Appeal decision

Appeal No. 2016-13222

Aichi, Japan
Appellant DENSO WAVE INCORPORATED

Aichi, Japan
Patent Attorney TASHITA, Akihito

The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2012-165061, entitled "Antenna" (the application published on February 6, 2014, Japanese Unexamined Patent Application Publication No. 2014-27417) has resulted in the following appeal decision.

Conclusion

The appeal of the case was groundless.

Reason

1. History of the procedures

The application was filed on July 25, 2012, reasons for refusal were notified on December 14, 2015, a written amendment was submitted on February 15, 2016, an examiner's decision of refusal was issued on May 30, 2016, an appeal against the examiner's decision of refusal was made on September 5, 2016 and a written amendment was submitted at the same time, reasons for refusal were notified by the body on March 29, 2017, and a written amendment was submitted on June 1, 2017.

2. The Invention

The invention according to Claim 1 of the application (hereinafter referred to as "the Invention") is recognized as follows, as specified by the matters described in Claim 1 of the scope of claims in the written amendment dated June 1, 2017.

"An antenna including:

a substrate;

an element comprising a body part made of a conductive material and protruding from a first board side of the substrate and extending longitudinally in a direction orthogonal to a longitudinal direction, which is a thickness direction of the substrate, a first connection part for connecting one longitudinal end of the body part and the substrate, and a second connection part for connecting the other longitudinal end of the body part and the substrate, and formed to supply power to the body part via the first connection part; and

a frequency adjustment part formed as a conductive path electrically connected on the substrate to the second connection part;

the antenna including a plurality of elements,

the elements being arranged around a predetermined central region on the

substrate so that the longitudinal direction of the body part of each element may be different from the longitudinal direction of the body parts of adjacent elements,

the substrate being formed as a rectangular shape,

the elements being arranged adjacent to the ends constituting a periphery of the substrate,

the frequency adjustment part being formed as a wiring pattern exposed from the first board side so as to be bent from the second connection part along the first board side, and arranged linearly with the tip toward the first connection part or with multiple bends."

3. Reasons for refusal of the body

The summary of the reasons for refusal notified by the body as of March 29, 2017 is that the invention according to Claim 1 of the application could be easily invented by a person skilled in the art on the basis of the invention described in Japanese Unexamined Patent Application Publication No. H7-297626 (hereinafter referred to as "Cited document 1") and Japanese Unexamined Patent Application Publication No. H3-166803 (hereinafter referred to as "Cited document 2"), and the appellant should not be granted a patent for the Invention in accordance with the provisions of Article 29 (2) of the Patent Act.

4. Cited Documents

Cited document 1 (underlines were added by the body) includes the following description. (Hereinafter referred to as "Cited invention".)

"[0009] The capacitor connected to the capacitance connection terminal in the invention can be formed in various embodiments. For example, the capacitor can be formed by using at least part of layers of a substrate as a dielectric layer. As an example of the structure, there can be a structure having a capacitance extraction electrode formed on one principal surface of the substrate and a ground electrode formed on the other surface opposite the capacitance extraction electrode, or a structure having at least one of a capacitance extraction electrode and a ground electrode arranged opposite the capacitance extraction electrode via some layers of the substrate, formed in the substrate.
[0010] The capacitor can be formed as a capacitor element mounted on a substrate. The capacitor can be also formed by interposing a dielectric layer between a pair of electrodes formed on a substrate.
[0011] As described above, the capacitor connected to a capacitance connection terminal in the invention can be formed in various embodiments. The embodiments of the capacitor can be appropriately selected in accordance by a capacitance required valueof capacitor connected to the radiator in an antenna device.
[0012] However, as described above, the capacitor is preferably formed using at least part of layers of a substrate as a dielectric layer. In the capacitor, no additional capacitor element is required. Therefore, there is no need to prepare an additional capacitor element to be mounted on a substrate, thereby enabling simple implementation."

"[0021] In reference to FIG. 2, the radiator 11 is obtained by mechanically machining a metal plate made of a metallic material, such as copper or copper alloy, into the shape

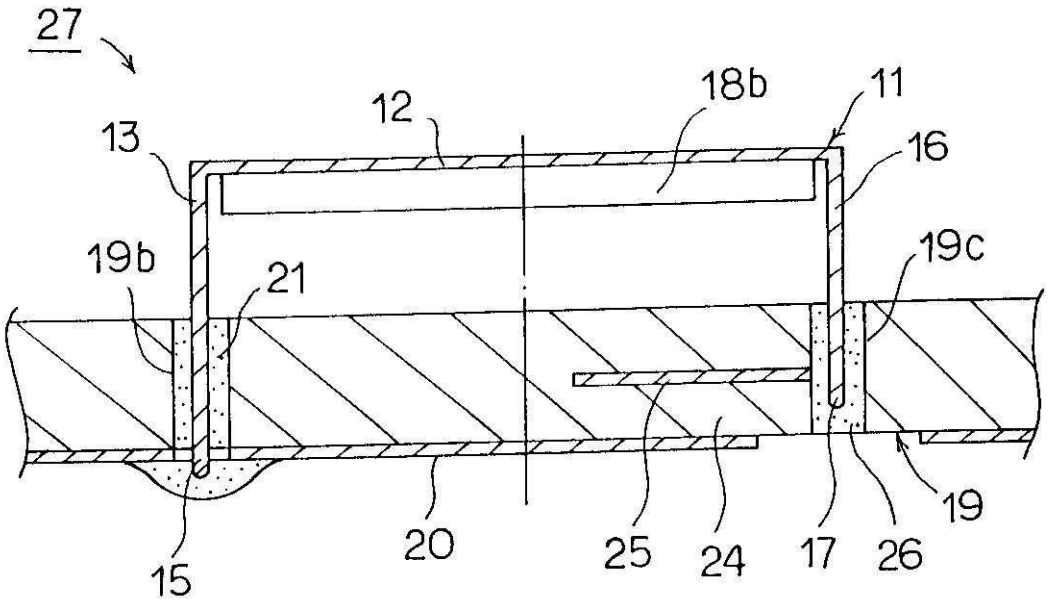
shown in the figure. The radiator 11 has a radiation part 12 with a rectangular surface. The radiation part 12 serves a function of transmitting/receiving radio waves. A bent part 13 which is bent downward with the width of the radiation part 12 is formed from one short-side edge of the radiation part 12. A narrow feeding terminal 14 and a ground terminal 15 are integrally formed with the bent part 13 at a tip of the bent part 13. In this embodiment, as described later, each of the feeding terminal 14 and the ground terminal 15 is inserted into an insertion hole of a printed circuit board, by determining position of a lower end 13a of the bent part 13, determining a distance between the radiation plate 12 and a upper surface of the printed circuit board.
[0022] A bent part 16 bent downward with the same width as the radiation part 12 is formed from the other short-side edge of the radiation part 12. A narrow capacitance connection terminal 17 is integrally formed with the bent part 16 at a tip of the bent part 16."

"[0024] In reference Figs. 3 (a) and (b), the radiator 11 is mounted on a printed circuit board 19, by using of insertion holes 19a-19c of the printed circuit board 19. The printed circuit board 19 is formed the insertion hole 19a where the feeding terminal 14 is inserted, the insertion hole 19b where the ground terminal 15 is inserted, and the insertion hole 19c where the capacitance connection terminal 17 is inserted. By inserting the feeding terminal 14 into the insertion hole 19a, inserting the ground terminal 15 into the insertion hole 19b, and inserting the capacitance connection terminal 17 into the insertion hole 19c, the radiator 11 is positioned with respect to the printed circuit board 19, as shown in the figure. In this case, the insertion ends at a position where the lower end 13a of the bent part 13 comes into contact with the upper surface of the printed circuit board 19. Therefore, as described above, by determining the position of the lower end 13a of the bent part 13, or determining the distance between the radiation part 12 and the lower end 13a, an insertion depth of the ground terminal 15 and a distance between the radiation part 12 and the upper surface of the printed circuit board 19 can be determined.
[0025] On a lower surface of the printed circuit board 19, a ground electrode 20 is formed. The ground electrode 20 is electrically connected to the ground terminal 15 inserted in the insertion hole 19b with solder 21.
[0026] As shown in Fig. 3 (b), a feeding electrode 22 is formed on the upper surface of the printed circuit board 19. The feeding electrode 22 is electrically connected to the feeding terminal 14 inserted in the insertion hole 19a with solder 23. As is obvious from Fig. 3 (a), a capacitance extraction electrode 25 is formed in the printed circuit board 19 so as to be opposite the ground electrode 20 via layers 24 of the printed circuit board 19. The capacitance extraction electrode 25 is formed to be exposed to the insertion hole 19c, and is electrically connected to the capacitance connection terminal 17 with solder 26 poured into the insertion hole 19c."

"[0038] In the antenna device of the first embodiment, the capacitor connected between the capacitance connection terminal and the ground terminal is formed of the capacitance extraction electrode 25 formed in the printed circuit board 19 and the ground electrode pattern 20 formed on the lower surface of the printed circuit board 19. The structure of the capacitor formed by using at least part of layers in the printed circuit board 19 requires only that at least one of a capacitance extraction electrode and

a ground electrode opposite the capacitance extraction electrode is inside of the printed circuit board 19. Thus, in contrast to the capacitor shown in Fig. 3A, the structure of the capacitor formed the capacitance extraction electrode 25 may be formed on the board surface of the printed circuit board 19, and a ground electrode connected to the ground electrode 20 may be made inside of the printed circuit board 19. Alternatively, a capacitance extraction electrode is formed on the upper surface of the printed circuit board 19, to extract capacitance with the ground electrode 20. In this case, the whole part of the printed circuit board 19 in the thickness direction functions as a dielectric layer for constituting a capacitor."

[FIG. 3] (a)



From the one short-side edge of the radiation part 12 which serves a function of transmitting/receiving radio waves, the bent part 13 bent downward is formed. The feeding terminal 14 and the ground terminal 15 are formed integrally with the bent part 13 at the tip of the bent part 13. The feeding terminal 14 and the ground terminal 15 are inserted into the insertion holes of the printed circuit board, respectively. Therefore, it can be said that the bent part 13 connects the one short-side edge of the radiation part 12 and the printed circuit board 19 and supplies electric power to the radiation part 12 via the bent part 13.

Meanwhile, from the other short-side edge, the bent part 16 bent downward is formed. The capacitance connection terminal 17 is formed integrally with the bent part 16. The capacitance connection terminal 17 is inserted into the insertion hole 19c formed in the printed board 19. Therefore, it can be said that bent part 16 connects the other short-side edge of the radiation part 12 and the printed circuit board 19.

It is obvious from Fig. 3 (a) that the radiation part 12 is formed to protrude from the upper surface of the printed circuit board 19 and arranged in a direction orthogonal to the longitudinal direction, which is a thickness direction of the printed circuit substrate.

Since the capacitance extraction electrode 25 is electrically connected to the capacitance connection terminal 17, it can be said that the bent part 16 and the capacitance extraction electrode are connected to each other.

In light of the above, it can be recognized that the Cited document 1 describes the following matter (hereinafter referred to as "Cited invention"):

"An antenna including:

a printed circuit board 19;

a radiator 11 comprising a radiation part 12 formed of a metal plate made of copper, protruding from a upper surface of the printed circuit board 19, arranged in a direction orthogonal to a longitudinal direction, which is a thickness direction of the printed circuit substrate, a bent part 13 bent downward from one short-side edge of the radiation part 12 with the width of the radiation part 12, and a bent part 16 bent downward from the other short-side edge of the radiation part 12 with the same width as the radiation part 12, and comprising a narrow feeding terminal 14 at a tip of the bent part 13; and

a capacitance extraction electrode 25 electrically connected to the bent part 16 via a capacitance connection terminal 17,

the capacitance extraction electrode 25 is formed on the board surface of the printed circuit board 19, and a ground electrode connected to a ground electrode 20 is made inside of the printed circuit board 19."

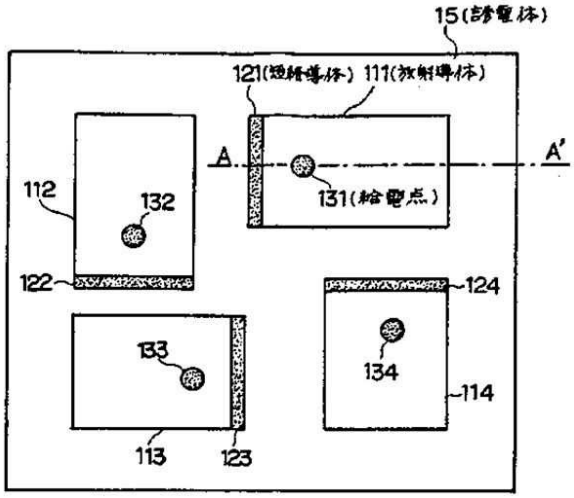
Cited document 2 (underlines were added by the body) includes the following description.

"(Example 1)

Fig. 1 is a first example of the invention. Here, as an example, a rectangular microstrip antenna with one side short-circuited is described. Fig. 1 (a) is a plan view and Fis. 1 (b) is a sectional view taken on the line A-A' in Fig. 1 (a). As shown, four radiation conductors 111 to 114 are disposed on a dielectric plate 15, and short-circuited to a conducting ground plane 14 via short-circuiting conductors 121 to 124, respectively. 131 to 134 denote feeding points of the radiation conductors 111 to 114, respectively, which are fed with power from the back side through feeders. The radiation conductors 111 and 112 are of the same size and have the same resonance frequency tuned to a frequency of a transmitting wave, Whereas the radiation conductors 113 and 114 are of the same size and have the same resonance frequency tuned to a frequency of a receiving wave. Consequently, the radiation conductor 111 and 113 are different in size.

As regards transmission, signals fed in phase to the radiation conductors 111 and 112 are thereby rendered into a circularly polarized wave, which must be formed within the half wavelength of the frequency used, as is well-known in the art. The same is true of reception, because of reversibility of the antenna and receiving antenna is formed by the radiation conductors 113 and 114 for receiving the circularly polarized wave. The radiation conductors 111, 112 for transmission and the radiation conductors 113, 114 for reception are disposed in such a manner as not to interfere with each other. To meet withthese requirements, the radiation conductors 111, 112, 113, and

114 are disposed as shown in Fig. 1, and for each radiation conductor, a plane passing through its feeding point and perpendicular to the corresponding short-circuiting conductor (a plane A-A' for the conductor 111, for instance) forms a rectangle or square on a dielectric plate 15. By limiting the sizes of the radiation conductors 111 to 114 to the bandwidths necessary for transmission and reception it is possible to prevent the coupling between transmission and receiption from constituting an obstacle to communications. The feeding points 131 and 132 are each connected from the back side of the conducting ground plane 14 to a transmitter via a feeder and a directional coupler. Since the radiation conductors 111 and 112 generate linearly polarized waves perpendicularly intersecting each other, the transmitting circularly polarized wave can be generated by feeding from directional coupler to feeding point as shown in Fig. 4(a) so that the phases of feeding are displaced 90 degrees apart from each other. Whether the polarized wave is right-handed or a left-handed is determined by the direction of connection of the directional coupler. For reception as well, a circularly polarized wave is received via the directional coupler on the same principle as mentioned above to a receiver." (p. 3 upper-right column l. 11 to bottom-right column l. 13)
FIG. 1 (a)



短絡導体	short-circuiting conductor
放射導体	radiation conductor
誘電体	dielectric plate
給電点	feeding point

"A Strip Loop Antenna with an L-Shaped Proximity Coupling feed system for a Circularly Polarized Wave" (hereinafter referred to as "Cited document 3", underlines other than "1. Introduction" and "2. Main subject" were added by the body) edited by Takaaki KONDO, Junji YAMAUCHI and Hisamatsu NAKANO, The 2002 communications society conference of IEICE, includes the following description.

"1. Introduction

A plate loop antenna for linear polarized wave fed by electromagnetic coupling

is addressed [1]. In this article, a plate loop antenna is fed at four points to examine circularly-polarized wave radiation characteristics.

2. Main subject

A test frequency of 3 GHz (λ_3=10 cm) is selected. Fig. 1 illustrates an antenna structure. A plate loop is printed on a dielectric plate substrate with a thickness B. A vertical wall with a width d is formed around the loop. The plate loop is fed by electromagnetic coupling with four L-shaped elements. A length of a vertical part of the L-shaped element is LV, and a length of a horizontal part is LH. A reflector is a square with a side g. Four terminals (F1, F2, F3, and F4) are fed at (1, -j, -1, j)."

FIG. 1

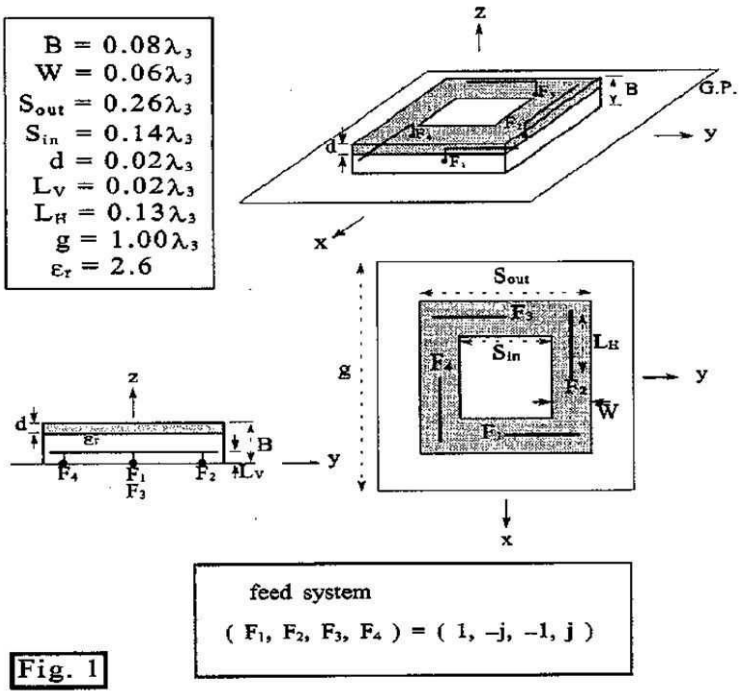


Fig. 1

Therefore, as indicated in Cited documents 2, 3, it is well-known that "four antennas are orthogonally arranged on a rectangle dielectric plate to constitute a circular-polarized wave antenna" (hereinafter referred to as "well-known technology").

5. Comparison between the Invention and the Cited invention

The "printed circuit board 19" in the Cited invention corresponds to the "substrate" in the Invention.

The "radiator 11" in the Cited invention corresponds to the "element" in the Invention.

The "bent part 13" in the Cited invention corresponds to the "first connection part" in the Invention.

The "bent part 16" in the Cited invention corresponds to the "second connection part" in the Invention.

As described in [0029] of the Cited document 1, "A capacitor is formed by laminating the capacitance extraction electrode 25 and a ground electrode 20 via a

substrate layer 24 which is a dielectric layer. (omitted) Thus, a resonance frequency of the antenna device is reduced due to a capacitance of the capacitor C1, thereby constituting a further compact antenna device," and the "capacitance extraction electrode 25" in the Cited invention constitutes a capacitor together with the ground electrode, and uses the capacitor to change a resonance frequency. Therefore, the "capacitance extraction electrode 25" in the Cited invention corresponds to the "frequency adjustment part" in the Invention.

It is a matter of technical common sense that "Copper" is a conductive material. Therefore, it can be said that the "radiation part 12" of the Cited invention is "formed of a conductive material." As is obvious from Fig. 3 of Cited document 1, the radiation part is arranged to protrude from a upper surface of the printed circuit board 19, and arrenged in a direction orthogonal to the longitudinal direction, which is a thickness direction of the printed circuit board 19. Therefore, there is no difference between the structure of the "radiation part 12" in the Cited invention and the structure of the "body part" in the Invention, which is made of a conductive material and protrudes from a first board side of the substrate and extends longitudinally in a direction orthogonal to the longitudinal direction, which is a thickness direction of the substrate.

According to the description in [0038] of the Cited document 1, in place of "the capacitance extraction electrode 25 formed in the printed circuit board 19 and the ground electrode pattern 20 formed on the lower surface of the printed circuit board 19," "the capacitance extraction electrode 25 may be formed on the board surface of the printed circuit board 19 and a ground electrode connected to the ground electrode 20 may be made inside of the printed circuit board 19." Therefore, it can be said that a structure where the capacitance extraction electrode 25 is formed on the board surface of the printed circuit board, that is, exposed from the board surface is disclosed. Since the capacitance extraction electrode 25 and the bent part 16 are connected to each other with solder 26, it can be said that the capacitance extraction electrode 25 seem to be bent in appearance from the bent part 16 along the board surface of the printed board.

It is obvious from Fig. 3 (a) that the capacitance extraction electrode 25 is arranged to be close to the bent part 13.

Thus, the Invention and the Cited invention correspond to each other in the following points:

"An antenna including:

a substrate;

an element comprising a body part made of a conductive material and protruding from a first board side of the substrate and extending longitudinally in a direction orthogonal to a longitudinal direction, which is a thickness direction of the substrate, a first connection part for connecting one longitudinal end of the body part and the substrate, and a second connection part for connecting the other longitudinal end of the body part and the substrate, and formed to supply power to the body part via the first connection part; and

a frequency adjustment part formed as a conductive path electrically connected on the substrate to the second connection part;

the antenna including a predetermined number of elements, and

the frequency adjustment part being formed as a wiring pattern exposed from the first board side so as to be bent from the second connection part along the first board side, and arranged to be close to the first connection part"

and, are different from each other in the following points:

Different feature 1

Regarding the term "a predetermined number of" in the corresponding feature, it is a plurality of elements in the Invention, whereas it is a single one in the Cited invention. In addition, in the Invention, the elements are arranged around a predetermined central region on the substrate so that the longitudinal direction of the body part of each element may be different from the longitudinal direction of the body parts of adjacent elements, and the elements being arranged adjacent to the ends constituting a periphery of the rectangular substrate. Whereas, the Cited invention does not specify the above configuration.

Different feature 2

Regarding the "wiring pattern" of the "frequency adjustment part" in the corresponding features, the wiring pattern is a "linear" arrangement or an arrangement having "a plurality of bent parts" in the Invention. Whereas, the pattern shape of the "capacitance extraction electrode" is unclear in the Cited invention.

6. Judgment by the body

The above-mentioned different features are examined.

Regarding the Different feature 1

As described in [0001] of the Cited document 1, the antenna in the Cited invention is an antenna to be used in portable communication.

It is a well-known problem that a circularly polarized wave antenna is formed in portable communication. In the Cited invention, employing the well-known technology to form a circularly polarized wave antenna only solves the well-known problem, and a person skilled in the art can easily conceive of it.

A circularly polarized wave antenna configured so that "four antennas are orthogonally arranged on a rectangle dielectric plate to constitute a circular-polarized wave antenna" is a well-known technology, and the printed circuit board of the Cited invention is a dielectric plate. Therefore, a person skilled in the art can easily conceive of arranging four antennas adjacent to ends constituting a periphery of a rectangular printed circuit board in the Cited invention, around a predetermined central region on the printed circuit board, in directions different from the longitudinal directions of the body parts of adjacent antennas on the printed circuit board, to function as a circularly polarized wave antenna.

Regarding the Different feature 2

The "capacitance extraction electrode 25" in the Cited invention, which

constitutes a capacitor with a ground electrode, has an arbitrary shape so as to secure predetermined capacitance, and it is a well-known matter that a linear pattern or a pattern having multiple bends is used for forming a capacitor. Therefore, the configuration according to the Different feature 2 is only a matter which can be achieved by a person skilled in the art as necessary.

7. Appellant's allegation

The appellant apples in the written opinion dated June 1, 2017 that the frequency adjustment part in the Invention is formed as a wiring pattern exposed from the first board side, so it is easy to confirm the length of wiring visually and to recognize existence of length change, and bent to arrangd to be close to the first connection part, so the position of the other side of the wiring pattern connected to the second connection part is not changed even if the position of the tip of the frequency adjustment part is changed, and manufacturing defects can be specified only by checking the position of the wiring pattern even if a substrate with a wiring pattern which does not conform to the required frequency is manufactured.

However, in the Cited invention, as described in "5. Comparison between the Invention and the Cited invention," the "capacitance extraction electrode 25" is formed on the board surface of the printed circuit board 19. The length of wiring can be confirmed visually, and the position of the wiring pattern can be confirmed. Even if the position of the tip of the capacitance extraction electrode 25 is changed, the position of the other end of the wiring pattern connected to the second connection part is not changed. Thus, the apples of the appellant cannot be accepted

8. Closing

As described above, the appellant should not be granted a patent for the Invention in accordance with the provisions of Article 29 (2) of the Patent Act.

Thus, the present application should be rejected without examining other claims.

Therefore, the appeal decision shall be made as described in the conclusion.

October 16, 2017

Chief administrative judge: OTSUKA, Ryohei
Administrative judge: YOSHIDA, Takayuki
Administrative judge: NAKANO, Hiromasa