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(54) **COMMUNICATION METHOD, TRANSCEIVER STATIONS AND ASSOCIATED COMPUTER PROGRAMS**

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H04W 74/08	(2009.01)
H04W 24/10	(2009.01)
H04W 84/18	(2009.01)
H04W 84/20	(2009.01)

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CPC ***H04W 52/0209*** (2013.01); ***H04W 24/10*** (2013.01); ***H04W 74/0816*** (2013.01); *H04W 84/18* (2013.01); *H04W 84/20* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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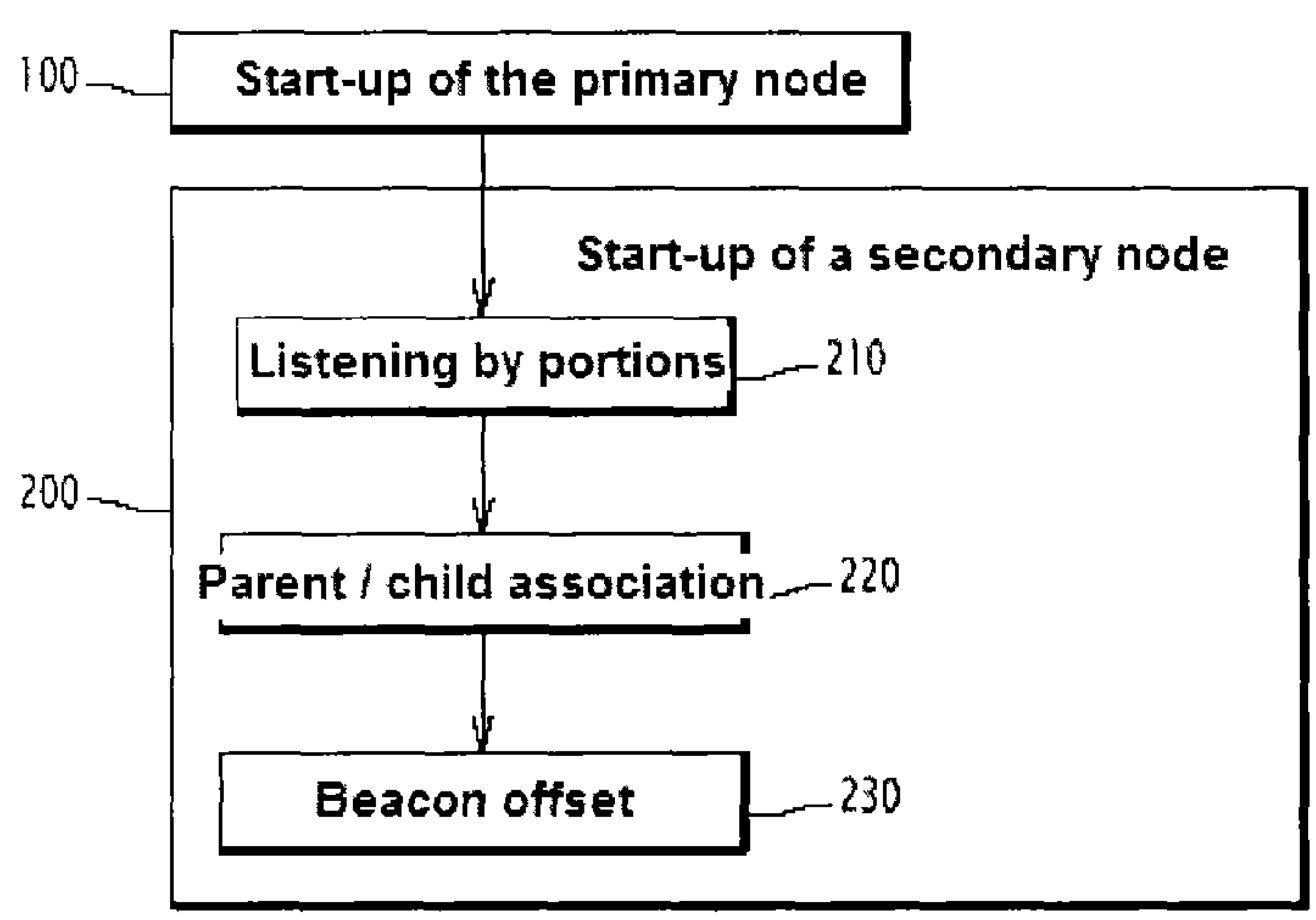
(57) **ABSTRACT**

A method for communicating over a radio frequency channel in a network including a primary node and multiple secondary nodes for telecommunications comprises receiving, by a secondary node on the radio frequency channel, beacon messages sent by nodes in its radio neighborhood, each indicating a number of radio hops separating the primary node from the node of the radio neighborhood having sent the message, selecting, by the secondary node, called child node, the node from the wireless neighborhood having sent the beacon message indicating a minimum number of hops as the parent node, and in order to send information to the primary node, transmitting the information over the radio frequency channel to the parent node thus selected.

18 Claims, 4 Drawing Sheets



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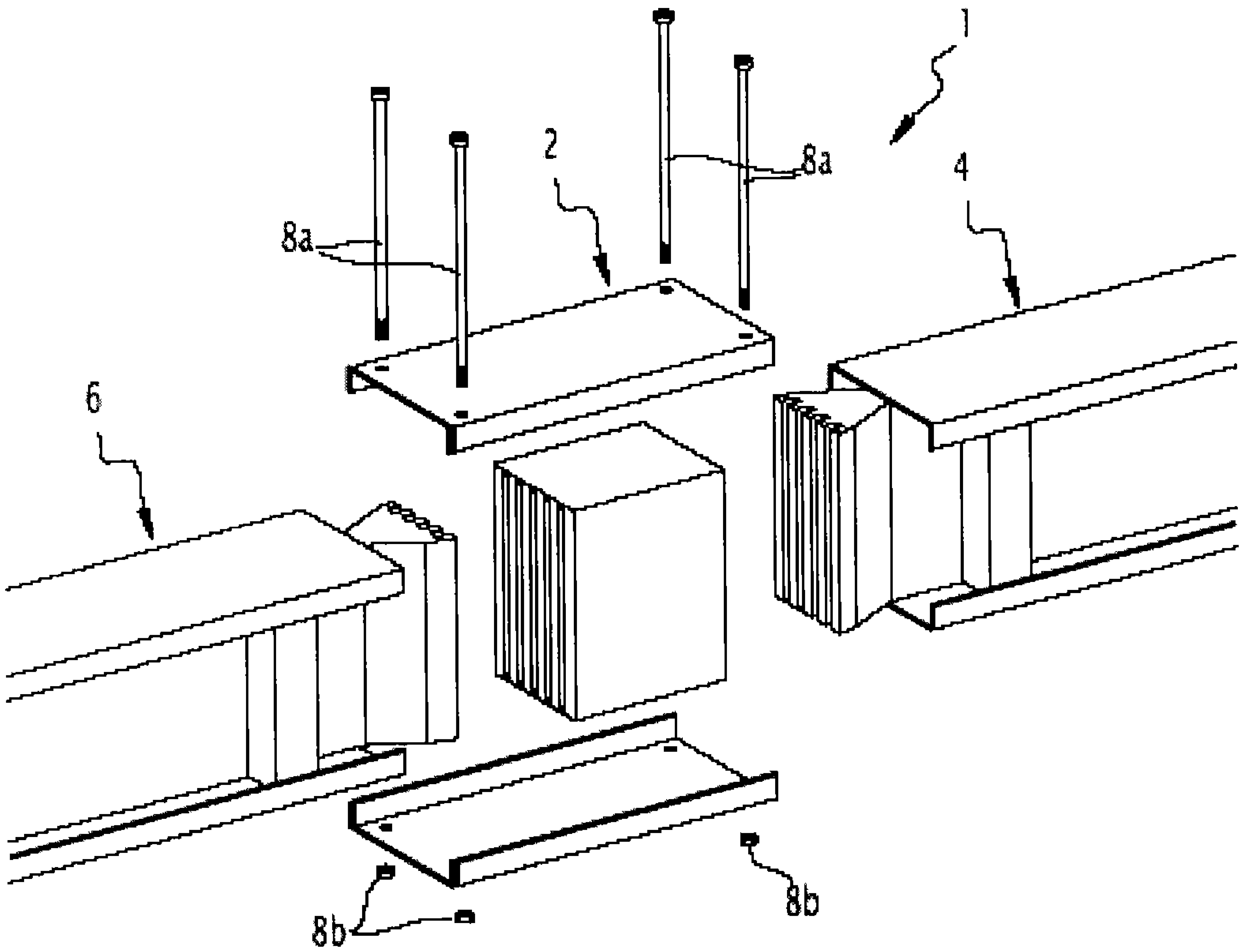

FIG.1

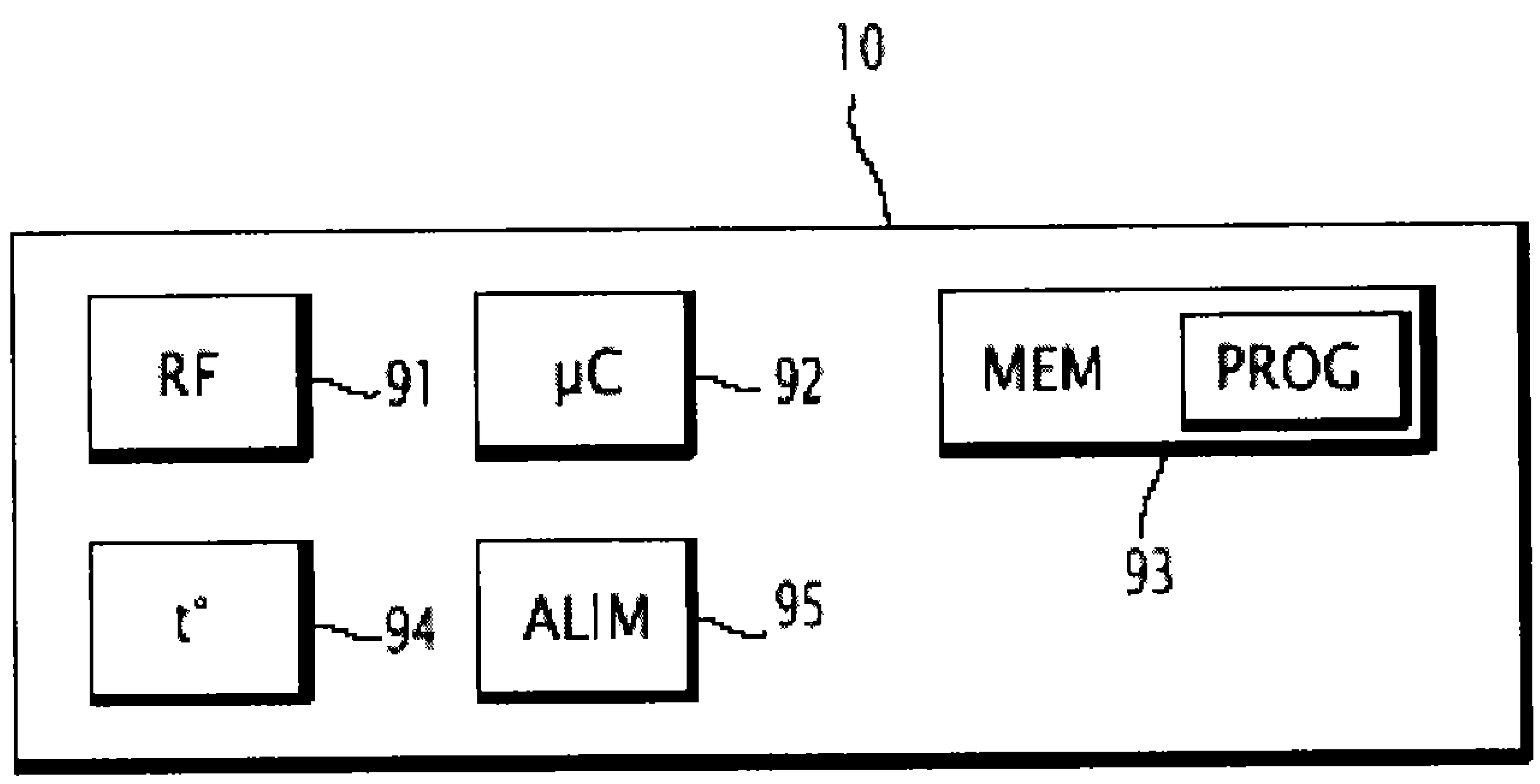

FIG.2

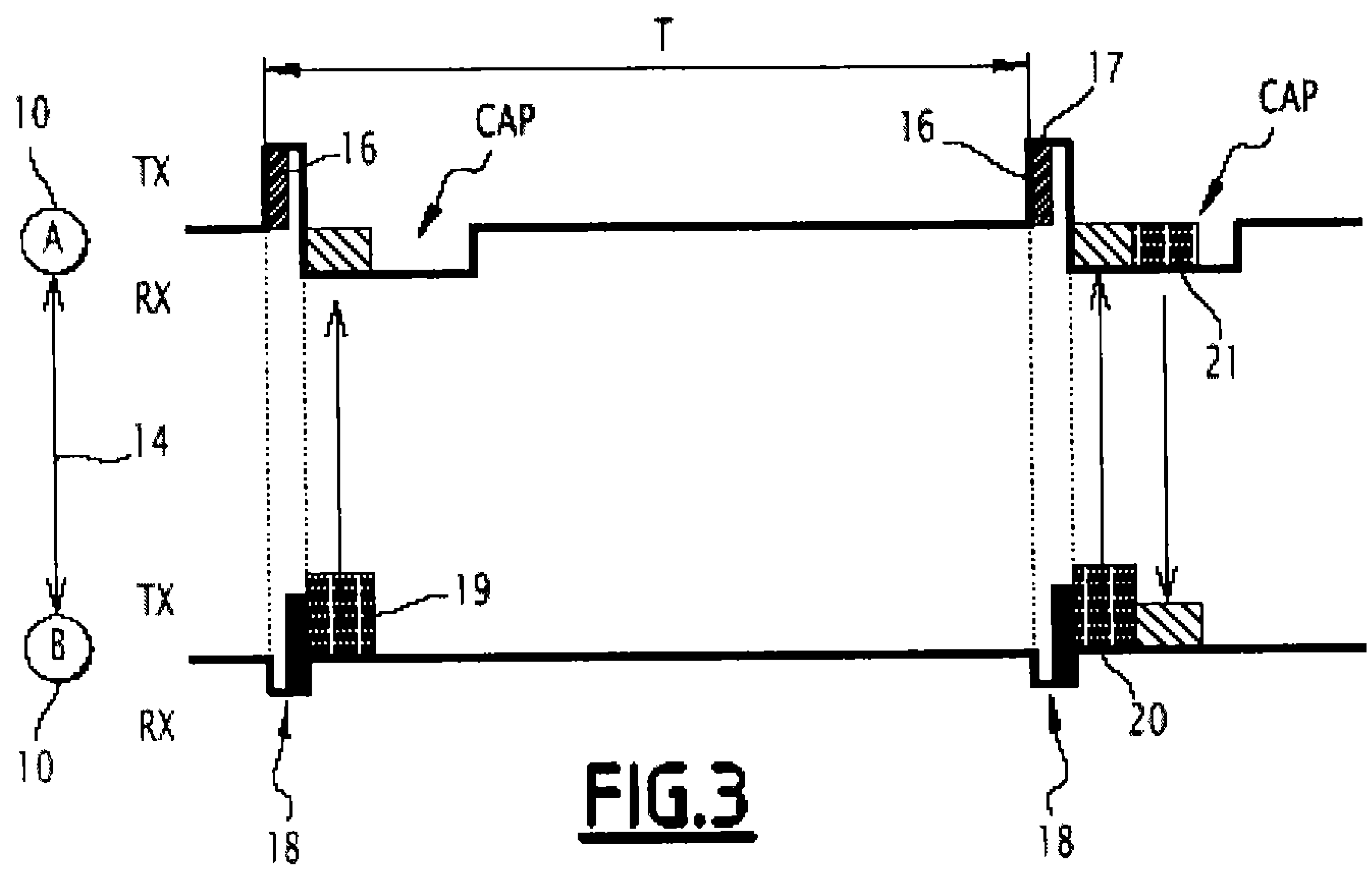
T
10
TX
RX
A
14
B
10
TX
RX
16
CAP
16
17
CAP
21
19
20
18
18

FIG.3

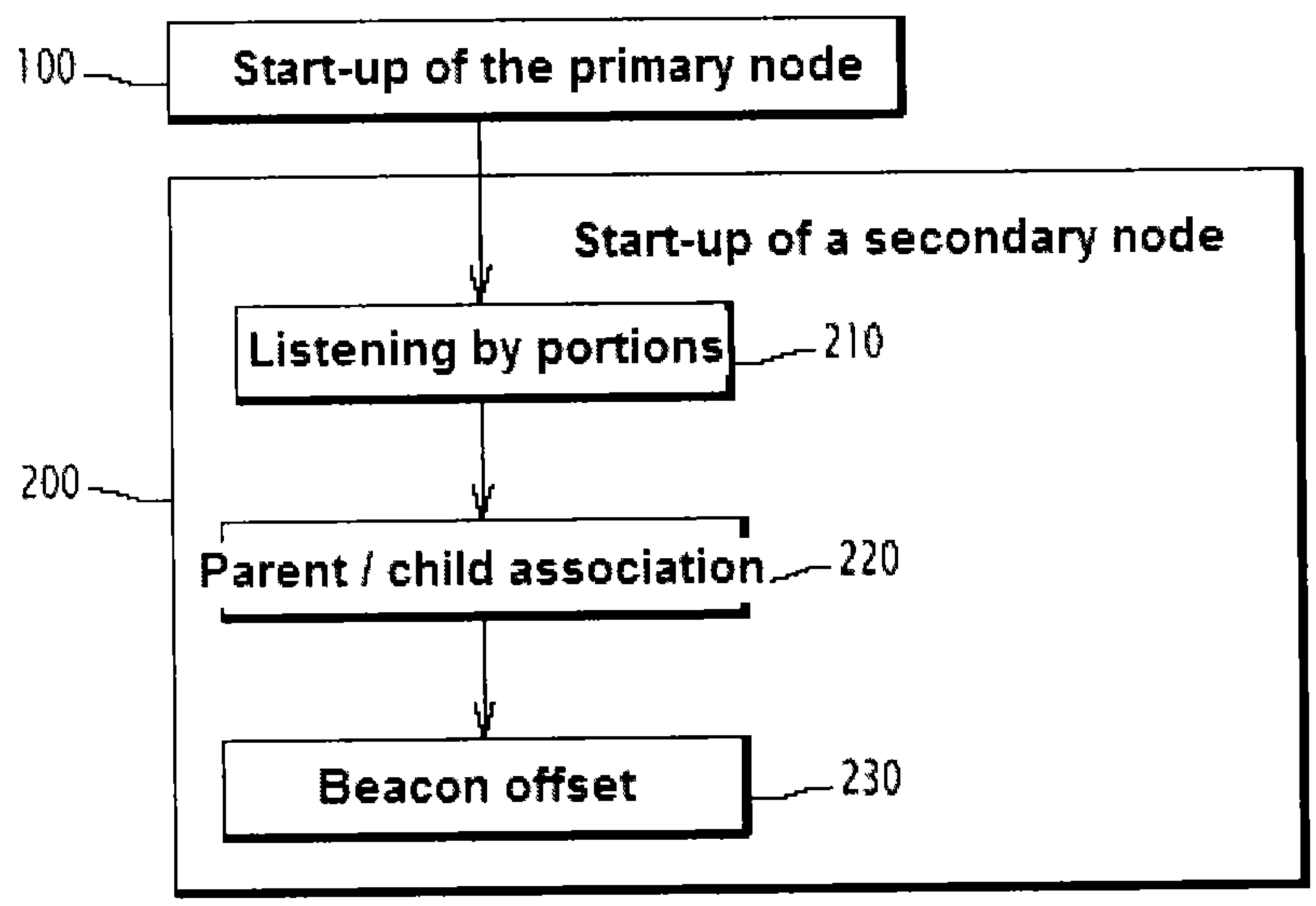
100
Start-up of the primary node
Start-up of a secondary node
Listening by portions
210
200
Parent / child association
220
Beacon offset
230

FIG.4

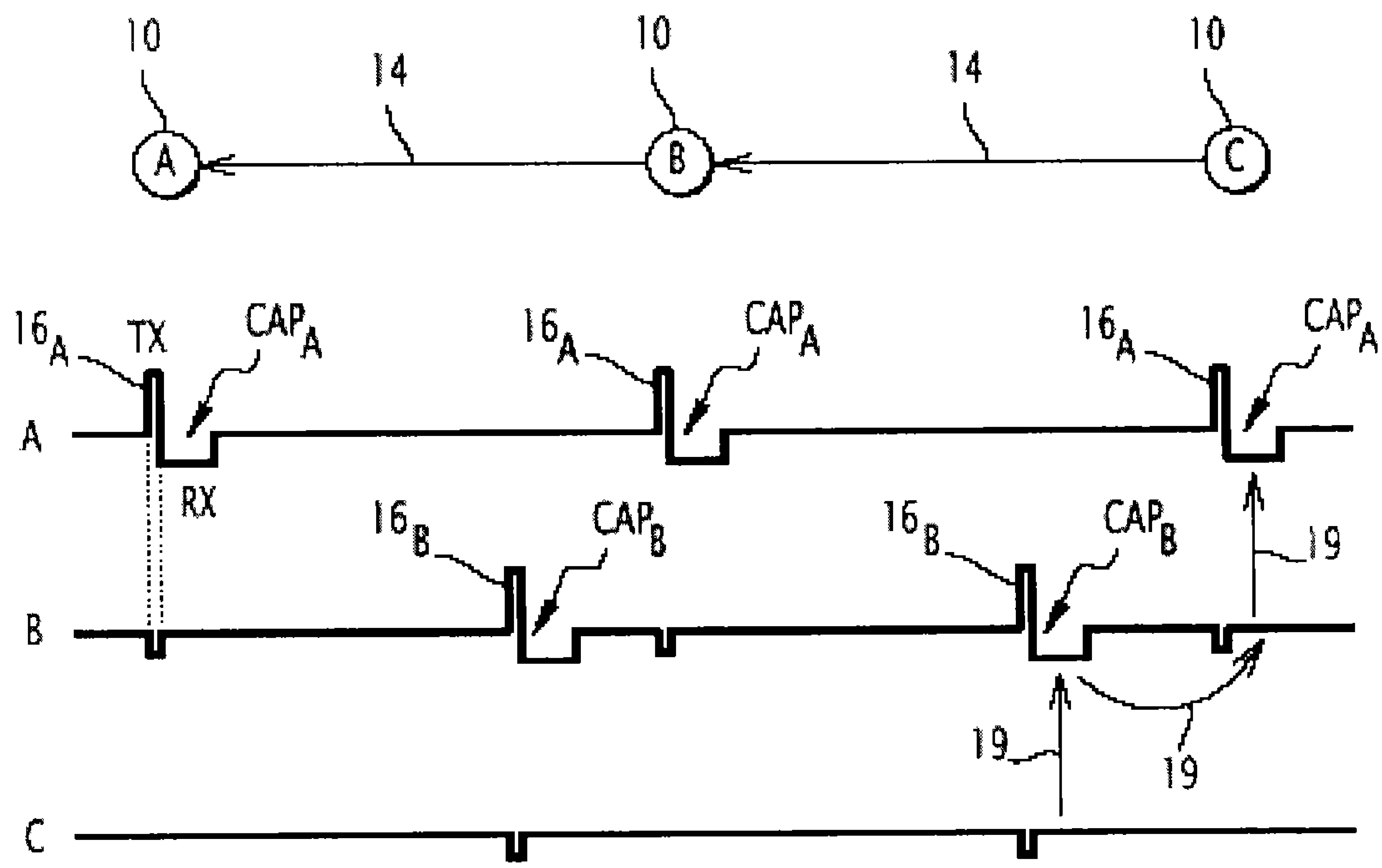
10
14
A
B
C
16_A
TX
CAP_A
RX
16_B
CAP_B
19

FIG.5

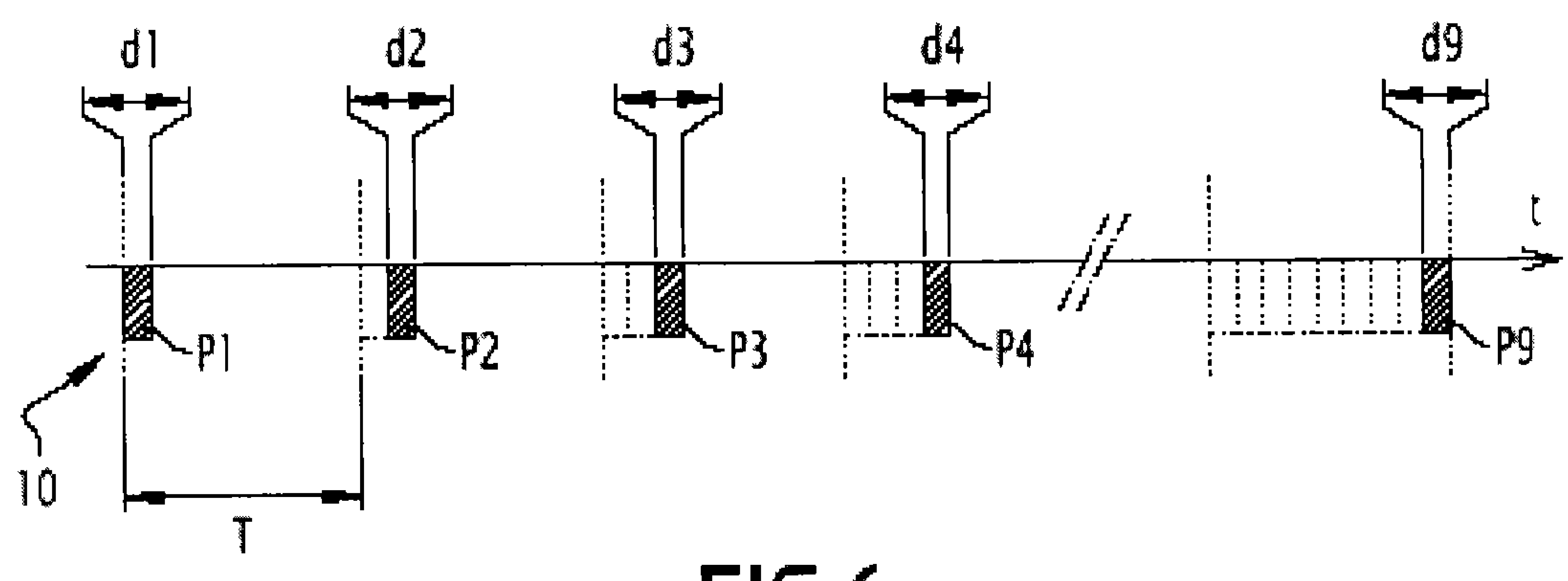
d1
d2
d3
d4
d9
t
P1
P2
P3
P4
P9
10
T

FIG.6

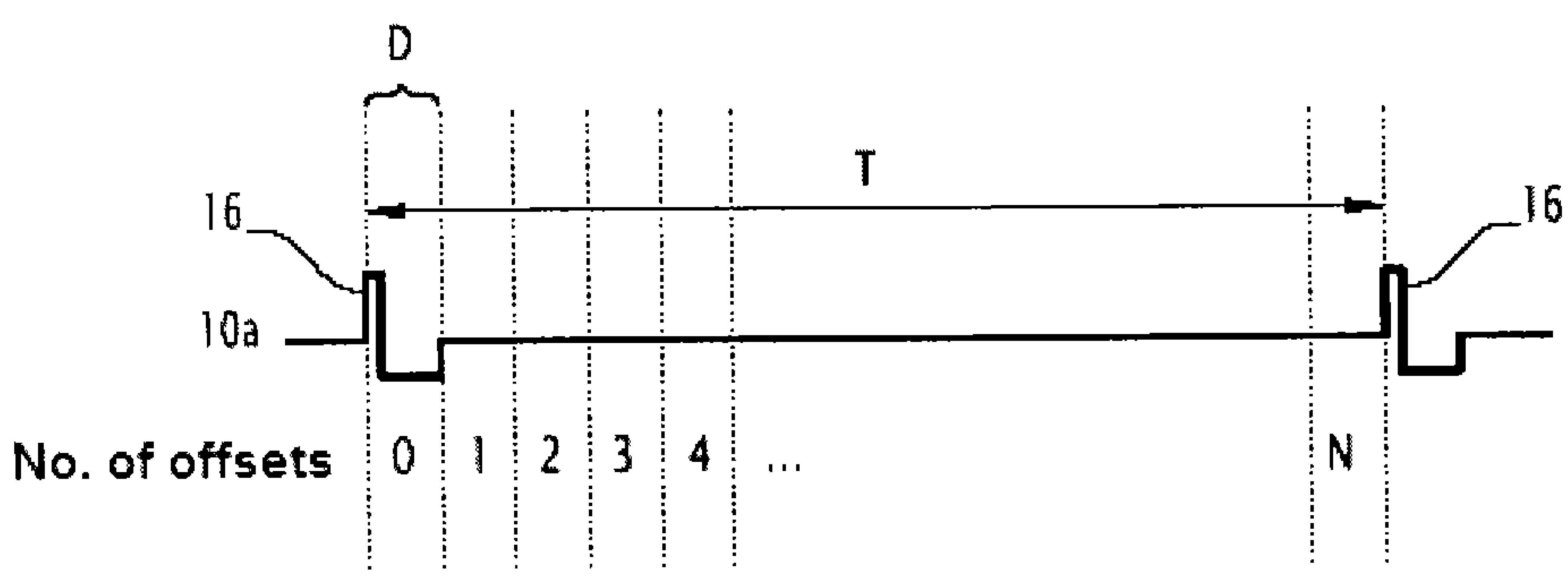

FIG.7

COMMUNICATION METHOD, TRANSCEIVER STATIONS AND ASSOCIATED COMPUTER PROGRAMS

FIELD OF THE INVENTION

The present invention relates to the communication techniques used in telecommunications networks, particularly, but not exclusively, in ad hoc networks.

BACKGROUND OF THE INVENTION

Ad hoc networks are telecommunications networks with no fixed infrastructure. A certain number of wireless stations equipped with wireless transmission and/or receiving means and suitable protocols form the nodes of an ad hoc network.

These stations can assume the form of fixed or portable computers, pocket computers, mobile telephones, vehicles, household appliances, etc. They can further be associated with modules such as sensors or actuators.

An ad hoc network of sensors thus makes it possible to collect information so as, for example, to watch or monitor installations.

In general, the nodes are powered by batteries that are difficult and expensive, or even impossible, to replace or recharge, or they are powered using a battery-free energy recovery technique. Energy savings are therefore a key factor in such networks.

Furthermore, a prefabricated wiring system installation is one example of an installation requiring temperature monitoring in many places so as to monitor its state.

Abnormal heating is frequently observed in the junction areas between two successive wiring system portions, due primarily to insufficient tightening of the bolts of the junction by the installer. The current solutions to these heating problems comprise preventive maintenance operations consisting of systematically tightening the bolts, and inspection operations to inspect the installations using thermal imaging cameras, making it possible to view areas undergoing abnormal heating.

However, these techniques have certain drawbacks: they are very long and complicated to carry out due to the large number of junctions to be checked and the positioning of the wiring system, which may be difficult to access: at a height, under the floor, under false ceilings, etc.

Furthermore, the reliability of the thermographic measurements depends on the measuring environment (presence of dust, grease, etc.), which makes the interpretation of the temperature state of the wiring systems relatively imprecise.

There is therefore a need to collect information from multiple points positioned along the electrical wiring systems regarding the temperatures noted at those multiple points.

SUMMARY OF THE INVENTION

According to a first aspect, the invention proposes a communication method, over a radio frequency channel in a network including a primary node and multiple secondary nodes for telecommunications,

characterized in that it comprises the following steps:

- reception by a secondary node on the radio frequency channel of beacon messages sent by the nodes in its radio neighborhood, each indicating a number of radio hops separating the primary node from said node of the radio neighborhood having sent the message;

- selection by said secondary node, called child node, of the node from the wireless neighborhood having sent the beacon message indicating a minimum number of hops as the parent node;
- in order to send information to the primary node, transmission of said information over the radio frequency channel to said parent node thus selected.

Such a method yields good performance in terms of transmission speed and energy consumption, particularly in the case of a linear network, typically a network in which the nodes are positioned at junctions of the wiring systems.

In one embodiment, the communication method comprises one or more of the following features:

- in order to send information to the primary node, said information is emitted by said secondary node only to said parent node;
- said secondary node periodically emits a beacon message on the radio frequency channel indicating a number of radio hops separating it from the primary node equal to the number of radio hops separating the primary node from the parent node plus 1;
- to emit said information on the radio frequency channel to said parent node, the child node detects a beacon message periodically emitted by its parent node defining the beginning of a time window where it is able to receive information from the child node, the child node sending the information to the parent node during that window;
- the child node periodically emits a beacon message defining the beginning of a time window where it can receive information from a node in its wireless neighborhood;
- in order to detect the emission at a first given frequency of beacon messages by nodes in its wireless neighborhood, and a standard period with a length equal to an inverse period relative to the first frequency divided into several portions, at least one portion is listened to by said secondary node with at least one offset period relative to the listening to another portion, said secondary node being put on standby for at least part of the time separating the two listening operations for the two portions;
- a new portion is listened to once said secondary node has a sufficient power level to listen to said portion;
- the size of at least one portion depends on the power supply current level of said node;
- the method is implemented to monitor the heat of wiring systems, such that the nodes are located at the wiring system junctions, and further comprise at least one temperature sensor, the information including data indicating at least temperatures measured by said sensors.

According to a second aspect, the invention proposes a transceiver station, to form a node capable of transmitting and receiving on a radio frequency communication channel, the node belonging to a network including a primary node and multiple secondary nodes for telecommunications, said station comprising:

- means for receiving respective beacon messages on the radio frequency channel that are transmitted by nodes in its radio neighborhood, each indicating a number of radio hops separating the primary node from said node of the radio neighborhood that transmitted the message;
- means for selecting, as the parent node of said node formed by the station, called child node, the node from the radio neighborhood having transmitted the beacon message indicating a minimum number of hops;
- means for transmitting information to said parent node thus selected on the radio frequency channel in order to send said information to the primary node.

In one embodiment, the transceiver station comprises one or more of the following features:

- to send information to the primary node, it comprises means for transmitting said information, through said second node, exclusively to said parent node;
- it comprises means for periodically transmitting a beacon message on the radio frequency channel, indicating a number of radio hops separating it from the primary node equal to the number of radio hops separating the primary node from its parent node plus 1;
- to transmit said information over the radio frequency channel to said parent node, it comprises means for detecting a beacon message periodically transmitted by its parent node, defining the beginning of a time window where it is able to receive information from the station, the station sending the information to the parent node during that window;
- it comprises means for sending a periodic beacon message defining the beginning of a time window where it is capable of receiving information from a node in its radio neighborhood;
- in order to detect the transmission of beacon messages at a first given frequency by nodes in its radio neighborhood, and a standard period with a length equal to a period equal to the inverse of the first frequency being divided into several portion, it comprises means for listening to at least one portion by said secondary node with at least one offset period relative to the listening to another portion, said secondary node being put on standby at least for part of the time separating the listening to the two portions;
- it comprises means for listening to a new portion as soon as it has a sufficient power level to listen to said portion;
- the size of at least one portion depends on the power current level of the station;
- the information sent by the parent node comprises an address for identifying the child node on the network;
- it is suitable for thermal monitoring of wiring systems, is located at a wiring system junction, and further comprises at least one temperature sensor, the information including data indicating at least the temperatures measured by said sensors.

According to a third aspect, the invention proposes a computer program, to be installed in a transceiver station to form a node capable of transmitting over a radio frequency channel, the node belonging to a network including a primary node and multiple secondary nodes for telecommunications, said program comprising instructions for carrying out the steps of a method according to the first aspect of the invention when the program is run by processing means of said transceiver station.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will appear upon reading the following description. This description is provided purely as an illustration and must be read in light of the appended drawings, in which:

FIG. **1** is an exploded perspective view of part of a wiring system installation at an electrical junction;

FIG. **2** diagrammatically illustrates a transceiver station according to the invention;

FIG. **3** is an explanatory diagram of the transmission of data between a parent node and a child node;

FIG. **4** is a flowchart of a communication method according to the invention;

FIG. **5** is an explanatory diagram of the transmission of data coming increasingly closer between nodes;

FIG. **6** is an explanatory diagram illustrating a beacon search operation for a secondary node;

FIG. **7** illustrates the referential of the offsets relative to the primary node.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. **1** shows, in one embodiment of the invention, a portion **1** of a wiring system installation at an electrical junction **2** using bolts **8***a*, **8***b* to connect a first wiring system segment **4** and a second wiring system segment **6**.

During the installation of the wiring systems, the different segments, similar to the first **4** and second **6** segments, are inserted into junctions, similar to the junction **2**. Next, bolts with separable heads, similar to the bolts **8***a*, **8***b*, are tightened using a dynamometric key in order to fasten the two segments to be connected, and current is passed from one segment to the other. Poor tightening at the junction **2** results in a deteriorated contact quality at one area of the junction which increases the current density and then causes abnormal heating at the junction **2**.

The considered wiring system is for example 400 m long and for example comprises a junction every 4 m, or approximately one hundred junctions **2**.

In one embodiment of the invention, each of these junctions **2** is provided with a station **10** associated with it, and which forms a telecommunications node of a telecommunications network according to the invention.

In the considered case, each station **10** associated with a junction is further adapted to monitor the thermal condition of the junction associated with it and to send information relative to that thermal condition to a particular station **10**, or particular node, which collects all of the information from the stations of the wiring system. The information coming from the measurements of a given node includes an identifier of that node.

Said particular node **10** is called the primary node **10***a*. It may or may not also be associated with a junction. The other nodes of the network, which send information to the primary node **10***a*, are called secondary nodes **10***b*.

In reference to FIG. **2**, each node, also called station, **10** comprises radio frequency transceiver means **91**, on a shared radio frequency channel **14**, for messages transmitted by, or to, nodes of its radio neighborhood.

A station **10** further includes a microcomputer **92**, capable of executing software instructions, and a memory **93**. A program PROG comprising software instructions is in particular stored in the memory **93**.

A station **10** further includes a power supply module **95**, suitable for powering the different elements of the station **10**.

This power supply module **95**, in the case of secondary nodes **10***b*, is for example suitable for converting the received vibrational and/or thermal energy into electricity.

The power supply module **95** for the primary node **10***a* includes, or is connected to, a power source that provides it with electricity at all times, for example the electrical grid.

In the case of a secondary node **10***b* and, if applicable, the primary node **10***a*, the station **10** further includes a heat sensor **94** capable of measuring the local temperature of the associated junction regularly.

In one embodiment, the station **10** is further suitable for processing temperature measurements done by the thermal sensor **94**, and based on a comparison of those processed measurements and a threshold, for example, generating an alert, inserted, with the identifier of the station **10**, into the information to be sent to the primary node **10***a*.

Each node **10** is capable of communicating directly with another node **10** of its radio neighborhood using a communication method according to the invention, based on a 802.15.4 communication protocol defined by the Institute of Electrical and Electronics Engineers, called IEEE, and applicable to wireless networks, the communication being done over the shared radio frequency channel **14**, at a given frequency.

The frequency chosen for the communication is for example comprised between 2400 MHz and 2483.5 MHz and is, in the considered equivalent case, in the radio spectrum of 2.4 GHz ISM (Industrial Scientific Medical, License Free).

The method according to the invention is in particular based on the PHY and MAC layers of protocol 802.15.4, and implements transmission and reception operations that are synchronized between the nodes **10** using beacons **16** transmitted at each period T by the nodes **10**.

All of the steps described below are carried out by the nodes **10** following the execution of software instructions by the computer program PROG on the microcomputers **92** of the nodes.

In reference to FIG. **3**, the sending of information between a parent node **10**, referenced A, and a child node **10**, referenced B, the definition of the terms parent and child being provided below, is done using an uplink communication, i.e., from the child node B to the parent node A, and a downlink communication, i.e., from the parent node A to the child node B.

A child node B is suitable for listening to the radio frequency channel **14** at the predetermined moment of the transmission of a beacon signal **16** by the parent node A and to detect the transmission of that beacon **16** (which corresponds to the "beacon tracking" operation of protocol 802.15.4).

This beacon **16** transmitted by the parent node A is a start-up signal for a child node B of the node A, so that it sends information to the node A. It includes several data fields, in particular a network identifier PANId, an identifier of the node A having transmitted beacon, and other information described below.

In fact, the node B transmits information **19** to its parent node A after the transmission of the beacon **16** by the node A, in a time window called CAP (Contention Access Period). In order to avoid any collisions between messages, before transmitting, it verifies that the channel **14** is not occupied, by listening **18** according to the CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) access method defined by the IEEE.

The parent node A listens to the messages that may be sent to it by each of its child nodes B in the CAP that follows the transmission of the beacon **16** transmitted by the node A.

Protocol 802.15.4 further provides a mechanism that allows a parent node A not only to receive messages from a child node B, but also to send them to it.

Thus, when the parent node A must send information to a child node B, the node A indicates in the beacon **16** that it will transmit information **21** available for the child node B (cf. indication **17** in FIG. **3**). The information then remains stored in the node A. The concerned child node B then transmits a command **20** in the CAP following the transmission of the beacon **16**, which causes the node A to transmit information **21**, the node B readying itself to receive that information **21** following the sending of its command **20**.

This communication is described as indirect, since the message **21** contained in the node A is not directly sent to the node B. Such a downlink communication mode, although offering lower throughputs due to this indirect communication is well-suited to the considered case, since the downlink data stream is much smaller than the uplink data stream.

The flowchart of FIG. **4** shows steps **100**, **200**, **210**, **220**, **230** of a communication method in one embodiment of the invention.

During a step **100** for starting up the primary node **10***a*, the latter ensures that no other network transmitting with a same identifier PANId exists on the channel **14** assigned to the network of the primary node **10***a*, to which an identifier PANId characterizing that network has been assigned.

To that end, the primary node **10***a* performs passive listening so as to verify that it does not receive any beacon **16** comprising an identifier.

The primary node **10***a* then transmits beacons **16** separated by a period T, in which it is identified as the primary node or "PAN coordinator", in accordance with protocol 802.15.4.

When it is started up **200**, any secondary node **10***b* carries out a certain number of steps **210**, **220**, **230**:

- a prior listening step **210** aiming to scan the channel **14** for a length of time equivalent to a complete period T, and to detect the beacons **16** transmitted on the channel **14** and thus determine the nodes present in its radio neighborhood;
- then, in step **220**, the secondary node **10***b* determines a single parent node to which it will send information **19** intended for the primary node **10***a;*
- then, during a step **230**, the secondary node **10***b* determines an offset to be performed between its own beacon signal and the beacon signal from its parent, then it in turn transmits a beacon **16** at each period T.
- Once the startup steps have been performed, the secondary node **10***b* can function operationally as for example described in reference to FIG. **3**.

These various steps are outlined below.

Only a certain number of secondary nodes **10***b* can communicate directly with the primary node **10***a*: these are secondary nodes **10***b* that are situated within radio range of the primary node **10***a*.

The rank of a node **10** is defined as the number of radio hops separating that node **10** from the primary node **10***a*.

Thus, the primary node **10***a* has rank zero. The secondary nodes **10***b* that receive the beacons **16** from the primary node **10***a* when they carry out a step **210** are ranked 1.

The secondary nodes **10***b* that receive, during step **210** which they perform upon start-up, the beacons **16** of rank 1 without receiving the beacons **16** from the primary node **10***a*, are ranked 2, etc.

Thus the transfer of information **19** from a secondary node **10***b*, with a rank strictly greater than 1 to the primary node **10***a* go through intermediate nodes **10***b* with a rank decreasing by 1 each time.

According to the invention, each node **10** includes its rank in the beacon signals **16** that it transmits.

Thus, when the node **10***b* listens **210** to the channel **14** equivalent to a period T, it receives the beacons **16** from all of the nodes **10** transmitting in its network neighborhood, each of these beacons **16** indicating the rank of the node **10** that emitted it.

In step **220**, the secondary node **10***b* then select, as parent node, among those nodes **10** in its radio neighborhood, that which emitted the beacon **16** indicating a minimum rank. The rank that the node **10***b* next transmits its own beacons **16** will be equal to the rank of its parent, plus one.

In one embodiment, the choice of the parent from among several nodes **10** by the given node depends on the rank of said nodes **10** and/or indicators of the quality of the communication between the given node and each of the nodes **10**, indicating the offset between its beacon signal and the beacon signal emitted by its own parent (a parent having the lowest beacon offset relative to that of its parent will for example be chosen as a priority, leading to a quicker collection of information by the primary node).

Once the secondary node **10**_b_ has chosen its parent node, it enters a beacon monitoring mode. This mode consists of putting itself in standby, only to wake up at the predetermined time of the transmission of the beacons **16** from its parent node so as to exchange data with the parent node in the CAP window of the parent node, or to wake up only upon transmission of its own beacons **16** so as to exchange data, during its own window CAP, with its child node(s).

FIG. **5** illustrates the transfer of data from a node C (rank K+1), to its parent node (rank K), and from there to the parent node A (rank K−1) of the node B, this data thus being relayed from child to parent up to the primary node **10**_a_.

The node B transmits beacons 16_B making it possible to calibrate its exchanges with its child node(s), including the node C. The node C examines the transmission of the beacons 16_B by its parent node B, so as to send information to be sent **19** during the window CAP_B following those beacons 16_B.

In one embodiment, the scanning step **210** upon start-up of a secondary node **10**_b_ is done in such a way as to save the available energy by performing listening equivalent to one period T per portion.

In reference to FIG. **6**, the node **10**_b_ listens, beginning at time t0, to the channel **14** so as to detect all of the beacons **16** transmitted by the nodes within radio range not over a complete period T, but it listens for several periods T of the portions P**1** to Pn, which modulo T, make it possible to go over the equivalent of a complete period. Each portion Pi lasts a time d_i. The duration di is strictly shorter than T. Between two consecutive listening portions, the node **10**_b_ enters standby mode so that the power supply module **95** recharges.

During the first period T beginning as of t0, the node **10**_b_ listens to the channel **14** for a portion P_1, from t0 to $t0+d_1$, to detect the transmitted beacons. It then enters standby mode to awaken during the second period beginning as of t0 only at $t0+T+d_1$ and to listen to the channel **14** for a portion P_2, from $t0+T+d_1$ to $t0+T+d_1+d_2$, before returning to standby mode.

Thus, for i=1 at n, these steps are reiterated: the node **10**_b_ enters standby mode following listening to the portion P_{i-1}, and awakens during the i^{th} period as of t0 only at $t0+T+d_1 \ldots +d_{i-1}$, and to listen to the channel **14** during the portion P_i, from $t0+T+d_1 \ldots +d_{i-1}$ two $t0+T+d_1 \ldots +d_{i-1}+d_i$, before returning to standby mode.

In the case illustrated in FIG. **6**, n=9, d_i=d constant for i=1 to 9.

In practice, the listening duration is greatly extended: with listening portions of 15 ms, it takes 17 min. to completely listen to a period between two beacons **16**, the transmission of which is separated by 4 s.

Alternatively, the portion to be listened to is defined by implementing a scanning algorithm by dichotomy.

Alternatively, the listening is not done with one listened portion per period T, but the node **10**_b_ listens to a new portion P_i as soon as it has accumulated enough power to listen to such a portion P with duration d_i. In this alternative, the overall listening is faster, but managing storage of the portions already listened to, or to be listened to, is more complex.

Also alternatively, the listening duration d_i is variable and for example depends on the power available in the node **10**_b_ performing the listening. In this alternative, the overall listening is faster.

Each node is identified by a single 64-bit address, called extended address.

In order to limit the volume of data exchanged, in particular due to the insertion of the identifier of a node into the beacons that it transmits or into the data collected by the primary node representative of the temperature measurements done by the node, the nodes integrated into the network are identified by a shorter address, specific to the network and assigned the primary node **10**_a_. Once a node has chosen a parent, it sends a request for the assignment of a short address relayed to the primary node **10**_a_, which will then send it that short address in return.

The secondary node **10**_b_ can then in turn transmit beacons **16** and data, using that short address.

In one embodiment of the invention, the transmission moment of the beacons **16** by the considered secondary node **10**_b_ is chosen in a step **230**, complying with certain rules, alternatingly or in combination which are described below.

A node **10**_b_ cannot transmit a beacon at the same time as its parent, as at that time it must be listening to the transmissions from its parent. Therefore, the offset δ between the transmission by the parent node of its beacon and the transmission by the secondary node **10**_b_ must be strictly shorter than T and strictly greater than zero.

The secondary node **10**_b_ therefore excludes the offset corresponding to its own parent from the list of potential offsets from which it selects its own offset.

The secondary node **10**_b_ also cannot transmit any beacons **16** when nodes **10** that are listening and within radio range, in the process of monitoring a beacon transmission **16** from another node, since the transmission of a beacon **16** is done without prior CSMA/CA, and the received signal would then be a mixture of two beacons **16** (the radio range is considered to be the same for transmission and reception).

To avoid this type of conflict, each node **10** further indicates, in its beacon **16**, the offset relative to its own beacon, from the beacon transmitted by its parent. Thus, once a node **10** has performed its initial listening for beacons **16** in step **210**, it knows, for all of the nodes **10** that are within its range, the list of those offsets to avoid. The secondary node **10**_b_ therefore excludes, from the list of potential offsets, those corresponding to the parents of the nodes located in its radio range.

Once the offsets δ already used by immediate neighbors and of the second order are excluded (a consequence is that information transmitted by a child node in the CAP of its parent are only received by the parent), many possible free offsets δ may remain, and choosing those offsets δ wisely makes it possible to escalate the data to the primary node **10**_a_ as quickly as possible.

In order to avoid disrupting the nodes seeking to join the network and that are within radio range of two nodes transmitting their beacon at the same time, the offsets corresponding to the transmission moments of the beacons of the nodes within radio range of the considered secondary node are excluded from the list of potential offsets.

To avoid pointless consumption (reception of a pointless beacon signal) and loss of bandwidth (reduction of moments in a window CAP where the other nodes may transmit), the offset must be such that the beacon transmitted by the considered secondary node is outside the CAP windows of the nodes within its radio range.

The length of the offset is chosen to be equal to a whole factor of the duration D equal to the sum of the transmission duration of the beacon and the duration of a CAP window, and the unit chosen to measure it has that duration D as its unit.

In reference to FIG. **7**, each of the offsets is thus numbered between 0 (which corresponds to the transmission moment by the primary node **10**_a_ of its beacon **16**) and N, equal to the whole value of the quotient of T divided by D. The numbers indicated in FIG. **7** correspond to the absolute reference (i.e., having for origin the offset of the primary node **10***a*).

In the beacons, the offsets may be according to the embodiments indicated in absolute value. An offset of the parent of a node indicated in the beacon of the node may, in one embodiment, be indicated in a reference relative to the node (i.e., having the offset of said node as its origin).

Once the aforementioned indicated offsets are excluded, many free possible offset values may remain. The considered secondary node **10***b* chooses, among them, the largest possible offset that is below the beacon offset of its parent.

If no offset meeting these two conditions is available, it chooses the greatest possible offset that is greater than the beacon offset of its parent.

This choice of the value of the offset allows a faster collection of information by the primary node **10***a*.

Applying the invention to the case described above therefore makes it possible to collect information allowing the location of thermal defects on an electrical installation while minimizing the energy used by each of the telecommunications nodes **10** and optimizing the information collection speed by a primary node **10***a*.

Of course, the invention may be used for data communication purposes other than for data relative to temperature, and in contexts other than wiring systems.

The invention claimed is:

1. A communication method, over a radio frequency channel in a network including a primary node and multiple secondary nodes for telecommunications, comprising:

receiving, by a secondary node on the radio frequency channel, beacon messages sent by the primary node or the multiple secondary nodes in its radio neighborhood, each beacon message indicating a number of radio hops separating the primary node from a node that sends the beacon message;

selecting, by said secondary node, one node from among the primary node and the multiple secondary nodes that sends the beacon message indicating a minimum number of hops as a parent node, said secondary node being a child node; and

in order to send information to the primary node, transmitting said information over the radio frequency channel to said selected parent node,

wherein, in order to detect an emission at a first frequency of the beacon messages emitted by the primary node or the multiple secondary nodes in its radio neighborhood, a standard period with a length equal to an inverse of the first frequency is divided into several portions, a first portion and a second portion of the standard period being listened to by said secondary node, and said secondary node being put on standby for at least part of a time between the first portion and the second portion.

2. The communication method according to claim **1**, wherein, in order to send said information to the primary node, said information is emitted by said secondary node only to said parent node.

3. The communication method according to claim **1**, wherein said secondary node periodically emits a corresponding beacon message on the radio frequency channel indicating a number of radio hops separating said secondary node from the primary node, the number of radio hops separating said secondary node from the primary node being equal to a number of radio hops separating the primary node from the parent node plus one.

4. The communication method according to claim **1**, wherein, to emit said information on the radio frequency channel to said parent node, the child node detects a corresponding beacon message periodically emitted by its parent node defining a beginning of a time window where said parent node is able to receive said information from the child node, the child node sending said information to the parent node during the time window.

5. The communication method according to claim **1**, wherein the child node periodically emits a corresponding beacon message defining a beginning of a time window where it can receive information from a corresponding node in its wireless neighborhood.

6. The communication method according to claim **1**, wherein a new portion is listened to as soon as said secondary node has a sufficient power level to listen to said new portion.

7. The communication method according to claim **1**, wherein a size of at least one portion of the standard period depends on a current power supply level of said secondary node.

8. The communication method according to claim **1**, further comprising monitoring heat of wiring systems, wherein

the primary node or the multiple secondary nodes are located at junctions of the wiring systems, and

the information includes data indicating at least temperatures measured by at least one temperature sensor.

9. A transceiver station, to form a node capable of transmitting and receiving on a radio frequency channel, the node belonging to a network including a primary node and multiple secondary nodes for telecommunications, said station comprising:

circuitry configured to:

receive beacon messages on the radio frequency channel that are transmitted by the primary node or the multiple secondary nodes in its radio neighborhood, each beacon message indicating a number of radio hops separating the primary node from a corresponding node that transmits the beacon message;

select, as a parent node of said node formed by the station, one node from among the primary node and the multiple secondary nodes that transmits the beacon message indicating a minimum number of hops, said node formed by the station being a child node; and

transmit information to said selected parent node on the radio frequency channel in order to send said information to the primary node,

wherein, in order to detect an emission at a first frequency of the beacon messages emitted by the primary node or the multiple secondary nodes in its radio neighborhood, a standard period with a length equal to an inverse of the first frequency is divided into several portions, a first portion and a second portion of the standard period being listened to by said node formed by the station, and said node formed by the station being put on standby for at least part of a time between the first portion and the second portion.

10. The transceiver station according to claim **9**, wherein to send said information to the primary node, the circuitry is configured to transmit said information, through said node formed by the station, exclusively to said parent node.

11. The transceiver station according to claim **9**, wherein the circuitry is configured to periodically transmit a corresponding beacon message on the radio frequency channel, indicating a number of radio hops separating the transceiver station from the primary node, the number of radio hops separating the transceiver station from the primary node being equal to a number of radio hops separating the primary node from its parent node plus one.

12. The transceiver station according to claim **9**, wherein to transmit said information over the radio frequency channel to said parent node, the circuitry is configured to detect a corresponding beacon message periodically transmitted by its parent node, and define a beginning of a time window where said parent node is able to receive said information from the station, the station sending said information to the parent node during the time window.

13. The transceiver station according to claim **9**, wherein the circuitry is configured to send a periodic beacon message defining a beginning of a time window where it is capable of receiving information from a corresponding node in its radio neighborhood.

14. The transceiver station according to claim **9**, wherein the circuitry is configured to listen to a new portion as soon as it has a sufficient power level to listen to said new portion.

15. The transceiver station according to claim **9**, wherein a size of at least one portion of the standard period depends on a current power level of the station.

16. The transceiver station according to claim **9**, wherein the information sent by the parent node comprises an address for identifying the child node on the network.

17. The transceiver station according to claim **9**, wherein the transceiver station is suitable for thermal monitoring of wiring systems, is located at a wiring system junction, and further comprises at least one temperature sensor, the information including data indicating at least temperatures measured by the at least one temperature sensor.

18. A non-transitory computer-readable storage medium, to be installed in a transceiver station to form a node capable of transmitting over a radio frequency channel, the node belonging to a network including a primary node and multiple secondary nodes for telecommunications, said non-transitory computer-readable storage medium comprising instructions for carrying out steps of the method according to claim **1** when the instructions are run by a computer of said transceiver station.

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