

CERTIFICATE OF TRANSLATION ACCURACY

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I served as Chief Examiner of the certified court interpreter test for the State of California and as a contract translator and interpreter for various federal agencies through the U.S. Department of State for more than a decade. I served as an instructor at the University of California at Berkeley and the Middlebury Institute of International Studies at Monterey (MIIS) Graduate Program in Translation.

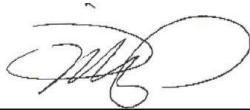
I have more than 30 years of experience reviewing thousands of technical, legal, and business documents from Japanese to English submitted to, among others, Japanese judicial authorities, U.S. federal courts, the U.S. International Trade Commission (ITC), and the USPTO Patent Trial and Appeal Board (PTAB).

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I certify under penalty of perjury that the foregoing is true and correct.

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(54) TITLE OF THE INVENTION

COMMUNICATION SYSTEM AND BODY-WEARABLE WIRELESS COMMUNICATION TERMINAL

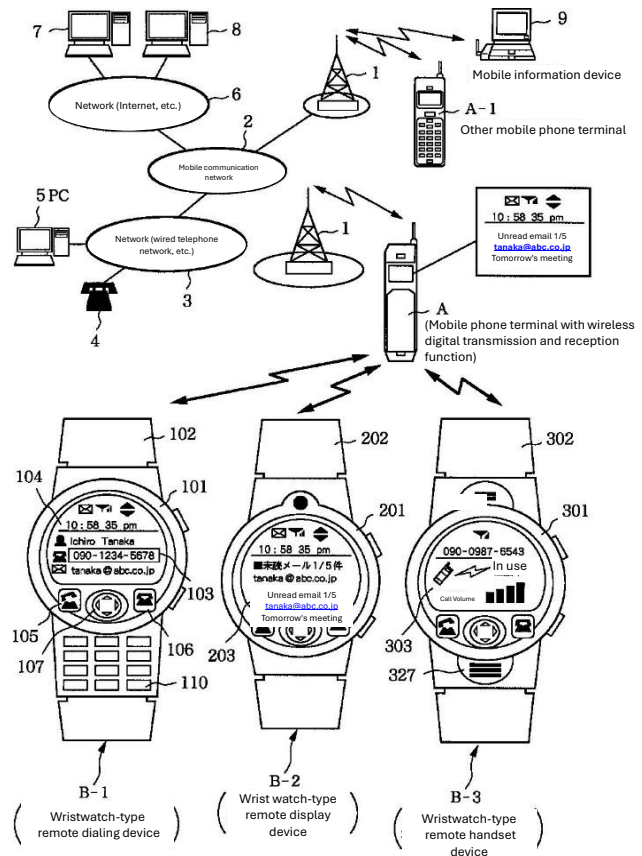
(57) ABSTRACT

PROBLEM

To provide a communication terminal system and a body-wearable wireless communication terminal capable of improving mobility without degrading basic functions related to usability.

SOLUTION MEANS

A parent terminal A and child terminals B-1, B-2, and B-3 that are capable of communicating with the parent terminal A are provided. The parent terminal A is a mobile phone terminal with wireless digital transmission and reception function, and can be connected to a wired telephone 4 and a PC 5 via a wireless base station 1, a mobile communication network 2, and a network (wired telephone network, etc.) 3, and can also be connected to a server 7 and a PC 8 via a network (Internet, etc.) 6, and can further be connected to other mobile phone terminals A-1 and mobile information devices 9 via the base station 1. On the other hand, the child terminal B-1 is a remote dialing device, the child terminal B-2 is a remote display device, and the child terminal B-3 is a remote handset device. Moreover, each of the child terminals B-1 to B-3 is a wristwatch type.



What is claimed is:

[Claim 1] A communication system comprising: a parent terminal capable of communicating with a system external unit, and a child terminal capable of wireless communication with the parent terminal; wherein the child terminal is provided with a portion of the communication function with a system external unit that should be achieved in the parent terminal; and implementing means is provided that achieves communication between the child terminal and a system external unit via the parent terminal by wireless communication.

[Claim 2] The communication system according to claim 1, wherein the child terminal includes: inputting means for inputting call data necessary for the parent terminal to perform a call operation as a portion of a communication function with the external system; and transmitting means for transmitting the call data input by the inputting means to the parent terminal.

[Claim 3] The communication system according to claim 1, wherein the child terminal includes: receiving means for receiving an incoming call signal and display data transmitted from the parent terminal, as a portion of a communication function with the external system; and displaying means for performing a display operation on the basis of the signal and display data received by the receiving means.

[Claim 4] The communication system according to claim 3, wherein the displaying means displays an image on the basis of the signal and display data received by receiving means.

[Claim 5] The communication system according to claim 1, wherein the child terminal includes: image capturing means; and transmitting means for transmitting image data captured by the image capturing means to the external system via the parent terminal as a portion of the communication function with the external system.

[Claim 6] The communication system according to claim 1, wherein the child terminal includes as a portion of the communication function with the external system: receiving means for receiving an audio signal transmitted from the parent terminal; playback means for playing back audio based on the audio signal received by the receiving means; audio signal generating means for detecting audio and generating an audio signal; and transmitting means for transmitting the audio signal to the parent terminal.

[Claim 7] The communication system according to any one of claims 1 to 6, wherein the parent terminal communicates with a system external unit via a first radio wave and communicates with the child terminal via a second radio wave.

[Claim 8] The communication system according to any one of claims 1 to 7, wherein the child terminal has a shape suitable for wearing on an arm of a user.

[Claim 9] A body-wearable wireless communication terminal, comprising: a parent terminal capable of communicating with an external system by a first radio wave; communicating means for wirelessly communicating by a second radio wave different from the first radio wave; and executing means for executing a portion of a function to be performed between the external system and the parent

terminal on the basis of data obtained by the communicating means.

[Claim 10] The body-wearable wireless communication terminal according to claim 9, further comprising: inputting means for inputting call data necessary for the parent terminal to perform a call operation as executing means; wherein the communicating means transmits the call data input by the inputting means to the parent terminal.

[Claim 11] The body-wearable wireless communication terminal according to claim 9, wherein the communicating means includes displaying means, as the executing means, that receives an incoming call signal and display data transmitted from the parent terminal, and performs a display operation on the basis of the received signal and display data.

[Claim 12] The body-wearable wireless communication terminal according to claim 11, wherein the displaying means displays an image based on the received signal and display data.

[Claim 13] The body-wearable wireless communication terminal according to claim 9, further comprising: capturing means; wherein the executing means provides first communication controlling means for controlling the communicating means to transmit image data captured by the capturing means to the external system via the parent terminal.

[Claim 14] The body-wearable wireless communication terminal according to claim 9, wherein the communicating means includes: playback means for receiving an audio signal transmitted from the parent terminal, and playing back audio based on the received audio signal as the executing means; audio signal generating means for detecting audio and generating an audio signal; and second communication controlling means for controlling the communicating means so as to transmit the audio signal to the parent terminal.

[Claim 15] The body-wearable wireless communication terminal according to any one of claims 9 to 14, wherein the shape is suitable for the user to wear the terminal on their arm.

DETAILED DESCRIPTION OF THE INVENTION

[0001]

TECHNICAL FIELD OF THE PRESENT INVENTION

The present invention relates to a communication system including a parent terminal capable of communicating with a system external unit and a child terminal capable of wireless communication with the parent terminal, and to a body-wearable wireless communication terminal.

[0002]

CONVENTIONAL TECHNOLOGY

Conventionally, with the progress of digitalization and the spread of the Internet, high-speed data communication and packet communication services have started even in mobile communication such as mobile phones, PHS, and the like, and the use of data communication other than audio is also rapidly increasing. Furthermore, mobile computing has also become widespread, wherein a PDA (Personal Digital Assistant) or notebook PC (Personal Computer) is connected to a mobile phone or PHS, and then remotely connected to an office, home server, or PC via a mobile communication network, public network, or the Internet, allowing users to transfer files, use e-mail, and access the World Wide Web while travelling.

[0003] Meanwhile, mobile communication terminals such as mobile phones (cellular) and PHS (Personal Handyphone System) have been rapidly becoming smaller and lighter in recent years, leading to the development of mobile phone terminals weighing just a few grams, wristwatch-type PHS terminals, and cellular terminals. Furthermore, wristwatch-type incoming call notification devices that vibrate to notify of incoming calls to a mobile phone terminal and wristwatch-type pager terminals that receive call messages are also now commercially available. Furthermore, in the field of wired telephone terminals, there are parent-child telephone systems in which a parent unit and a child unit are capable of wireless communication, portable child units of cordless telephones, and the like.

[0004]

PROBLEM TO BE SOLVED BY THE INVENTION

Therefore, under the current circumstances, it would be technically possible to make various communication terminals, for example, in the form of a wristwatch, to improve mobility and prevent the terminal from being left behind. However, if all the functions of a mobile phone are incorporated into a single device, the device's size will inevitably increase, compromising the wearability and decorative properties of the device as a wristwatch. Furthermore, since a large number of components are arranged in a concentrated manner within a limited size, there is a strong demand for each component to be as compact as possible. Thereby, implementing a display unit with sufficient area, providing keys that are large enough to be easy to operate, installing a battery with sufficient capacity, and the like, is difficult, and thus avoiding degradation of basic functions related to usability such as display, operability, battery capacity, and the like is not possible.

[0005] In light of the foregoing, an object of the present invention is to provide a communication system and a body-wearable communication terminal that can improve mobility without compromising basic functions related to usability.

[0006]

MEANS FOR SOLVING THE PROBLEM

In order to resolve the aforementioned problems, the communication system according to the invention according to claim 1 includes a parent terminal capable of communicating with a system external unit, and a child terminal capable of wireless communication with the parent terminal; wherein the child terminal is provided with a portion of the communication function with a system external unit that should be achieved in the parent terminal; and implementing means is provided that achieves communication between the child terminal and a system external unit via the parent terminal by wireless communication. Therefore, communication with the system external unit can be achieved at the child terminal via the parent terminal by carrying both the parent terminal and the child terminal. Here, the child terminal is equipped with a portion of the communication functions with a system external unit that should be achieved in the parent terminal, so not only can the parent terminal be made smaller, but it is also possible to implement a display unit with sufficient area, provide keys that are large enough to be easy to operate, or install a battery with sufficient capacity, thereby ensuring basic functions related to usability, such as

display, operability, battery capacity, and the like. Moreover, since the child terminal only has a portion of the communication functions with the system external unit that should be achieved in the parent terminal, the child terminal does not become larger.

[0007] In addition, in the communication system according to the invention described in claim 2, the child terminal includes, as a portion of the communication functions with the external system, inputting means for inputting call data necessary for the parent terminal to make a call operation, and transmitting means for transmitting the call data input by the input means to the parent terminal. Therefore, by carrying both the parent terminal and the child terminal, the parent terminal can be made to make a call by inputting information into the child terminal without taking out the parent terminal.

[0008] In addition, in the communication system according to the invention described in claim 3, the child terminal includes, as a portion of the communication function with the external system, receiving means for receiving an incoming call signal and display data transmitted from the parent terminal, and displaying means for performing a display operation based on the signal and display data received by the receiving means. Therefore, by carrying both the parent terminal and the child terminal, it is possible to visually check the on the child terminal for signals and data received by the parent terminal, without taking out the parent terminal.

[0009] Furthermore, with the communication system according to the invention of claim 4, the displaying means displays an image based on the signal and display data received by the receiving means. Therefore, by carrying both the parent terminal and the child terminal, the image can be viewed on the child terminal without taking out the parent terminal.

[0010] Furthermore, with the communication system according to the invention of claim 5, the child terminal includes: image capturing means; and transmitting means for transmitting image data captured by the image capturing means to the external system via the parent terminal as a portion of the communication function with the external system. Therefore, by carrying the child terminal equipped with this image capturing means, an image capturing function not had by the parent terminal can be added, and captured images can be transmitted to the parent terminal, or even from the parent terminal to a system external unit.

[0011] Furthermore with the communication system according to the invention of claim 6, the child terminal includes as a portion of the communication function with the external system: receiving means for receiving an audio signal transmitted from the parent terminal; playback means for playing back audio based on the audio signal received by the receiving means; audio signal generating means for detecting audio and generating an audio signal; and transmitting means for transmitting the audio signal to the parent terminal. Therefore, by carrying the parent terminal and the child terminal, a conversation can be conducted in a hands-free state without taking out the parent terminal, by outputting audio from the child terminal and inputting audio to the child terminal.

[0012] Furthermore with the communication system according to the invention of claim 7, the parent terminal communicates with a system external unit via a first radio wave and communicates with the child terminal via a second radio wave. In other words, communication with the outside of the system is performed using a first radio wave, and communication within the system is performed using a second radio wave that is different from the first radio wave.

[0013] Furthermore with the communication system according to the invention of claim 8, the child terminal has a shape suitable for wearing on an arm of a user. Therefore, the parent terminal can be carried in a pocket or bag, and the child terminal can be worn on the arm, which is convenient when carrying the terminals.

[0014] Furthermore, the body-wearable wireless communication terminal according to the invention of claim 9 includes: a parent terminal capable of communicating with an external system by a first radio wave; communicating means for wirelessly communicating by a second radio wave different from the first radio wave; and executing means for executing a portion of a function to be performed between the external system and the parent terminal on the basis of data obtained by the communicating means. Therefore, a portion of the functions that should be achieved between an external system and the parent terminal can be achieved by carrying this body-wearable wireless communication terminal. Moreover, the body-wearable wireless communication terminal only has a portion of the communication functions with the system external unit that should be achieved in the parent terminal, so the size is not large.

[0015] Furthermore, the body-wearable wireless communication terminal according to the invention of claim 10 further includes: inputting means for inputting call data necessary for the parent terminal to perform a call operation as executing means; wherein the communicating means transmits the call data input by the inputting means to the parent terminal. Therefore, a call can be made by the parent terminal by inputting information into the body-wearable wireless communication when carrying the body-wearable wireless communication terminal.

[0016] Furthermore, with the body-wearable wireless communication terminal according to the invention of claim 11, the communicating means includes displaying means, as the executing means, that receives an incoming call signal and display data transmitted from the parent terminal, and performs a display operation on the basis of the received signal and display data. Therefore, the signals and data received by the parent terminal can be visually confirmed using the body-wearable wireless communication terminal when carrying the body-wearable wireless communication terminal.

[0017] Furthermore, with the body-wearable wireless communication terminal according to the invention of claim 12, the displaying means displays an image based on the received signal and display data. Therefore, the image can be visually confirmed on the body-wearable wireless communication terminal without taking out the parent terminal, when carrying the body-wearable wireless communication terminal.

[0018] Furthermore, the body-wearable wireless communication terminal according to the invention of claim 13, further includes capturing means; and the executing means provides first communication controlling means for

controlling the communicating means to transmit image data captured by the capturing means to the external system via the parent terminal. Therefore, an image capturing function not had by the parent terminal can be added by carrying the body-wearable wireless communication terminal equipped with this image capturing means, and captured images can be transmitted to the parent terminal, or even from the parent terminal to a system external unit.

[0019] Furthermore, with the body-wearable wireless communication terminal according to the invention of claim 14, the communicating means includes: playback means for receiving an audio signal transmitted from the parent terminal, and playing back audio based on the received audio signal as the executing means; audio signal generating means for detecting audio and generating an audio signal; and second communication controlling means for controlling the communicating means so as to transmit the audio signal to the parent terminal. Therefore, a conversation can be conducted in a hands-free state without taking out the parent terminal by outputting audio from the body-wearable wireless communication terminal and inputting audio to the child terminal when carrying the body-wearable wireless communication terminal.

[0020] Furthermore, the body-wearable wireless communication terminal according to the invention of claim 15 has a shape suitable for wearing on an arm of a user. Therefore, the parent terminal can be carried in a pocket or bag, and the body-wearable wireless communication terminal can be worn on the arm, which is convenient when carrying the terminals.

[0021]

PREFERRED EMBODIMENTS OF THE INVENTION

Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

(First Embodiment) As depicted in FIG. 1, the system according to the first embodiment includes a parent terminal A and the child terminals B-1, B-2, and B-3 that are capable of communicating with the parent terminal A. The parent terminal A is a mobile phone terminal with wireless digital transmission and reception function, and can be connected to a wired telephone 4 and a PC 5 via a wireless base station 1, a mobile communication network 2, and a network (wired telephone network) 3, and can also be connected to a server 7 and a PC 8 via a network (Internet, etc.) 6, and can further be connected to other mobile phone terminals A-1 and mobile information devices 9 via the base station 1. On the other hand, the child terminal B-1 is a remote dialing device, the child terminal B-2 is a remote display device, and the child terminal B-3 is a remote handset device. Furthermore, each of the child terminals B-1 to B-3 is a wristwatch type, and includes a device body 101, 201, 301 and wristbands 102, 202, 302 fastened to both end parts of the device body 101, 201, 301.

[0022] (parent Terminal A) FIG. 2 is a block diagram depicting the circuit configuration of the parent terminal A, which is a mobile phone terminal with wireless digital transmission and reception function. As depicted in the figure, the circuit is broadly divided into a mobile phone functional unit 401 which generates functions as a mobile phone, and a link software unit 402 and a link hardware unit 403 which establish wireless data links with the child terminals B-1 to B-3. The mobile phone functional unit 401 is similar to the circuits provided in well-known mobile phone terminals, and has a CPU 405 connected to a bus 404.

In addition, the bus 404 is connected to a transceiver unit 406, a communication processing unit 407, a program memory 408, a clock unit 409, a display I/F 410, a driver 411, a SIM card 412, data memory 413, an input/output I/F 414, an operation inputting unit 415, and an audio decoding/encoding processing unit 416.

[0023] The transceiver unit 406 has an antenna 417 for transmitting and receiving radio waves on which an audio signal is superimposed with a wireless base station 1, and the received audio signal is provided to a low noise amplifier 451 via a transmitter/receiver duplexer 418, demodulated by a demodulator 419 which operates by receiving a signal from a synthesizer 421, equalized by an equalizer 420, and provided to a communication processing unit 407 which performs channel coding/decoding processing. In addition, the transmission audio signal encoded by the communication processing unit 407 is modulated by a modulation unit 422 which operates by receiving a signal from the synthesizer 421, amplified by a power amplifier 423, and radiated from an antenna 417 via a transmitter/receiver duplexer 418.

[0024] The program memory 408 contains ROM and has areas for storing application software, upper layer protocols, and driver software. The CPU 405 controls each circuit unit on the basis of various programs stored in the program memory 408. Furthermore, the clock unit 409 keeps track of the current time and the like. The display I/F 410 is connected to a display unit 425 containing an LCD via a display driver 424, and the display unit 425 is provided on the front surface of the body of the parent terminal A. Furthermore, under the control of the CPU 405, the display driver 424 drives the display unit 425, whereby various types of information, characters constituting an e-mail, and the like are displayed on the display unit 425. Under the control of the CPU 405, the driver 411 drives an LED 426, and the LED 426 is provided at a predetermined position on the body of the parent terminal A.

[0025] The SIM card 412 stores subscriber information such as the terminal ID of the parent terminal A. The data memory 413 is RAM that stores various data such as memory dial information containing a plurality of call destination names and telephone numbers and received data, and is also used as a working area for the CPU 405. The input/output I/F 414 inputs and outputs data to and from an input/output I/F 430 of the link software unit 402, which will be described later. An operation inputting unit 415 contains keys arranged on the front of the body of the parent terminal A. The audio decoding/encoding processing unit 416 is an audio codec, and is connected to a vibrator motor 427, a speaker 428, and a microphone 429. The vibrator motor 427 rotates synchronous with the ring tone decoded by the audio decoding/encoding processing unit 416 to generate vibrations when the speaker 428 is in an off state. The speaker 428 reproduces the ring tone and received audio decoded by the audio decoding/encoding processing unit 416, the microphone detects the input audio and inputs to the audio decoding/encoding processing unit 416, and the input audio signal is encoded by the audio decoding/encoding processing unit 416.

[0026] The link software unit 402 includes a CPU 432 connected to a bus 431. Furthermore, ROM 433, SRAM 434, a software storage unit 435, the input/output I/F 430, a packet output unit 436, a connection control unit 417, a packet inputting unit 488, and a wireless device ID unit 439 are connected to the bus 431. Based on the system program stored in ROM 433, the CPU 432 controls not only each part of the link software unit 402 but also each part of the link hardware unit 403 in accordance with the "link management software", "hardware control software", and "other software" stored in the software storage unit 435.

[0027] The packet output unit 436 is controlled by the connection control unit 417 to supply the packet data to the RF control unit 440 of the link hardware unit 403, and the packet inputting unit 488 receives the packet data from the RF control unit 440. The wireless device ID unit 439 stores an ID unique to the link software unit 402.

[0028] The link hardware unit 403 includes an antenna 441 for transmitting and receiving radio waves to and from the child terminals B1 to B3. The radio wave is for close proximity wireless communication, for example, in the 2.4 GHz ISM band that conforms to Bluetooth, and in the present embodiment, data links are established with the child terminals B-1 to B-3 by performing frequency hopping spread spectrum communication in this frequency band. The radio waves received by the antenna 441 are then received by a receiving unit 443 via a switch control unit 442 which controls switching of the antenna switch, and demodulated by a spread spectrum demodulation unit 444 which operates by receiving a signal from a frequency synthesizer 447 to which an OSC 446 is connected. The received signal that has been spread spectrum demodulated by the spread spectrum demodulation unit 444 is demodulated into packet information by the information demodulation unit 445 and input from the RF control unit 440 to the packet input unit 438 of the link software unit 402.

[0029] Furthermore, the transmission signal input from the packet output unit 436 of the link software unit 402 to the RF control unit 440 is information-modulated by an information modulation unit 448 and spread-modulated by a spread modulation unit 449. The transmission signal spread-modulated by the spread modulation unit 449 is configured to be radiated from the antenna 411 via the transmission unit 450 and the switch control unit 442.

[0030] FIG. 3 is a flow chart depicting the operation when the parent terminal A functions as a mobile phone terminal. In other words, an incoming call control channel (P-CH) is searched (step S401), and a determination is made as to whether the searched incoming call control channel (P-CH) is the channel with the maximum reception strength (step S402). If the incoming call control channel is the channel with the maximum reception strength, a determination is made as to whether the current reception channel is the same as the previous reception channel, and if the channels are not the same, location registration is performed (step S404).

If the channels are the same, location registration will have already been completed, so the process of step S404 is not performed, and the current call control channel (P-CH) is selected and set. Thereafter, a standby process (step S405) is executed to transition to a standby state.

[0031] In the standby state, monitoring is performed to determine whether communication is possible on the selected channel (step S407), and if communication is impossible, the process is re-executed from step S401. If communication is possible, a determination is made as to whether a call has been placed or received (steps S408, S409). If a call has been placed, outgoing call processing is executed (step S411), and if an incoming call has been received, incoming call processing is executed (step S410). The call or data communication continues (step S412), and if the base station with which the user communicates changes as a result of movement during the call/data communication, channel switching is performed (step S413). Furthermore, the call/data communication process is executed (step S412) until the call or data communication is completed (step S414), and when the call or data communication is completed (step S414: YES), a call termination process is executed (step S415) and a standby state is entered (step S406).

[0032] (child Terminal B-1) FIG. 4 depicts the external structure of the child terminal B-1. The child terminal B-1 is a wristwatch type as described above, and contains a device body 101 and wristbands 102, 102 fastened to both ends of the device body. A dial input display unit 103 and a communication destination selection display unit 104 are provided at approximately the center of an upper surface of the device body 101, and an on-hook switch 105 and an off-hook switch 106 are provided on one end, with a display selection operation unit 107 provided between the hook switches 105, 106. Furthermore, an antenna 109 is provided inside an extension part 108 that extends from one end of the device body 101, and a dial operation input unit 110 containing a plurality of keys is provided on the surface thereof.

[0033] As depicted in the figure, the parent terminal that forms a wireless link relationship with the child terminal B-1 is not limited to a mobile phone-type parent terminal A, but may also be a pen-type parent terminal A-2 or an electronic notebook-type parent terminal A-3.

[0034] FIG. 5 is a block diagram depicting the circuit configuration of the child terminal B-1. As depicted in the figure, this circuit is roughly divided into a clock functional unit 111 which performs the basic functions of a wristwatch, and a link software unit 112 and a link hardware unit 113 which establish a link with the parent terminal A. The clock functional unit 111 includes a circuit that is included in well-known digital wristwatches, and has a CPU 115 connected to a bus 114.

Furthermore, a program memory 116, a clock unit 117, a display I/F 118, a key input unit 119, data memory 120, an input/output I/F 121, an external I/O interface 122, and an amplifier 123 are connected to the bus 114.

[0035] The program memory 116 includes ROM, and stores system programs for performing functions such as a clock. The CPU 115 controls each unit on the basis of the various programs stored in the program memory 116. Furthermore, the clock unit 117 keeps track of the current time. The display I/F 118 is connected to a display unit 125 containing an LCD via a display driver 124, and the display unit 125 includes the dial input display unit 103 and the communication destination selection display unit 104. Furthermore, under the control of the CPU 115, the display driver 124 drives the display unit 125, so that the destination telephone number input via the dial operation input unit 110 is displayed on the dial input display unit 103, and the destination name is displayed on the communication destination selection display unit 104 (see FIG. 4).

[0036] The key input unit 119 includes the on-hook switch 105, the off-hook switch 106, the display selection operation unit 107, and a dial operation input unit 110. The data memory 120 is RAM that stores memory dial information containing a plurality of call destination names and telephone numbers, and is also used as a working area for the CPU 115. The input/output I/F 121 inputs and outputs data to and from an input/output I/F 130 of the link software unit 112, which will be described later. The external I/O interface 122 is used for inputting and outputting data to and from other connected electronic devices, and the vibrator motor 126 and the speaker 127 are connected to the amplifier 123. The vibrator motor 126 generates vibrations in place of an alarm sound when the speaker 127 is in an off state, and the speaker 127 is used to generate the alarm sound.

[0037] The circuit configuration of the link software unit 112 and link hardware unit 113 of the child terminal B-1 is similar to the circuit configuration of the link software unit 402 and link hardware unit 403 of the parent terminal A described above, and therefore both are configured to be wirelessly linked. In other words, the link software unit 112 has a CPU 132 connected to a bus 129. Furthermore, ROM 133, SRAM 134, the software storage unit 135, the input/output I/F 130, the packet output unit 136, the connection control unit 117, the packet input unit 188, and the wireless device ID unit 139 are connected to the bus 129. Based on the system program stored in ROM 133, the CPU 132 controls not only each part of the link software unit 112 but also each part of the link hardware unit 113 in accordance with the "link management software", "hardware control software", and "other software" stored in the software storage unit 135.

[0038] The packet output unit 136 is controlled by the connection control unit 117 to supply the packet data to the RF control unit 140 of the link hardware unit 113, and the packet inputting unit 188 receives the packet data from the RF control unit 140. The wireless device ID unit 139 stores an ID unique to the link software unit 112.

[0039] The link hardware unit 113 includes the antenna 109 for transmitting and receiving radio waves to and from the parent terminal A. The radio wave is for close proximity wireless communication, for example, in the 2.4 GHz ISM band that conforms to Bluetooth, and in the present embodiment, data links are established with the parent terminal A by performing frequency hopping spread spectrum communication in this frequency band. The radio waves received by the antenna 109 are then received by a receiving unit 143 via a switch control unit 142 which controls switching of the antenna switch, and demodulated by a spread spectrum demodulation unit 144 which operates by receiving a signal from a frequency synthesizer 147 to which an OSC 146 is connected. The received signal that has been spread spectrum demodulated by the spread spectrum demodulation unit 144 is demodulated into packet information by the information demodulation unit 145 and input from the RF control unit 140 to the packet input unit 138 of the link software unit 112.

[0040] Furthermore, the transmission signal input from the packet output unit 136 of the link software unit 112 to the RF control unit 140 is information-modulated by an information modulation unit 148 and spread-modulated by a spread modulation unit 149. The transmission signal spread-modulated by the spread modulation unit 149 is configured to be radiated from the antenna 109 via the transmission unit 150 and the switch control unit 142.

[0041] FIG. 6 depicts an operation sequence of the wireless link between the parent terminal A and the child terminal B-1. As depicted in the figure, when the off-hook switch 106 of the child terminal B-1 is operated while the parent terminal A is in the on-hook state (step S101), a start (off-hook) signal is transmitted from the child terminal B-1 (step S102), and a signal indicating whether the calling number display is enabled or disabled is transmitted (step S103). In response, the parent terminal A transmits dial tone data indicating the tone type (step S104), and the child terminal B-1 generates a dial tone from the speaker 127 on the basis of the dial tone data (step S105).

[0042] Next, when a dialing operation is performed on the dial operation input unit 110 of the child terminal B-1 (step S106), the input dial number is transmitted (step S107). When the dialing is completed or when a predetermined time has elapsed (step S108), the parent terminal A transmits a call setup (SET UP) and a call status report to the base station 1 on the network side (step S109). The base station 1 that receives this transmission returns a call setup acceptance (CALL PROC) to the parent terminal A (step S110), and executes an authentication procedure between the parent terminal A and the base station 1 (step S111). When the authentication and the like are completed, the base station 1 assigns a wireless channel to the parent terminal A (step S112), and transmits a signal indicating that the parent terminal A is being called (ALERT) (step S113).

[0043] Upon receiving this signal, the parent terminal A transmits a call-in-progress indicator ON signal to the child terminal B-1 (step S114), which causes the child terminal B-1 to display a call-in-progress indicator on the display unit 125 (step S115). The call-in-progress indicator, as depicted in FIG. 7, displays the telephone number of the communication destination in the dial input display unit 103, and the name of the communication destination is displayed in the communication destination selection display unit 104. Subsequently, the parent terminal A transmits a ring tone signal indicating the tone type to the child terminal B-1 (step S116), and the child terminal B-1 receiving this signal generates a ring tone from the speaker 127 (step S117). Furthermore, when the called party responds, a signal (CONNECT) indicating this state is sent from the base station 1 (step S118), and then the state changes to a call-in-progress state between the base station 1 and the parent terminal A (step S119).

[0044] Furthermore, when the on-hook switch 105 is operated on the child terminal B-1 to end the call (step S120), an end (on-hook) signal is transmitted from the child terminal B-1 to the parent terminal A (step S121), and the parent terminal A receives this signal and disconnects (DISC) the communication connection with the base station 1 (step S122). In response, the base station 1 transmits a release (REL) signal to the parent terminal A (step S123), and the parent terminal A transmits a command to the child terminal B-1 to turn off the call-in-progress indicator (step S124). Furthermore, the parent terminal A transmits a release completion (REL COMP) to the base station 1 (step S125), and transmits a fee notification and dialing completion (as well as the dialed number) to the child terminal B-1 (step S126). The child terminal B-1 receives this signal and displays the fee, or the like on the display unit 125 (step S127). On the other hand, the base station 1 transmits a wireless channel disconnection signal to the parent terminal A (step S128), and the parent terminal A receives this signal and transmits a wireless channel disconnection confirmation signal to the base station 1 (step S129), thereby completing the call completion operation.

[0045] Therefore, as depicted in FIG. 7, if a user U carries the parent terminal A in a breast pocket or the like and wears the child terminal B-1 on their arm, the user can make and complete calls without taking out the parent terminal A. Moreover, by visually checking the dial input display unit 103 and the communication destination selection display unit 104, the destination telephone number and destination name can be confirmed.

[0046] (Variation of the child Terminal B-1) FIG. 8 depicts a variation of the operation sequence of the wireless link between the parent terminal A and the child terminal B-1, and depicts the case of data communication. When the parent terminal A is on-hook, as depicted in the figure, if a dialing operation for data communication or an automatic call is made by the dialing operation input unit 110 of the child terminal B-1 (step S151), a non-call service request, which is a command to turn on the modem, is transmitted from the child terminal B-1 to the parent terminal A (step S152), and a start command is also transmitted (step S153).

In response, the parent terminal A transmits dial tone data indicating the type of tone (step S154), and the child terminal B-1 generates a dial tone from the speaker 127 on the basis of this dial tone data (step S155).

[0047] Next, the dial number input in step S151 is transmitted from the child terminal B-1 (step S156), and when the dialing is completed or a predetermined time has elapsed (step S157), the parent terminal A notifies the base station 1 on the network side of the data and modem SET UP (step S158). The base station 1 receives this notification and accepts the setting and returns (PROC) to the parent terminal A (step S159), and the parent terminal A receives this signal and transmits a call-in-progress indicator ON signal to the child terminal B-1 (step S160). As a result, the child terminal B-1 indicates a call-in-progress on the display unit 125 (step S161). Meanwhile, the base station 1 transmits an INFO signal to activate the modem (step S162). The parent terminal A receives this signal and transmits to the child terminal B-1 a non-call service confirmation signal indicating that the data/modem has been turned ON (step S163).

[0048] Meanwhile, an operation for establishing wireless section synchronization is performed between the base station 1 and the parent terminal A (step S164), and the base station 1 transmits a signal indicating that a call is being made (ALART) (step S165). When the called party responds, a signal indicating this state (CONNECT) is transmitted from the base station 1 (step S166). Thereafter, the state shifts to data communication-in-progress between the base station 1 and the parent terminal A (step S167). Furthermore, when data transmission is completed, the on-hook switch 105 is operated at the child terminal B-1 to input an end of data communication (step S168), an OFF signal for requesting a non-call service (data/modem) is transmitted from the child terminal B-1 to the parent terminal A (step S169), and a signal (INFO) indicating this state is transmitted from the parent terminal A to the base station 1 (step S170). In response, a modem deactivation command is transmitted from the base station 1 to the parent terminal A (step S171), and the parent terminal A receives this command and transmits non-call service confirmation information indicating that data transmission and the modem have been turned off to the child terminal B-1 (step S172). This information is received by the child terminal B-1, thereby completing the series of processes. [0049] (child Terminal B-2) FIG. 8 depicts the external structure of the child terminal B-2. The child terminal B-2 is a wristwatch type as described above, and contains a device body 201 and wristbands 202, 202 fastened to both ends. A communication content display unit 203 is provided at approximately the center of the upper surface of the device body 201, and an on-hook switch 205 and an off-hook switch 206 are provided at

one end, with a display selection operation unit 207 provided between the hook switches 205, 206. An LED 204 is provided on the surface of one end of the device body 201, and an antenna 209 is provided inside.

[0050] As depicted in the figure, the parent terminal that forms a wireless link relationship with the child terminal B-2 is not limited to a mobile phone-type parent terminal A, but may also be a pen-type parent terminal A-2 or an electronic notebook-type parent terminal A-3.

[0051] FIG. 10 is a block diagram depicting the circuit configuration of the child terminal B-2. As depicted in the figure, this circuit is roughly divided into a clock functional unit 211 which performs the basic functions of a wristwatch, and a link software unit 212 and a link hardware unit 213 which establish a link with the parent terminal A. The clock functional unit 211 includes a circuit that is included in well-known digital wristwatches, and has a CPU 215 connected to a bus 214. Furthermore, a program memory 216, a clock unit 217, a display I/F 218, a driver 208, a key input unit 219, data memory 220, an input/output I/F 221, an external I/O interface 222, and an amplifier 223 are connected to the bus 214.

[0052] The program memory 216 includes ROM, and stores system programs for performing functions such as a clock. The CPU 215 controls each unit on the basis of the various programs stored in the program memory 216. Furthermore, the clock unit 217 keeps track of the current time. The display I/F 218 is connected to a display unit 225 containing an LCD via a display driver 224. The display unit 225 has the communication content display unit 203, and the driver 208 is connected to the LED 204. Under the control of the CPU 215, the display driver 224 drives the display unit 225, whereby the communication data received by the parent terminal A and transmitted from the parent terminal A is displayed on the communication content display unit 203 (see FIG. 9), and the driver 208 drives the LED 204, causing the LED 204 to light up.

[0053] The key input unit 219 includes the on-hook switch 205, the off-hook switch 206, and the display selection operation unit 207. The data memory 220 is RAM that stores memory dial information containing a plurality of call destination names and telephone numbers, and is also used as a working area for the CPU 215. The input-output I/F 221 inputs and outputs data to and from an input-output I/F 230 of the link software unit 212, which will be described later. The external I/O interface 222 is used for inputting and outputting data to and from other connected electronic devices, and the vibrator motor 226 and the speaker 227 are connected to the amplifier 223. The vibrator motor 226 generates vibrations in place of an alarm sound when the speaker 227 is in an off state, and the speaker 227 is used to generate the alarm sound.

[0054] The circuit configuration of the link software unit 212 and link hardware unit 213 of the child terminal B-2 is similar to the circuit configuration of the link software unit 402 and link hardware unit 403 of the parent terminal A described above, and therefore both are configured to be wirelessly linked. In other words, the link software unit 212 has a CPU 232 connected to a bus 229. Furthermore, ROM 233, SRAM 234, the software storage unit 235, the input/output I/F 230, the packet output unit 236, the connection control unit 217, the packet input unit 288, and the wireless device ID unit 239 are connected to the bus 229. Based on the system program stored in ROM 233, the CPU 232 controls not only each part of the link software unit 212 but also each part of the link hardware unit 213 in accordance with the "link management software", "hardware control software", and "other software" stored in the software storage unit 235.

[0055] The packet output unit 236 is controlled by the connection control unit 217 to supply the packet data to the RF control unit 240 of the link hardware unit 213, and the packet inputting unit 288 receives the packet data from the RF control unit 240. The wireless device ID unit 239 stores an ID unique to the link software unit 212.

[0056] The link hardware unit 213 includes the antenna 209 for transmitting and receiving radio waves to and from the parent terminal A. The radio wave is for close proximity wireless communication, for example, in the 2.4 GHz ISM band that conforms to Bluetooth, and in the present embodiment, data links are established with the parent terminal A by performing frequency hopping spread spectrum communication in this frequency band. The radio waves received by the antenna 209 are then received by a receiving unit 243 via a switch control unit 242 which controls switching of the antenna switch, and demodulated by a spread spectrum demodulation unit 244 which operates by receiving a signal from a frequency synthesizer 247 to which an OSC 246 is connected. The received signal that has been spread spectrum demodulated by the spread spectrum demodulation unit 244 is demodulated into packet information by the information demodulation unit 245 and input from the RF control unit 240 to the packet input unit 238 of the link software unit 212.

[0057] Furthermore, the transmission signal input from the packet output unit 236 of the link software unit 212 to the RF control unit 240 is information-modulated by an information modulation unit 248 and spread-modulated by a spread modulation unit 249. The transmission signal spread-modulated by the spread modulation unit 249 is configured to be radiated from the antenna 209 via the transmission unit 250 and the switch control unit 242.

[0058] FIG. 11 depicts an operation sequence of the wireless link between the parent terminal A and the child terminal B-2. As depicted in the figure, when a call signal is transmitted from the base station 1 while the parent terminal A is on-hook (step S201), the parent terminal A issues an incoming call wireless

status report (step S202), and then a response and authentication procedure, and the like are executed between the base station 1 and the parent terminal A (step S203). Thereafter, the base station 1 assigns a wireless channel to the parent terminal A (step S204), and when a call is set up (SETUP) (step S205), the parent terminal A transmits a display ON command to the child terminal B-2 (step S206). The child terminal B-2 receives this command and generates a ringtone from the speaker 227 or operates the vibrator motor 226 to generate vibrations, and further displays the incoming call on the communication content display unit 203 and turns on the LED 204 (step S207).

[0059] In addition, the parent terminal A transmits a signal to the base station 1 indicating that a call is being made (ALERT) (step S213), and then transmits a calling number notification and dial completion (along with the dialed number) to the child terminal B-2 (step S209). Upon receiving this transmission, the child terminal B-2 displays the calling number on the display unit 225 and turns on the LED 204 (step S210). In addition, the parent terminal A transmits a called number notification and dialing completion (as well as the dialed number) to the child terminal B-2 (step S211). Upon receiving this transmission, the child terminal B-2 displays the called number on the display unit 225 and turns on the LED 204 (step S212). At this time, the called number received from terminal A is collated with the telephone number in data memory 220, and if there is a matching called party name, the name is read and displayed as depicted in FIG. 12(a). In addition, dial tone data indicating the tone type is transmitted from the parent terminal A (step S213), and when the off-hook switch 205 is operated on the child terminal B-2 (step S214), a start (off-hook) command is transmitted from the child terminal B-2 to the parent terminal A (step S215). Upon receiving this transmission the parent terminal A transmits a response (CONNECT) to the base station 1 (step S216), and the base station 1 transmits a response confirmation (CONN ACK). Upon receiving this transmission the parent terminal A transmits to the child terminal B-2 a call-in-progress indicator ON command and related data read from the data memory 413 on the basis of the called number, such as previously received email data, schedule data, and the like (step S219). The child terminal B-2 receives this data and displays a message indicating that a call is in progress on the display unit 225, and performs a display similar to that depicted in FIG. 12(c) (step S220). Thereafter, the base station 1 and the parent terminal A enter a call-in-progress state (step S221).

[0060] Furthermore, when the on-hook switch 205 is operated on the child terminal B-2 to end the call (step S222), an end (on-hook) signal is transmitted from the child terminal B-2 to the parent terminal A (step S223), and the parent terminal A, receiving this signal, disconnects (DISC) the communication connection with the base station 1 (step S224).

In response to this, the base station 1 transmits a release (REL) signal to the parent terminal A (step S227), and the parent terminal A transmits a command to the child terminal B-2 to turn off the call-in-progress indicator (step S226).

Furthermore, the parent terminal A transmits a release completion (REL COMP) to the base station 1 (step S227), and transmits a fee notification and dialing completion (as well as the dialed number) to the child terminal B-2 (step S228). Upon receiving this transmission, the child terminal B-2 displays the fee, or the like on the display unit 225 (step S229). On the other hand, the base station 1 transmits a wireless channel disconnection signal to the parent terminal A (step S230), and the parent terminal A, upon receiving this transmission, transmits a wireless channel disconnection confirmation signal to the base station 1 (step S229), thereby completing the call ending operation.

[0061] Therefore, as depicted in FIG. 12, if a user U carries the parent terminal A in a breast pocket or the like and wears the child terminal B-2 on their arm, the user U can recognize an incoming call by LED 204, and as depicted in FIG. 12(a), various information related to the audio call can be displayed on the display unit 225 of the child terminal B-2 while performing a call start operation on the parent terminal A.

[0062] (Variation of the child Terminal B-2) FIG. 13 depicts a variation of the operation sequence of the wireless link between the parent terminal A and the child terminal B-2, and depicts the case of data communication. When the base station 1 transmits a call signal (SET UP) to the parent terminal A in the on-hook state (step S251), as depicted in the figure, the parent terminal A transmits a display ON command to the child terminal B-2 (step S252). The child terminal B-2 receives this command and generates a ringtone from the speaker 227 or operates the vibrator motor 226 to generate vibrations, and further displays the incoming call on the communication content display unit 203 and turns on the LED 204 (step S253).

[0063] In addition, the parent terminal A transmits a signal to the base station 1 indicating that a call is being made (ALART) (step S254), and then transmits a calling number notification and dial completion (along with the dialed number) to the child terminal B-2 (step S255). Upon receiving this transmission, the child terminal B-2 displays the calling number on the display unit 225 and turns on the LED 204 (step S256). Furthermore, the parent terminal A transmits a called number notification and dialing completion (as well as the dialed number) to the child terminal B-2 (step S257), and the child terminal B-2, receiving this transmission, displays the called number on the display unit 225 (step S258). In addition, dial tone data indicating the tone type is sent from the parent terminal A (step S259), and when an ATA input or an automatic response is made at the child terminal B-2 (step S260), a start (off-hook) command is sent from the child terminal B-2 to the parent terminal A (step S261). Upon receiving this transmission, the parent terminal A transmits an incoming call display OFF command to the child terminal B-2 (step S262) and also transmits a call-in-progress indicator ON command (step S263), and the child terminal B-2 receives this transmission

and performs a call-in-progress indication on the display unit 225 (step S264). Furthermore, a non-communication service request, which is a command to turn on the modem, is transmitted from the child terminal B-2 to the parent terminal A (step S265).

[0064] Meanwhile, the base station 1 transmits an INFO signal to activate the modem (step S267), and the parent terminal A receives this transmission and transmits to the child terminal B-1 a non-call service confirmation signal indicating that the data/modem has been turned ON (step S268). On the other hand, an operation for establishing wireless section synchronization is performed between the base station 1 and the parent terminal A (step S264). At this time, if the parent terminal A sends a notification XID (CONNECT) to the child terminal B-2 (step S270), the child terminal B-2 receives this transmission and displays on the display unit 203 a message indicating that data communication is in progress as well as the contents of the received data (step S271). However, if the parent terminal A does not send a notification XID (CONNECT) to the child terminal B-2 (process of step S270 is not performed), the child terminal B-2 does not display on the display unit 203 that data communication is in progress nor the contents of the received data (process of step S271 is not performed).

[0065] Therefore, when the parent terminal A transmits a notification XID (CONNECT) to the child terminal B-2 (step S270), not only is a state created in which data communication is in progress between the base station 1 and the parent terminal A (step S272), but also a state is created in which data communication is in progress between the parent terminal A and the child terminal B-2 (step S273).

[0066] Furthermore, when data transmission is completed, the on-hook switch 205 is operated at the child terminal B-2 to input an end of data communication (step S274), an OFF signal for requesting a non-call service (data/modem) is transmitted from the child terminal B-1 to the parent terminal A (step S275), and a signal (INFO) indicating this state is transmitted from the parent terminal A to the base station 1 (step S276). In response, a modem deactivation command is transmitted from the base station 1 to the parent terminal A (step S277), and the parent terminal A receives this command and transmits non-call service confirmation information indicating that data transmission and the modem have been turned off to the child terminal B-2 (step S278). This information is received by the child terminal B-1, thereby completing the series of processes.

[0067] Therefore, as depicted in FIG. 12, if a user U carries the parent terminal A in a breast pocket or the like and wears the child terminal B-2 on their arm, the user can display incoming messages and e-mails as depicted in FIG. 12(b), and can read and display e-mails and files as depicted in FIG. 12(c).

[0068] (Child Terminal B-3) FIG. 14 depicts the external structure of the child terminal B-3. The child terminal B-3 is a wristwatch type as described above, and contains a device body 301 and wristbands 302, 302 fastened to both ends.

A call status display unit 303 is provided in approximately the center of the upper surface of the device body 301, and an on-hook switch 305 and an off-hook switch 306 are provided at one end. A display selection operation unit 307 is provided between the hook switches 305, 306, and a hands-free switch 304 is provided on the periphery. Furthermore, a speaker 327 serving as a handset and a microphone 328 serving as a transmitter are provided at both ends of the device body 301, and an antenna 309 is embedded in one of the wristbands 309. [0069] As depicted in the figure, the parent terminal that forms a wireless link relationship with the child terminal B-3 is not limited to a mobile phone-type parent terminal A, but may also be a pen-type parent terminal A-2 or an electronic notebook-type parent terminal A-3.

[0070] FIG. 15 is a block diagram depicting the circuit configuration of the child terminal B-3. As depicted in the figure, this circuit is roughly divided into a clock functional unit 311 which performs the basic functions of a wristwatch, and a link software unit 312 and a link hardware unit 313 which establish a link with the parent terminal A. The clock functional unit 311 includes a circuit that is included in well-known digital wristwatches, and has a CPU 315 connected to a bus 314. In addition, the bus 314 is connected to a program memory 316, a clock unit 317, a display I/F 318, a key input unit 319, a data memory 320, an input/output I/F 321, an external I/O interface 322, and an audio signal processing unit (audio codec) 323. [0071] The program memory 316 includes ROM, and stores system programs for performing functions such as a clock. The CPU 315 controls each unit on the basis of the various programs stored in the program memory 316. Furthermore, the clock unit 317 keeps track of the current time. The display I/F 318 is connected to a display unit 325 containing an LCD via a display driver 324, and the display unit 325 includes the call status display unit 303. Under the control of the CPU 315, a display driver 324 drives a display unit 325, whereby the call status is displayed on the call status display unit 303 (see FIG. 14).

[0072] The key input unit 319 includes the on-hook switch 305, the off-hook switch 306, the display selection operation unit 307, and the hands-free switch 304. The data memory 320 is RAM that stores memory dial information containing a plurality of call destination names and telephone numbers, and is also used as a working area for the CPU 315. The input-output I/F 321 inputs and outputs data to and from an input-output I/F 330 of the link software unit 312, which will be described later. The external I/O interface 322 performs data input/output with other connected electronic devices, and a vibrator motor 326, a speaker 327, and a microphone 328 are connected to an audio signal processing unit (audio codec) 323. The vibrator motor 326 generates vibrations in place of an incoming call tone when the speaker 327 is in the off state. The speaker 327

generates the audio of the call and the incoming call tone, and the microphone 328 inputs the audio of the call.

[0073] The circuit configuration of the link software unit 312 and link hardware unit 313 of the child terminal B-3 is similar to the circuit configuration of the link software unit 402 and link hardware unit 403 of the parent terminal A described above, and therefore both are configured to be wirelessly linked. In other words, the link software unit 312 has a CPU 332 connected to a bus 329. Furthermore, ROM 333, SRAM 334, the software storage unit 335, the input/output I/F 330, the packet output unit 336, the connection control unit 317, the packet input unit 388, and the wireless device ID unit 339 are connected to the bus 329. Based on the system program stored in ROM 333, the CPU 332 controls not only each part of the link software unit 312 but also each part of the link hardware unit 313 in accordance with the "link management software", "hardware control software", and "other software" stored in the software storage unit 335.

[0074] The packet output unit 336 is controlled by the connection control unit 317 to supply the packet data to the RF control unit 340 of the link hardware unit 313, and the packet inputting unit 388 receives the packet data from the RF control unit 340. The wireless device ID unit 339 stores an ID unique to the link software unit 312.

[0075] The link hardware unit 313 includes the antenna 309 for transmitting and receiving radio waves to and from the parent terminal A. The radio wave is for close proximity wireless communication, for example, in the 2.4 GHz ISM band that conforms to Bluetooth, and in the present embodiment, data links are established with the parent terminal A by performing frequency hopping spread spectrum communication in this frequency band. The radio waves received by the antenna 309 are then received by a receiving unit 343 via a switch control unit 342 which controls switching of the antenna switch, and demodulated by a spread spectrum demodulation unit 344 which operates by receiving a signal from a frequency synthesizer 347 to which an OSC 346 is connected. The received signal that has been spread spectrum demodulated by the spread spectrum demodulation unit 344 is demodulated into packet information by the information demodulation unit 345 and input from the RF control unit 340 to the packet input unit 338 of the link software unit 312.

[0076] Furthermore, the transmission signal input from the packet output unit 336 of the link software unit 312 to the RF control unit 340 is information-modulated by an information modulation unit 348 and spread-modulated by a spread modulation unit 349. The transmission signal spread-modulated by the spread modulation unit 349 is configured to be radiated from the antenna 309 via the transmission unit 350 and the switch control unit 342.

[0077] FIG. 16 depicts an operation sequence of the wireless link between the parent terminal A and the child terminal B-3. As depicted in the figure, when a call is in progress between the base station 1 and the parent terminal A (step S301), when the hands-free switch 304 of the child terminal B-3 is operated (step S302), a hands-free notification (ON) signal is transmitted from the child terminal B-3 to the parent terminal A (step S303). Therefore, the parent terminal A transmits a hands-free confirmation (ON) signal to the child terminal B-3 (step S304), and the child terminal B-3, receiving this transmission, displays on the display unit 303 that a hands-free call is in progress (step S305).

[0078] Meanwhile, the parent terminal A is set to hands-free mode (ON) (step S306), establishes a call-in-progress state with the base station 1 (step S2307), and establishes a hands-free call-in-progress state with the child terminal B-3 (step S308). As a result, the call audio signal received by the parent terminal A is transmitted to the child terminal B-3, the call audio is generated from the speaker 327 of the child terminal B-3, the call audio signal detected by the microphone 328 is transmitted to the parent terminal A, and then a hands-free state is created in which the call audio signal is transmitted from the parent terminal A to the base station 1.

[0079] Furthermore, if necessary, the hands-free switch 304 is operated again to turn OFF (step S309), and a hands-free notification (OFF) signal is transmitted from the child terminal B-3 to the parent terminal A (step S310). Next, the parent terminal A transmits a hands-free confirmation (OFF) signal to the child terminal B-3 (step S311), and then sets the child terminal B-3 to hands-free mode (OFF) (step S312). This cancels the hands-free mode, and the parent terminal A becomes capable of receiving and transmitting calls.

[0080] Therefore, as depicted in FIG. 17, if a user U carries the parent terminal A in a breast pocket or the like and wears the child terminal B-3 on their arm, the user can make and receive calls without taking out the parent terminal A, and can make and receive calls while checking the call status on the display unit 303 of the child terminal B-3.

[0081] (Wireless link operation sequence) FIGS. 18 to 21 depict the wireless link operation sequence common to the parent terminal A and the child terminals B-1, B-2, and B-3 (hereinafter, the child terminals B-1, B-2, and B-3 are collectively referred to as "child terminal B"). In other words, FIG. 18 depicts a memory dial read request operation sequence for reading memory dial information which contains the name and telephone number of the party being called, stored in the data memory 120 of the parent terminal A, to the child terminal A. First, the child terminal B transmits a memory dial information read request to the parent terminal A (step S501), requests reading (step S502), and also requests secret transmission (step S503). Furthermore, after requesting the

record bank (step S504), the record address (1st digit) and the record address (2nd digit) are requested (steps S505 and S506).

[0082] FIG. 19 depicts a memory dial write request operation sequence for writing the memory dial stored in the data memories 120, 220, 320 of the child terminal B into the data memory 413 of the parent terminal A. The child terminal B issues a memory dial information write request to the parent terminal A (step S511), and also issues a write request (step S512). Furthermore, an indication is made that secret transmission will be performed (step S513). Furthermore, after transmitting the record bank (step S514), the record address (1st digit) and the record address (2nd digit) are transmitted (steps S515 and S516). In addition, the index registration code (1st digit) and index registration code (2nd digit) are transmitted (steps S517, S518), the index data length (1st digit) and index data length (2nd digit) are transmitted (steps S519, S520), and then the index data (1st digit upper), index data (1st digit lower), and index data (nth digit) are transmitted in sequence (steps S521 to S523).

[0083] Furthermore, the number content length (1st digit) and number content length (2nd digit) are transmitted (steps S524, S525), the type (1st digit) and type (2nd digit) are transmitted (steps S526, S527), and then the telephone number (1st digit upper), telephone number (1st digit lower), telephone number (nth digit upper), and telephone number (nth digit lower) are transmitted in sequence (steps S528 to S531). Thereafter, the group number (1st digit) and the group number (2nd digit) are transmitted (steps S532, S533), thereby completing the memory dial writing request operation.

[0084] FIG. 20 depicts the memory dial read/write abnormal termination operation sequence. The parent terminal A notifies the child terminal B of the memory dial information (step S541), and then transmits a signal indicating abnormal termination (step S542).

[0085] FIG. 21 depicts the memory dial read/write normal termination operation sequence. The parent terminal A notifies the child terminal B of memory dial information (step S551) and also notifies the child terminal B of normal completion (step S552). Furthermore, an indication is made that secret transmission will be performed (step S553), and after transmitting the record bank (step S554), the record address (1st digit) and the record address (2nd digit) are transmitted (steps S555, S556). In addition, the index registration code (1st digit) and index registration code (2nd digit) are transmitted (steps S557, S558), the index data length (1st digit) and index data length (2nd digit) are transmitted (steps S559, S560), and then the index data (1st digit upper), index data (1st digit lower), and index data (nth digit) are transmitted in sequence (steps S561 to S563).

[0086] Furthermore, the number content length (1st digit) and number content length (2nd digit) are transmitted (steps S564, S565), the type (1st digit) and type (2nd digit) are transmitted (steps S566, S567), and then the telephone number (1st digit upper), telephone number (1st digit lower), telephone number (nth digit upper), and telephone number (nth digit lower) are transmitted in sequence (steps S568 to S571). Thereafter, the group number (1st digit) and the group number (2nd digit) are transmitted (steps S572, S573), thereby completing the memory dial read/write request operation.

[0087] FIG. 22 depicts a sequence for verifying a secret number when a memory dial call is made from the child terminal B-1 to the parent terminal A. The child terminal B-1 requests the parent terminal A to make a specified call request of a memory dial number (step S581), and also requests password verification (step S582). Subsequently, the dial (1st digit) through dial (4th digit) are transmitted in sequence (steps S583 to S586), and then a dial completion signal is transmitted (step S587). Next, a signal indicating either PIN acceptance or PIN rejection is transmitted from the parent terminal A to the child terminal B-1 (step S588).

[0088] FIG. 23 is a diagram depicting a sequence of a call request operation when a memory dial call is placed. An operation signal of an on-hook (start) switch is transmitted from the child terminal B (B-1 to B-3) (step S591), and a dial tone is transmitted from the parent terminal A (step S592). Subsequently, a memory dial number designation call request is transmitted from the child terminal B to the parent terminal A (step S593), followed by a transmission request (step S594) and a reservation (step S595). Furthermore, the record bank is transmitted from the child terminal B (step S596), and the record address (1st digit) and record bank (2nd digit) are also transmitted (steps S597, S598).

[0089] FIG. 24 depicts an operation sequence for abnormal termination of memory dialing, in which a busy tone is transmitted from the parent terminal A to the child terminals B (B-1 to B-3) (step S601).

[0090] FIG. 25 depicts a configuration example of a software stack of wireless link built-in devices built into the parent terminal A and the child terminal B (B-1 to B-3) when Bluetooth is adopted as the communication method, as an example of a wireless link in the present embodiment. As depicted in the figure, the application software unit 501 stores the following software: audio handset (HeadSet) 502, dialing (Dialing) 503, file exchange (File Exchange) 504, browser/email Internet wireless LAN 505, and telephone application (Telephony) 506.

UPnP/SLP 507, SDP (Service Discovery) 508, IrMC/OBEX 509, RFCOMM 510, WAO 511, TCP/UDP 512, IP 513, and TCS (Telephone Control) 514 are provided between the application software unit 501 and L2CAP (Logical Link Control & Adaptation Protocol) 515. Furthermore, LC (Link Controller) 520, HIC (Host Controller I/F) 517, UART/serial I/F/SB 518, and LMP (Link Manager Protocol) 519 are provided between the packet assembly/disassembly block 516 and the baseband. The baseband, LC (Link Controller) 520 is connected to an RF unit 521, and an antenna 522 is connected to the RF unit 521. [0091] In other words, LMP 519 and L2CAP 515 (logical link control protocol: controls logical channel setting, packet disassembly and assembly, data allocation to each higher-level protocol, etc.) are provided on the physical layer of the RF unit 521 and baseband signal processing units such as the baseband and LC (link controller) 520. The audio signal S1 is exchanged with the application layer from the baseband and LC (link controller) 520, and the control signal S2 is exchanged with the application layer via the LMP 519. The data signal is passed via the L2CAP 515 to higher-level application programs such as dialing and FAX applications, and telephone and cordless telephone applications via corresponding control protocols such as higher-level SDP (service discovery protocol) 508, RFCOMM (virtual COM port) 510, TCP/UDP 512, IP (internet protocol) 513, and TCS (telephone control protocol) 514.

[0092] FIG. 26 to FIG. 31 depict examples of stack configurations for each application. FIG. 26 depicts the case of wireless link control by L2CAP, where the parent terminal A is provided with a main application 531, an upper layer protocol 532, L2CAP 533, a lower layer (Link Manager) 534, RF 536 and an antenna 536. On the other hand, the child terminal B (B-1 to B-3) also has a main application 537, an upper layer protocol 538, an L2CAP 539, a lower layer (Link Manager) 540, an RF 541, and an antenna 542.

[0093] Furthermore, when a request is generated and transmitted by the upper layer protocol 532 → L2CAP 533 → lower layer 534 of the parent terminal A, an indication in response to the request is generated in the child terminal B by the lower layer 540 → L2CAP 539 → upper layer protocol 538. Furthermore, when a response is generated and transmitted in the child terminal B by the upper layer protocol 538 → L2CAP 539 → lower layer 540, the response is confirmed in the parent terminal A by the lower layer 534 → L2CAP 533 → upper layer protocol 532.

[0094] FIG. 27 depicts an example of a protocol stack configuration for a wireless headset. The parent terminal A is provided with an antenna 551 for communicating with the base station 1, and this antenna 511 is connected to a body functional unit 552. An application (audio output) 553 is connected to the body functional unit 552, and a headset control 554, an SDP 555, a RECOMM 556, an L2CAP 557, an LMP 558, and a baseband/LC 559 are provided between the application 553 and an RF unit 560, and an antenna 561 is connected to the RF unit 560.

[0095] The child terminal B-2 is provided with an audio input/output circuit 572 to which a speaker 582 and a microphone 583 are connected, and an application (audio driver) 573 is connected to the audio input/output circuit 572. Similar to the parent terminal A, a headset control 574, an SDP 575, a RECOMM 576, an L2CAP 577, an LMP 578, and a baseband/LC 579 are provided between the application 573 and an RF unit 580, and an antenna 581 is connected to the RF unit 580.

[0096] FIG. 28 shows an example of a protocol stack configuration for a parent-child telephone/cordless telephone. The parent terminal A is provided with an antenna 601 for communicating with the base station 1, and this antenna 511 is connected to a parent device functional unit 602. A telephone application 603 is connected to the parent device functional unit 602, and an SDP 604, a TCS Binary 605, an L2CAP 606, an LMP 607, and a baseband/LC 608 are provided between the telephone application 603 and an RF unit 609, and an antenna 610 is connected to the RF unit 609.

[0097] The child terminal B-1 is provided with a child terminal control unit 622 to which a speaker 631, a microphone 632, a display unit 633, and an operating unit 643 are connected, and a telephone application 623 is connected to the child terminal control unit 622. Similar to the parent terminal A, SDP 624, TCS Binary 625, L2CAP 626, LMP 627, and baseband/LC 628 are provided between the telephone application 623 and the RF unit 629, and an antenna 630 is connected to the RF unit 629.

[0098] FIG. 29 depicts an example of a dial-up (net connection) protocol configuration. The parent terminal A is provided with an antenna 551 for communicating with the base station 1, and this antenna 511 is connected to a wireless modem device 642. An application (modem) 643 is connected to the wireless modem device 642, and Dialing & Control 645, SDP 646, RECOMM 647, L2CAP 648, LMP 649, and baseband/LC 650 are provided between the application 643 and an RF unit 651, and an antenna 652 is connected to the RF unit 651.

[0099] The child terminal B-1 is provided with a data terminal functional unit 662 to which a display unit 661 and an operating unit 664 are connected, and an application (modem driver) 663 is connected to the data terminal functional unit

662. Similar to the parent terminal A, Dialing & Control 665, an SDP 666, a RECOMM 667, an L2CAP 668, an LMP 669, and a baseband/LC 670 are provided between the application 663 and an RF unit 671, and an antenna 672 is connected to the RF unit 671.

[0100] FIG. 30 depicts a configuration example of a file transfer/sync protocol. The parent terminal A is provided with a body functional unit 682, to which an application <server> (file transfer/sync) 682 is connected. OBEX/IrMC 684, SDP 685, RECOMM 686, L2CAP 687, LMP 688, and baseband/LC 689 are provided between the application 682 and an RF unit 690, and an antenna 691 is connected to the RF unit 690.

[0101] The child terminal B (B-1 to B-3) is provided with a body functional unit 702 to which a display unit 802 and an operating unit 803 are connected, and an application <client> (file transfer/sync) 702 is connected to the body functional unit 702. Similar to the parent terminal A, OBEX/IrMC 704, SDP 705, RECOMM 706, L2CAP 707, LMP 708, and baseband/LC 709 are provided between the application 702 and the RF unit 800, and an antenna 801 is connected to the RF unit 800.

[0102] FIG. 31 and FIG. 32 depict an example in which the wireless link is controlled by sending a command and receiving a response code. As depicted in FIG. 31, the parent terminal A is provided with a wireless telephone main unit 812 having an antenna 811 for communicating with the base station 1. The wireless telephone main unit 812 is connected to a wireless modem unit 814 via a wireless link control unit 813, and the wireless modem unit 814 has an antenna 815 used for communication with the child terminal B-1.

[0103] The child terminal B (B-1 to B-3) includes a wireless link (wireless modem) unit 822 having an antenna 821, and the wireless link unit 822 is connected to a terminal body control unit 824 via a wireless link control unit 823. An operating unit 825, an audio input/output unit 826, and a display unit 827 are connected to the terminal body control unit 824. The wireless link control unit 823 includes a command recognition unit 823, a command decoding unit 829, a memory unit 830, a command executing unit 831, and a response code generation unit 832.

[0104] With this configuration, the parent terminal A and the child terminal B-1 operate in accordance with the flow chart depicted in FIG. 31. In other words, when a command is input, a determination is made as to whether or not the command is a command start code (step S601), and if the command is a command start code, a determination is made as to whether or not there is input data (step S602). If there is input data, a determination is made as to whether the data is a command end code (step S603), and if the data is not a command end code, the input data is stored in the command buffer (step S604).

Furthermore, verification is performed to determine whether the command buffer has overflowed (step S605), and if the buffer has not overflowed, the process returns to step S602. If an overflow has occurred, an error message is output (step S606), and the process returns to step S601.

[0105] Furthermore, if the result of the determination in step S603 is a command end code, verification is performed as to whether the command buffer is empty (step S607), and if the buffer is not empty, the command is decoded (step S608). Furthermore, a determination is made as to whether the format of the decoded command is correct (OK) (step S609), and if the format is not correct, an error message is output (step S606). Furthermore, if the format is correct, the command is executed (step S610), and various settings, dialing, automatic answering, data communication, and other processes corresponding to the command are executed in accordance with the command.

[0106] On the other hand, if the result of the determination in step S607 is that the command buffer is empty, a response code is output, such as command execution completed, ringing, communication in progress, carrier/tone not detected, call-in-progress, error, or the like (step S611). Thereafter, a determination is made as to whether the command input mode has been released, and the process from step S601 is repeated until the command input mode is released, at which point the command input process ends.

[0107] (Configuration Examples of Modulation and Demodulation Circuits) FIGS. 33 to 38 depict modified examples of modulation and demodulation circuits built into the parent terminal A and the child terminals B (B-1 to B-3).

[0108] FIG. 33 depicts the configuration of a direct spread spectrum modulation circuit. In other words, the information modulation unit 814, to which the transmission data is input, is sequentially connected to a spread modulation unit 842, a frequency converter 843, a power amplifier 844, and an antenna 845, and is configured so that the spread code generated by the spread spectrum code generation unit 846 is provided to the spread modulation unit 842. FIG. 34 depicts the configuration of a direct spread spectrum demodulation circuit. In other words, a high frequency amplifier 852, a frequency converter 853, a spread spectrum demodulation unit 854, and an information demodulation unit 855 are connected in this order to an antenna 851 that receives radio waves. The received data that has been frequency converted by the frequency converter 854 is branched and input to the code synchronization unit 856, and the spreading code generated by the spreading code generation unit 857 is provided to the code synchronization unit 856 and the spreading demodulation unit 854.

[0109] FIG. 35 depicts a configuration example of a QPSK modulation unit. In other words, a serial/parallel converter 861 to which transmission data (0, 1) is input is connected via data conversion units 862 and 863, multipliers 864 and 865, and a combiner 866 to a transmission filter 869 which outputs a QPSK modulated wave. An oscillator 868 and a $\pi/2$ phase shifter 867 are connected between the two multipliers 864 and

865. FIG. 36 depicts a configuration example of a QPSK modulation unit. In other words, a serial/parallel converter 861 to which a QPSK modulated wave is input is connected via data conversion units 862 and 863, multipliers 864 and 865, and a combiner 866 to a transmission filter 869 which outputs received data (0, 1). An oscillator 868 and a $\pi/2$ phase shifter 867 are connected between the two multipliers 864 and 865.

[0110] FIG. 37 depicts a frequency hopping type modulation circuit. In other words, an information modulation unit 881 to which transmission data is input is connected to an antenna 884 via a frequency converter 882 and a power amplifier 883. Furthermore, the spreading code generation unit 885 is connected to the frequency converter 882 via a frequency synthesizer 886. FIG. 38 depicts the configuration of a frequency hopping demodulation circuit. In other words, a frequency amplifier 892 and an information demodulation unit 894 are connected in order to an antenna 891 for receiving radio waves. The received signal amplified by the high frequency amplifier 892 is branched and input to a code synchronization unit 895, and the spreading code generated by the spreading code generation unit 896 is provided to the code synchronization unit 895 and a frequency synthesizer 897, and the output of the frequency synthesizer 897 is provided to the frequency converter 893.

[0111] (Example of the configuration of the RF/transceiver unit of the wireless link (for Bluetooth)) FIGS. 39 and 40 depict variations of the configuration of the RF/transceiver unit of the wireless link (for Bluetooth) built into the parent terminal A and the child terminals B (B-1 to B-3). FIG. 39 depicts an example of a general configuration. On the transmitting side of the control unit 901, an information modulator (FSK, PSK, and the like) 902 is connected to a TX-Data terminal, a power control unit 903 is connected to the Power Control terminal, and an antenna switch 913 is connected to the RX/TX terminal. The power control unit 903 is connected to the PA 912 via D/A converters 904 and 905, LPFs 906 and 907, dividers 908 and 909 which constitute an FH spread modulation unit 926, a phase shifter 910, and a combiner 911. The power control unit 903 is connected to the PA 912, which is also connected to an antenna 915 via an antenna switch 913 and a BPF 914.

[0112] Furthermore, on the transmitting side, an LNA 916 is connected to the antenna switch 913. The LNA 916 is connected to the RX-Data terminal of the control unit 901 via multipliers 917 and 918, phase shifter 928, LPFs 919 and 920, A/D converters 921 and 922, and an information demodulation unit (FSK, PSK, and the like) 923 which constitute an FH spread spectrum demodulation unit 927. In addition, the LNA 916 is connected to the RSSI terminal of the control unit 901 via an RSSI received signal strength block 924. The Clock terminal and the FH-Control terminal of the control unit 901 are connected to a PLL/VCO 925, and the output of the PLL/VCO 925 is provided between the multiplier 908 and the phase shifter 910 of the FH spread modulation unit 926, and between the phase shifter 928 and multiplier 917 of the FH spread spectrum demodulation unit 927.

[0113] FIG. 40 depicts a simple example of a configuration in which a PLL and a VCO are used in common by time division of transmission/reception. The transmission unit 932 is connected to the TX-Data terminal of the control unit 931, and the antenna switch 938 is connected to the RX/TX terminal. The transmission unit 932 contains a D/A converter 933, an LPF 934, an FM modulator 935, a PA 936, and a burst modulator 937, and the PA 936 is connected to the antenna switch 938. In addition, the antenna switch 938 is connected to the antenna 940 via a BPF 939. On the other hand, a receiving unit 948 is connected to the RX-Data terminal and the FH-Control terminal of the control unit 931. The receiving unit 948 has an LNA 941, a BPF 942, a multiplier 943, a BPF 944, an FM demodulator 945, and a threshold detection/clock recovery unit 946, which are connected in sequence to the antenna switch 938, as well as a PLL/VCO 949 and a switch 947.

[0114] (Second Embodiment) As depicted in FIG. 41, the system according to the second embodiment includes the parent terminal A and the child terminals B-11, B-12, and B-13 that can communicate with the parent terminal A. The Parent terminal A has the same configuration as in the first embodiment described above, and is a mobile phone terminal with wireless digital transmission and reception functions, and is connectable to a wired telephone 4 and a PC 5 via a wireless base station 1, a mobile communication network 2, and a network (wired telephone network) 3, and is connectable to a server 7 and a PC 8 via a network (Internet, or the like) 6, and is further connectable to other mobile phone terminals A-1 and mobile information devices 9 via the base station 1. On the other hand, the child terminal B-11 is a remote dialing device equipped with an image capture function, the child terminal B-12 is a remote display device equipped with an image capture function, and the child terminal B-13 is a remote handset device equipped with an image capture function. Furthermore, each of the child terminals B-11 to B-13 is a wristwatch type, and includes a device body 101, 201, 301 and wristbands 102, 202, 302 fastened to both end parts of the device body 101, 201, 301.

[0115] (Parent Terminal A) The circuit configuration of the parent terminal A is the same as that of the first embodiment depicted in FIG. 2, so a description thereof will be omitted.

[0116] (Child Terminal B-11) The child terminal B-11 has all the components of the child terminal B-1 in the first embodiment described above, and further has an image capturing device 161 provided at the end of device body 101.

[0117] FIG. 42 is a block diagram depicting the circuit configuration of the child terminal B-11. In this block diagram, the same parts as those of the child terminal B-1 in the first embodiment depicted in FIG. 5 are assigned the same reference numerals and a description thereof will be omitted. In other words, the child terminal B-11 according to the present embodiment differs from the child terminal B-1 according to the first embodiment only in that the child terminal B-11 includes an image capturing device 161 and

further includes an image display unit 170 in the display unit 125. The image capturing device 161 is configured to include a lens unit 162, an image sensor 163, an A/D converter 164, an image processing unit 165, and an image data memory 166, and the image processing unit 165 and the image data memory 166 are connected to the bus 114.

[0118] Therefore, with the child terminal B-11 of the present embodiment, not only can functions similar to those of the child terminal B-1 be generated, but the subject image formed on the image sensor 163 by the lens unit 162 can be displayed on the image display unit 170, or the image data can be stored in the image data memory 166, or even transmitted to the parent terminal A.

[0119] (Child Terminal B-12) The child terminal B-12 has all the components of the child terminal B-2 in the first embodiment described above, and further has an image capturing device 261 provided at the end of device body 201.

[0120] FIG. 43 is a block diagram depicting the circuit configuration of the child terminal B-12. In this block diagram, the same parts as those of the child terminal B-2 in the first embodiment depicted in FIG. 10 are assigned the same reference numerals and a description thereof will be omitted. In other words, the child terminal B-12 according to the present embodiment differs from the child terminal B-2 according to the first embodiment only in that the child terminal B-12 includes an image capturing device 261 and further includes an image display unit 270 in the display unit 225. The image capturing device 261 is configured to include a lens unit 262, an image sensor 263, an A/D converter 264, an image processing unit 265, and an image data memory 266, and the image processing unit 265 and the image data memory 266 are connected to the bus 214.

[0121] Therefore, with the child terminal B-12 of the present embodiment, not only can functions similar to those of the child terminal B-2 be generated, but the subject image formed on the image sensor 263 by the lens unit 262 can be displayed on the image display unit 270, or the image data can be stored in the image data memory 266, or even transmitted to the parent terminal A.

[0122] (Child Terminal B-13) The child terminal B-13 has all the components of the child terminal B-3 in the first embodiment described above, and further has an image capturing device 361 provided at the end of device body 301.

[0123] FIG. 44 is a block diagram depicting the circuit configuration of the child terminal B-13. In this block diagram, the same parts as those of the child terminal B-3 in the first embodiment depicted in FIG. 15 are assigned the same reference numerals and a description thereof will be omitted. In other words, the child terminal B-13 according to the present embodiment differs from the child terminal B-3 according to the first embodiment only in that the child terminal B-13 includes an image capturing device 361 and further includes an image display unit 370 in the display unit 325.

The image capturing device 361 is configured to include a lens unit 362, an image sensor 363, an A/D converter 364, an image processing unit 365, and an image data memory 366, and the image processing unit 365 and the image data memory 366 are connected to the bus 314.

[0124] Therefore, with the child terminal B-13 of the present embodiment, not only can functions similar to those of the child terminal B-3 be generated, but the subject image formed on the image sensor 363 by the lens unit 362 can be displayed on the image display unit 370, or the image data can be stored in the image data memory 366, or even transmitted to the parent terminal A.

[0125] FIG. 45 depicts a data format of transmission/reception data used for transmission/reception between the parent terminal A and the child terminals B (B-1 to B-3, B-11 to B-13) in each embodiment. The transmitted/received data contains an access code AC, a header H, and a payload (packet contents) PA. The access code AC is made up of a preamble Pr, a synchronization word SW, and a trailer Tr. Of course, the present invention is not limited to this case, and any suitable data format may be used.

[0126] When Bluetooth is used for communication between the parent terminal A and the child terminal B (B-1 to B-3, B-11 to B-13), the commands and their functions have the following relationships.

[0127] (Communication control command)

Create_Connection: Establishes a communication link with another device.

Link_Control: Controls baseband signal processing on the basis of the instruction of Create_Connection.

Link_Policy: Determines the communication link state, such as management and control of the piconet.

(Module control state)

Hold_Mode: Changes the module state to hold mode.

Host_controller_&_Baseband: Sets parameters for the baseband processing signal circuit, and the like.

Write_Page_Timeout: Sets the time until a page operation (processing a connection request) is completed.

Information: Obtain information related to baseband signal processing.

Read_BD_ADDR: Obtains the device address of the wireless link unit (Bluetooth module).

Status: Reads the status of the baseband signal processing circuit.

Read_RSSI: Reads information indicating the received signal strength.

Testing: The baseband signal processing circuit is put into a test mode.

Furthermore, the packets and functions have the following relationships:

[0128] (Packet)

Event packet: A packet that is sent from the wireless link unit (Bluetooth module) to the device main control unit in response to completion of command processing, processing results, and the like.

ACL data packet (asynchronous, connectionless communication): A packet for sending and receiving asynchronous data.

SOC Data Packet (Synchronous, Connection-Oriented Communication): A packet for sending and receiving synchronous data.

[0129] Furthermore, the commands are not limited to those of Bluetooth and may be, for example, modem AT commands of Hayes Corporation of the United States.

[0130]

EFFECT OF THE INVENTION

As described above, the present invention is a communication system containing a parent terminal capable of communicating with system external unit, and a child terminal capable of wireless communication with the parent terminal, in which the child terminal is equipped with a portion of the communication functions with the system external unit that should be achieved by the parent terminal, and is equipped with implementing means for achieving communication between the child terminal and the system external unit via the parent terminal by wireless communication. Therefore, by carrying the parent terminal and the child terminal, the child terminal can communicate with the system external unit via the parent terminal. Therefore, since the child terminal is equipped with a portion of the communication functions with the system external unit that should be achieved in the parent terminal, not only can the parent terminal be made smaller, but a display unit can be achieved with a sufficient area, keys that are large enough to be easy to operate, or with a battery having sufficient capacity, thereby ensuring basic functions related to usability such as display, operability, and battery capacity. Furthermore, since the child terminal only has a portion of the communication function with the system external unit that should be achieved by the parent terminal, the size of the child terminal does not increase and the appearance is not impaired. Therefore, mobility can be improved without compromising basic functions related to usability.

[0131] In addition, the child terminal or a body-wearable wireless communication terminal is provided with means for inputting call data required for the parent terminal to make a call, and means for transmitting the input call data to the parent terminal, or is provided with means for receiving an incoming call signal and display data transmitted from the parent terminal and means for displaying on the basis of the received signal and data, or is provided with a function for transmitting and receiving audio signals and for playing back the received audio signals. Therefore, by selecting and carrying one of these child terminals, calls can be made, received data can be viewed, and hands-free conversations can be achieved on the child terminal side, thereby improving convenience according to the needs.

[0132] In addition, by having the child terminal or the body-wearable wireless communication terminal further include image capturing means and communication controlling means for controlling the transmission of captured image data to the external system via the parent terminal, an image capturing function that the parent terminal does not have can be added, and the captured images can be transmitted to the parent terminal and even from the parent terminal to a system external unit.

[0133] In addition, since the child terminal or the body-wearable wireless communication terminal is designed to have a shape suitable to be worn on the arm of the user, the user can carry the parent terminal in a pocket or bag, or the like, and select one of the sub-terminals according to purpose for wearing on the arm, thereby further improving convenience when carrying the terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a system configuration diagram depicting the first embodiment of the present invention;
 FIG. 2 is a block configuration diagram depicting a circuit configuration of the parent terminal A;
 FIG. 3 is a flowchart depicting the basic operation of the parent terminal A;
 FIG. 4 is a diagram depicting the external configuration and link relationship of the child terminal B-1;
 FIG. 5 is a block diagram depicting a circuit configuration of the child terminal B-1;
 FIG. 6 is a diagram depicting an operation sequence between the parent terminal A and the child terminal B-1;
 FIG. 7 is a diagram depicting an example of use of the parent terminal A and the child terminal B-1;
 FIG. 8 is a diagram depicting a modified example of the operation sequence between the parent terminal A and the child terminal B-1;
 FIG. 9 is a diagram depicting the external configuration and link relationship of the child terminal B-2;
 FIG. 10 is a block diagram depicting a circuit configuration of the child terminal B-2;
 FIG. 11 is a diagram depicting an operation sequence between the parent terminal A and the child terminal B-2;
 FIG. 12 is a diagram depicting an example of use of the parent terminal A and the child terminal B-2;
 FIG. 13 is a diagram depicting a modified example of the operation sequence between the parent terminal A and the child terminal B-2;
 FIG. 14 is a diagram depicting the external configuration and link relationships of the child terminal B-3;
 FIG. 15 is a block diagram depicting a circuit configuration of the child terminal B-3;
 FIG. 16 is a diagram depicting an operation sequence between the parent terminal A and the child terminal B-3;
 FIG. 17 is a diagram depicting an example of use of the parent terminal A and the child terminal B-3;
 FIG. 18 is a diagram depicting a memory dial read request operation sequence;
 FIG. 19 is a diagram depicting a memory dial write request operation sequence;
 FIG. 20 is a diagram depicting a memory dial read/write abnormal termination operation sequence;
 FIG. 21 is a diagram depicting a memory dial read/write normal termination operation sequence;

FIG. 22 is a diagram depicting a sequence of a PIN verification operation when a memory dial call is placed;
 FIG. 23 is a diagram depicting a sequence of a call request operation when a memory dial call is placed;
 FIG. 24 is a diagram depicting an operation sequence for abnormal termination when calling by memory dialing;
 FIG. 25 is a block diagram depicting a configuration example of a software stack of a device with a built-in wireless link;
 FIG. 26 is a block diagram depicting a wireless link control configuration according to L2CAP;
 FIG. 27 is a block diagram depicting a configuration example of a protocol stack of a wireless headset;
 FIG. 28 is a block diagram of an example of a protocol stack configuration for a parent-child telephone/cordless telephone;
 FIG. 29 is a block diagram depicting a configuration example of a dial-up (net connection) protocol;
 FIG. 30 is a block diagram depicting a configuration example of a file transfer/sync protocol;
 FIG. 31 is a block diagram depicting a configuration example of wireless modem control;
 FIG. 32 is a flowchart depicting a control procedure for wireless modem control;
 FIG. 33 is a block diagram depicting a configuration example of a direct spread modulation circuit;
 FIG. 34 is a block diagram depicting a configuration example of a direct spread spectrum demodulation circuit;
 FIG. 35 is a block diagram depicting a configuration example of a QPSK modulation unit;
 FIG. 36 is a block diagram depicting a configuration example of a QPSK demodulation unit;
 FIG. 37 is a block diagram depicting a configuration example of a frequency hopping modulation circuit;
 FIG. 38 is a block diagram depicting a configuration example of a frequency hopping demodulation circuit;
 FIG. 39 is a block diagram depicting a typical configuration example of a wireless link RF transceiver unit;
 FIG. 40 is a block diagram depicting a simple configuration example of a wireless link RF transceiver unit;
 FIG. 41 is a system configuration diagram depicting a second embodiment of the present invention;
 FIG. 42 is a block diagram depicting the circuit configuration of the child terminal B-11;
 FIG. 43 is a block diagram depicting the circuit configuration of the child terminal B-12;
 FIG. 44 is a block diagram depicting the circuit configuration of the child terminal B-13; and
 FIG. 45 is a diagram depicting a format of data used for transmission and reception between the parent terminal and the child terminal.

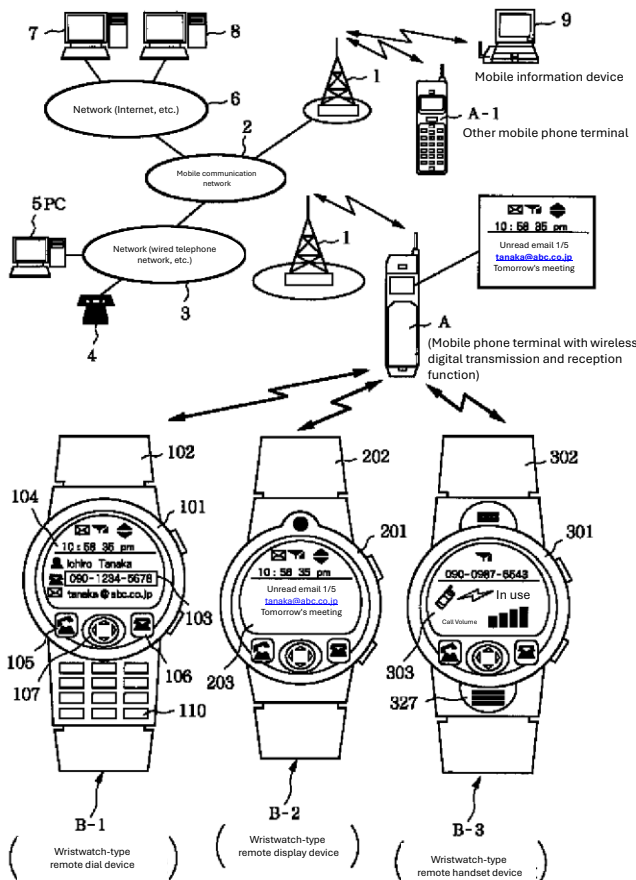
DESCRIPTION OF REFERENTIAL CODES AND NUMERALS

A. Parent terminal
 B-1. Child terminal
 B-2. Child terminal

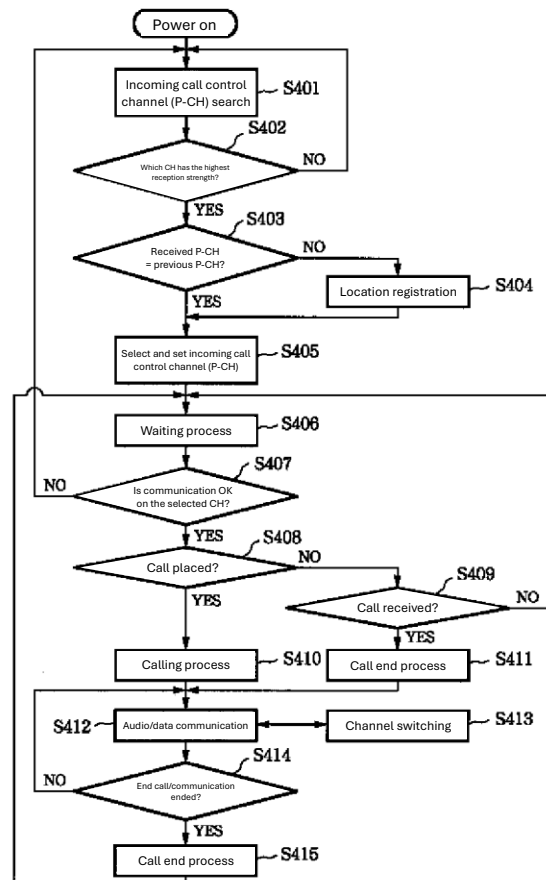
B-3. Child terminal
 1. Wireless base station 1
 2. Mobile communication network
 101. Device body
 103. Dial input display unit
 104. Communication destination selection display unit
 110. Dial operation input unit
 116. Program memory
 201. Device body
 301. Device body
 B-13. Child terminal
 161. Capturing device

401. Mobile phone functional unit
 402. Link software unit
 403. Link hardware unit
 406. Transceiver unit
 B-11. Child terminal
 B-12. Child terminal
 B-13. Child terminal
 161. Capturing device
 261. Capturing device
 361. Capturing device

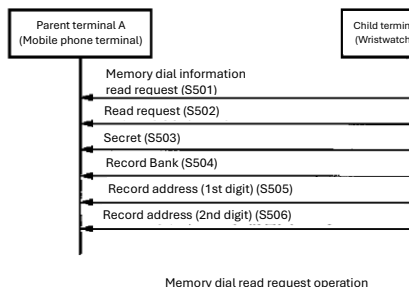
[FIG. 1]



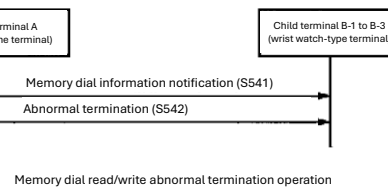
[FIG. 3]



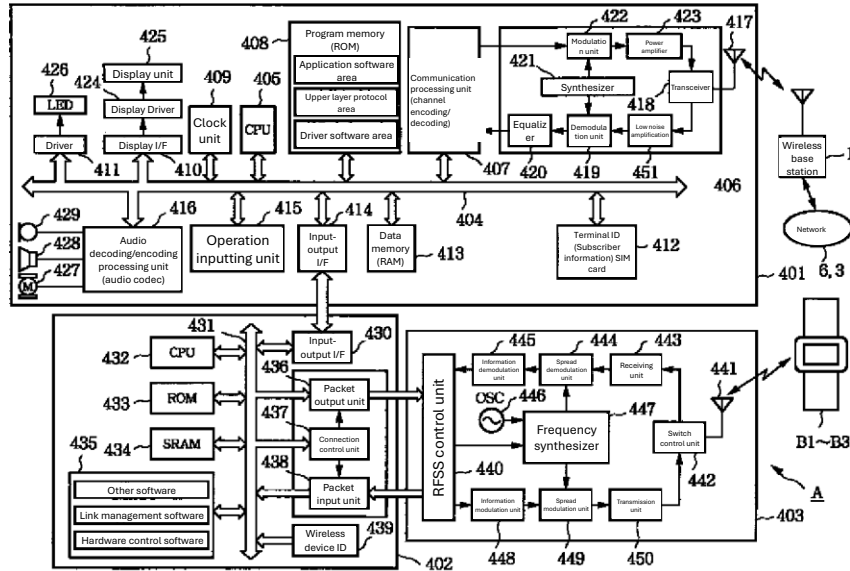
[FIG. 18]



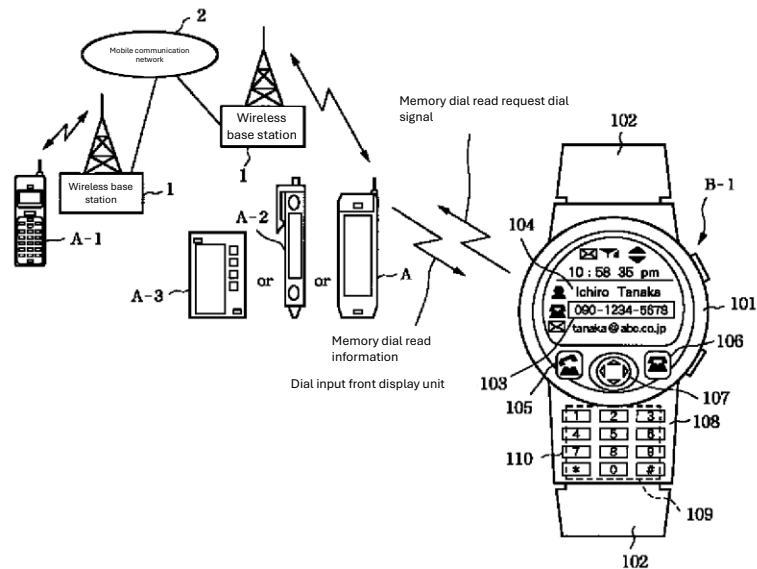
[FIG. 20]



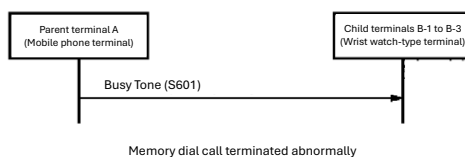
[FIG. 2]



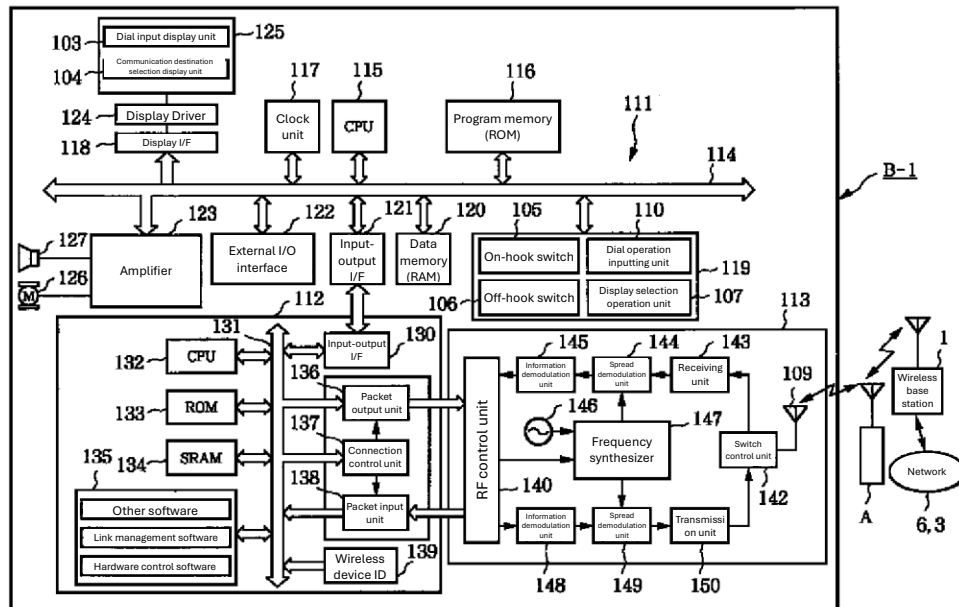
[FIG. 4]



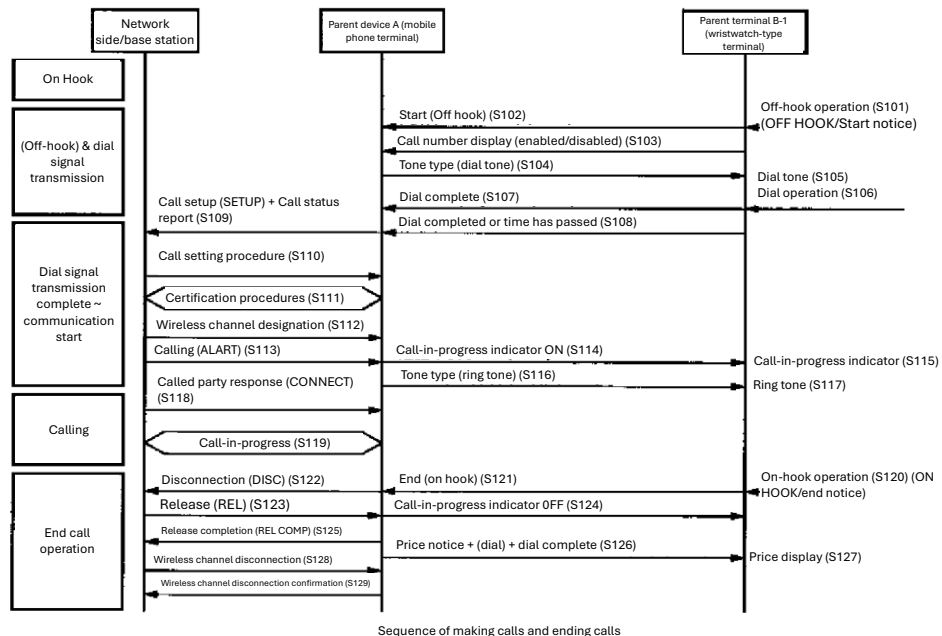
[FIG. 24]



[FIG. 5]

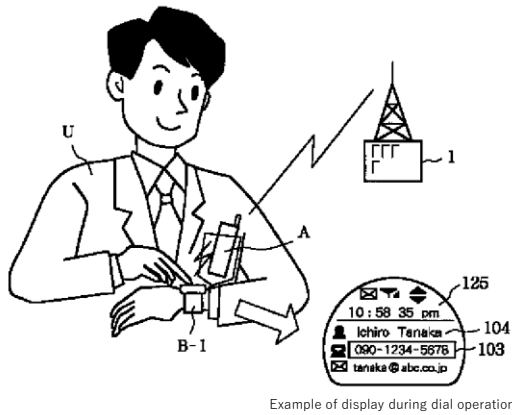


[FIG. 6]

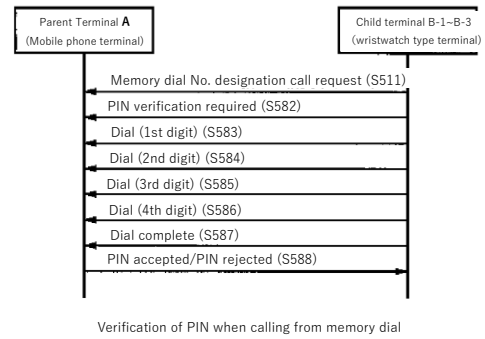


Sequence of making calls and ending calls

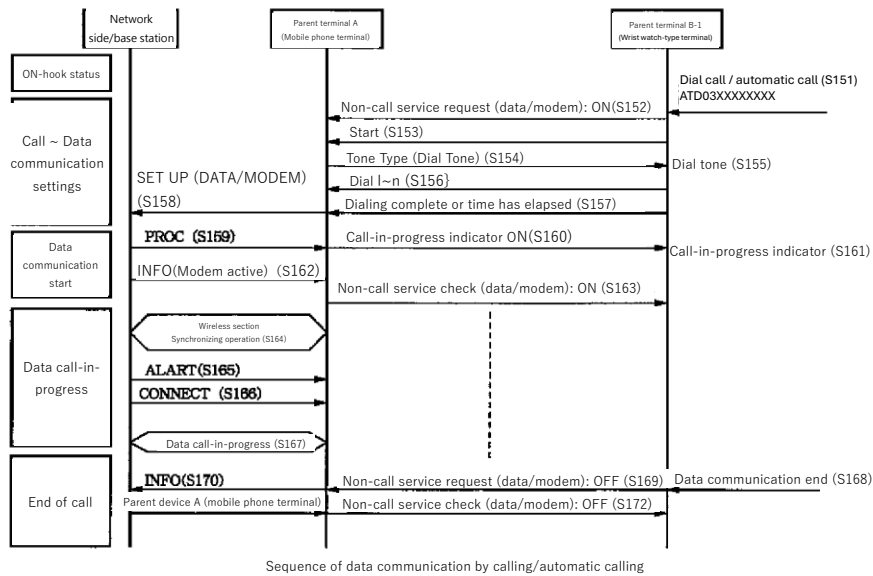
[FIG. 7]



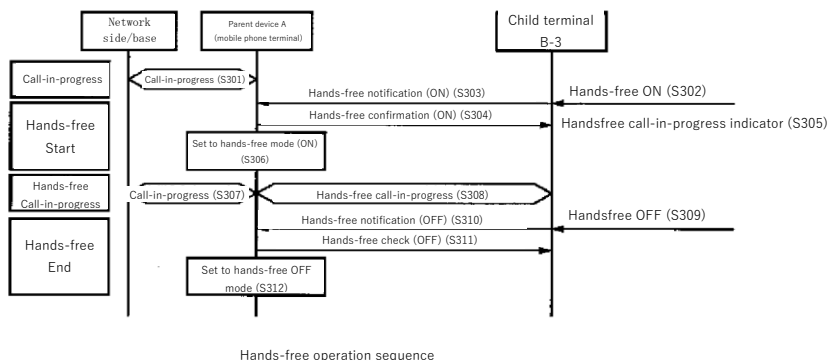
[FIG. 22]



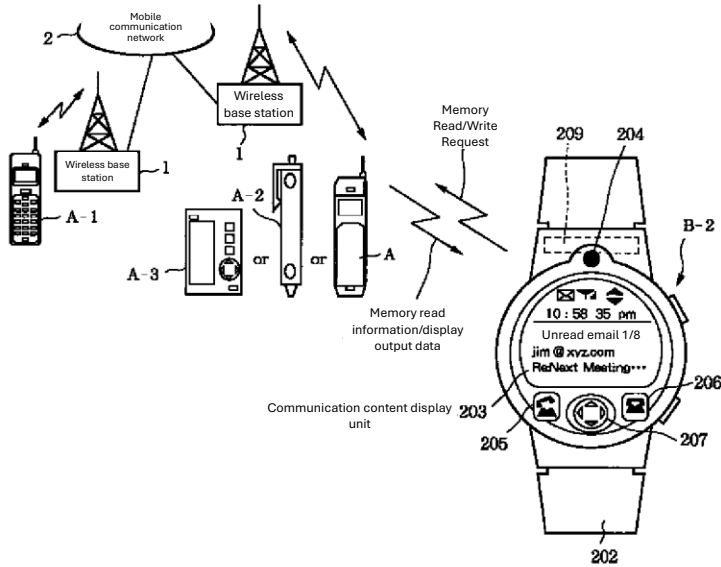
[FIG. 8]



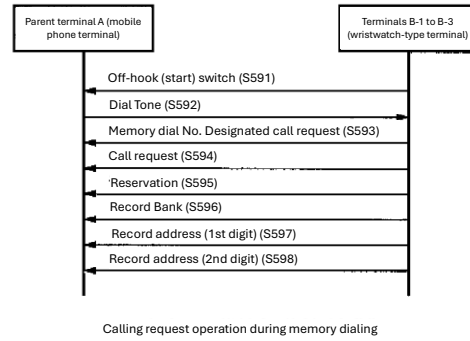
[FIG. 16]



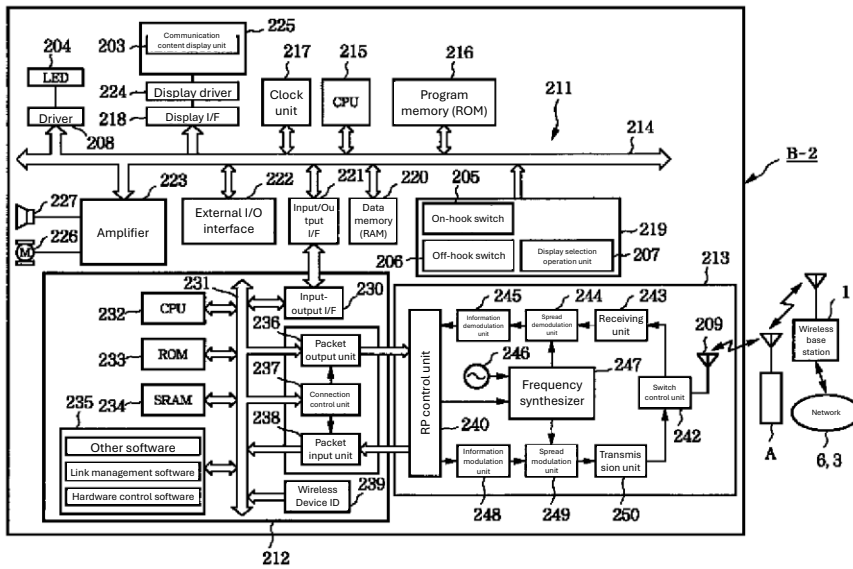
[FIG. 9]



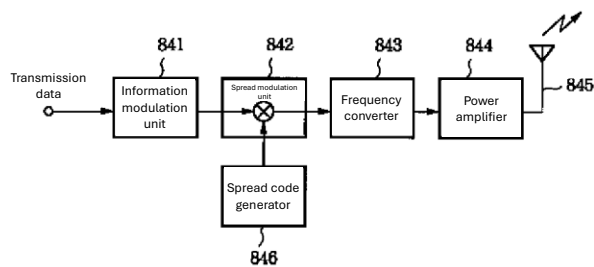
[FIG. 23]



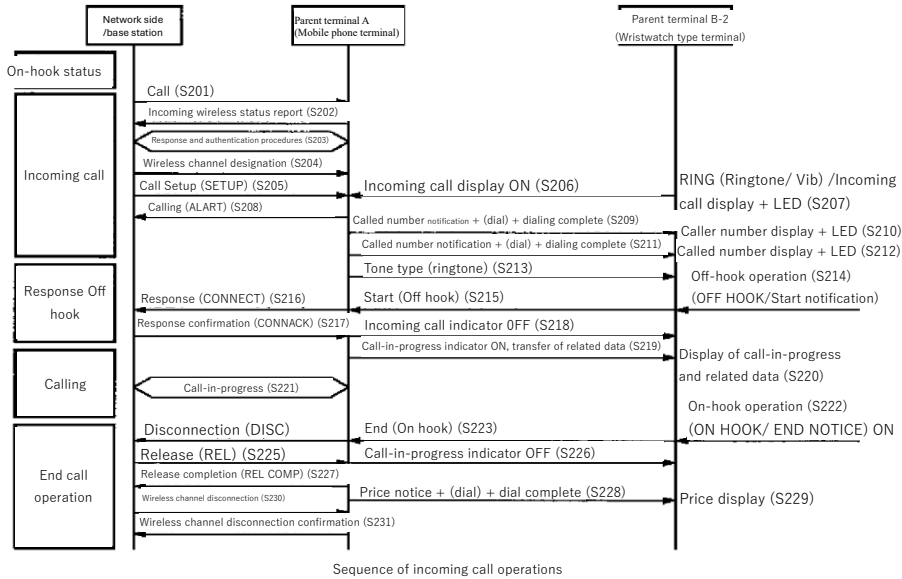
[FIG. 10]



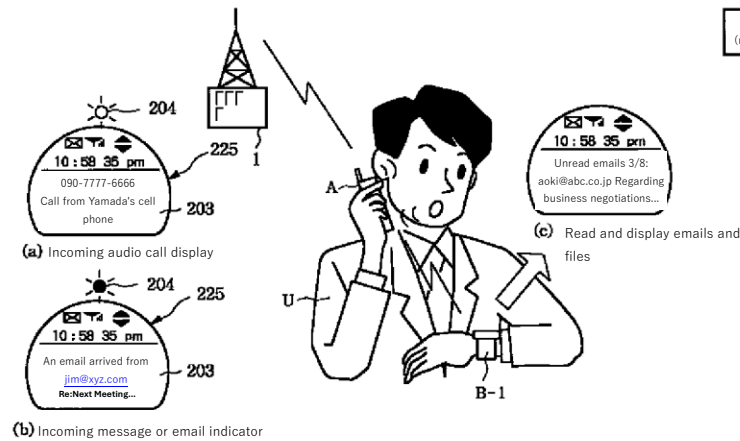
[FIG. 33]



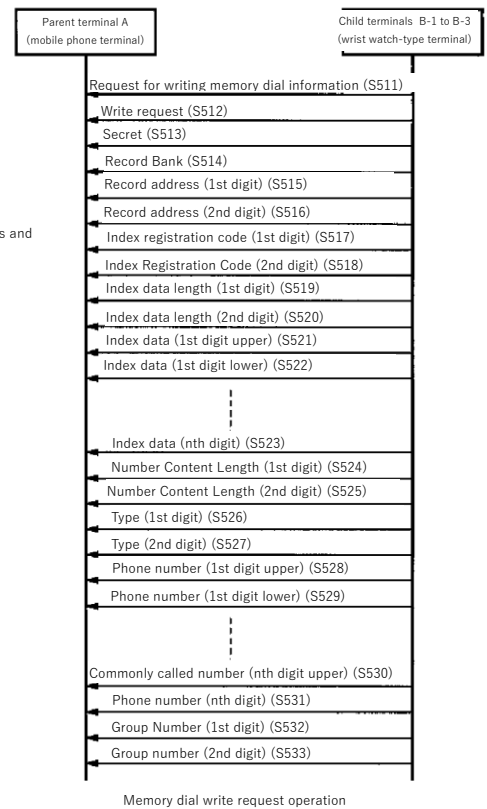
[FIG. 11]



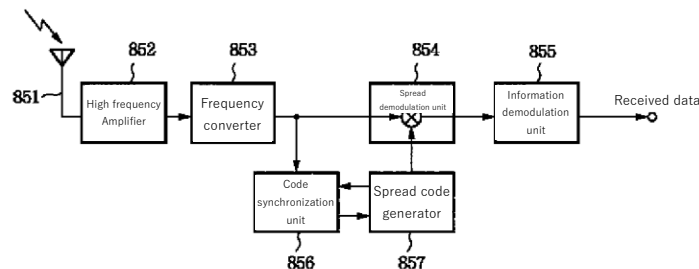
[FIG. 12]



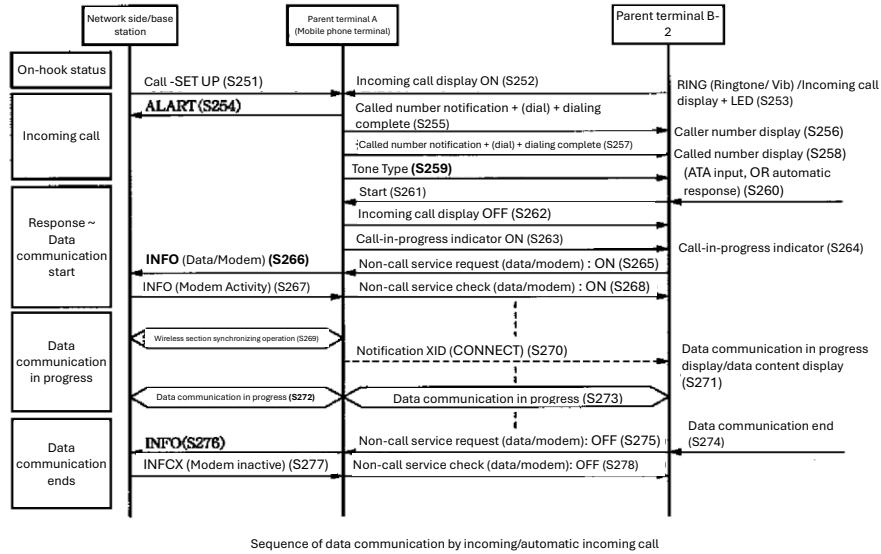
[FIG. 19]



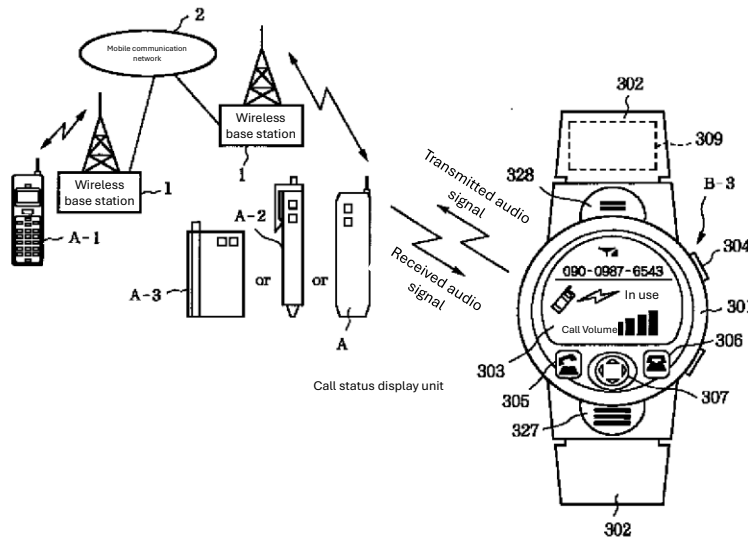
[FIG. 34]



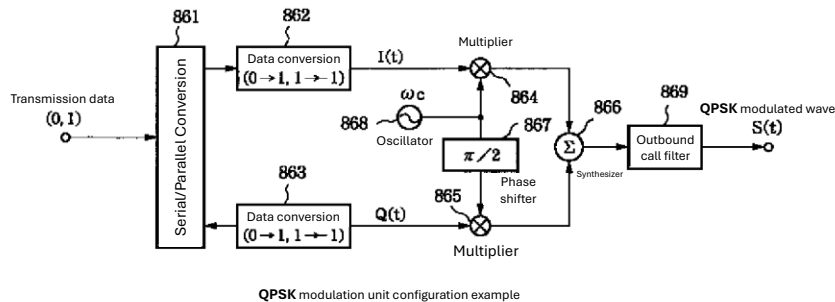
[FIG. 13]



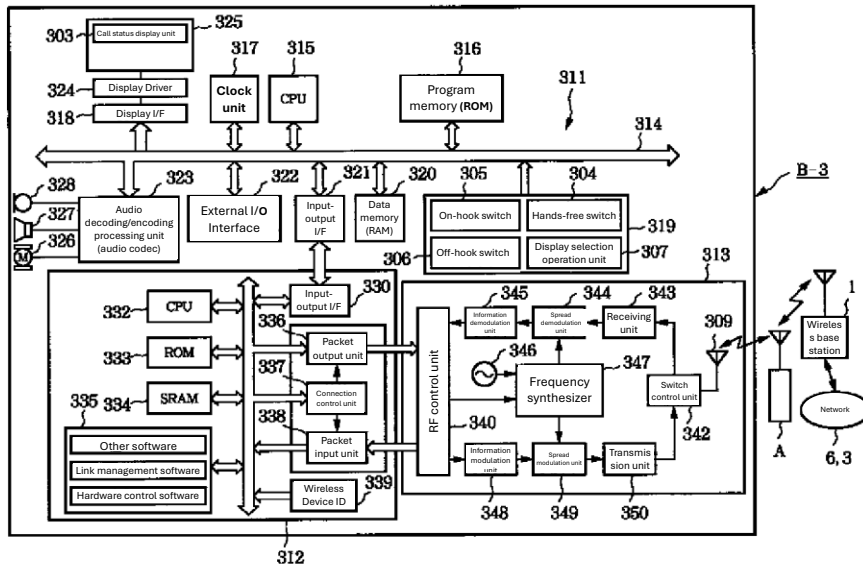
[FIG. 14]



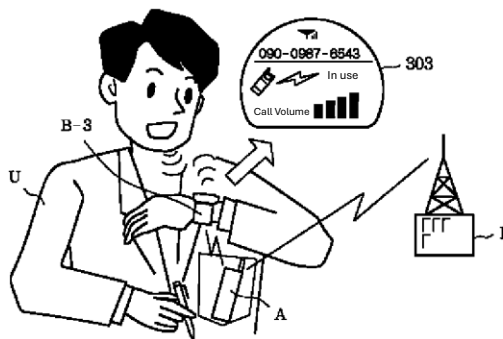
[FIG. 35]



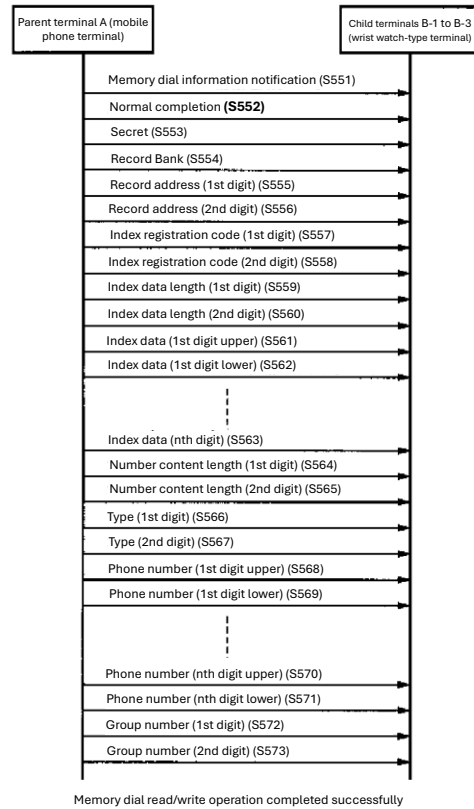
[FIG. 15]



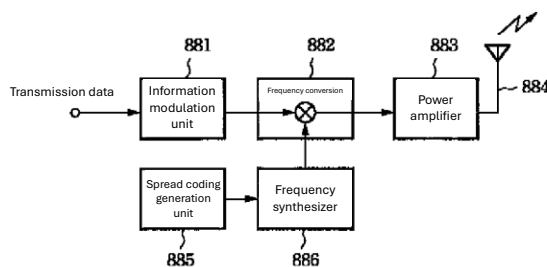
[FIG. 17]



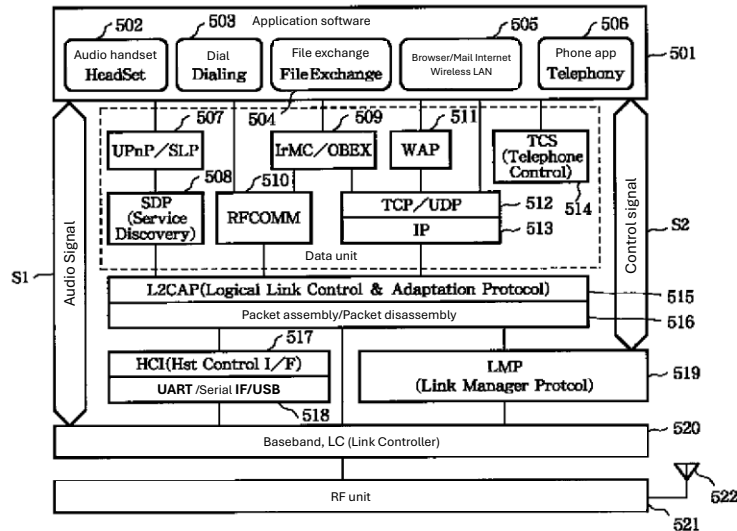
[FIG. 21]



[FIG. 37]

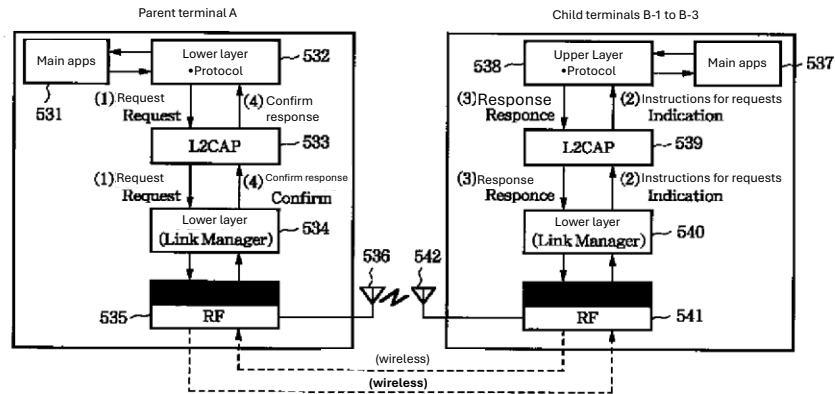


[FIG. 25]

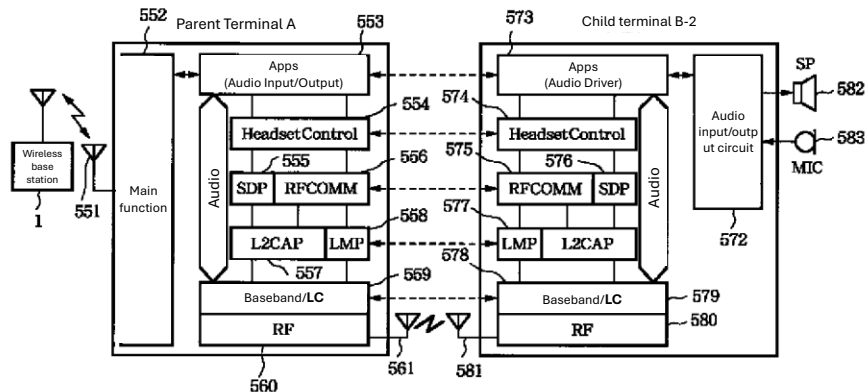


Example of software stack configuration for device with built-in wireless link (Bluetooth example)

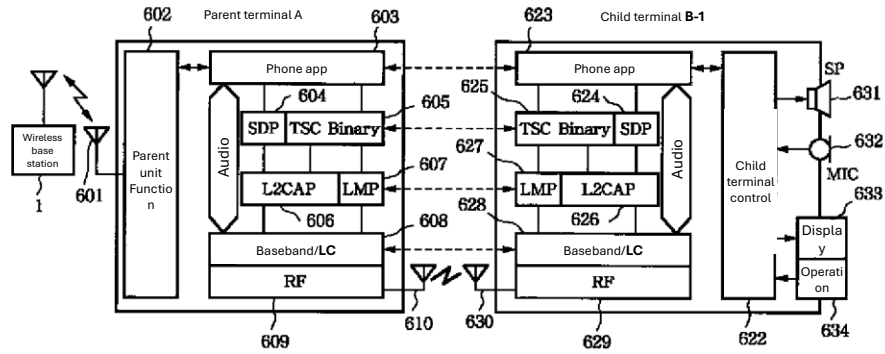
[FIG. 26]



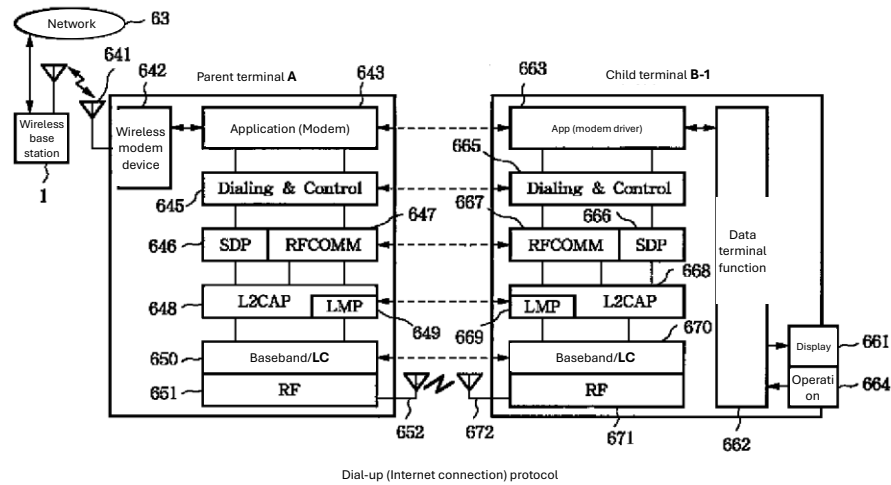
[FIG. 27]



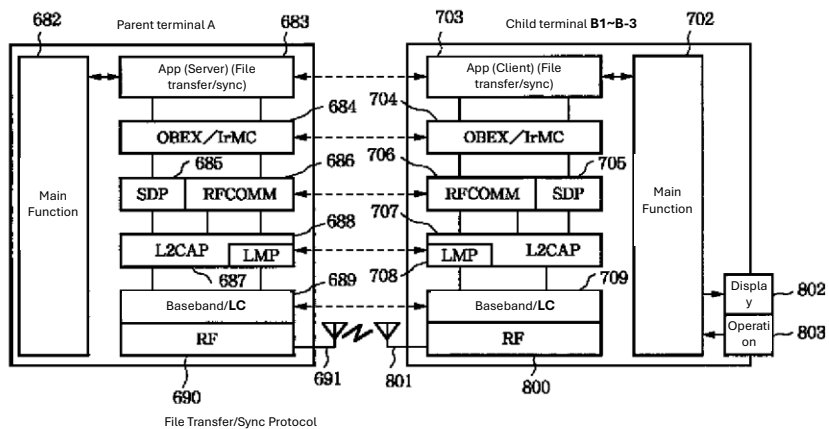
[FIG. 28]



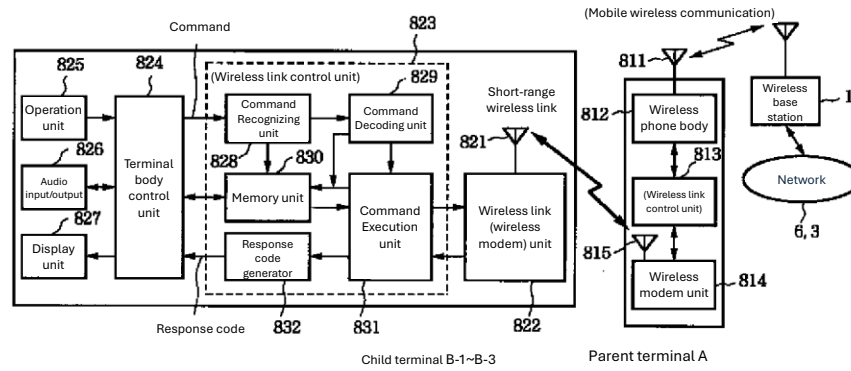
[FIG. 29]



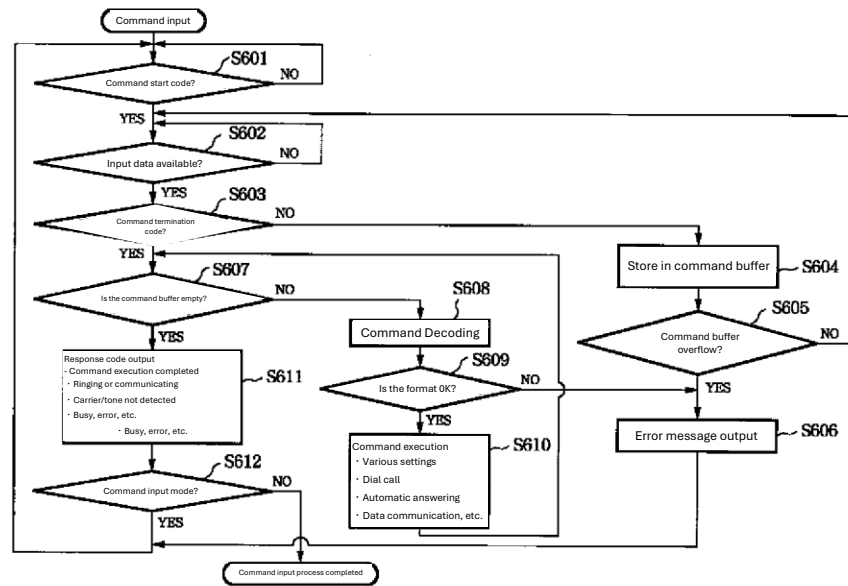
[FIG. 30]



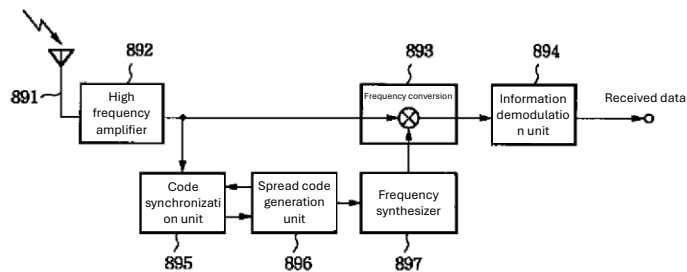
[FIG. 31]



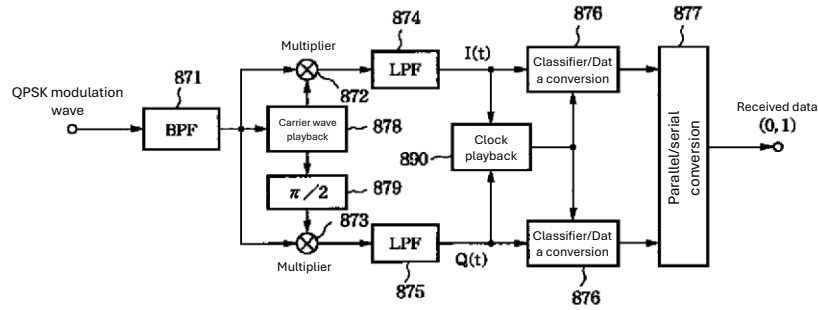
[FIG. 32]



[FIG. 38]

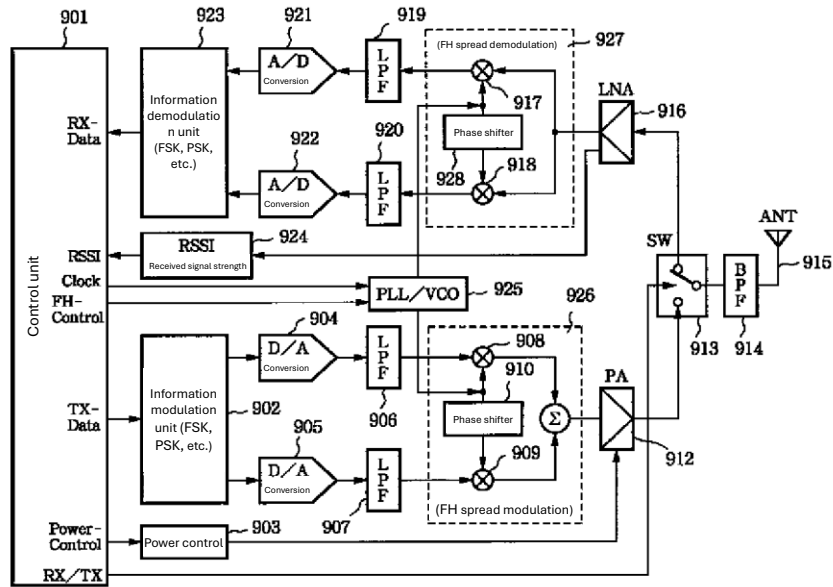


[FIG. 36]



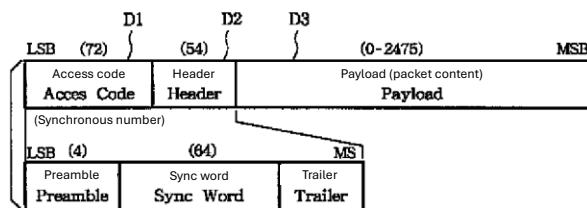
QPSK demodulation unit configuration example

[FIG. 39]

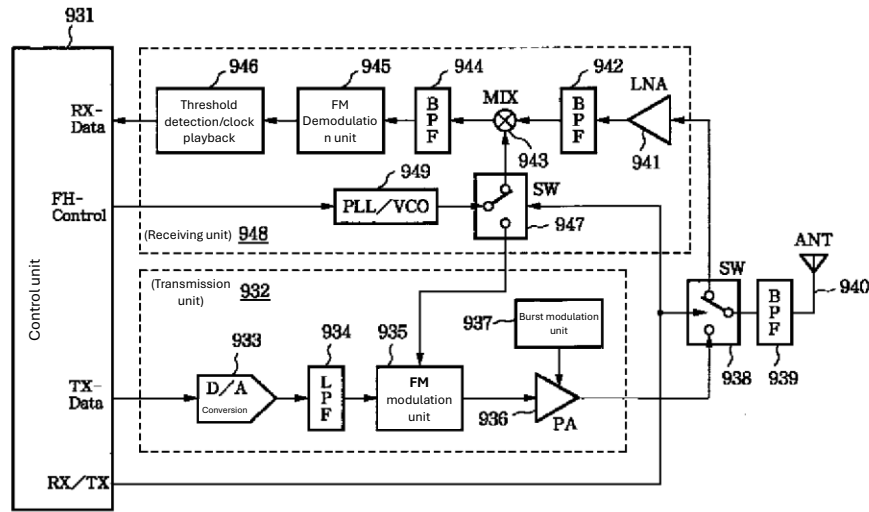


Common configuration examples

[FIG. 45]

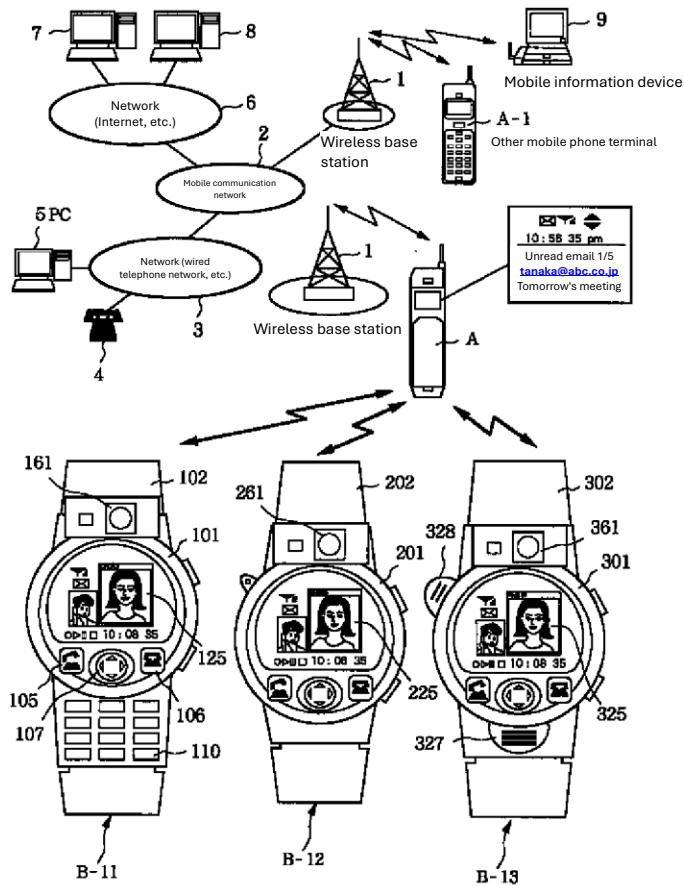


[FIG. 40]

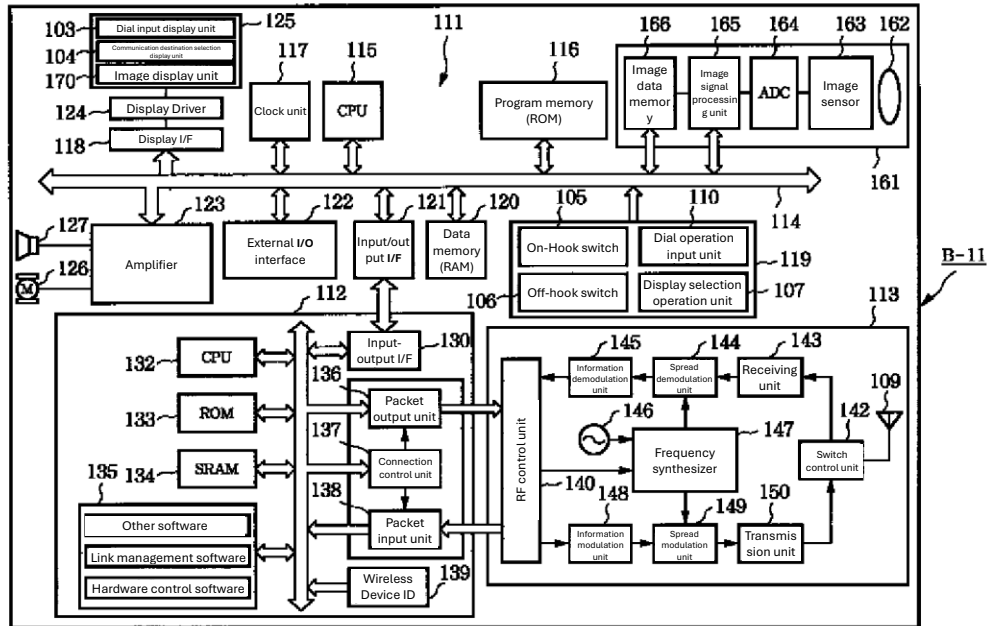


Simple configuration example
(PLL and VCO can be used together by time division of transmission/reception)

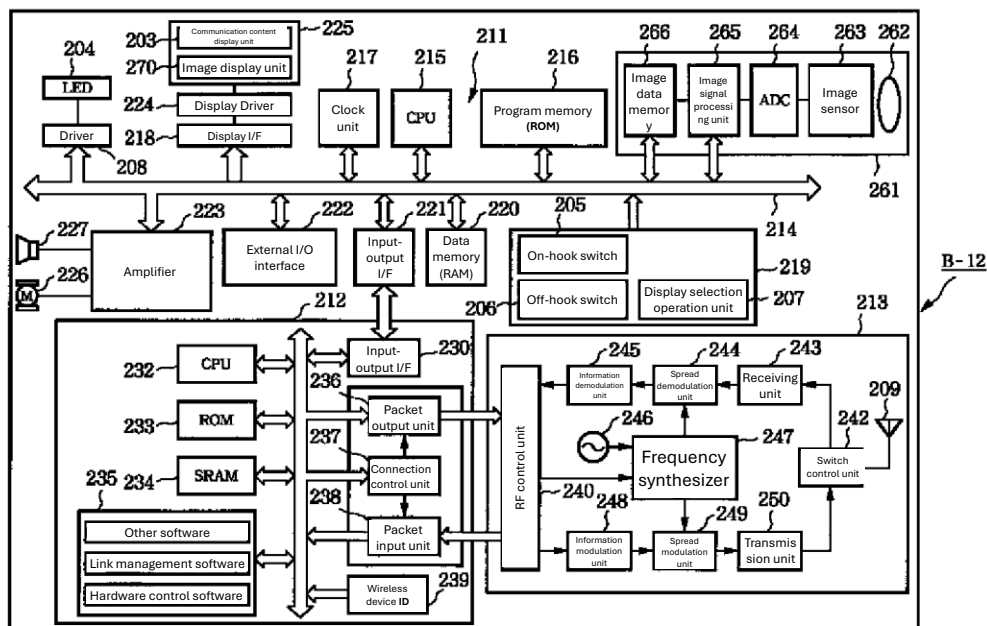
[FIG. 41]



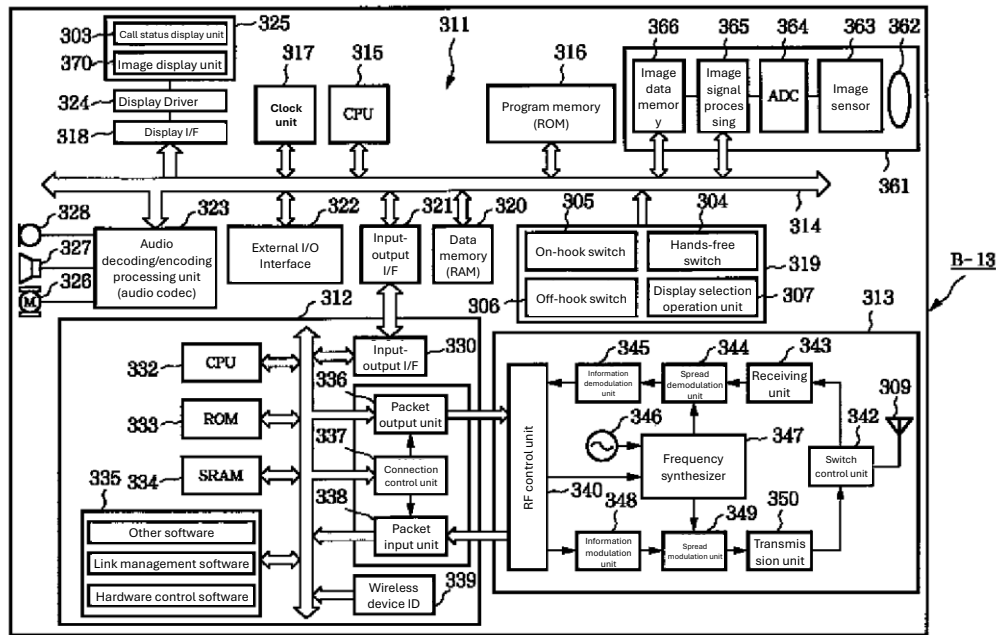
[FIG. 42]



[FIG. 43]



[FIG. 44]



Continued from front page

(51) Int. CL. ⁷	ID Number	FI	Theme Code (Reference)
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11/00	302	H 04 N 5/64	511Z
H 04 N 5/64	511	7/14	
7/14		H 04 B 7/26	109F
			109B

F term (reference) 5C064 AA01 AB03 AC02 AC13 AC16
AD08 AD09 AD14
5K023 AA07 BB11 GG05 GG06 HH07
HH08 HH12 LL05 MM00
5K027 AA11 BB02 CC08 FF22 HH03
HH26 MM03 MM13 MM16 MM17
5K051 AA08 BB01 BB02 CC01 CC07
DD01 DD12 DD13 DD15 EE01
EE02 HH01 HH12 HH13 HH14
5K067 AA34 AA42 BB04 DD23 DD52
EE03 EE10 EE16 HH05
5K101 KK02 KK16 LL01 LL03 LL05 LL11
NN03 NN17 NN25 NN34 NN36
NN37 RR11 SS07 TT06 UU16