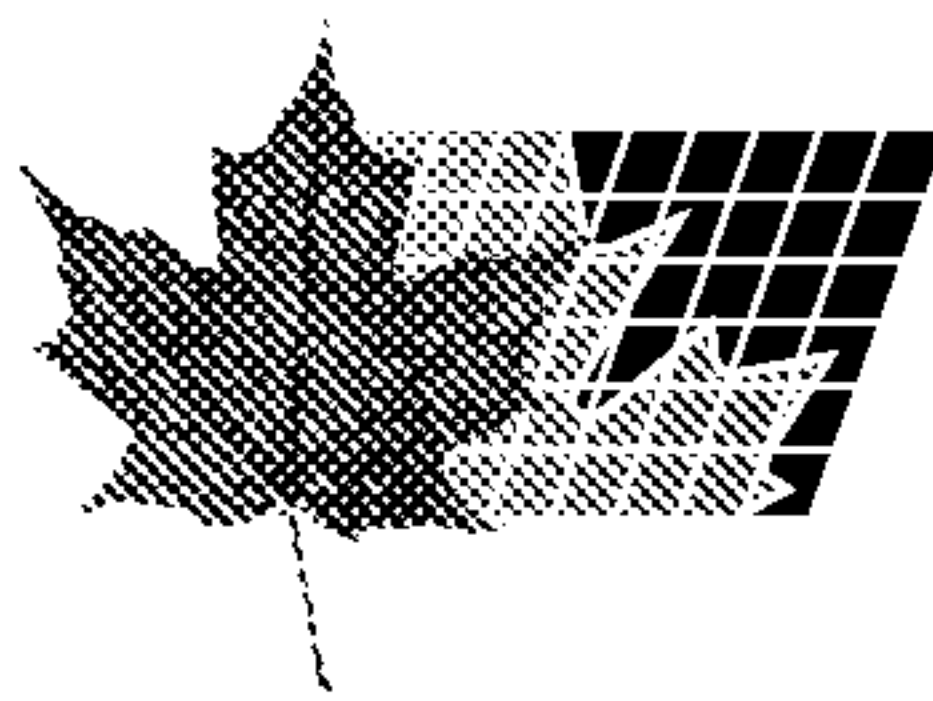




(72) IDE, MINAKO, JP

(72) HIRAMATSU, KATSUHIKO, JP

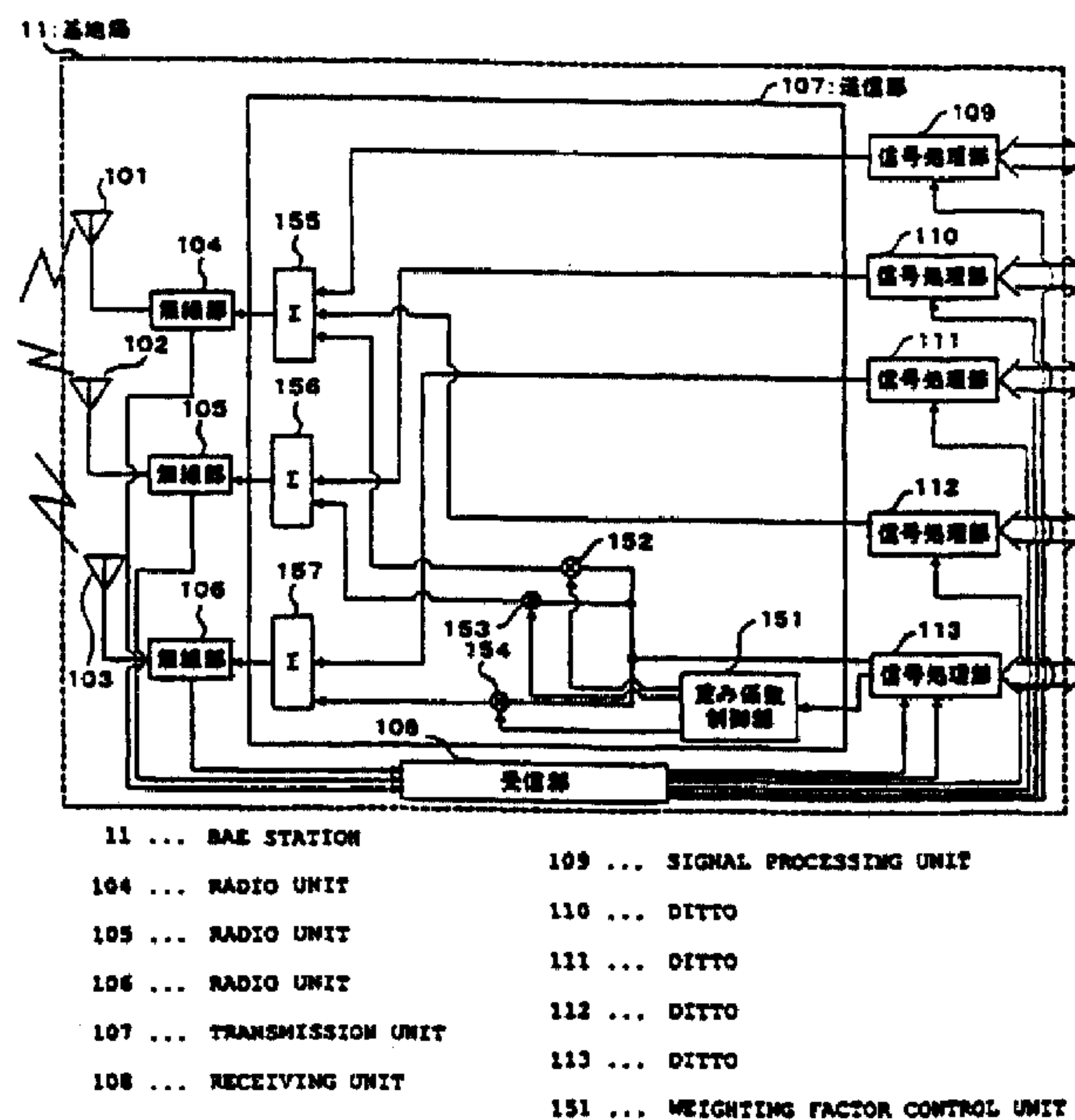
(71) MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD., JP

(51) Int.Cl.⁶ H04B 1/04, H04B 7/26, H04B 7/06

(30) 1998/09/18 (10-264349) JP

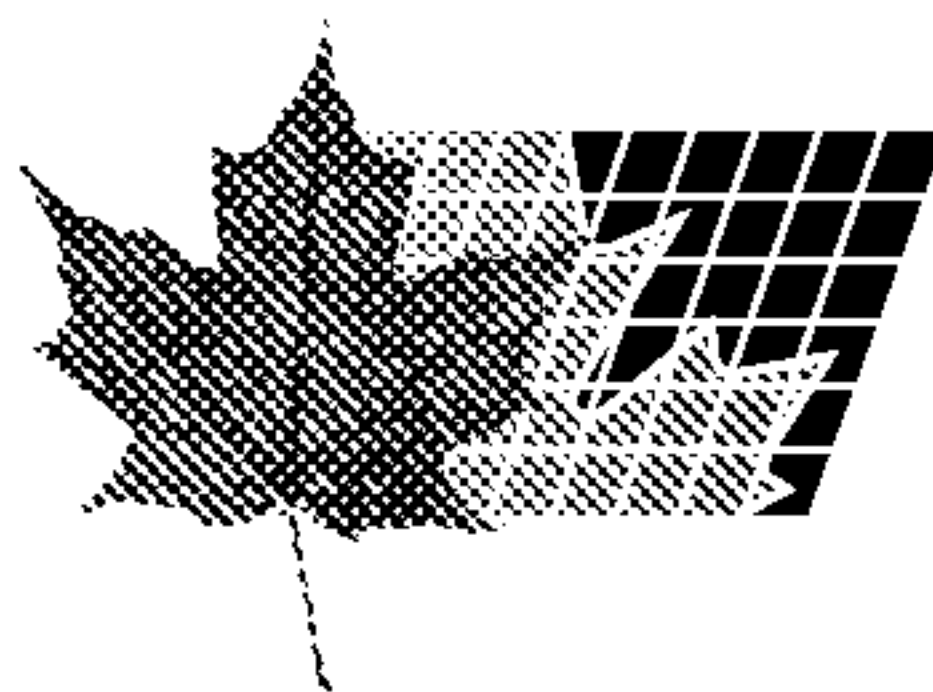
(54) **DISPOSITIF STATION DE BASE ET PROCEDE D'EMISSION**

(54) **BASE STATION DEVICE AND TRANSMISSION METHOD**



(57) Les signaux destinés à être émis de manière directionnelle variable sont multipliés par plusieurs facteurs de pondération pour différentes antennes (101 à 103) par un multiplicateur (152), de sorte que ces signaux peuvent être émis respectivement vers divers circuits de synthèse (155 à 157). Les signaux n'ayant pas été émis de manière directionnelle variable sont émis respectivement vers n'importe lequel de ces circuits de synthèse (155 à 157). Une entrée du signal dans un circuit de synthèse (155) est synthétisée, puis soumise à une modulation radioélectrique par une unité radioélectrique (104), avant d'être émise par une antenne

(57) Signals to be subject to variable directional transmission are multiplied by weighting factors for individual antennas (101 to 103) at a multiplier (152) for outputting to synthesis circuits (155 to 157) respectively, while signals not subject to variable directional transmission are output to any one of the synthesis circuits (155 to 157) respectively. A signal input to a synthesis circuit (155) is synthesized, radio-modulated at a radio unit (104) and transmitted from an antenna (101). Similarly, a signal input to a synthesis circuit (156) is synthesized, radio-modulated at a radio unit (105) and transmitted from an antenna (102), and a signal input to



(101). De même, une autre entrée du signal dans un circuit de synthèse (156) est synthétisée, puis soumise à une modulation radioélectrique par une unité radioélectrique (105), avant d'être émise par une antenne (102), et une troisième entrée du signal dans un circuit de synthèse (157) est synthétisée, soumise à une modulation radioélectrique par une unité radioélectrique (106), avant d'être émise par une antenne (103). Il est ainsi possible d'émettre de manière diffuse, depuis différentes antennes, des signaux non émis de manière directionnelle variable, afin de réduire la puissance d'émission et de limiter la taille d'un dispositif, lorsque cette émission directionnelle variable depuis différentes antennes s'effectue uniquement au moyen d'un équipement terminal.

a synthesis circuit (157) is synthesized, radio-modulated at a radio unit (106) and transmitted from an antenna (103). Thereby, it is possible to dispersedly transmit signals not subject to variable directional transmission from individual antennas to reduce a transmission power and the size of a device when variable directional transmission is performed on part of terminal devices only.

PCT

特許協力条約に基づいて公開された国際出願



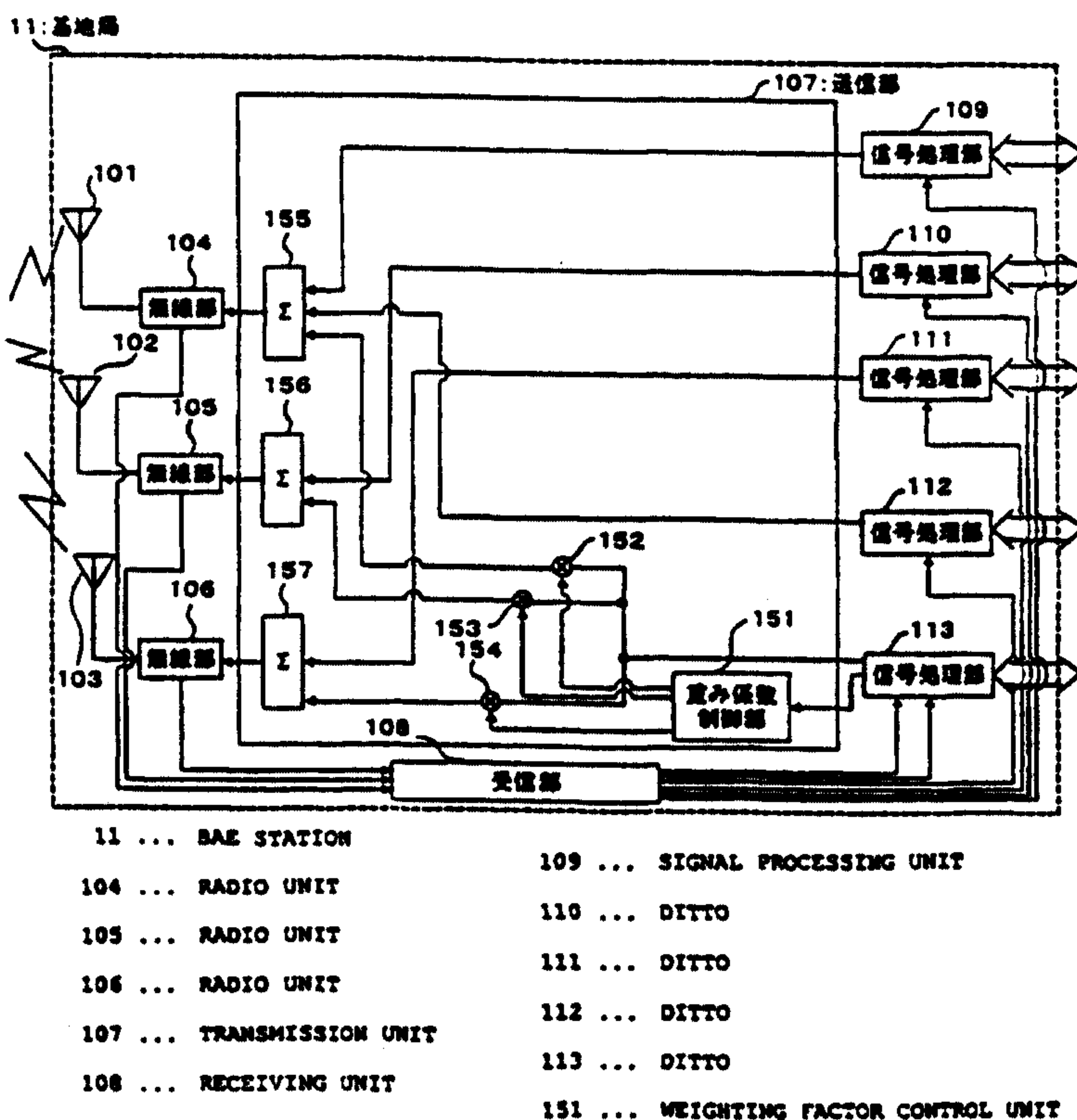
(51) 国際特許分類6 H04B 1/04, 7/26, 7/06	A1	(11) 国際公開番号 WO00/18022 (43) 国際公開日 2000年3月30日 (30.03.00)
(21) 国際出願番号 PCT/JP99/04964 (22) 国際出願日 1999年9月13日 (13.09.99) (30) 優先権データ 特願平10/264349 1998年9月18日 (18.09.98) JP (71) 出願人 (米国を除くすべての指定国について) 松下電器産業株式会社 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) [JP/JP] 〒571-8501 大阪府門真市大字門真1006番地 Osaka, (JP) (72) 発明者; および (75) 発明者/出願人 (米国についてのみ) 井出美奈子 (IDE, Minako) [JP/JP] 〒247-0009 神奈川県横浜市栄区鍛冶ヶ谷2-4-10-102 Kanagawa, (JP) 平松勝彦 (HIRAMATSU, Katsuhiko) [JP/JP] 〒239-0831 神奈川県横須賀市久里浜4-21-4-102 Kanagawa, (JP) (74) 代理人 鷺田公一 (WASHIDA, Kimihito) 〒206-0034 東京都多摩市鶴牧1丁目24-1 新都市センタービル5階 Tokyo, (JP)	(81) 指定国 AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, 欧州特許 (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI特許 (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG), ARIPO特許 (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), ニーラシア特許 (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM) 添付公開書類 国際調査報告書	

(54) Title: BASE STATION DEVICE AND TRANSMISSION METHOD

(54) 発明の名称 基地局装置及び送信方法

(57) Abstract

Signals to be subject to variable directional transmission are multiplied by weighting factors for individual antennas (101 to 103) at a multiplier (152) for outputting to synthesis circuits (155 to 157) respectively, while signals not subject to variable directional transmission are output to any one of the synthesis circuits (155 to 157) respectively. A signal input to a synthesis circuit (155) is synthesized, radio-modulated at a radio unit (104) and transmitted from an antenna (101). Similarly, a signal input to a synthesis circuit (156) is synthesized, radio-modulated at a radio unit (105) and transmitted from an antenna (102), and a signal input to a synthesis circuit (157) is synthesized, radio-modulated at a radio unit (106) and transmitted from an antenna (103). Thereby, it is possible to dispersedly transmit signals not subject to variable directional transmission from individual antennas to reduce a transmission power and the size of a device when variable directional transmission is performed on part of terminal devices only.



DESCRIPTION

BASE STATION APPARATUS AND TRANSMITTING METHOD
Technical Field

5 The present invention relates to a base station apparatus for use in a digital radio communication system that performs directional transmission by an adaptive array antenna in a forward link, and relates to a transmitting method.

10

Background Art

 The digital radio communication system such as a cellular phone, a car phone, and the like uses a cellular system in which a communication area is divided into
15 cells, one base station apparatus is placed at each cell, and a plurality of terminal apparatuses performs broadcast communication with this base station apparatus. In recent years, since the cellular systems have rapidly widespread and the
20 number of system users has rapidly increased, improvement of increasing a channel capacity in one cell has become the important subject.

 As a technique for improving in an increase of channel capacity, there is an adaptive array antenna
25 described in such as "Waveform Equalizing Technology for Digital Mobile Communications (supervised by Jun Horikoshi, Triceps). This is the technique in which the adaptive array antenna adds

amplitude and phase shift to the antenna outputs of the array antenna composed of a plurality of antennas and combines them to form the directivity of array, whereby the adaptive array antenna
5 determines a weighting factor of each antenna output based on a predetermined control algorithm, and controls the directivity as adapting to a change in an environmental state.

Then, the adaptive array antenna is mounted on
10 the base station apparatus and interference from the other cell is canceled to improve a reception quality, and this makes it possible to improve an increase in the channel capacity of a reverse link.

In addition, the base station apparatus on
15 which the adaptive array antenna is mounted estimates an arrival direction of a signal transmitted from the terminal apparatus, and performs directional transmission in the estimated direction, so that transmission power from the base station
20 apparatus can be lessened as maintaining a link quality. This makes it possible to reduce interference with the other terminal apparatus and to improve the increase in the channel capacity of the forward link.

25 However, the base station apparatus estimates the signal arrival direction with respect to all terminal apparatuses with which the base station apparatus performs communications in the forward

link, and carries out directional transmission, and this increases an amount of signal processing so as to cause a problem in which the apparatus size increases.

5 In order to solve such a problem, the conventional base station apparatus performs directional transmission with respect to some of the terminal apparatuses such as the terminal apparatus, which performs high-speed data transmission, or the
10 terminal apparatus, which needs large transmission power by use of the array antenna. Then, the conventional base station apparatus performs transmission having no directivity such as sector transmission, omnidirectional transmission (here-
15 inafter referred to as "nondirectional transmission") with respect to the other terminal apparatuses by use of an antenna prepared separately from the array antenna or one of antennas included in the array antenna.

20 This improves the increase in the channel capacity without increasing the apparatus size of a signal processing section so much.

 However, since the aforementioned conventional base station apparatus combines a plurality of
25 signals subjected to nondirectional transmission and transmits the combined signal from one antenna, transmission power in this antenna is not reduced. This causes a problem in which a dynamic range at

an amplifying operation time of a radio section cannot be suppressed, so that a large-sized and large-valued amplification must be used.

5 Disclosure of Invention

It is an object of the present invention is to provide a base station apparatus, which can suppress necessary power for an amplifier and which can miniaturize the size of the apparatus in performing
10 directional transmission with respect to only some of terminal apparatuses, and to provide the transmission method.

This object can be achieved by dividing signals subjected to directional transmission into signal
15 components whose number is the same as that of antenna elements of an array antenna, respectively, assigning weights to the respective signal components of the divided signals subjected to directional transmission, allocating a signal
20 subjected to no variable directional transmission to any one of the antenna elements, and combining signals transmitted from the same antenna element so as to perform radio transmission.

25 Brief Description of Drawings

FIG. 1 is a system view of a radio communication system including a base station apparatus of the present invention.

FIG. 2 is a block diagram showing a configuration of the base station apparatus according to a first embodiment of the present invention; and

5 FIG. 3 is a block diagram showing a configuration of the base station apparatus according to a second embodiment.

Best Mode for Carrying Out the Invention

10 The following will specifically explain the best mode for carrying out the present invention with reference to the drawings accompanying herewith. FIG. 1 is a system view of a radio communication system including a base station
15 apparatus of the present invention.

A base station apparatus 11 of FIG. 11 serves as a repeater for communications, processes signals radio transmitted from terminal apparatuses to radio or cable transmit the processed signals to an
20 external network 21, and processes signals radio or cable transmitted from the external network 21 and radio transmit the processed signals to the respective terminal apparatuses.

Here, it is assumed that the base station
25 apparatus 11 of FIG. 1 has three antennas 101, 102, and 103, performs broadcast communication with five terminal apparatuses. Then, it is assumed that the base station apparatus 11 performs nondirectional

transmission with respect to terminal apparatuses 1, 2, 3, and 4, and directional transmission with respect to terminal apparatus 5.

(First embodiment)

5 FIG. 2 is a block diagram showing a configuration of the base station apparatus according to a first embodiment of the present invention.

10 The base station apparatus 11 of FIG. 2 comprises three antennas 101, 102, 103, radio sections 104, 105, 106, a transmitting section 107, a receiving section 108, and signal processing sections 109, 110, 111, 112, 113. The transmitting section 107 includes a weighting factor controlling section 151, multiplication circuits 152, 153, 154, and combining circuits 155, 156, 157.

20 The radio section 104 converts a high-frequency signal received by the antenna 101 to a baseband signal and outputs it to the receiving section 108. The radio section 104 also converts a baseband signal input from the combining circuit 155 to a high-frequency signal, and radio transmits it from the antenna 101. The radio section 105 converts a high-frequency signal received by the antenna 102 to a baseband signal, and outputs it to the receiving section 108. The radio section 105 also converts a baseband signal input from the combining signal 156 to a high-frequency signal, and radio transmits it

25

from the antenna 102. The radio section 106 converts a high-frequency signal received by the antenna 103 to a baseband signal and outputs it to the receiving section 108. The radio section 106 also converts a
5 baseband signal input from the combining circuit 157 to a high-frequency signal, and radio transmits it from the antenna 103.

The transmitting section 107 spreads transmission signals input from the respective
10 signal processing sections with respect to the respective terminal apparatuses, combines them, and outputs it to each radio section. The receiving section 108 demodulates baseband signals from the respective radio sections, fetches signals received
15 from the respective terminal apparatuses, combines them, and outputs it to the respective signal processing sections. Moreover, the receiving section 108 estimates an arrival direction of a received signal (hereinafter referred to as "fifth
20 received signal") subjected to directional reception from the terminal apparatus 5, and outputs information of the arrival direction to the signal processing section 113.

The signal processing section 109 decodes a
25 received signal (hereinafter referred to as "first received signal"), which has been sent from the terminal apparatus 1 and which input from the receiving section 108. Then, the signal processing

section 109 outputs the decoded signal to an external network. Moreover, the signal processing section 109 codes a transmission signal (hereinafter referred to as "first transmission signal") with respect to the terminal apparatus 1, which has been input from the external network, modulates the coded signal, and outputs it to the combining circuit 155.

The signal processing section 110 decodes a received signal (hereinafter referred to as "second received signal"), which has been sent from the terminal apparatus 2 and which input from the receiving section 108. Then, the signal processing section 110 outputs the decoded signal to an external network. Moreover, the signal processing section 110 codes a transmission signal (hereinafter referred to as "second transmission signal") with respect to the terminal apparatus 2, which has been input from the external network, modulates the coded signal, and outputs it to the combining circuit 156.

The signal processing section 111 decodes a received signal (hereinafter referred to as "third received signal"), which has been sent from the terminal apparatus 3 and which input from the receiving section 108. Then, the signal processing section 111 outputs the decoded signal to an external network. Moreover, the signal processing

section 111 codes a transmission signal (hereinafter referred to as "third transmission signal") with respect to the terminal apparatus 3, which has been input from the external network, 5 modulates the coded signal, and outputs it to the combining circuit 157.

The signal processing section 112 decodes a received signal (hereinafter referred to as "fourth received signal"), which has been sent from the 10 terminal apparatus 4 and which input from the receiving section 108. Then, the signal processing section 112 outputs the decoded signal to the external network. Moreover, the signal processing section 112 codes a transmission signal 15 (hereinafter referred to as "fourth transmission signal") with respect to the terminal apparatus 4, which has been input from the external network, modulates the coded signal, and outputs it to the combining circuit 155.

20 The signal processing section 113 decodes a fifth received signal input from the receiving section 108, and outputs the decoded signal to the external network. Moreover, the signal processing section 113 codes a transmission signal with respect 25 to the terminal apparatus 5 (hereinafter referred to as "fifth transmission signal"), which has been input from the external network, modulates the coded signal, and outputs it to the respective

multiplication circuits in parallel. Furthermore, the signal processing section 113 outputs information of the arrival direction input from the receiving section 108 to the weighting factor
5 controlling section 151.

The weighting factor controlling section 151 calculates a weighting factor of each antenna output based on information of the arrival direction input from the signal processing section 113, and outputs
10 the calculated weighting factor to each multiplication circuit. The multiplication circuit 152 multiplies the fifth transmission signal by the weighting factor input from the weighting factor controlling section 151, and outputs it to the
15 combining circuit 155. The multiplication circuit 153 multiplies the fifth transmission signal by the weighting factor input from the weighting factor controlling section 151, and outputs it to the combining circuit 156. The multiplication circuit
20 154 multiplies the fifth transmission signal by the weighting factor input from the weighting factor controlling section 151, and outputs it to the combining circuit 157.

The combining circuit 155 combines the signals
25 input from the signal processing section 109, signal processing section 112, and multiplication circuit 152, and outputs it to the radio section 104. The combining circuit 156 combines the signals input

from the signal processing section 110, and multiplication circuit 153, and outputs it to the radio section 105. The combining circuit 157 combines the signals input from the signal processing section 111, and multiplication circuit 154, and outputs it to the radio section 106.

The following will explain the flow of the received signals from the respective terminal apparatuses in the base station apparatus 11 of FIG. 2.

The signal received from the antenna 101 is converted to the baseband signal from the high-frequency signal by the radio section 104, and the converted signal is output to the receiving section 108. Similarly, the signal received from the antenna 102 is converted to the baseband signal from the high-frequency signal by the radio section 105, the signal received from the antenna 103 is converted to the baseband signal from the high-frequency signal by the radio section 106, and these converted signals are output to the receiving section 108, respectively.

Then, in the receiving section 108, the baseband signals from the respective radio sections are demodulated, the received signals are fetched from the respective terminal apparatuses, diversity combining, which includes adaptive array antenna processing, is performed, and the arrival direction

of the fifth received signal, which has been directionally received, is estimated.

The first received signal is decoded by the signal processing section 109, and the decoded
5 signal is transmitted to an external network system. Similarly, the second received signal is decoded by the signal processing section 110, the third received signal is decoded by the signal processing section 111, the fourth received signal is decoded
10 by the signal processing section 112, the fifth received signal is decoded by the signal processing section 113, and these decoded signals are transmitted to the external network system, respectively.

15 Furthermore, information of the arrival direction estimated by the receiving section 108 is output to the weighting factor controlling section 151 via the signal processing section 113. Then, the weighting factor controlling section 151 calculates
20 the weighting factor of the fifth transmission signal based on information of the arrival direction, and outputs the calculated weighting factor to the multiplication circuits 152, 153, 154, respectively.

25 Next, an explanation is given of the flow of the transmission signals to the respective terminal apparatuses in the base station apparatus 11 of FIG. 2.

The first transmission signal is coded, modulated, and output to the combining circuit 155 by the signal processing section 109. The second transmission signal is coded, modulated, and output to the combining circuit 156 by the signal processing section 110. The third transmission signal is coded, modulated, and output to the combining circuit 157 by the signal processing section 111. The fourth transmission signal is coded, modulated, and output to the combining circuit 155 by the signal processing section 112.

The fifth transmission signal is coded and modulated by the signal processing section 113. The modulated fifth transmission signal is multiplied by the weighting factor with respect to the antenna 101 by the multiplication circuit 152, and the resultant is output to the combining circuit 155. Similarly, the modulated fifth transmission signal is multiplied by the weighting factor with respect to the antenna 102 by the multiplication circuit 153, and the resultant is output to the combining circuit 157.

The signals input to the combining circuit 155 are combined, and radio modulated by the radio section 104, and transmitted through the antenna 101. The signals input to the combining circuit 156 are combined, and radio modulated by the radio section 105, and transmitted through the antenna 102. The

signals input to the combining circuit 157 are combined, and radio modulated by the radio section 106, and transmitted through the antenna 103.

Thus, the signals other than those subjected
5 to the directional transmission are transmitted in such a manner that they are spread to the respective antennas of the array antenna, so that transmission power of antennas can be spread. This eliminates the case in which an antenna whose transmission power
10 is considerably large as compared with the other antenna, and makes it possible to miniaturize the size of the amplifier in the radio section.

Here, since the phase of the output of the amplifier differs in accordance with an
15 amplification rate in general, a radio section calibration for adjusting this phase between the respective antennas is needed. According to this embodiment, since the width of the signal amplification rate can be suppressed to be small,
20 a phase rotation width can be reduced at a signal amplifying time, and this is effective in simplifying the radio section calibration necessary for the adaptive array antenna.

(Second embodiment)

25 FIG. 3 is a block diagram showing a configuration of the base station apparatus according to a second embodiment.

In the base station apparatus of FIG. 3, the

same reference numerals as those of the base station apparatus of FIG. 2 are added to the portions common to the portions of FIG. 2.

The base station apparatus of FIG. 3 adopts the
5 configuration in which a switch control section 201 and connection switches 202 to 213 are added to the base station apparatus of FIG. 2.

The switch control section 201 controls the
10 respective connection switches such that transmission power of the respective antennas is equalized to each other based on transmission power with respect to each terminal apparatus, which has been input from the respective signal processing sections and the weighting factor input from the
15 weighting factor controlling section 151. The connection switches 202 to 213 are connected or disconnected by control of the switch controlling section 201.

The following will explain an example of the
20 control of the switch controlling section 201 wherein transmission power to the terminal apparatus 1 is "1.0", transmission power to the terminal apparatus 2 is "1.5", transmission power to the terminal apparatus 3 is "1.8", transmission
25 power to the terminal apparatus 4 is "2.2", transmission power to the terminal apparatus 5 is "2.0", weighting factor to be output to the multiplication circuit 152 is "0.5", weighting

factor to be output to the multiplication circuit 153 is "0.3", and weighting factor to be output to the multiplication circuit 154 is "0.2".

First, the switch controlling section 201 multiplies transmission power of the directional transmission signal by the weighting factor, and calculates transmission power of each antenna of the directional transmission signal. In this example, transmission power to the terminal apparatus 5 of antenna 101 is "1.0", transmission power to the terminal apparatus 5 of antenna 102 is "0.6", and transmission power to the terminal apparatus 5 of antenna 103 is "0.4".

Next, antennas for transmitting nondirectional transmission signals are allocated such that transmission power of the respective antennas is equalized to each other. In this example, the first transmission antenna is transmitted from the antenna 103, the second transmission antenna is transmitted from the antenna 103, the third transmission antenna is transmitted from the antenna 101, and the fourth transmission antenna is transmitted from the antenna 102. As a result, transmission power of antenna 101 becomes "2.8", transmission power of antenna 102 becomes "2.8", transmission power of antenna 103 becomes "2.9", and the difference between the respective antennas in transmission power becomes the smallest.

Finally, the switch controlling section 201 controls the respective switches based on the antenna allocation result. In this example, the switch controlling section 201 connects the connection switches 204, 207, 208, 212, and disconnects the other connection switches.

For reference sake, the switch controlling section 201 appropriately controls the connection switches in accordance with the change in transmission power to each terminal apparatus and each weighting factor.

Thus, the transmission signals with respect to the respective terminal apparatus are allocated to the respective antennas such that transmission power of the respective antennas achieves substantially the same level as each other. This makes it possible to further miniaturize the apparatus as compared with the first embodiment.

The second embodiment performed the selection of antenna for transmitting the signals other than those subjected to the directional transmission by changing the switch. However, this can be carried out by weighting factor control by use of the weighting factor controlling section and the multiplication circuit in place of the switch control section and the connection switches. In this case, the weighting factor controlling section sets one of the weighting factors to be output to "1" and

the other to "0". The input of the weighting factor "1" to the multiplication circuit is equivalent to the connection of the connection switches, and the signal input to the multiplication circuit is directly output. The input of the weighting factor "0" to the multiplication circuit is equivalent to the disconnection of the connection switches, and nothing is output from the multiplication circuit.

This allows the respective signal processing sections to process both the nondirectional transmission signals and the directional transmission signals. More specifically, in the case of processing the directional transmission signal, each signal processing section outputs the weighting factor to the weighting factor controlling section based on information of the arrival direction, and in the case of processing the nondirectional transmission signal, each signal processing section outputs the weighting factor of "1" or "0" to the weighting factor controlling section.

The present invention can be applied to any system in which directional transmission and nondirectional transmission are mixed, and is not limited by such as a signal multiplex division system.

As explained above, according to the base station apparatus of the present invention and the

transmitting method, since the nondirectional transmission signals can be allocated to the respective antennas of the array antenna, transmission power of the respective antenna can be spread. This eliminates the case in which an antenna whose transmission power is considerably large as compared with the other antennas, and makes it possible to miniaturize the size of the amplifier in the radio section. This means that a phase rotation width can be reduced at a signal amplifying time, and this is effective in simplifying the radio section calibration necessary for the adaptive array antenna.

This application is based on the Japanese Patent Application No. HEI10-264349 filed on September 18, 1998, entire content of which is expressly incorporated by reference herein.

Industrial Applicability

The present invention is suitable for a digital radio communication system in which an adaptive array antenna is mounted on a base station apparatus and directional transmission is performed with respect to only some terminal apparatuses.

Claims

1. A base station apparatus comprising:
an array antenna for forming directivity using
a plurality of antenna elements;

5 dividing means for dividing first signals,
which are subjected to directional transmission
into signal components whose number is the same as
that of said antenna elements;

 weighting means for assigning weights to the
10 respective signal components of said first signals;

 allocating means for allocating second signals,
which are subjected to no variable directional
transmission, to any one of said antenna elements;

 combining means for combining said first and
15 second signals transmitted from the same antenna
element; and

 radio transmitting means for radio transmit-
ting the combined signal from each of said antenna
elements.

20 2. The base station apparatus according to
claim 1, wherein said allocating means spreads the
allocating destinations of the respective second
signals.

 3. The base station apparatus according to
25 claim 1, wherein said allocating means minimizes the
difference between the respective antenna elements
in the number of second signals to be allocated to
the respective antenna elements.

4. The base station apparatus according to claim 1, wherein said allocating means minimizes the difference between the respective antenna elements in transmission power based on transmission power of the weighted first signal components and that of the weighted second signal components.

5. The base station apparatus according to claim 1, wherein connection switches are provided on the way of each path through which said second signals are sent to the antenna element, said allocating means connects said connection switch provided on the way of the antenna element of the allocating destination of the respective second signals, and disconnects the other switches.

6. The base station apparatus according to claim 1, wherein multipliers, which multiply input second signals by coefficients, are provided on the way of each path through which said second signals are sent to the antenna elements, said allocating means outputs a coefficient of "1" to the multiplier provided on the way of the antenna element of the allocating destination of the respective second signals, and outputs a coefficient of "0" to the other multipliers.

7. A terminal apparatus, which performs radio communications with the base station apparatus described in claim 1.

8. A transmitting method comprising the steps

of:

dividing means for dividing first signals, which are subjected to directional transmission into signal components whose number is the same as
5 that of said antenna elements;

weighting means for assigning weights to the respective signal components of said first signals;

allocating means for allocating second signals, which are subjected to no variable directional
10 transmission, to any one of said antenna elements;

combining means for combining said first and second signals transmitted from the same antenna element; and

radio transmitting means for radio transmit-
15 ting the combined signal from each of said antenna elements.

9. The transmitting method according to claim 8, wherein said allocating step spreads the allocating destinations of the respective second
20 signals.

10. The transmitting method according to claim 8, wherein said allocating step minimizes the difference between the respective antenna elements in the number of second signals to be allocated to
25 the respective antenna elements.

11. The transmitting method according to claim 8, wherein said allocating step minimizes the difference between the respective antenna elements

in transmission power based on transmission power of the weighted first signal components and that of the weighted second signal components.

12. The transmitting method according to claim
5 8, wherein connection switches are provided on the way of each path through which said second signals are sent to the antenna element, said allocating means connects said connection switch provided on the way of the antenna element of the allocating
10 destination of the respective second signals, and disconnects the other switches.

13. The transmitting method according to claim
8, wherein multipliers, which multiply input second signals by coefficients, are provided on the way of
15 each path through which said second signals are sent to the antenna elements, said allocating means outputs a coefficient of "1" to the multiplier provided on the way of the antenna element of the allocating destination of the respective second
20 signals, and outputs a coefficient of "0" to the other multipliers.

1/3

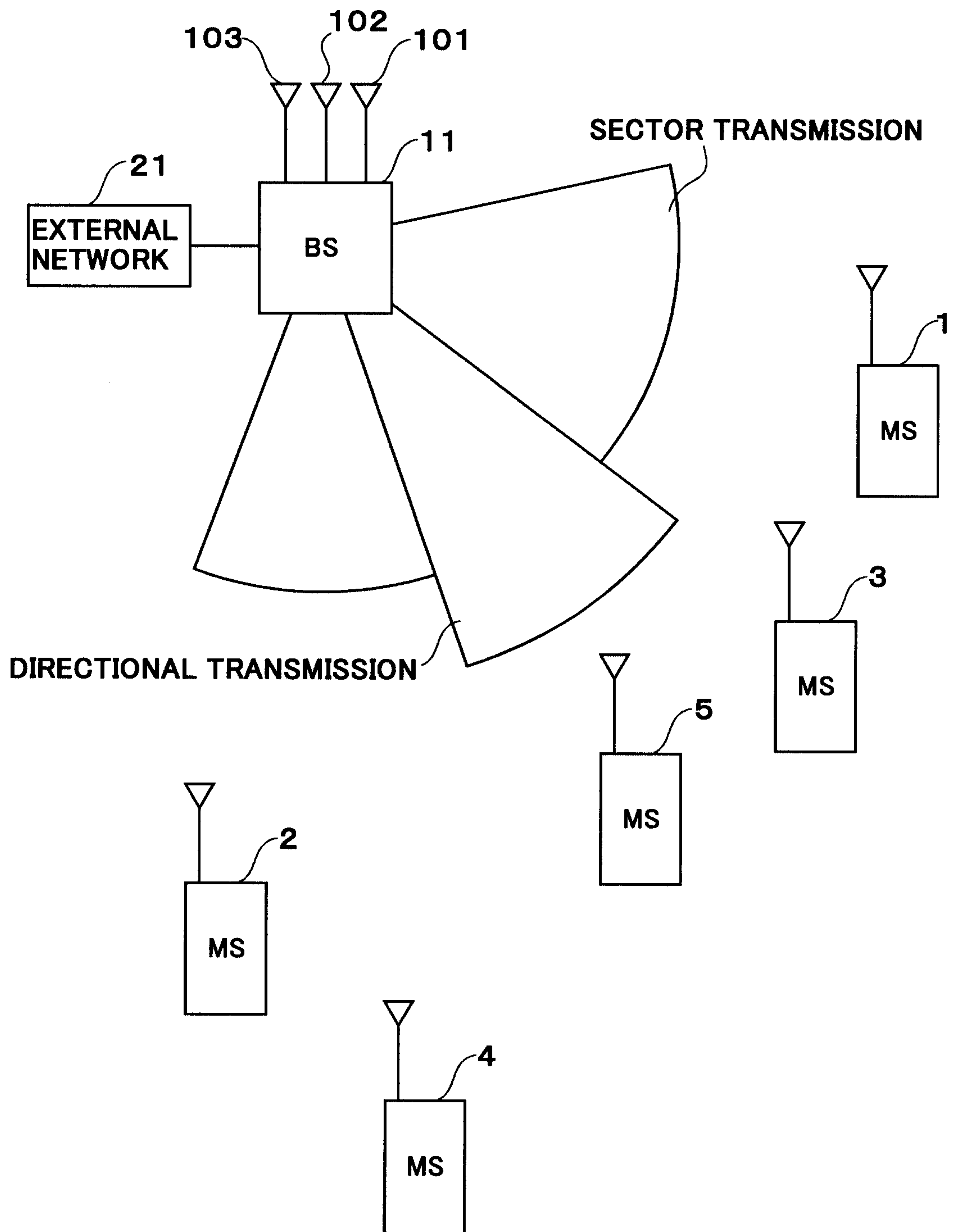


FIG.1

2/3

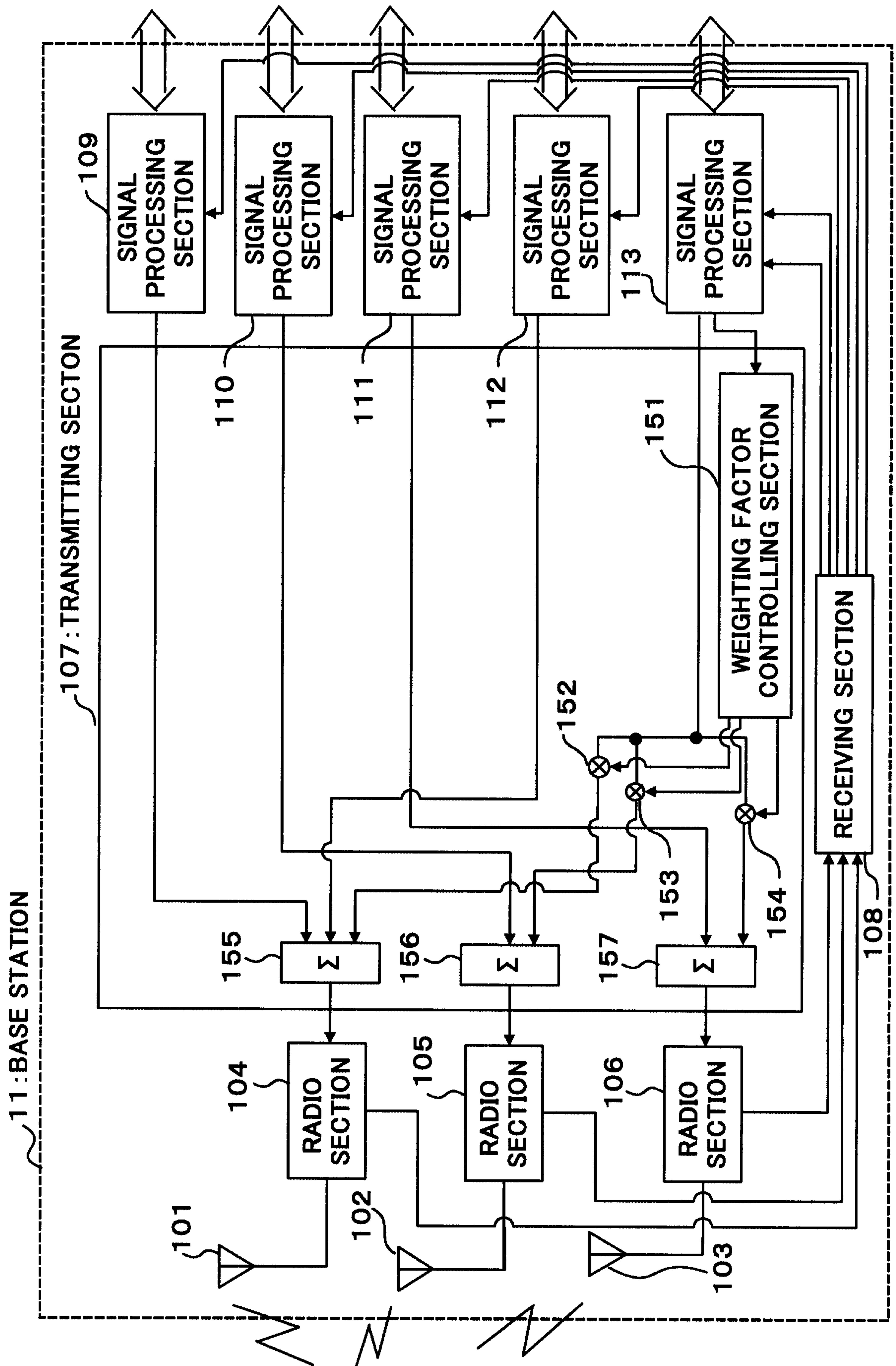


FIG.2

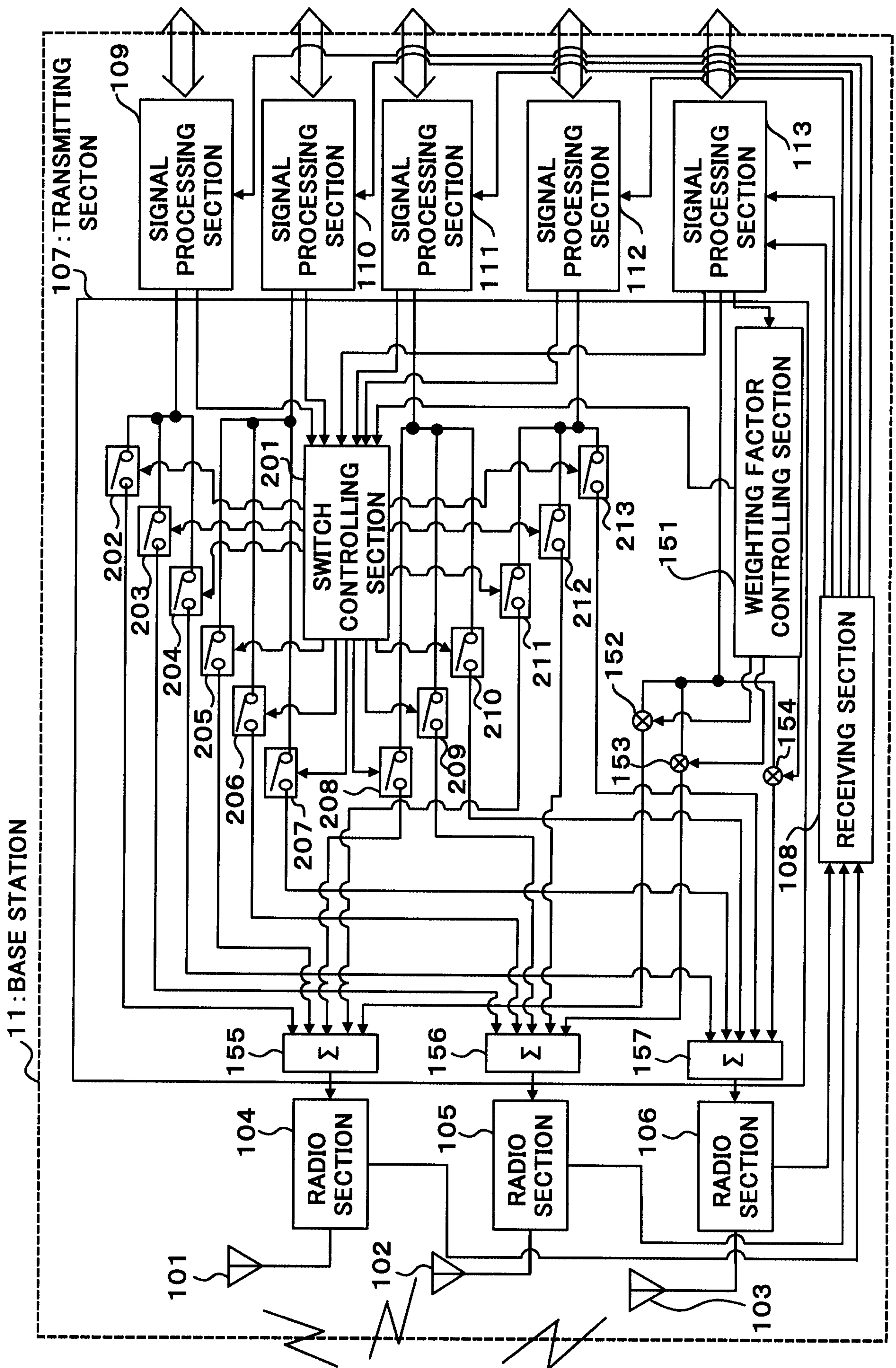


FIG. 3