

HEATER CONTROL IN A RADIO NETWORK NODE

TECHNICAL FIELD

The present invention relates to an arrangement and a method in a radio network node for
5 controlling the temperature in the arrangement and more particular, to an arrangement
and method for heater control.

BACKGROUND

Generally, a radio communication system of today comprises a radio access network and
10 a number of communication devices. The radio access network is built up of several radio
network nodes, in particular, radio base stations. The primary task of a radio base station
is to send and receive information to/from the communication devices within a cell served
by the radio base station. In many cases, the base station is run 24 hours a day.

Therefore, it is of particular interest and importance to ensure that the base station is
15 operable predictably and reliably. The radio base station further comprises a cabinet,
which comprises an enclosure for housing circuitry, or electronic equipment, for
performing different tasks of the radio base station. For example, the circuitry may
comprise a power control unit, a radio unit comprising a radio amplifier, and a filtering unit
for performing corresponding tasks.

20

Due to low efficiency of the radio amplifier of the radio base station, heat generated in the
circuitry of the base station, in particular the radio unit, may not always dissipate naturally
to a sufficiently high degree. Instead, heat is accumulated in the circuitry and temperature
of the circuitry increases. The increased temperature of the circuitry may decrease the
25 performance of circuitry within the radio base station, e.g. the circuitry within the radio
base station may fail. Hence, as is known in the art, systems for cooling of heat
generating equipment within a radio base station have been developed. These systems
are sometimes referred to as climate systems or climate control systems for radio base
stations.

30

Externally mounted enclosures for mobile radio base stations potentially experience a
wide range of ambient temperatures. At low external ambient temperatures, the heating
which arises naturally from the electronic equipment is sometimes insufficient to keep the

internal temperature sufficiently high. A heater is therefore desired for warming up the air within the enclosure. Further, in a cold start situation in which the internal temperature in the radio base station is below that at which the electronic equipment is operative, a heater is needed to warm up the equipment before starting up the system.

5

In the prior art it is known to use resistor heaters, for example a metal tube heater or a Positive Temperature Coefficient - heater (PTC – heater) for warming up an enclosure comprising electronic equipment within a radio base station. These two types of resistor heaters have slightly different working modes. The temperature of a metal tube heater
10 depends on the temperature of the cooling media temperature, the cooling media flow and the electrical voltage. A higher cooling media temperature, a reduced media flow and a higher electrical voltage give a higher heater temperature. For a PTC-heater, the heat generation of the heater depends on the temperature of the PTC-heater, whereby the higher the temperature the lower the heat generation. This means that the heat
15 generation is dependent on the cooling media temperature and the cooling media flow.

Normally, a heater used for warming up the air within the cabinet is located in the passage of the media flow for the whole cabinet, i.e. a system media flow. A resistor heater with a high cooling fin density causes a high pressure drop. Consequently, the total system
20 pressure drop will increase and hence the required power consumption for the temperature regulating media flow generation will also increase as the heater is positioned where the system media flow has to pass. If just a part of the media flow is made to pass through the heater, this flow will be very limited because of the pressure drop over the heater, and thus results in a low heat generation for a PTC-heater or a high
25 heater temperature for a metal tube heater.

This problem can be solved by adding a separate fan for the heater. However, the added fan occupies precious space in the radio base station and decreases reliability of the system as there is always a risk for fan failure. Further, a separate fan also adds on extra
30 costs. To avoid the high pressure drop, metal tube heaters without fins are sometimes used. However, when the heater temperature rises it results in a high heat radiation from the heater affecting the electrical equipment or other objects near to the heater.

SUMMARY

It is an object of the present invention to provide an arrangement and a method in a radio network node with improved heater control.

- 5 According to a first aspect of the invention, the object is achieved by an arrangement for controlling a heater in a radio network node. The arrangement comprises a heater for warming air in the arrangement and at least a first flow regulating device and a second flow regulating device for generating a general air flow within the arrangement. The heater is arranged in between the first flow regulating device and the second flow regulating
10 device whereby the air flowing through the heater becomes dependent on the setting of the first and second flow regulating devices.

- According to a second aspect of the invention, the object is achieved by a method for controlling a heater in radio network node arrangement. The arrangement comprises a
15 heater and at least a first flow regulating device and a second flow regulating device for generating a general air flow in the arrangement. The first flow regulating device generates a first fluid flow to one side of the heater and the second flow regulating device generates a second fluid flow to the opposite side of the heater. By regulating the first and second flow regulating devices, a fluid flow through the heater occurs which is dependent
20 on the setting of the first and second flow regulating devices.

- An advantage with the present invention is that the system pressure drop is minimised due to the position of the heater in between the flow regulating devices whereby the heater is not disturbing the general temperature regulating media flow. Further, there is no
25 need for a separate heater fan and, thus both space and costs are saved by the arrangement and method according the invention. Hence, an improved arrangement and method for heater control in a radio network node is provided in accordance with the object of the invention.

30 BRIEF DESCRIPTION OF THE DRAWINGS

The various aspects of the invention, including its particular features and advantages, will be readily understood from the following detailed description and the accompanying drawings, in which

Figure 1 illustrates a side view of a schematic radio network node comprising the

arrangement according to the present invention,

Figures 2a and 2b show a schematic front view of a part of the arrangement according to some embodiments, and

Figure 3 is a flow chart showing a method in a radio network node.

5

DETAILED DESCRIPTION

Figure 1 shows a side view of a schematic arrangement 100 comprised in a radio network node 200. The arrangement 100 comprises a heater 101 for warming air within the arrangement, if necessary. The arrangement 100 further comprises at least two flow regulating devices 102, 103 for generating a general air flow 105 within the arrangement 100 for regulating the temperature of electronic equipment 110 housed within the arrangement. The at least two flow regulating devices 102, 103 may be for example fans. The heater 101 is positioned in between the first flow generating device 102 and the second flow generating device 103. When the first and second flow generating devices 102, 103 are set to generate a general air flow 105 within the arrangement 100, the amount of air flowing through the heater 101 becomes dependent on the setting of the first and second flow generating devices. The arrangement also comprises a controller 112 for controlling the first and second flow regulating devices 102, 103.

20 As **Figure 1** is a side view of the arrangement 100 in which the heater 101 and the first and second flow regulating devices 102, 103 cannot be seen separately. Instead, the box with reference numbers 101, 102, 103 represents all three items being the heater 101 and the first and second flow regulating devices 102, 103. Further, it is to be understood that the arrangement shown in **Figure 1** is simplified and hence does not show all the parts of a radio network node. For example, the arrangement according to **Figure 1** may also comprise one or more heat exchangers for cooling of electronic equipment, enclosures for housing the equipment and further flow regulating devices.

Figure 2a and 2b show a more detailed front view of a part of the arrangement 100 according to the invention. The heater 101 is positioned in between to the first and second flow regulating devices 102, 103. **Figure 2a** shows the arrangement 100 in a heating mode which means that the heater 101 is set to warm air within the arrangement 100. **Figure 2b** shows the arrangement 100 in a non-heating mode, thus the heater 101 is turned off and the first and second flow regulating devices 102, 103 generate a general air flow 105 for cooling purposes.

35

In Figure 2a, the first flow regulating device 102 generates a first air flow 105a at one side of the heater 101. This is illustrated by three arrows and the air flow 105a provides a first portion to the general air flow 105 within the arrangement 100. The second flow
 5 generating device 103 generates a second air flow 105b at the other side of the heater 101. This is illustrated by a single arrow and the air flow 105b provides a second portion to the general air flow 105 within the arrangement. The difference in flow velocity between the first and second air flow 105a, 105b, is illustrated by the number of the arrows. Thus, the flow velocity of the first portion 105a of the general air flow 105 is greater than the flow
 10 velocity of the second portion 105b of the general air flow 105. The heater 101 is positioned in between the first and second flow regulating devices 102, 103. The difference in flow velocity on the respective sides of the heater 101 generates a difference in pressure build-up on the two sides of the heater 101, which generates an air flow 105c through the heater 101.

15

The size of the fluid flow 105c through the heater 101 is determined by the regulation of the first and second flow regulating devices 102, 103. The higher difference in flow velocity between the first and second air flow 105a, 105b, the more air 105c passes through the heater 101. It is to be understood that it may also be the other way round,
 20 such that the second flow regulating device 103 generates a higher air flow velocity than the first flow regulating device 102.

By controlling the first flow regulating device 102 or the second flow regulating device 103 or both the first and second regulating devices 102, 103, i.e. at least one of the first and
 25 second flow regulating devices 102, 103, the heater 101 temperature or heat generation of the heater 101 can be regulated. The temperature of the heater 101 or heat generation of the heater 101 is regulated without addition of any new parts or components. For example, no specific heater fan is needed. Further, the heater 101 is mounted in a way that no adding to the system pressure drop is made. The heater 101 used in this
 30 arrangement 100 may be any kind of resistor heater, such as a metal tube heater or a Positive Temperature Coefficient – heater (PTC-heater), for example. The described arrangement 100 as illustrated in Figure 2a makes it possible to generate high heat output in a limited space without disturbing the general air flow 105 in for example a radio network node.

35

In Figure 2b the first flow regulating device 102 generates a first air flow 105a at one side of the heater 101. This is illustrated by two arrows and the air flow 105a provides a first portion to the general air flow 105 within the arrangement. The second flow generating device 103 generates a second air flow 105b at the other side of the heater 101. This is illustrated by two arrows and the air flow 105b provides a second portion to the general air flow 105 within the arrangement 100. In this case, there is no difference in flow velocity between the first and second air flow 105a, 105b and no pressure build-up will take place and consequently no air flow occurs through the heater 101. By its position in between the first and second flow generating devices 102, 103 the heater does not disturb the general air flow 105 when it is not used.

The general air flow 105 comprises the first air flow 105a, the second air flow 105b and the air flow through the heater 105c, if any.

It is to be understood that the radio network node may be a Radio Base Station (RBS) or any other kind of node in a radio communication system, which radio network node comprises heat generating electronic equipment. Examples of other kinds of nodes are transmission nodes, Remote Subscriber Switches (RSS) and nodes with similar functionality.

20

The method steps in the radio network node 200 for controlling a heater 101 in a radio network node arrangement 100 will now be described with reference to a flow chart depicted in Figure 3. As mentioned above, the arrangement 100 comprises a heater 101 and at least a first flow regulating device 102 and a second flow regulating device 103 for generating a general air flow 105 in the arrangement.

301. The first flow regulating device 102 generates a first air flow 105a at one side of the heater 101.
302. The second flow regulating device 103 generates a second air flow 105b at the opposite side of the heater 101.
303. By regulating the first and second flow regulating devices 102, 103, an air flow 105c through the heater 101 occurs which is dependent on the setting of the first

and second flow regulating devices 102, 103.

5 304. This step is optional. According to an embodiment of the invention the heater temperature or heat generation of the heater 101 is controlled by regulating the first flow regulating device 102 and the second flow regulating device 103 respectively. The control of the heater temperature or heat generation of the heater 101 is based on a difference in flow velocity of the first air flow 105a and the flow velocity of the second air flow 105b.

10 When using the word "comprise" or "comprising" it shall be interpreted as non-limiting, in the meaning of "consist at least of".

The present invention is not limited to the above described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above
15 embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

CLAIMS

1. An arrangement (100) for controlling a heater in a radio network node (200), the arrangement comprising
 - the heater (101) for warming air in the arrangement (100),
 - a first flow generating device (102) and a second flow generating device (103) for generating a general air flow (105) within the arrangement (100), the heater (101) is arranged in between the first flow generating device (102) and the second flow generating device (103) whereby the air flowing through the heater (105c) becomes dependent on the setting of the first and second flow generating devices (102, 103), the arrangement (100) further comprises a controller (112) for controlling the first and second flow generating devices (102, 103), wherein the control of the heater (101) temperature or the heat generation of the heater (101) is based on a difference in fluid flow velocity of the first fluid flow (105a) generated by the first flow generating device (102) and the velocity of the second fluid flow (105b) generated by the second flow generating device (103).
2. Arrangement according claim 1, wherein the heater (101) is a Positive Temperature Coefficient - heater.
3. Arrangement according to claim 1, wherein the heater (101) is a metal tube heater.
4. Arrangement according to any one of the preceding claims, wherein the radio network node (200) is a radio base station.
5. A method in a radio network node arrangement (100) for controlling a heater (101), the arrangement (100) comprising the heater (101) and a first flow generating device (102) and a second flow generating device (103) for generating a general air flow (105) in the arrangement (100), the method comprising the steps of:
 - *generating* a first fluid flow (105a) from the first flow generating device (102) at one side of the heater (101),
 - *generating* a second fluid flow (105b) from the second flow generating device (103) at the opposite side of the heater (101),
 - *regulating* the first and second flow generating devices (102, 103) such that an air flow (105c) through the heater (101) occurs which air flow (105c) is dependent

on the setting of the first and second flow generating devices (102, 103), and
- *controlling* the heater (101) temperature or the heat generation of the heater
(101) by regulating the first flow generating device (102) and the second flow
generating device (103) respectively based on a difference in fluid flow velocity of
the first fluid flow (105a) and the velocity of the second fluid flow (105b).