



159159



G00002

WIRELESS COMMUNICATIONS SYSTEM

Field of the Invention

5 The present invention relates to a wireless communications system that performs wireless communications by using a plurality of wireless channels.

Background of the Invention

10

 Recently, there is known a wireless communications system which exchanges control signals to initiate, change or terminate functions of devices installed at a remote place or exchanges measurement results from measuring instruments installed at a remote place, by using a wireless communications station such as a low-power wireless communications station. Such a wireless communications system is applied to various types of systems such as illumination control systems, security systems, door phone systems, fire information systems, and automatic remote meter-reading systems. For example, there is disclosed a fire information system in Patent document 1.

15

20

 In the fire information system disclosed in Patent document 1, a plurality of fire detectors (wireless units) is installed at multiple portions and each of the fire detectors has a wireless communications function. In the

25

fire information system, when any one of the fire detectors detects a fire, the fire detector sounds the alarm while continuously transmitting a wireless signal including fire detection information to other fire detectors. In the
5 meantime, each of the other fire detectors receiving the wireless signal from the fire detector activates a fire alarm based on the fire detection information included in the wireless signal.

Herein, the wireless signal transmitted or received by
10 the fire detectors includes a synchronous bit (preamble), a frame synchronization (sync) pattern (unique word), a destination address, a source address, a message, and an error detection code. The preamble is a bit pattern for bit synchronization of about 8 bits length in which 0 and 1 are
15 alternately arranged, for example. Further, the unique word is a bit stream having a bit pattern differing from that of the preamble, and uses a bit pattern that is hard to be included in a pattern for a message or the like.

The detector detects the preamble and the unique word
20 included in the received wireless signal and determines that the received wireless signal is a wireless signal used in the system to which it belongs. Then, the detector can obtain information by receiving the destination address or the message following the unique word. Further, the error
25 detection code is formed of, e.g., a Cyclic Redundancy Check (CRC) or the like, and is used in checking the integrity of

the received wireless signal and detecting a cause why the bit inversion or the like has occurred.

In the above-described wireless communications system, there is provided a plurality of wireless channels for wireless signals within a specific frequency band and the wireless signals are transmitted between multiple wireless communications stations (transmitters and receiver). In this case, the transmitter alternatively selects one among the wireless channels and transmits a wireless signal through the wireless channel. The receiver scans all wireless channels at a predetermined time period interval, for example, in a time division manner.

Further, the receiver measures signal strength of each wireless channel based on a Received Signal Strength Indication (RSSI) signal and, when the measured signal strength is greater than a predetermined threshold, detects a preamble and receives the wireless signal. In this way, the receiver can receive the wireless signal through the wireless channel arbitrarily selected by each transmitter, and the wireless signal can be transferred between multiple wireless communications stations.

[Patent document 1] Japanese Patent Application Publication No. 2009-177340

However, when the transmitter selects a wireless channel to transmit a wireless signal, a power of the wireless signal may be leaked into wireless channels other

than the wireless channel selected to transmit the wireless signal. Further, the receiver and the transmitter may be installed close to each other, and there may be the case where the signal strengths of other wireless channels exceed
5 a predetermined threshold. In this case, there is a possibility that the receiver erroneously selects as a reception target another wrong wireless channel and starts reception of a wireless signal therefrom. For that reason, it is concerned that the receiver may miss the wireless
10 signal transmitted from the transmitter via the correct wireless channel.

On the other hand, in such a wireless communications system, a wireless reception station may be shared by a plurality of electronic devices. For example, a single
15 receiver can receive a detection signal from a human body detection sensor of a door phone device, and receive a dimming signal for manipulating a dimming level from an illumination control device to operate a dimming level of a lighting equipment. Further, a plurality of transmitters
20 can be connected to each of the door phone system and the illumination control system.

In the conventional wireless communications system, the bit length of the preamble is set to a minimum number of bits required to perform the bit synchronization (8 bits in
25 the above-described fire information system). For that reason, as the number of transmitters increases, the

probability becomes higher that the receiver scans another wrong wireless channel when a certain transmitter transmits a wireless signal. Accordingly, it is highly possible for the receiver to miss the preamble of the target wireless
5 signal.

In this case, the transmitter transmits the same wireless signal again. However, if a length of a message to be transmitted is long, the time needed for the wireless signal to be retransmitted after the preamble has been
10 missed is very long. As a result, there arises a problem that the time taken in the transmission and reception of the wireless signal becomes prolonged.

Summary of the Invention

15

In view of the above, the present invention provides a wireless communications system in which a receiver can reliably receive a wireless signal when the receiver is installed close to a transmitter.

20

Further, the present invention provides a wireless communications system which a preamble of a wireless signal transmitted by a transmitter can be reliably received and the transmission and reception of the wireless signal can be performed in a short period of time.

25

In accordance with a first aspect of the present invention, there is provided a wireless communications

system including: a transmitter which selects one wireless channel among a plurality of wireless channels each having a different frequency from each other and transmitting a wireless signal through the selected wireless channel; and a receiver which receives the wireless signal transmitted from the transmitter, wherein the receiver includes: a signal strength detection unit which scans each of target wireless channels for a predetermined scan period by sequentially switching the target wireless channels and measures a signal strength thereof, a storage unit for storing the signal strengths of the target wireless channels measured by the signal strength detection unit; and a signal reception unit which preferentially receives a wireless signal on the wireless channel having a higher priority determined based on the order of the signal strength stored in the storage unit, among the target wireless channels.

With such configuration, the wireless signal is detected on the wireless channel with the greatest signal strength. Accordingly, when the transmitter which has transmitted the wireless signal is positioned close to the receiver, the receiver can reliably receive the wireless signal through the wireless channel of the transmitter positioned close to itself other than the wireless channel into which the power of the wireless signal is leaked. As a result, it is possible to reduce the probability that the receiver misses the wireless signal from the transmitter

even if the transmitter and the receiver are positioned close to each other.

In the above system, the wireless signal may include a destination address indicative of a receiver of destination, and the receiver may sequentially switch the target wireless channels and receives the wireless signal on each of the wireless channels in the order of the signal strength until the destination address of the received wireless signal matches its own address.

In accordance with a second aspect of the present invention, there is provided a wireless communications system including: one or more transmitters each of which selects one wireless channel among a plurality of wireless channels each having a different frequency from each other and transmits a wireless signal through the selected wireless channel; and a receiver which receives the wireless signal transmitted from the transmitter, wherein the wireless signal includes a preamble in which a predetermined bit sync pattern is repeated, and data having an address for identifying a transmitter and a transmission information, the receiver includes a synchronous bit detection unit which scans by sequentially switching the wireless channels in a predetermined scan period in a time division manner, and detects the bit sync pattern from each wireless channel, and a data reception unit which receives the data following the preamble when the bit sync pattern is detected, the preamble

has at least a total bit length of a bit length corresponding to one scan period and a bit length required to detect the bit sync pattern.

5 With such configuration, it is possible to increase the probability that the receiver detects the bit sync pattern of the wireless signal transmitted by the transmitter. As a result, the probability of missing the preamble of the wireless signal transmitted by the transmitter is decreased, and the wireless signal can be
10 transmitted and received in a short period of time.

The receiver may include a channel setting unit for setting the target wireless channels, and the transmitter may change a length of the preamble in accordance with the number of wireless channels set by the channel setting unit.

15 Thus, since the length of the preamble of the transmitter can be increased or decreased in accordance with the number of scans of the wireless channels set by the receiver, a more suitable preamble length can be selected. As a result, the wireless signal can be transmitted and
20 received in a short period of time while decreasing the probability of missing the preamble of the wireless signal transmitted by the transmitter.

Further, the receiver may include a priority setting unit for setting priorities for the target wireless channels,
25 and the synchronous bit detection unit may set the number of scans of the respective wireless channels during each scan

period based on the priorities set for the respective wireless channels.

By doing so, for, e.g., a single scan period, a wireless signal on the wireless channel having higher priority is detected a plurality of times. Therefore, the probability of detecting a wireless signal from a transmitter having the higher priority is further increased.

Furthermore, the receiver may include a priority setting unit for setting priorities for the target wireless channels, and the synchronous bit detection unit may set the time for which the respective wireless channels are scanned during each scan period based on the priorities set for respective wireless channels.

With such configuration, for, e.g., a single scan period, a period time for which a wireless signal on a wireless channel having higher priority is detected is extended. As a result, the probability of detecting a wireless signal from the transmitter having higher priority is further increased.

The wireless signal may include a frame sync pattern having a bit pattern differing from that of the bit sync patterns which follows the bit sync pattern, the receiver further may include a signal strength detection unit for detecting signal strengths of the target wireless channels and a frame detection unit for detecting the frame sync pattern, and the wireless channels may be scanned again when

the frame sync pattern is not detected until a predetermined period of time is elapsed after detecting a signal strength of a predetermined strength or more by the signal strength detection unit.

5 In this case, when a frame sync pattern is not detected, detection of the wireless signal is performed again. Accordingly, it is possible to prevent reception of a normal wireless signal from being interrupted by an abnormal wireless signal.

10 Further, the receiver may include a signal strength detection unit for detecting signal strengths of the target wireless channels, and, if a signal strength of the receiving wireless channel, detected by the signal strength detection unit while the data reception unit is receiving
15 the data, is less than a predetermined strength, scan of the target wireless channels may be restarted while reception of the wireless signal is stopped.

With this configuration, when the signal strength is weakened during the reception of the wireless signal, the
20 reception is stopped and the detection of a wireless signal is performed again. Accordingly, there can be avoided the case in which a normal wireless signal is not received due to another abnormal wireless signal.

25 Brief Description of the Drawings

The objects and features of the present invention will be apparent from the following description of preferred embodiments which is given in conjunction with the accompanying drawings, as follows:

5 Fig. 1 is a schematic block diagram showing a wireless communications system in accordance with a first embodiment of the present invention;

10 Fig. 2A is a schematic diagram showing a format of a wireless signal in the wireless communications system of the first embodiment, Fig. 2B is a schematic diagram for explaining a time division method by which a wireless signal is scanned, in the wireless communications system of the first embodiment, and Fig. 2C is a graph showing an example of measurement results of wireless signal strengths, in the
15 wireless communications system of the first embodiment;

 Fig. 3 is a schematic block diagram illustrating a configuration of a wireless communications system in accordance with a second embodiment;

20 Fig. 4A is a schematic diagram depicting a format of a wireless signal in the wireless communications system of the second embodiment, and 4B and 4C are schematic diagrams showing the time for which the wireless signals are scanned, in the wireless communications system of the second embodiment; and

25 Fig. 5 is a table showing settings set by a receiver in the wireless communications system of the second

embodiment.

Detailed Description of the Preferred Embodiments

5 Embodiments of the present invention will be described in detail below with reference to the accompanying drawings which form a part hereof. The same reference numerals will be given to the same or similar components throughout the drawings, and redundant descriptions thereof will be omitted.

10 <Embodiment 1>

 Hereinafter, a first embodiment in accordance with the present invention will be described with reference to Figs. 1 and 2.

 As shown in Fig. 1, a wireless communications system
15 of the present embodiment includes a single receiver 10 and a plurality of transmitters 20. Further, in the present embodiment, the transmitters 20 including seven transmitters 20a to 20d and 20x to 20z are described, but the present invention is not limited thereto.

20 The transmitters 20a, ..., 20d together with the receiver 10 may be included in a door phone system. Each of the transmitters 20a, ..., 20d includes a door phone outdoor unit which transmits a call signal in response to manipulation of a user, e.g., a human body detection sensor
25 implemented as a camera or the like to transmit a human body detection signal, or a locking device attached to a door at

a porch or the like and configured to transmit a key lock/unlock signal.

Further, the transmitters 20x, ..., 20z together with the receiver 10 may be included in an illumination control system. In this case, each of the transmitters 20x, ..., 20z may be a remote controller for transmitting a dimming signal in accordance with manipulation of a user, a lighting equipment for outputting a lighting signal indicative of a lighting state of a light source, or an illuminance sensor attached to a ceiling surface or the like and configured to output an illuminance detection signal indicative of brightness in a room.

Each transmitter 20 is provided with a transmission unit 21 serving as, e.g., a low-power wireless station. The transmitter 20 is configured to transmit to the receiver 10 a wireless signal including information about its own type and the type of system to which it belongs. The transmission unit 21 selects a wireless channel among a plurality of wireless channels provided within a specific frequency band, and then transmits the wireless signal to the receiver 10 through the selected wireless channel. Further, in the present embodiment, the wireless channels used by the transmitters 20a, ..., 20d and 20x, ..., 20z, include wireless channels ch1, ch2, ..., ch7.

The receiver 10 serves as a main control part common to both the door phone system and the illumination control

system, and includes a control unit 11 such as a microcomputer or the like, a reception unit 12 such as, e.g., a low-power wireless station, and a storage unit 13 such as non-volatile semiconductor memory.

5 The reception unit 12 is operated under the control of the control unit 11. Specifically, when a wireless channel to be scanned is designated by the control unit 11, the reception unit 12 measures the signal strength of the designated wireless channel by using a signal strength
10 detection unit 12a based on, e.g., RSSI, and outputs the measurement result to the control unit 11. Further, the reception unit 12 receives a wireless signal flowing through the designated wireless channel when the wireless channel is designated by the control unit 11, and outputs various types
15 of control information or the like included in the received wireless signal to the control unit 11.

 The information is stored in the storage unit 13 by the control unit 11. In the storage unit, signal strengths measured by the signal strength detection unit 12a of the
20 reception unit 12 are stored in association with respective wireless channels.

 The control unit 11 activates the reception unit 12 at every scan period interval using a built-in timer (not shown) to measure signal strengths of target wireless
25 channels. Further, the control unit 11 controls the reception unit 12 to receive a wireless signal transmitted

from one of the transmitters 20 based on the signal strength of each wireless channel. In the present embodiment, the signal strength is measured, e.g., for 2ms per a wireless channel, and the time corresponding to one scan period interval required to measure the signal strengths of seven
5 wireless channels Ch1 to Ch7 is set to 14 ms (See Fig. 2B).

The wireless signal transmitted from the transmitter 20 to the receiver 10 has a format shown in Fig. 2A, and includes a preamble PA, a unique word UW, a destination
10 address DA, a source address SA, a message MG, and an error detection code CR. The preamble PA is a bit stream formed of, e.g., a bit synchronization (sync) pattern in which 0 and 1 are alternately repeated, and in which, for example, the first bit is set to 0 and the last bit is set to 1, or
15 vice versa. The receiver can obtain frequency pulling-in range while receiving the bit stream.

The unique word UW includes bits differing from those of the preamble PA, and is set to have a length of, e.g., 32 bits in the present embodiment. The destination address DA
20 is a bit stream required to identify the receiver 10 as a destination for receiving the wireless signal. The source address SA is a bit stream required to uniquely identify each transmitter 20 which transmits the wireless signal.

Further, the message MG is a bit stream including
25 transmission information that is transmitted by the transmitter 20, and may have a variable bit length depending

on contents of the transmission information. The error
detection code CR is a bit stream such as, e.g., a Cyclic
Redundancy Check (CRC), and is set such that an abnormality
such as bit inversion occurring at least in the bit stream
5 of the message MG can be detected upon transmission and
reception.

Hereinafter, operation of the receiver 10 receiving a
wireless signal is described. First, the control unit 11 of
the receiver 10 activates the reception unit 12 at every
10 scan period interval, and measures signal strengths of all
wireless channels to be scanned. The results of
measurements are sequentially stored in the storage unit 13
by the control unit 11. The signal strengths of the
respective wireless channels are given as shown in, e.g.,
15 Fig. 2C.

In the following description, it is assumed that the
signal strength reaches a maximum at Ch4 and gradually
decreases in the order of Ch2, Ch1, Ch5, Ch3, Ch6, and Ch7.
Further, the signal strengths at the channels Ch1 to Ch5 are
20 greater than a threshold th , which is determined to be a
valid signal strength for the reception unit 12, and those
at the channels Ch6 and Ch7 are smaller than the threshold
 th .

Next, the control unit 11 sets as a target wireless
25 channel of the reception unit 12 the wireless channel (Ch4
in this case) having the strongest signal strength, and

controls the reception unit 12 to start receiving the wireless signal. The reception unit 12 fixes the target wireless channel, and detects bit patterns corresponding to the preamble PA, the unique word UW, the destination address
5 DA, the source address SA, the message MG, and the error detection code CR.

Further, if the respective bit patterns are correctly detected, there is no abnormality in the signal information based on the error detection code, and the address of the
10 reception unit 12 itself is included in the destination address DA, the reception unit 12 determines the wireless signal to be a valid wireless signal, and outputs information stored in the message MG to the control unit 11. Accordingly, the wireless signal flowing through the
15 wireless channel having the strongest signal strength can be correctly received by the receiver 10.

On the other hand, when the respective bit patterns are not normally detected from the target wireless channel, or when the address of the reception unit 12 itself is not
20 included in the destination address DA, the control unit 11 stops the reception unit 12 from receiving a wireless signal flowing through the wireless channel. Then, the control unit 11 sets a wireless channel (Ch2 in this case) having the second-highest signal strength among the signal
25 strengths of respective wireless channels stored in the storage unit 13, as a target wireless channel, and controls

the reception unit 12 to start receiving a wireless signal through the wireless channel.

The control unit 11 repeats the above-described receiving operation on wireless channels having the third
5 signal strength (CH1), the fourth signal strength (CH 5), ..., and the like, in the order of signal strength until the reception unit 12 receives a valid wireless signal and obtains the message MG included in the received wireless signal. However, when the signal strength of the target
10 wireless channel is less than the threshold th, the control unit 11 starts measurement of signal strengths again at every predetermined scan period interval without performing reception through subsequent wireless channels.

That is, in the case of the signal strengths shown in
15 Fig. 2C, the reception of wireless signals can be attempted in the order of Ch4, Ch2, Ch1, Ch5, and Ch3 until a valid wireless signal is received. Further, when a valid wireless signal has not been received even in the reception of wireless signals through the wireless channel Ch3, the
20 measurement of signal strengths is repeated at every scan period interval.

In this way, since the reception of the wireless signal is sequentially performed through all wireless channels in the order of signal strength, it is possible to
25 reduce the occurrence of the case where the reception starts through another wrong wireless channel having the signal

strength which is greater than the threshold th due to the leakage of power, and a wireless signal is missed on the target wireless channel through which the transmitter transmitted the wireless signal.

5 Further, reception of a wireless signal is performed sequentially from wireless channels in the order of signal strength until the wireless signal is received. If the corresponding reception unit is not included in the destination of a wireless signal having a higher signal
10 strength, the reception unit can receive wireless signals flowing through other channels. Accordingly, even when wireless communications systems are arranged close to each other, the occurrence of the case where the reception unit misses wireless signals which include the reception unit as
15 a destination, through the transmitted and received wireless signal, can be reduced, thereby improving communication efficiency.

 Further, when the reception unit 12 cannot normally detect each of the bit patterns, or when the reception unit
20 12 is not included in the destination address DA , the signal strength may be measured again and may set a wireless channel having the next-highest signal strength to a reception target. By doing this, it is possible to always receive a wireless signal based on the latest signal
25 strengths, and reduce the probability that a newly transmitted wireless signal is missed.

<Embodiment 2>

Hereinafter, a second embodiment of the present invention will be described with reference to Figs. 3 to 5.

As shown in Fig. 3, in a wireless communications system of the present embodiment, a receiver 10 further includes a manipulation input unit 14 such as a liquid crystal panel, a switch, or the like. Below, a description will be made while focusing on a configuration different from that of the first embodiment.

10 A reception unit 12 is operated under the control of a control unit 11, and a signal strength detection unit 12a measures a signal strength of a wireless channel based on, e.g., RSSI, when a wireless channel to be scanned is designated. When the measured signal strength is greater
15 than a predetermined threshold, the reception unit 12 receives a wireless signal flowing through the wireless channel and outputs the wireless signal to the control unit 11. When the signal strength is less than the predetermined threshold, the reception unit 12 does not receive the
20 wireless signal and waits for a new designation of a wireless channel by the control unit 11.

 A storage unit 13 stores information recorded by the control unit 11, so that in the present embodiment, pieces of information such as the priorities, identification
25 addresses and wireless channel numbers of respective transmitters 20 are stored. In the present embodiment, the

manipulation input unit 14 to be described later includes a channel setting unit 14a and a priority setting unit 14b. Further, setting information as shown in, e.g., Fig. 5, is stored in accordance with a manipulation input from the manipulation input unit 14. For example, for a transmitter 20a, an identification address of 001, a wireless channel of ch1, and a priority of 「2」 are set, and an identification address, a wireless channel, and a priority is set in the same manner for transmitters 20b, ..., 20d, 20x, ..., 20z. As for the priorities, it is assumed that the priority is higher as the number is smaller, that is, 「1」 is the highest priority.

The manipulation input unit 14 outputs a manipulation input signal to the control unit 11 in response to the manipulation input by a user. The user manipulates a switch or the like of the manipulation input unit 14 based on the character or the figure displayed on the liquid crystal panel of the manipulation input unit 14, and may modify settings by, e.g., adding, changing or deleting the identification addresses, priorities, and wireless channel numbers of respective transmitters 20 and the total number of transmitters 20. Further, the setting information performed by the user using the manipulation input unit 14 is stored in the storage unit 13 by the control unit 11, and the control unit 11 performs operations based on the information recorded in the storage unit 13.

In this case, the wireless signal transmitted from the transmitter 20 to the receiver 10 has the format as shown in Fig. 4A, and includes a preamble PA, a unique word UW, data DA, and an error detection code CR. The preamble PA is a
5 bit stream such as a bit sync pattern in which 0 and 1 are alternately repeated and the first and the last bit are set to 0 and 1, respectively. In the present embodiment, it is determined that the bit stream is the preamble PA only when its length is 64 or more bits.

10 The unique word UW (frame sync pattern) includes bits differing from those of the preamble PA, and is set to have a length of 32 bits in the present embodiment. The data DA is a bit stream including the identification address of a transmitter 20 that transmits the wireless signal and
15 transmission information transmitted by the transmitter 20. Further, the data DA may have a variable bit length depending on the contents of the transmission information to be transmitted. The error detection code CR is a bit stream such as CRC, and is set such that an abnormality such as a
20 bit inversion occurring at least in the bit stream of the data DA can be detected upon transmission and reception.

The control unit 11 activates the reception unit 12 at every predetermined time interval (scan period) by using a built-in timer (not shown), sequentially scans preset
25 wireless channels, and receives a wireless signal transmitted from the transmitter 20. In the present

embodiment, as shown in Fig. 4B, each wireless channel is scanned for 2 ms based on the setting information stored in the storage unit 13. In this case, the priorities of the wireless channels ch5 to ch7 allotted to the transmitters
5 20x to 20z are set to 「1」, so that the wireless channels ch5 to ch7 are set to be scanned twice for one scan period. The priorities of the transmitters 20a to 20d are set to 「2」, so that the corresponding channels are set to be scanned once for one period. Accordingly, the time interval
10 corresponding to one scan period required to scan all wireless channels is 20ms.

Next, an operation of scanning each of the wireless channels is described. The control unit 11 controls the reception unit 12 to detect a signal strength of a target
15 wireless channel by using the signal strength detection unit 12a. Then, if the detected signal strength is sufficient, the reception unit 12 inputs the wireless signal to the control unit 11.

At this point, the control unit 11 detects the above-described bit sync pattern from the wireless signal inputted
20 from the reception unit 12 by using a synchronous bit detection unit 11a. When the bit sync pattern is not detected in the time of 2 ms for every wireless channel, the control unit 11 switches a wireless channel to be scanned to
25 the next wireless channel and detects a bit sync pattern therefrom again. On the other hand, when the bit sync

pattern is detected in 2 ms, the control unit 11 fixes the wireless channel, continues to scan for a predetermined period of time, and detects a unique word UW by using a frame detection unit 11b.

5 In the present embodiment, the period of time required to perform the detection is set to 40 ms from the start of the detection of the bit sync pattern, and this time period is obtained by summing up the time of 20 ms corresponding to one scan period required to scan all wireless channels, the
10 time of 13.3 ms corresponding to 64 bits required to determine that the bit stream is the preamble PA, and the time of 6.7 ms corresponding to 32 bits of the unique word UW.

 Next, the receiver 10 stops receiving the wireless
15 signal through the wireless channel when the unique word UW is not detected, and starts to scan each wireless channel again. When the unique word UW is detected, the data DA subsequent to the unique word UW is received by the data reception unit 12b, and it is determined whether signal
20 information is normal or abnormal by using an error correction code (ECC) CR. Further, information included in the wireless signal is obtained if the signal information is normal.

 In the meantime, the reception unit 12 periodically
25 detects the signal strength of the wireless signal even while receiving the data DA. If the signal strength becomes

lower than a predetermined threshold, the reception unit 12 outputs a signal indicative of a decrease in the signal strength to the control unit 11. Further, the control unit 11 controls the reception unit 12 to terminate the reception of the wireless signal through the wireless channel, and to start scan of a wireless signal flowing through a subsequent wireless channel.

Thus, the receiver 10 receives wireless signals, each including a preamble PA, through respective wireless channels at every predetermined scan period interval (20 ms).

Here, the bit length of the preamble PA is set to 160 bits in which 96 bits correspond to the scan period (20 ms) of the receiver 10 and 64 bits correspond to the period required to detect the preamble PA. Accordingly, the probability that the receiver 10 detects the bit sync pattern for an interval of 96 bits from the start bit of the preamble PA is further increased.

Further, since the bit sync pattern of 64 bits required to detect at least the preamble PA follows the interval, the receiver 10 can reliably detect the preamble PA and then receive a wireless signal. Consequently, it is possible to increase the probability that the wireless signal transmitted from the transmitter 20 is received by the receiver 10, while reducing a need for the transmitter 20 to retransmit the same wireless signal, thus reducing the time required for transmission and reception.

Further, as shown in Fig. 4C, the receiver 10 may scan for a longer time period for the wireless channels ch5 to ch7 having higher priorities than the wireless channels ch1 to ch4 having lower priorities. For example, the wireless channels ch1 to ch4 may be scanned for 2 ms and the wireless channels ch5 to ch7 for 4 ms.

Furthermore, in the present embodiment, the bit length of the preamble PA of the wireless signal transmitted from each of the transmitters 20 is set to a fixed length of 160 bits, but it may be possible to provide a setting unit in each of the transmitters 20 and to change the bit length of the preamble in accordance with the number of wireless channels set in the receiver 10. Alternatively, it is possible to change the bit length of the preamble in accordance with the length of one period required to scan each of the wireless channels.

As for changing the bit length, when the user changes settings for the receiver 10 via the manipulation input unit 14, the receiver 10 may send a signal indicative of the length of the preamble to the transmitter 20, and the transmitter 20 may change a preamble length in a wireless signal to be transmitted in response to the received signal.

Further, in the description of the above embodiments, an example was given in which the wireless communications system is applied to the door phone system and the illumination control system, but, it is not limited thereto,

and the wireless communications system of the present invention can be applied to various systems such as remote meter-reading systems. For example, the present invention may be applied to remote meter-reading systems in such a way
5 that a measurement is automatically performed by using measuring instruments such as power meters, gas meters and water meters installed at remote places, and measurement results are transmitted as remote meter-reading information. Further, the present invention may also be applied to fire
10 information systems.

Although the preferred embodiments of the present invention have been described above, the present invention is not limited to those specific embodiments. Various modifications and variations can be realized without
15 departing the scope of the following claims, and fall within the scope of the present invention.

What is claimed is:

1. A wireless communications system comprising:

5 a transmitter which selects one wireless channel among a plurality of wireless channels each having a different frequency from each other and transmitting a wireless signal through the selected wireless channel; and

a receiver which receives the wireless signal transmitted from the transmitter,

10 wherein the receiver comprises:

a signal strength detection unit which scans each of target wireless channels for a predetermined scan period by sequentially switching the target wireless channels and measures a signal strength thereof,

15 a storage unit for storing the signal strengths of the target wireless channels measured by the signal strength detection unit; and

a signal reception unit which preferentially receives a wireless signal on the wireless channel having a higher
20 priority determined based on the order of the signal strength stored in the storage unit, among the target wireless channels.

2. The system of claim 1, wherein:

25 the wireless signal includes a destination address indicative of a receiver of destination, and

the receiver sequentially switches the target wireless channels and receives the wireless signal on each of the wireless channels in the order of the signal strength until the destination address of the received wireless signal matches its own address.

3. A wireless communications system comprising:

one or more transmitters each of which selects one wireless channel among a plurality of wireless channels each having a different frequency from each other and transmits a wireless signal through the selected wireless channel; and

a receiver which receives the wireless signal transmitted from the transmitter,

wherein the wireless signal includes a preamble in which a predetermined bit sync pattern is repeated, and data having an address for identifying a transmitter and a transmission information,

the receiver includes a synchronous bit detection unit which scans by sequentially switching the wireless channels in a predetermined scan period in a time division manner, and detects the bit sync pattern from each wireless channel, and a data reception unit which receives the data following the preamble when the bit sync pattern is detected,

the preamble has at least a total bit length of a bit length corresponding to one scan period and a bit length required to detect the bit sync pattern.

4. The system of claim 3, wherein:

the receiver includes a channel setting unit for setting the target wireless channels, and

5 the transmitter changes a length of the preamble in accordance with the number of wireless channels set by the channel setting unit.

5. The system of claim 3 or 4, wherein:

10 the receiver further includes a priority setting unit for setting priorities for the target wireless channels, and

the synchronous bit detection unit sets the number of scans of the respective wireless channels during each scan period based on the priorities set for the respective
15 wireless channels.

6. The system of claim 3 or 4, wherein:

the receiver further includes a priority setting unit for setting priorities for the target wireless channels, and

20 the synchronous bit detection unit sets the time for which the respective wireless channels are scanned during each scan period based on the priorities set for respective wireless channels.

25 7. The system of any one of claims 3 to 6, wherein:

the wireless signal includes a frame sync pattern

having a bit pattern differing from that of the bit sync patterns which follows the bit sync pattern,

the receiver further includes a signal strength detection unit for detecting signal strengths of the target wireless channels and a frame detection unit for detecting the frame sync pattern, and

the wireless channels is scanned again when the frame sync pattern is not detected until a predetermined period of time is elapsed after detecting a signal strength of a predetermined strength or more by the signal strength detection unit.

8. The system of any one of claims 3 to 6, wherein:

the receiver further includes a signal strength detection unit for detecting signal strengths of the target wireless channels, and

if a signal strength of the receiving wireless channel, detected by the signal strength detection unit while the data reception unit is receiving the data, is less than a predetermined strength, scan of the target wireless channels is restarted while reception of the wireless signal is stopped.

9. The system of any one of claims 1 to 8, wherein the wireless communications system is a remote meter-reading system and the wireless signal is a signal including remote

meter reading information.