 

# Exhibit 23

# to Motorola's Opening Claim Construction Brief

# July 28, 2011

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# United States Patent [19]

**Deluca et al.**

[11] **Patent Number: 6,008,737**

[45] **Date of Patent: *Dec. 28, 1999**

[54] **APPARATUS FOR CONTROLLING UTILIZATION OF SOFTWARE ADDED TO A PORTABLE COMMUNICATION DEVICE**

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[73] Assignee: **Motorola, Inc.**, Schaumburg, Ill.

[ * ] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/672,004**

[22] Filed: **Jun. 24, 1996**

**Related U.S. Application Data**

[63] Continuation-in-part of application No. 08/452,785, May 30, 1995, Pat. No. 5,612,682.

[51] **Int. Cl.**[6] .................... **G07D 7/00**

[52] **U.S. Cl.** .................... **340/825.34**; 340/825.34; 340/825.44; 455/408; 379/121; 705/32

[58] **Field of Search** .................... 340/825.34, 825.44, 340/825.33, 825.35, 825.22; 455/426, 405, 406, 408; 395/200.01, 200.05, 230, 232, 228, 229; 379/114, 121

[56] **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 4,875,038 | 10/1989 | Siwiak et al. | 340/825.44 |
| 5,155,680 | 10/1992 | Wiedemer | 395/232 |
| 5,325,418 | 6/1994 | McGregor et al. | 455/406 |
| 5,335,278 | 8/1994 | Matchett et al. | 340/825.34 |
| 5,371,493 | 12/1994 | Sharpe et al. | 340/825.33 |
| 5,493,492 | 2/1996 | Cramer et al. | 385/232 |
| 5,577,100 | 11/1996 | McGregor et al. | 455/406 |
| 5,606,497 | 2/1997 | Cramer et al. | 395/232 |
| 5,612,682 | 3/1997 | De Luca et al. | 340/825.44 |
| 5,633,932 | 5/1997 | Davis et al. | 340/825.34 |
| 5,652,793 | 7/1997 | Priem et al. | 340/825.34 |
| 5,664,006 | 9/1997 | Monte et al. | 455/405 |

*Primary Examiner*—Edwin C. Holloway, III
*Assistant Examiner*—Anthony A. Asongwed

[57] **ABSTRACT**

An apparatus at a fixed portion (**102**) of a communication system controls utilization of software (**398**) in a portable communication device (**122**) that includes a transceiver (**302**) for communicating with the fixed portion. The portable communication device receives (**604**) a request for utilization of the software. In response, the portable communication device seeks (**612**) a usage authorization for utilizing the software by generating (**614**) an external authorization request (**428**) that includes at least one of a size (**396**) of the software, a software name (**394**), a secure checksum, and an address (**313**) identifying the portable communication device, and by communicating (**616**) the external authorization request to the fixed portion. The secure checksum is a secure cyclic redundancy check of the software for which the portable communication device is requesting usage authorization, and is generated (**624**) by the portable communication device from a secure polynomial (**311**) stored in the portable communication device and separately by the apparatus from a same secure polynomial (**230**) stored in the apparatus. The portable communication device disallows (**640**) the utilization of the software, in response to the usage authorization being unobtainable.

**9 Claims, 7 Drawing Sheets**

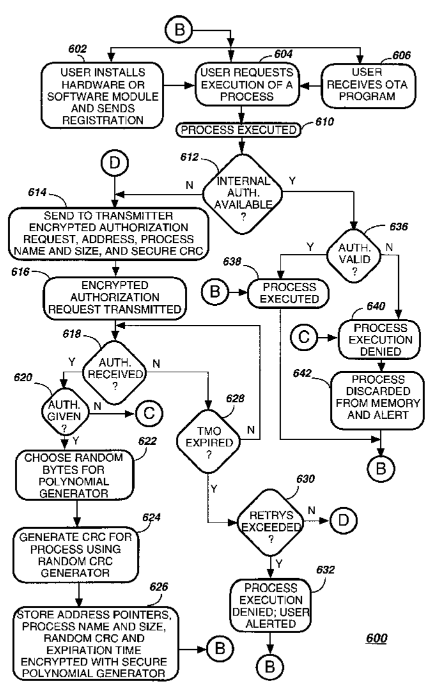



EXHIBIT 23
PAGE 1

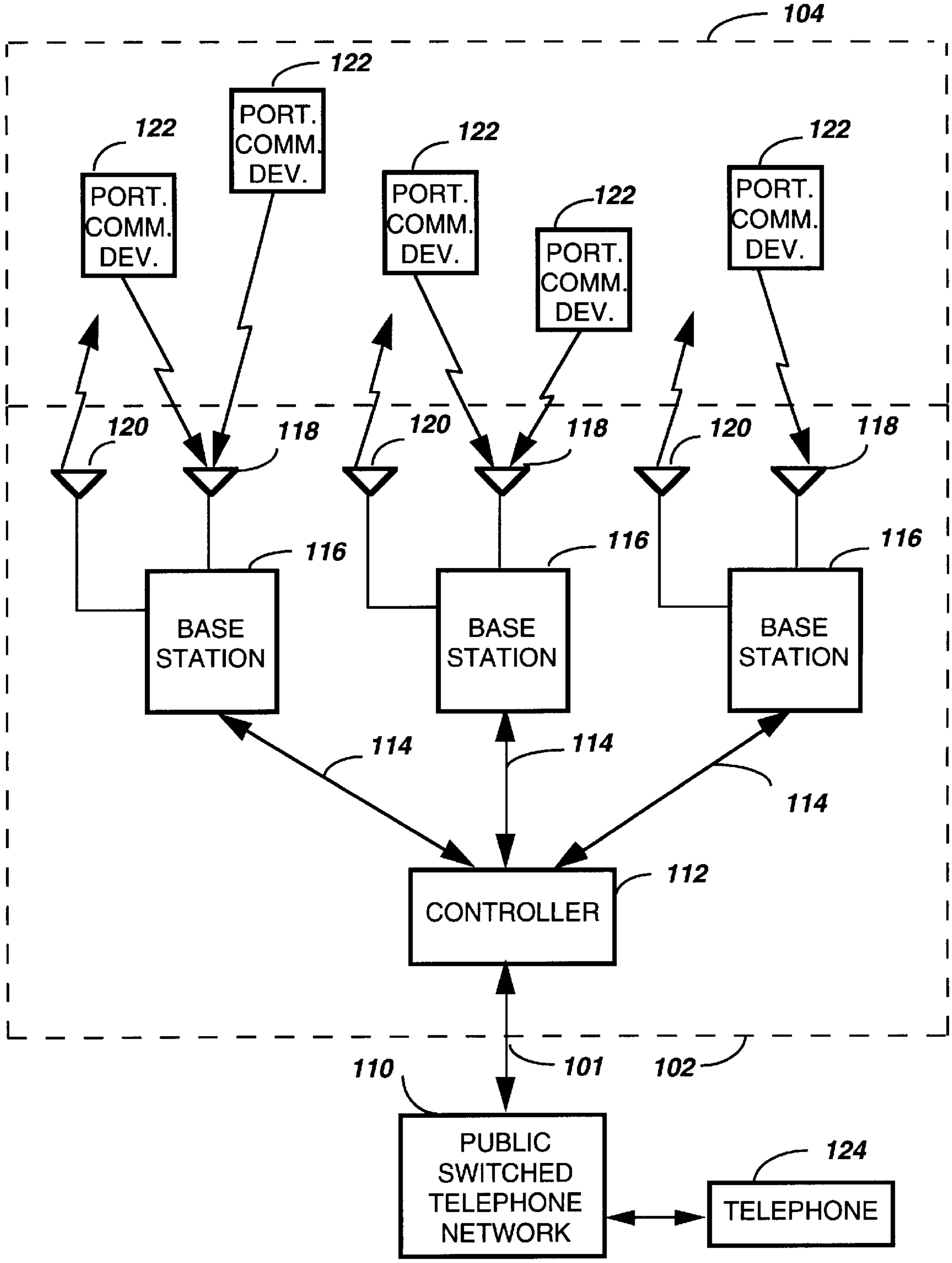



*FIG. 1*

EXHIBIT 23
PAGE 2

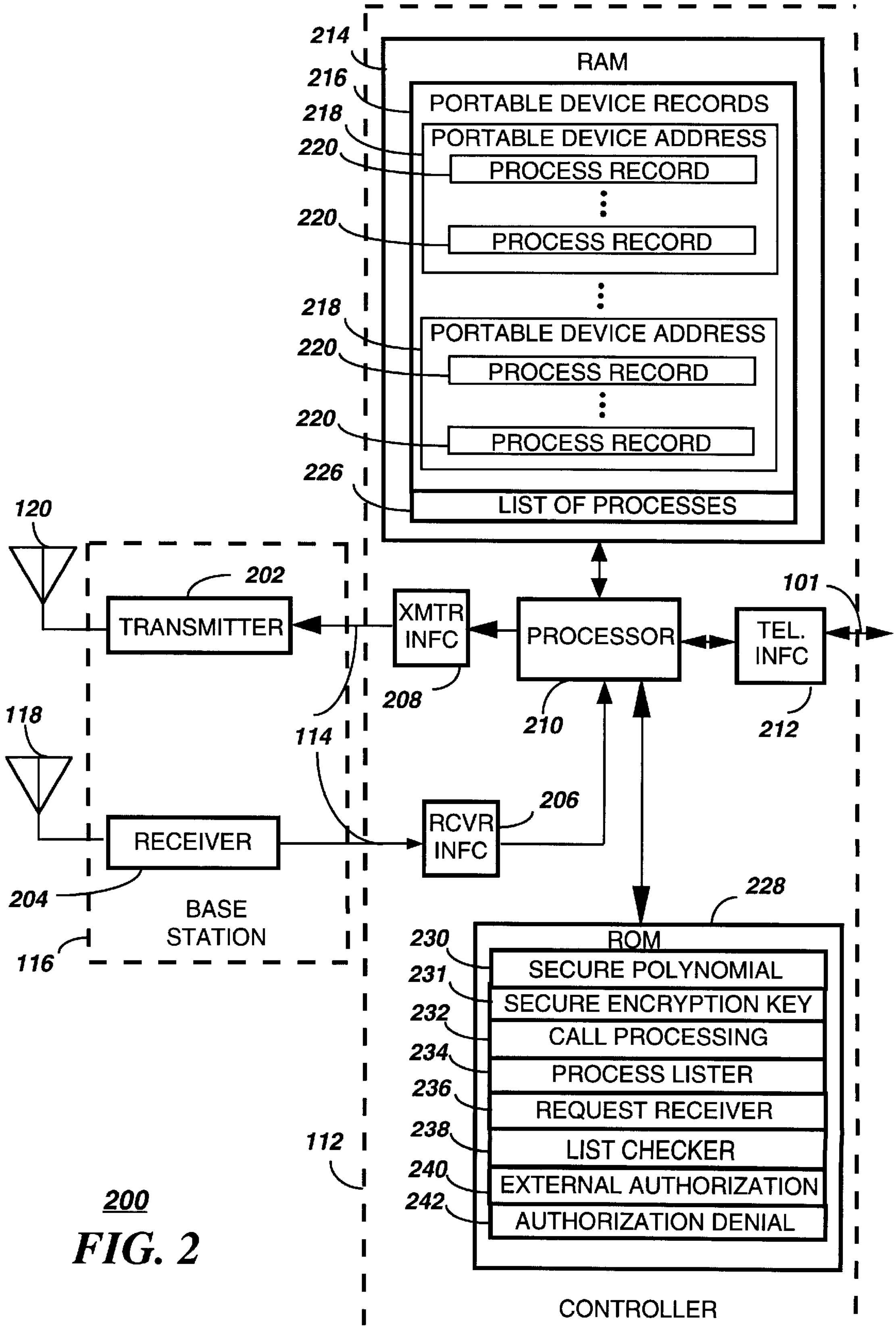

214
RAM
216
PORTABLE DEVICE RECORDS
218
PORTABLE DEVICE ADDRESS
220
PROCESS RECORD
220
PROCESS RECORD
218
PORTABLE DEVICE ADDRESS
220
PROCESS RECORD
220
PROCESS RECORD
226
LIST OF PROCESSES
120
202
TRANSMITTER
XMTR INFC
PROCESSOR
101
TEL. INFC
208
210
212
118
114
206
RCVR INFC
RECEIVER
204
BASE STATION
116
228
ROM
230
SECURE POLYNOMIAL
231
SECURE ENCRYPTION KEY
232
CALL PROCESSING
234
PROCESS LISTER
236
REQUEST RECEIVER
238
LIST CHECKER
240
EXTERNAL AUTHORIZATION
242
AUTHORIZATION DENIAL
112
CONTROLLER
200

FIG. 2

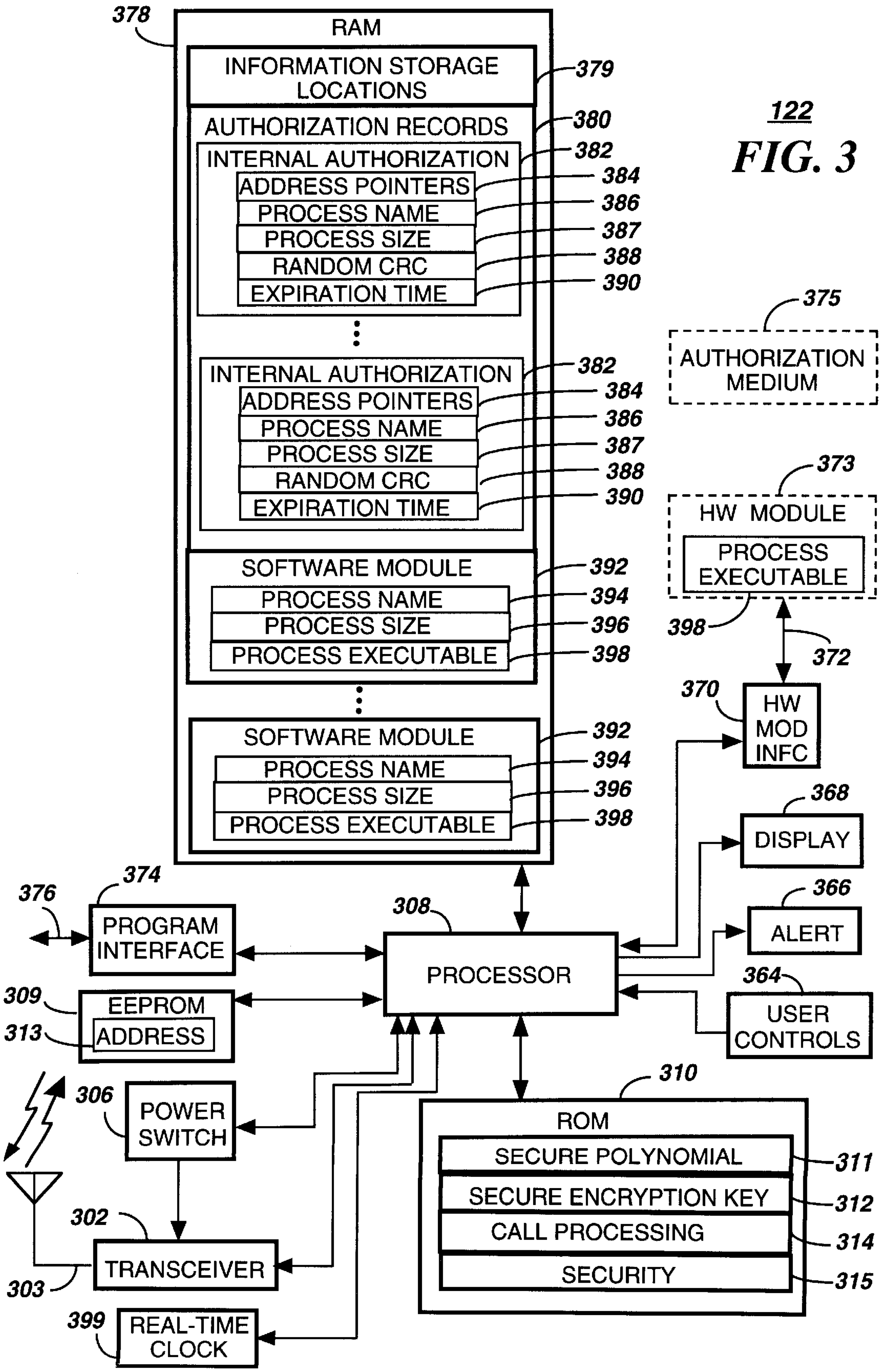

378
RAM
INFORMATION STORAGE LOCATIONS
379
AUTHORIZATION RECORDS
380
INTERNAL AUTHORIZATION
382
ADDRESS POINTERS
384
PROCESS NAME
386
PROCESS SIZE
387
RANDOM CRC
388
EXPIRATION TIME
390
INTERNAL AUTHORIZATION
382
ADDRESS POINTERS
384
PROCESS NAME
386
PROCESS SIZE
387
RANDOM CRC
388
EXPIRATION TIME
390
SOFTWARE MODULE
392
PROCESS NAME
394
PROCESS SIZE
396
PROCESS EXECUTABLE
398
SOFTWARE MODULE
392
PROCESS NAME
394
PROCESS SIZE
396
PROCESS EXECUTABLE
398
122
375
AUTHORIZATION MEDIUM
373
HW MODULE
PROCESS EXECUTABLE
398
372
370
HW MOD INFC
368
DISPLAY
366
ALERT
364
USER CONTROLS
308
PROCESSOR
374
376
PROGRAM INTERFACE
309
EEPROM
313
ADDRESS
306
POWER SWITCH
302
TRANSCEIVER
303
399
REAL-TIME CLOCK
310
ROM
SECURE POLYNOMIAL
311
SECURE ENCRYPTION KEY
312
CALL PROCESSING
314
SECURITY
315

FIG. 3

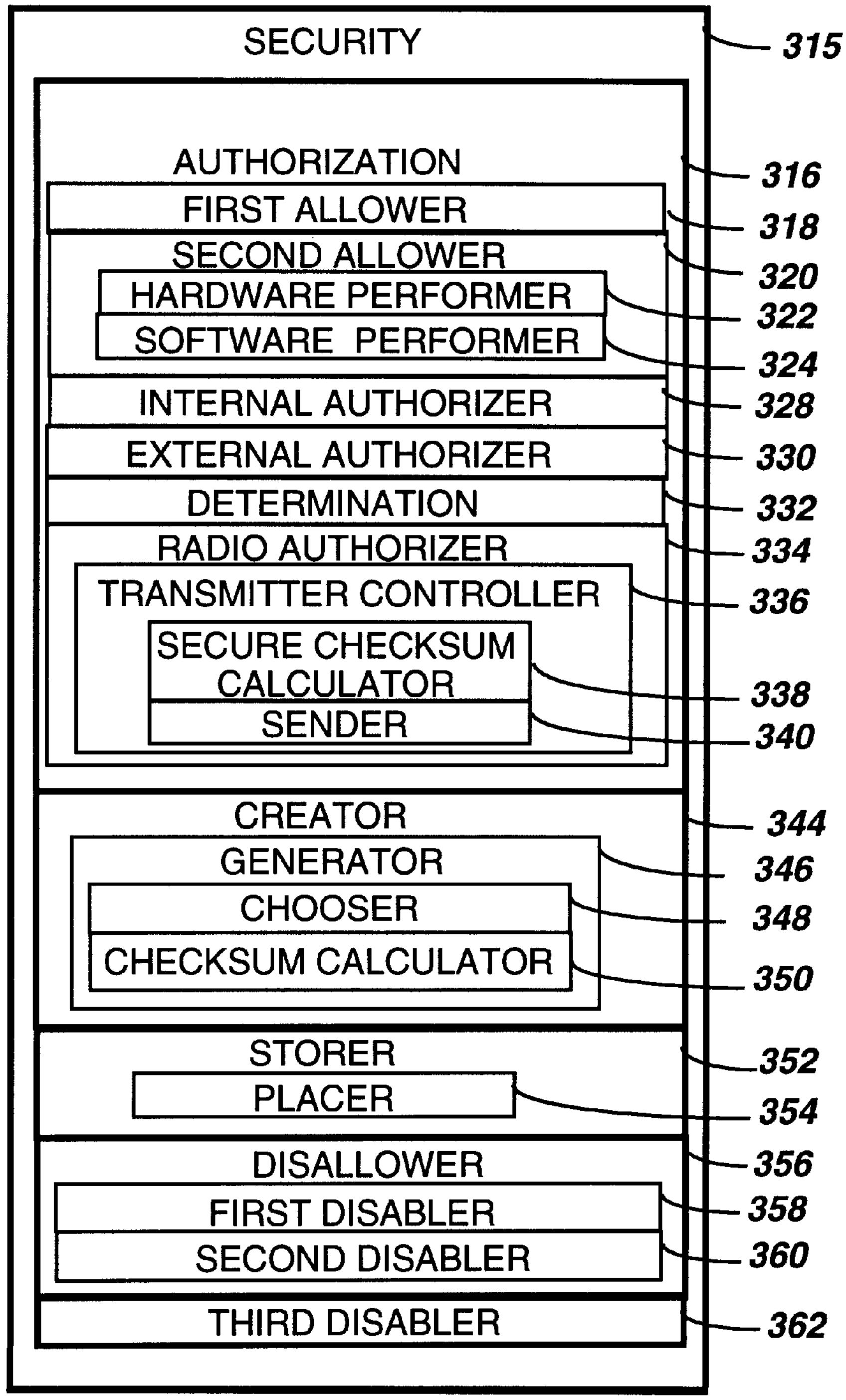
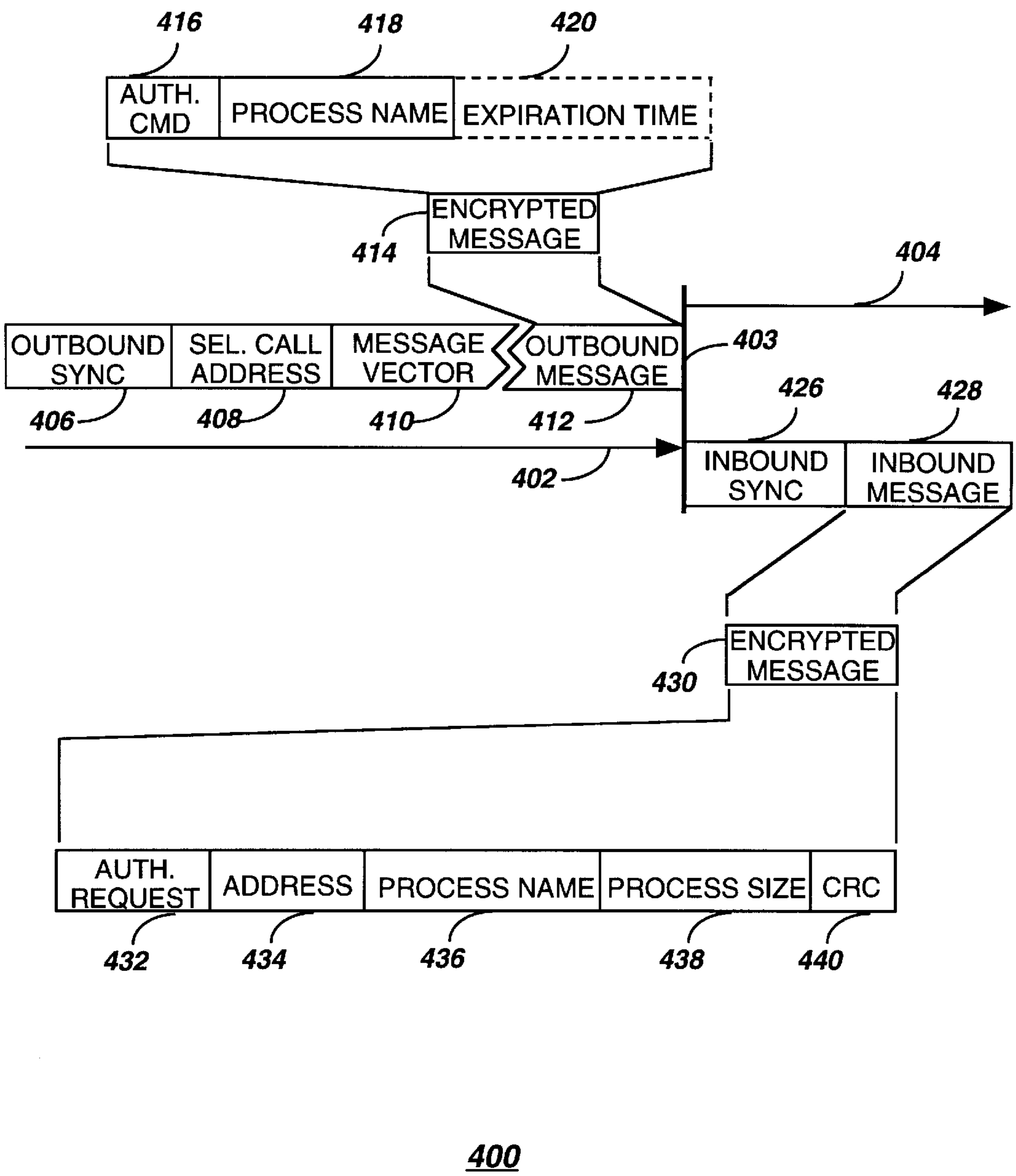
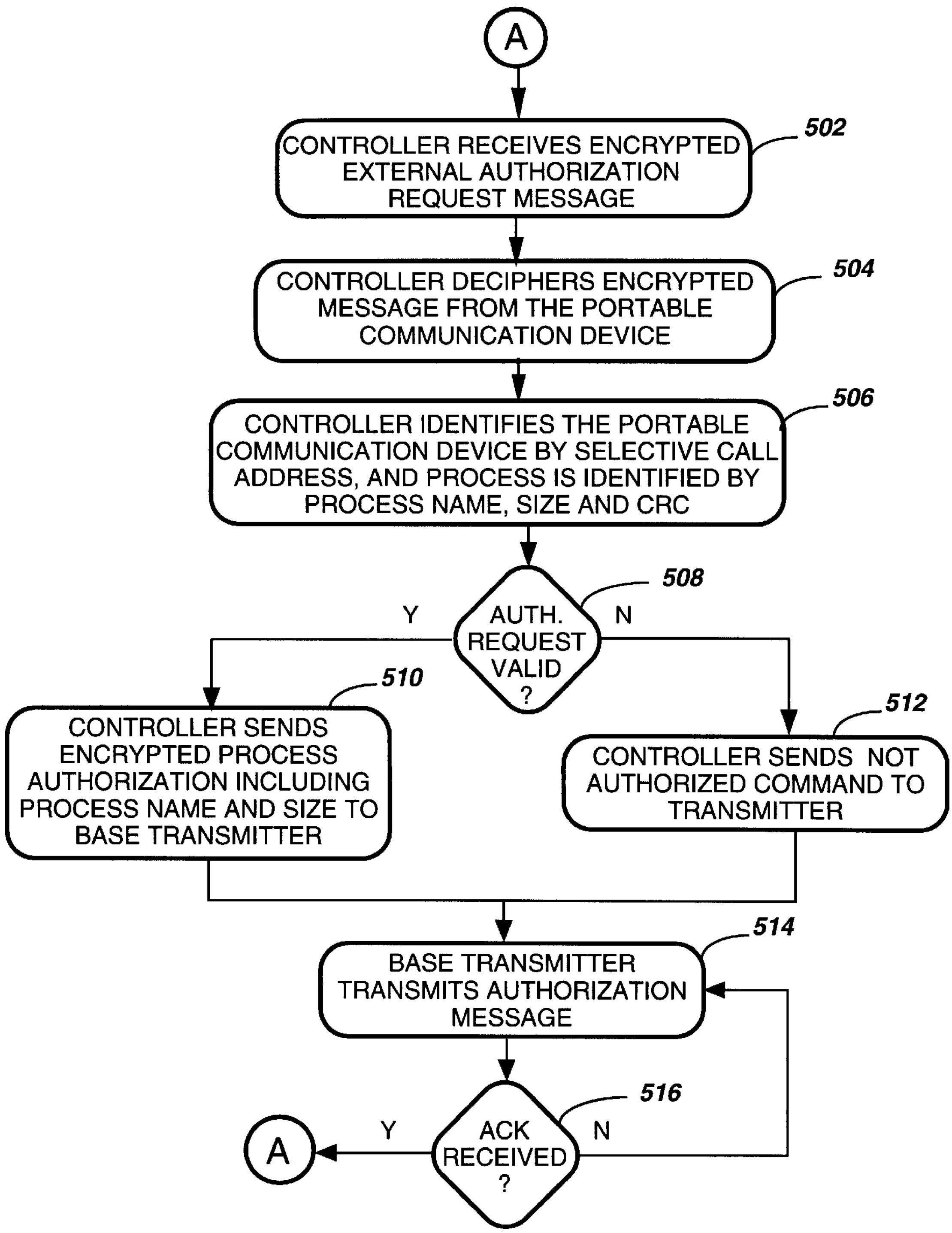

SECURITY
315
AUTHORIZATION
316
FIRST ALLOWER
318
SECOND ALLOWER
320
HARDWARE PERFORMER
322
SOFTWARE PERFORMER
324
INTERNAL AUTHORIZER
328
EXTERNAL AUTHORIZER
330
DETERMINATION
332
RADIO AUTHORIZER
334
TRANSMITTER CONTROLLER
336
SECURE CHECKSUM CALCULATOR
338
SENDER
340
CREATOR
344
GENERATOR
346
CHOOSER
348
CHECKSUM CALCULATOR
350
STORER
352
PLACER
354
DISALLOWER
356
FIRST DISABLER
358
SECOND DISABLER
360
THIRD DISABLER
362

*FIG. 4*



416
418
420
AUTH. CMD
PROCESS NAME
EXPIRATION TIME
ENCRYPTED MESSAGE
414
404
OUTBOUND SYNC
SEL. CALL ADDRESS
MESSAGE VECTOR
OUTBOUND MESSAGE
403
426
428
406
408
410
412
INBOUND SYNC
INBOUND MESSAGE
402
ENCRYPTED MESSAGE
430
AUTH. REQUEST
ADDRESS
PROCESS NAME
PROCESS SIZE
CRC
432
434
436
438
440
400


*FIG. 5*


A
CONTROLLER RECEIVES ENCRYPTED EXTERNAL AUTHORIZATION REQUEST MESSAGE
502
CONTROLLER DECIPHERS ENCRYPTED MESSAGE FROM THE PORTABLE COMMUNICATION DEVICE
504
CONTROLLER IDENTIFIES THE PORTABLE COMMUNICATION DEVICE BY SELECTIVE CALL ADDRESS, AND PROCESS IS IDENTIFIED BY PROCESS NAME, SIZE AND CRC
506
AUTH. REQUEST VALID ?
508
Y
N
CONTROLLER SENDS ENCRYPTED PROCESS AUTHORIZATION INCLUDING PROCESS NAME AND SIZE TO BASE TRANSMITTER
510
CONTROLLER SENDS NOT AUTHORIZED COMMAND TO TRANSMITTER
512
BASE TRANSMITTER TRANSMITS AUTHORIZATION MESSAGE
514
ACK RECEIVED ?
516
Y
N
A

500

*FIG. 6*

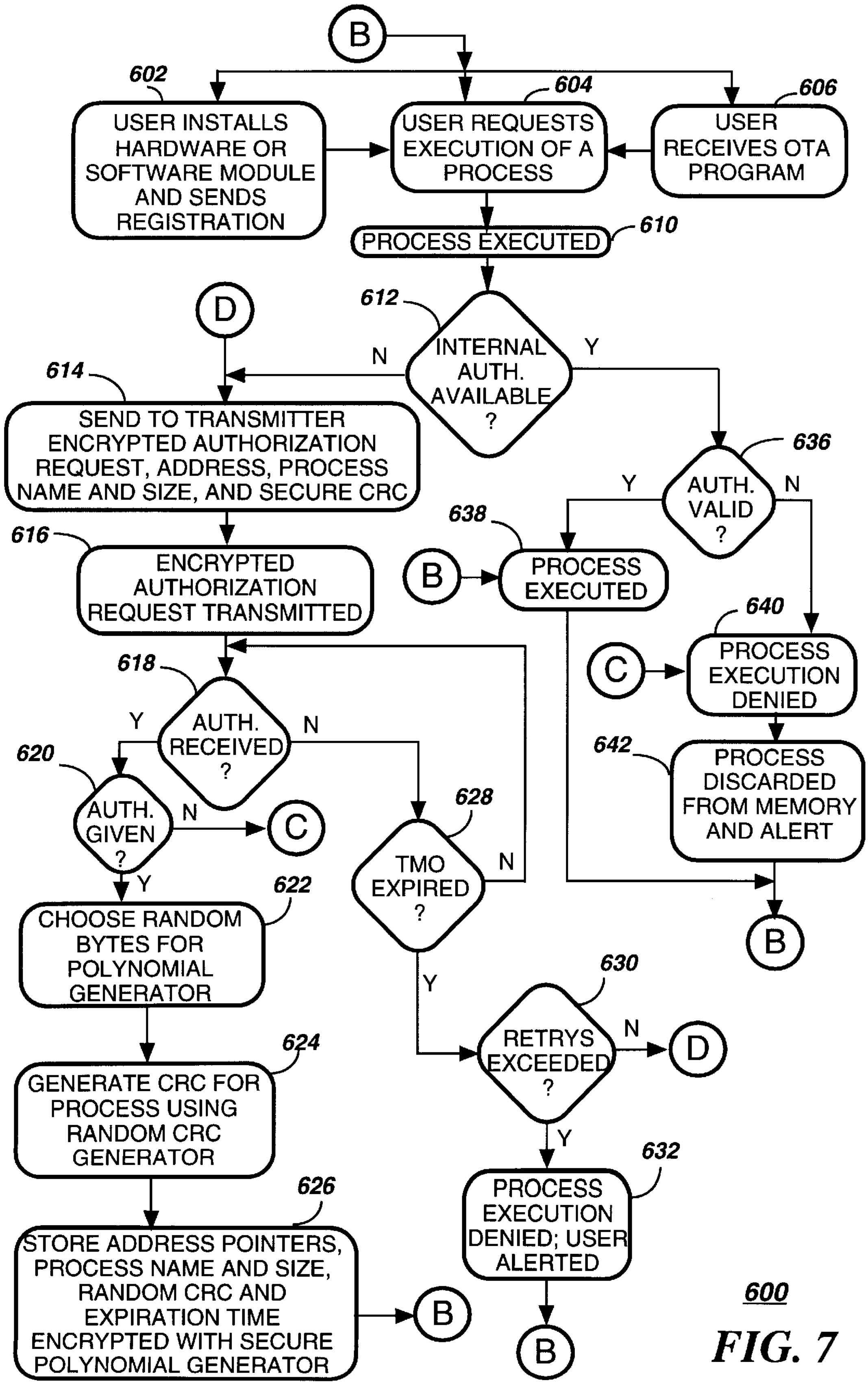

B
602
USER INSTALLS HARDWARE OR SOFTWARE MODULE AND SENDS REGISTRATION
604
USER REQUESTS EXECUTION OF A PROCESS
606
USER RECEIVES OTA PROGRAM
PROCESS EXECUTED
610
612
INTERNAL AUTH. AVAILABLE ?
N
Y
D
614
SEND TO TRANSMITTER ENCRYPTED AUTHORIZATION REQUEST, ADDRESS, PROCESS NAME AND SIZE, AND SECURE CRC
636
AUTH. VALID ?
Y
N
638
B
PROCESS EXECUTED
616
ENCRYPTED AUTHORIZATION REQUEST TRANSMITTED
640
C
PROCESS EXECUTION DENIED
618
AUTH. RECEIVED ?
Y
N
642
PROCESS DISCARDED FROM MEMORY AND ALERT
620
AUTH. GIVEN ?
N
C
Y
628
TMO EXPIRED ?
N
B
622
CHOOSE RANDOM BYTES FOR POLYNOMIAL GENERATOR
Y
630
RETRYS EXCEEDED ?
N
D
Y
624
GENERATE CRC FOR PROCESS USING RANDOM CRC GENERATOR
632
PROCESS EXECUTION DENIED; USER ALERTED
626
STORE ADDRESS POINTERS, PROCESS NAME AND SIZE, RANDOM CRC AND EXPIRATION TIME ENCRYPTED WITH SECURE POLYNOMIAL GENERATOR
B
B
600

FIG. 7

# APPARATUS FOR CONTROLLING UTILIZATION OF SOFTWARE ADDED TO A PORTABLE COMMUNICATION DEVICE

This application is a continuation-in-part of application Ser. No. 08/452,785 filed May 30, 1995, by Deluca et al., entitled "Method and Apparatus for Controlling Utilization of a Process Added to a Portable Communication Device", now U.S. Pat. No. 5,612,682, issued Mar. 18, 1997.

## FIELD OF THE INVENTION

This invention relates in general to communication systems, and more specifically to a method and apparatus for controlling utilization of a process added to a portable communication device.

## BACKGROUND OF THE INVENTION

In the past, paging devices were limited to alpha-numeric and voice paging. With technology improvements in circuit integration and more efficient communication protocols that provide two-way communication, paging devices have grown in sophistication and services provided. With today's technology improvements, paging devices are expected to acquire more sophisticated functions such as electronic mailing services, spread sheet applications, investment finance services such as stock market charts, quotation requests, purchase and sale transactions, etc. These services require sophisticated software applications and/or hardware modules to be operated in the paging device. Paging devices using sophisticated services such as these will require a means for registration and licensing to prevent unauthorized use of processes, including software applications and hardware modules. In prior art devices registration has been accomplished by mailing a signed certificate with a purchase receipt of a software application or hardware module. This form of registration, however, does not prevent an unscrupulous user from using pirated software applications and/or unauthorized hardware modules.

Thus, what is needed is a method and apparatus for controlling utilization of a process added to a portable communication device. Preferably, the method and apparatus should serve as a mechanism to prevent unauthorized use of software applications and hardware modules.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an electrical block diagram of a communication system in accordance with the preferred embodiment of the present invention.

FIG. **2** is an electrical block diagram of elements of a fixed portion of the communication system in accordance with the preferred embodiment of the present invention.

FIGS. **3** and **4** are elements of an electrical block diagram of a portable communication device in accordance with the preferred embodiment of the present invention.

FIG. **5** is a timing diagram of elements of an outbound protocol and an inbound protocol of the fixed and portable portions of the communication system in accordance with the preferred embodiment of the present invention.

FIG. **6** is a flow chart depicting an authorization operation of the fixed portion in response to a message originated by the portable communication device in accordance with the preferred embodiment of the present invention.

FIG. **7** is a flow chart depicting an authorization operation of the portable communication device as it attempts to obtain authorization to use a process in accordance with the preferred embodiment of the present invention.



## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, an electrical block diagram of a communication system in accordance with the preferred embodiment of the present invention comprises a fixed portion **102** and a portable portion **104**. The fixed portion **102** includes a plurality of base stations **116**, for communicating with the portable portion **104**, utilizing conventional techniques well known in the art, and coupled by communication links **114** to a controller **112** which controls the base stations **116**. The hardware of the controller **112** is preferably a combination of the Wireless Messaging Gateway (WMG™) Administrator!™ paging terminal and the RF-Conductor!® message distributor manufactured by Motorola, Inc. The hardware of the base stations **116** is preferably a combination of the Nucleus® RF-Orchestra!™ transmitter and RF-Audience!™ receivers manufactured by Motorola, Inc. It will be appreciated that other similar hardware can be utilized as well for the controller **112** and base stations **116**.

Each of the base stations **116** transmits radio signals to the portable portion **104** comprising a plurality of portable communication devices **122** via a transmitting antenna **120**. The base stations **116** each receive radio signals from the plurality of portable communication devices **122** via a receiving antenna **118**. The radio signals comprise selective call addresses and messages transmitted to the portable communication devices **122** and acknowledgments received from the portable communication devices **122**. It will be appreciated that the portable communication devices **122** can also originate messages other than acknowledgments, as will be described below. The controller **112** preferably is coupled by telephone links **101** to a public switched telephone network (PSTN) **110** for receiving selective call originations therefrom. Selective call originations comprising voice and data messages from the PSTN **110** can be generated, for example, from a conventional telephone **124** coupled to the PSTN **110** in a manner that is well known in the art.

Data and control transmissions between the base stations **116** and the portable communication devices **122** preferably utilize a protocol similar to Motorola's well-known FLEX™ digital selective call signaling protocol. This protocol utilizes well-known error detection and error correction techniques and is therefore tolerant to bit errors occurring during transmission, provided that the bit errors are not too numerous in any one code word.

Outbound channel transmissions comprising data and control signals from the base stations **116** preferably utilize two and four-level frequency shift keyed (FSK) modulation, operating at sixteen-hundred or thirty-twohundred symbols-per-second (sps), depending on traffic requirements and system transmission gain. Inbound channel transmissions from the portable communication devices **122** to the base stations **116** preferably utilize four-level FSK modulation at a rate of ninety-six-hundred bits per second (bps). Inbound channel transmissions preferably occur during predetermined data packet time slots synchronized with the outbound channel transmissions. It will be appreciated that, alternatively, other signaling protocols, modulation schemes, and transmission rates can be utilized as well for either or both transmission directions. The outbound and inbound channels preferably operate on a single carrier frequency utilizing well-known time division duplex (TDD) techniques for sharing the frequency. It will be further appreciated that, alternatively, the outbound and inbound channels can operate on two different carrier frequencies using frequency division multiplexing (FDM) without requiring the use of TDD techniques.

U.S. Pat. No. 4,875,038 to Siwiak et al., which describes a prior art acknowledge-back radio communication system, is hereby incorporated herein by reference. For further information on the operation and structure of an acknowledge-back radio communication system, please refer to the Siwiak et al., patent.

Referring to FIG. **2**, an electrical block diagram of elements **200** of the fixed portion **102** in accordance with the preferred embodiment of the present invention comprises portions of the controller **112** and the base stations **116**. The controller **112** comprises a processor **210** for directing operation of the controller **112**. The processor **210** preferably is coupled through a transmitter interface **208** to a transmitter **202** via the communication links **114**. The communication links **114** use conventional means well known in the art, such as a direct wire line (telephone) link, a data communication link, or any number of radio frequency links, such as a radio frequency (RF) transceiver link, a microwave transceiver link, or a satellite link, just to mention a few. The transmitter **202** transmits two and four-level FSK data messages to the portable communication devices **122**. The processor **210** is also coupled to at least one receiver **204** through a receiver interface **206** via the communication links **114**. The receiver **204** demodulates four level FSK and can be collocated with the base stations **116**, as implied in FIG. **2**, but preferably is positioned remote from the base stations **116** to avoid interference from the transmitter **202**. The receiver **204** is for receiving one or more acknowledgments and/or messages from the portable communication devices **122**.

The processor **210** is coupled to a telephone interface **212** for communicating with the PSTN **110** through the telephone links **101** for receiving selective call originations. The processor **210** is also coupled to a random access memory (RAM) **214** comprising a database of portable device records **216** and a database of processes **226**. The database of portable device records **216** contains, as a minimum, a list of process records **220** for each portable communication device **122**. To access the list of process records **220** of a portable communication device **122**, a portable device address **218** corresponding to the address of a portable communication device **122** is used to search the database of portable device records **216**. The list of process records **220** specifies the software and hardware processes which are authorized for use by a portable communication device **122** having the portable device address **218**. Each process record **220** contains a list of process verification elements used for process authorization of external authorization requests transmitted by the portable communication devices **122**, as will be described below. The verification elements contained in the process record **220** for both hardware and software processes include a process name, a process size and a secure cyclic redundancy check (CRC).

The database of processes **226** preferably comprises binary executables (machine code) of many of the authorized software processes available for use by the portable communication devices **122**. The software processes stored in the RAM **214** of the controller preferably can be delivered to portable communication devices **122** by way of over-the-air (OTA) programming utilizing techniques well known in the art.

The processor **210** also is coupled to a read-only memory (ROM) **228**. It will be appreciated that other types of memory, e.g., electrically erasable programmable ROM (EEPROM) or magnetic disk memory, can be utilized for the ROM **228**, as well as the RAM **214**. It will be further appreciated that the RAM **214** and the ROM **228**, singly or in combination, can be integrated as a contiguous portion of the processor **210**. Preferably, the processor **210** is similar to the DSP**56100** digital signal processor (DSP) manufactured by Motorola, Inc. It will be appreciated that other similar processors can be utilized for the processor **210**, and that additional processors of the same or alternate type can be added as required to handle the processing requirements of the controller **112**.



The first two elements in the ROM **228** include a secure polynomial **230** and a secure encryption key **231**. The secure polynomial **230** is used as a secure polynomial generator for CRC verification of process executables requested by external authorization request messages transmitted by portable communication devices **122**. The portable communication devices **122** use the same secure polynomial generator for CRC generation. Using the same secure polynomial generator for both the fixed portion **102** and portable portion **104** of the communication system provides a means for verifying authenticity of software and hardware processes requested by the portable communication devices **122**. The secure encryption key **231** is used for encryption and decryption of authorization messages transmitted between the portable communication devices **122** and the base stations **116**. Similarly, the portable communication devices **122** use the same secure encryption key for external authorization message transactions. Using secure encryption between the fixed portion **102** and the portable portion **104** of the communication system provides a method for transmitting secure two-way messages which are unlikely to be breached. The encryption process converts an unscrambled sequence to a pseudo-random sequence coded by a scrambler and decoded by a descrambler. The scrambler and descrambler use preferably polynomial generators with feedback paths which use modulo **2** (Exclusive Or) addition on the feedback taps. The descrambler uses the same architecture as the scrambler for descrambling the message. Using a nonlinear feedback shift register (NFSR) architecture provides a secure approach for message encryption which makes it difficult, if not computationally intractable for a person to decipher the encryption key. The present invention preferably uses a conventional self-synchronizing stream encryption system which utilizes a NFSR architecture, as is well known by one of ordinary skill in the art. It will be appreciated that, alternatively, other methods which provide suitably secure encryption can be used. It will be further appreciated that, alternatively, message transactions between the base stations **116** and the portable communication devices **122** can be non-encrypted.

To protect against unauthorized access, the secure polynomial **230** and the secure encryption key **231** preferably are stored in a secure portion of the ROM **228** which can only be accessed by the processor **210**. Preferably, this portion of the ROM **228** is integrated with the processor **210** as a protected mask read only memory (MROM), and is programmed during the manufacturing process of the processor **210**. As is well known by one of ordinary skill in the art, once a protected MROM has been programmed the protected portion of the MROM is only accessible by the processor **210** and cannot be accessed by external hardware coupled to the processor **210**. Alternatively, the secure polynomial **230** and the secure encryption key **231** can be included in a re-programmable non-volatile memory such as a FLASH memory, an EEPROM memory or magnetic disk memory, but accessibility of the secure polynomial **230** and secure encryption key **231** are preferably restricted by the service provider to authorized personnel only. Using re-programmable non-volatile memories provides flexibility of adding more polynomial elements and encryption keys for system and subscriber unit expansion.

The ROM **228** of the processor **210** also includes firmware elements for use by the processor **210**. The firmware elements include a call processing element **232**, a process lister element **234**, a request receiver element **236**, a list checker element **238**, an external authorization element **240** and an authorization denial element **242**. The call processing element **232** handles the processing of an incoming call for a called party and for controlling the transmitter **202** to send a selective call message to the portable communication device **122** corresponding to the called party, utilizing techniques well known in the art. The process lister element **234** manages the database of portable device records **216** stored in the RAM **214** for each portable communication device **122** utilizing database management techniques well known in the art. The request receiver element **236** processes encrypted external authorization request messages received by the receiver **204** of the base station **116** and originating from the portable communication devices **122**. The encrypted external authorization request message is decrypted with the secure encryption key **231** described above. The external authorization request for hardware and software processes comprises at least a process name and a process size corresponding to the process, along with a secure checksum and an address identifying the portable communication device **122**. Optionally, an authorization request command can accompany the external authorization request message. Preferably, the authorization request command is included in the address portion of the portable communication device **122** address. Alternatively, the authorization request command can be in a separate element in the external authorization request message. The secure checksum is preferably a secure CRC of the software process for which the portable communication device **122** is requesting authorization. The CRC is generated by the portable communication device **122** by using a polynomial generator stored in its memory, which is the same as the secure polynomial **230** used by the controller **112**, as described above. The secure checksum provides a means for verifying that the process being used by the portable communication device **122** is an authorized version. The list checker element **238** uses the address, corresponding to the portable communication device **122**, received in the external authorization request message as a portable device address **218**. The processor **210**, as described above, searches through the database of portable device records **216** to find the list of process records **220** corresponding to the portable device address **218** matching the address of the portable communication device **122**. The list checker element **238** then checks each process record **220** for a match to the process name, process size and secure CRC received in the external authorization request message. If a match is found, then authorization is given to the portable communication device **122** for using the requested software or hardware process. If a match is not found, then authorization is denied. When the list checker element **238** authorizes a process requested by the portable communication device **122**, the processor **210** calls on the external authorization element **240** to process the external authorization response message to be transmitted to the portable communication device **122**. The external authorization response message preferably comprises an authorization command, the process name of the authorized process and an expiration time for the process. It will be appreciated that, alternatively, the external authorization response message can include a plurality of process names and expiration times authorizing a plurality of processes requested by the portable communication device **122**. Before the external authorization element **240** sends the external authorization response message to the transmitter **202** of the base station **116**, the external authorization response message is encrypted, using the method described above, to secure the RF transmission of the message. When the list checker element **238** denies authorization of a process to a portable communication device **122**, the processor **210** calls on the authorization denial element **242** to process the external authorization denial response message to be transmitted to the portable communication device **122**. The external authorization denial response message comprises an authorization command which includes a "not authorized" signal denying authorization, and a process name of the process being denied. It will be appreciated that the external authorization denial response message can include a plurality of process names denying authorization to a plurality of processes requested by the portable communication device **122**. As is done with the external authorization response message, the external authorization denial response message is encrypted before it is transmitted to the portable communication device **122** by the base stations **116**.

According to an auditing operation of the fixed portion **102**, the processor **210** is programmed by way of the ROM **228** to periodically audit the portable communication device **122** through a radio channel of the communication system to determine a catalog of internal authorizations **382** (FIG. **3**) stored in the portable communication device **122**. In addition, the processor **210** is programmed to periodically audit the portable communication device **122** through a radio channel of the communication system to determine a quantitative usage of each of the processes **398** (FIG. **3**) used by the portable communication device **122**, and to bill a user of the portable communication device **122** in response to the quantitative usage determined. The processor **210** is also programmed by way of the ROM **228** to maintain a list of authorized processes **398** in the process records **220** corresponding to the portable communication device **122**, and to compare the catalog of internal authorizations **382** with the list of authorized processes **398** corresponding to the portable communication device to determine whether any of the internal authorizations **382** stored in the portable communication device **122** are invalid. The processor **210** is further programmed by way of the ROM **228** to store an indication in a user database entry (not shown) in the RAM **214** corresponding to the portable communication device **122** that an invalid internal authorization **382** has been found therein, in response to determining that at least one of the internal authorizations **382** stored in the portable communication device **122** is invalid. The processor **210** is also programmed to transmit a command to the portable communication device **122** to delete at least one of the internal authorizations **382**, in response to determining that the at least one of the internal authorizations **382** stored in the portable communication device **122** is invalid. These operational features will be described further herein below.

According to a message sending operation of the fixed portion **102**, the processor **210** is programmed by way of the ROM **228** to queue a message for transmission to the portable communication device **122**, the message requiring a predetermined process **398** in the portable communication device **122** in order to process the message. In addition, the processor **210** is programmed to determine that the portable communication device **122** does not have a predetermined usage authorization **382** for utilizing the predetermined process **398**; and in response, to grant the predetermined usage authorization **382** to the portable communication device **122** through the radio channel of the communication system (after verifying, for example, that the account of the user of the portable communication device **122** is in good standing). Preferably, the processor **210** determines that the portable communication device **122** does not have the predetermined usage authorization **382** by auditing the portable communication device **122** over the radio channel. It will be appreciated that, alternatively, the processor **210** can determine from its own internal process records **220** that the portable communication device **122** has not been previously authorized for utilizing the predetermined process **398**.

If the predetermined process **398** is a software process, the processor **210** is further programmed to determine that the portable communication device **122** does not have the software process, e.g., by receiving from the portable communication device **122** a request for the software process; and in response, to download the software process to the portable communication device **122** through the radio channel. Preferably, before downloading the software process, the processor **210** is further programmed to transmit terms of a licensing agreement to the portable communication device **122**, to receive from the portable communication device **122** a reply indicating whether the user of the portable communication device **122** agrees to the terms, and to omit downloading of the software process in response to the reply indicating that the user does not agree to the terms of the licensing agreement. These operational features will be described further herein below.

Referring to FIG. **3**, an electrical block diagram of the portable communication device **122** in accordance with the preferred embodiment of the present invention comprises a transceiver antenna **303** for transmitting radio signals to the base stations **116** and for intercepting radio signals from the base stations **116**. The transceiver antenna **303** is coupled to a transceiver **302** utilizing conventional techniques well known in the art. The radio signals received from the base stations **116** use conventional two and four-level FSK. The radio signals transmitted by the portable communication device **122** to the base stations **116** use fourlevel FSK.

Radio signals received by the transceiver **302** produce demodulated information at the output. The demodulated information is coupled to the input of a processor **308**, which processes the information in a manner well known in the art. Similarly, inbound response messages are processed by the processor **308** and delivered to the transceiver **302** which is coupled to the processor **308**. The response messages transmitted by the transceiver **302** are preferably modulated using four-level FSK.

A conventional power switch **306**, coupled to the processor **308**, is used to control the supply of power to the transceiver **302**, thereby providing a battery saving function. The processor **308** is coupled to a random access memory (RAM) **378** for storing messages in information storage locations **379**. The RAM **378** further comprises authorization records **380** and software modules **392**. The authorization records **380** include internal authorization records **382** of processes, either software or hardware, which have been authorized for use by the portable communication device **122**. The software modules **392** include a process name **394**, a process size **396** and a process executable **398**. The internal authorization record **382** is encrypted using a secure encryption key **312** stored in a read only memory (ROM) **310** of the portable communication device **122**. The encryption key used is the same as that used by the controller **112** described above. The internal authorization record **382** for hardware and software processes comprises address pointers **384**, a process name **386**, a process size **387**, a random CRC **388** of the authorized hardware or software process executable **398** and an expiration time **390**. The address pointers **384** preferably include two address pointers which point to two byte locations within the process executable **398** of the authorized hardware or software process. The two bytes are chosen by a random process which preferably uses a real-time clock **399** for generating random address pointers. The real-time clock **399** determines time (in hours, minutes and seconds) and calendar date, which is also used for determining the expiration time of a process, as will be described below. To determine the two random address pointers the real-time clock **399** is used in conjunction with the random event of the user requesting use of a process through the user controls **364**. When the user depresses a button on the user controls **364** requesting execution of a process, the processor **308** reads the time specified by the real-time clock **399**. The real-time clock **399** reading is in binary format and is sufficiently long to cover a wide address spectrum. Depending on the number of bytes contained in the process executable **398** the user is requesting, a limited number of bits are chosen in the real-time clock reading to cover the size of the process executable **398**. The limited real-time clock reading is then used as an address pointer to a first random byte in the requested process executable **398**. The second random address pointer points to a second random byte location. The two bytes together represent a 16 bit polynomial generator seed for generating the random CRC **388** of the hardware or software process executable **398**. As is well known by one of ordinary skill in the art, a polynomial generator must follow certain guidelines such as, for example, the polynomial generator must not contain all zeros or all ones. When the two bytes chosen violate any polynomial generator rules, the address pointers are moved to a next higher location in the process executable **398**. If the end of the process executable **398** is reached then the random address pointers wrap around to the beginning of the process executable **398**. This process continues until a valid set of bytes are chosen which meet the polynomial generator rules. It will be appreciated that, alternatively, more than two bytes can be used for the random polynomial generator. The expiration time **390** includes a date, and optionally a time when the authorization of the hardware or software process expires. Whenever a process execution is requested by the user, the expiration time **390** is compared to the real-time clock **399** to determine if authorization of the hardware or software process has expired. It will be appreciated that reprogrammable non-volatile memory devices, such as, for example, EEPROM or FLASH memories, can be used to prevent loss of the authorization records **380** stored in the RAM **378** during a power outage.

The processor **308** is also coupled to a programming interface **374** and a hardware module interface **370**. The programming interface **374** allows for external software module download into the RAM **378**. The programming interface **374** preferably uses a serial communication interface **376** for communication with the processor **308**. The serial interface preferably uses a conventional universal asynchronous receiver transmitter (UART) well known in the art. The physical means for the interface preferably uses metal contacts. It will be appreciated that, alternatively, other physical means can be used, such as infrared, inductive coupling, etc. The hardware module interface **370** allows for attachments of hardware modules to the portable communication device **122**. The hardware module interface **370** preferably uses a hardware interface **372**, well known in the art, such as the Personal Computer Memory Card International Association (PCMCIA) interface. With this interface any type of hardware module **373** conforming to the PCMCIA standard can be attached to the portable communication device **122**. The function of the hardware module **373** can include any number of functions such as a software module hardware accelerator, video graphics card, expanded memory card, etc. It will be appreciated that the programming interface **374** and the hardware module interface **370** can use other interfaces for software download and hardware attachments, well known in the art.

The ROM **310** coupled to the processor **308** comprises a secure polynomial **311**, a secure encryption key **312** and firmware elements for use by the processor **308**. It will be appreciated that other types of memory, e.g., EEPROM, can be utilized as well for the ROM **310**. The secure polynomial **311** includes a secure polynomial generator for CRC generation of hardware and software process executables **398**. The secure polynomial **311** used by the portable communication device **122** matches the secure polynomial **230** used by the controller **112** described above. The secure encryption key **312** is used for scrambling and descrambling external authorization messages transmitted between the portable communication device **122** and the base stations **116**. The secure encryption key **312** used by the portable communication device **122** matches the secure encryption key **231** used by the controller **112**. The secure polynomial **311** and secure encryption key **312** are stored in a protected portion of the ROM **310** utilizing the techniques described for the controller **112**.

The firmware elements comprise a call processing element **314** which handles incoming messages on the outbound channel using techniques well known in the art. When an address is received by the processor **308**, the call processing element **314** compares one or more addresses **313** stored in an EEPROM **309**, and when a match is detected, a call alerting signal is generated to alert a user that a message has been received. The call alerting signal is directed to a conventional audible or tactile alerting device **366** for generating an audible or tactile call alerting signal. In addition, the call processing element **314** processes the message which is received in a digitized conventional manner and then stores the message in one of the information storage locations **379** in the RAM **378**. The message can be accessed by the user through user controls **364**, which provide functions such as lock, unlock, delete, read, etc. More specifically, by the use of appropriate functions provided by the user controls **364**, the message is recovered from the RAM **378**, and then displayed on a display **368**, e.g., a conventional liquid crystal display (LCD).

The firmware elements further comprise a security element **315** for processing authorization of software modules **392** and hardware modules **373**. The elements contained in the security element **315** are shown in FIG. **4**. The security element **315** includes an authorization element **316**, a second allower element **320**, a creator element **344**, a storer element **352**, a disallower element **356** and a third disabler element **362**. When a user requests utilization of a hardware or software process by the use of appropriate functions provided by the user controls **364**, the processor **308** calls on the authorization element **316** to process the request. The processor **308** begins the authorization process by invoking a first allower element **318** which, optionally, allows immediate utilization of the process requested. Whether or not the first allower element **318** allows immediate utilization of a process is determined by programming of the portable communication device **122** performed by the system provider. The processor **308** follows by invoking a determination element **332** which is used for making a determination of whether an internal authorization record **382** exists for utilizing the hardware or software process. The determination of a valid internal authorization record **382** is made by searching through the authorization records **380** for a process name **386** which matches the module name of the hardware or software process requested by the user. If a match is determined, then an internal authorizer element **328** is called on by the processor **308** to read the address pointers **384** to determine the random polynomial generator to be used for random CRC generation over the process executable **398** of the hardware or software module. The internal authorizer element **328** uses the process size **387** corresponding to the module size of the hardware or software process executable **398** to calculate a random CRC over the process executable **398** of the hardware or software process. If the CRC generated matches the random CRC **388** stored in the internal authorization record **382**, then the processor **308** invokes the second allower element **320** to check the expiration time **390** against the real-time clock **399**. If the expiration time has not expired, then the processor **308** allows the utilization of the process, in response to the usage authorization being obtained. However, if the expiration time has expired then the processor **308** calls on the third disabler element **362** for disabling further utilization of the process in response to an expiration of the usage authorization.

If the determination element **332** does not find an internal authorization record **382** for the hardware or software process requested by the user, then a radio authorizer element or authorizer element **334** is called on for communicating with the fixed portion **102** by sending a signal indicative of the hardware or software module to obtain the usage authorization as an external authorization, in response to the internal authorization being absent from the authorization records **380**. The radio authorizer element **334** attempts to obtain the usage authorization through a first radio channel (the inbound channel) of the communication system. If the external authorization request is denied, then the processor **308** calls on a first disabler element **358** to disable further utilization of the process, in response to receiving a "not authorized" signal through a second radio channel (the outbound channel) of the communication system. If the external authorization request is not received within a predetermined time interval, then the processor **308** invokes a second disabler element **360** to disable utilization of the process requested by the user. To create the external authorization request message, the radio authorizer element **334** invokes a transmitter controller element **336**. The transmitter controller element **336** calls on a secure checksum calculator element **338** which uses the secure polynomial **311** stored in the ROM **310** to calculate a secure CRC over the process executable **398** of the hardware or software process requested by the user. Once the secure CRC is determined, the processor **308** prepares an external authorization request message comprising an authorization request command, the address of the portable communication device **122**, the process name, the size of the hardware or software process executable **398**, and the secure CRC calculated by the secure checksum calculator element **338**. Once the external authorization request message has been determined the transmitter controller element **336** encrypts the message with the secure encryption key **312**. The processor **308** then invokes a sender element **340** and sends the message to the transceiver **302**, which thereafter transmits the encrypted external authorization request message to the base stations **116**. If an encrypted external authorization response message is received from the base stations **116** indicating the hardware or software process is authorized, then the processor **308** accesses a second allower element **320** to process the message. If the external authorization response message was for a hardware module **373** authorizing utilization of the process, then the second allower element **320** invokes a hardware performer element **322** for performing the process in accordance with circuits of the hardware module **373**. If the external authorization response message was for a software module **392** authorizing utilization of the process, then the second allower element **320** invokes a software performer element **324** for performing the process in accordance with instructions of the software module **392**.

For software modules **392** or hardware modules **373** which are user-installed, an authorization medium **375** (preferably a registration form with proof of purchase) is physically sent to the service provider to obtain authorization. When the user requests execution of the installed process, the process is optionally executed and the processor **308** invokes the external authorizer element **330** to request an external authorization from the controller **112**. The external authorizer element **330** obtains usage authorization by receiving an external authorization from the service provider through a radio channel (the outbound channel) of the communication system. The external authorization request message sent to the base stations **116**, as described above, comprises an authorization request command, the portable communication device **122** address, the process name and size, and a secure CRC of the hardware or software process executable **398**. When the controller **112** sends an authorization message granting authorization of the hardware or software process, the second allower element **320** allows the utilization of the process, in response to the usage authorization being obtained. In response to obtaining an external authorization allowing utilization of a process, the processor **308** accesses the creator element **344** to create an internal authorization record **382**. To create the internal authorization record the processor **308** invokes a generator element **346** which first calls on a chooser element **348** to select preferably two random bytes of the hardware or software process executable **398**. The random bytes are preferably chosen using the real-time clock **399** and user invocation of the user controls **364** as described above. Once the random bytes have been determined, and satisfy the polynomial generator rules, a checksum calculator element **350** is invoked to perform a CRC generation on the process executable **398** of the hardware or software module. Once the random CRC **388** has been calculated, the storer element **352** collects the verification elements used for the internal authorization record **382**. The verification elements comprise the address pointers **384** for the random polynomial generator, the process name **386**, the random CRC **388** calculated by the checksum calculator element **350** and the expiration time **390** received in the external authorization message from the controller **112**. The processor **308** then calls on a placer element **354** which uses the secure encryption key **312** to encrypt the verification elements and then stores the result in the authorization records **380** in the RAM **378**.

For cooperation with the auditing operation of the fixed portion **102**, the processor **308** is programmed by way of the ROM **310** to maintain in the RAM **378** a record (not shown) of usage of the process **398**, and to report the usage in response to receiving a usage audit command from the fixed portion **102** of the communication system. In addition, the processor **308** is programmed to maintain the record of internal authorizations **382** present within the portable communication device **122** for utilizing the processes **398**, and to report the internal authorizations **382** present, in response to receiving an internal authorization audit command from the fixed portion **102** of the communication system. The processor **308** is also programmed to delete an internal authorization **382**, in response to receiving a delete authorization command directed at the internal authorization **382** from the fixed portion **102** of the communication system. These operational features will be described further herein below.

For cooperation with the message sending operation of the fixed portion **102**, the processor **308** is programmed by way of the ROM **310** to control the transceiver **302** to request a download of a predetermined software process **398** in response to receiving from the fixed portion **102** a message that requires the predetermined software process **398** for processing the message. In addition, the processor **308** is programmed by way of the ROM **310** to control the display **368** to display the terms of a software license agreement, in response to receiving the terms of the software license agreement from the fixed portion **102** through the radio channel.

Referring to FIG. **5**, a timing diagram **400** depicts elements of an outbound protocol and an inbound protocol of the fixed portion **102** and portable portion **104** of the communication system in accordance with the preferred embodiment of the present invention. The signaling format on the outbound and inbound channels preferably operates on a single carrier frequency utilizing well-known time division duplex (TDD) techniques for sharing the frequency. It will be appreciated that the outbound and inbound channels can use separate frequency channels utilizing frequency division multiplexing (FDM) techniques well known in the art. Using TDD transmission the outbound RF channel transmission is depicted during an outbound transmission time interval **402**, while the inbound RF channel transmission is depicted during an inbound transmission time interval **404**. The outbound transmission time interval **402** and the inbound transmission time interval **404** are subdivided by a time boundary **403**. The time boundary **403** depicts a point in time when the outbound transmissions cease and the inbound transmissions commence.

The elements of the outbound protocol comprise an outbound sync **406**, a selective call address **408**, a message vector **410** and an outbound message **412**, while the inbound protocol comprises an inbound sync **426** and an inbound message **428**. The outbound sync **406** provides the portable communication device **122** a means for synchronization utilizing techniques well known in the art. The selective call address **408** identifies the portable communication device **122** for which the outbound message **412** is intended. The message vector **410** points in time within the TDD signal format to the position of the outbound message **412** to be received by the portable communication device **122**. The outbound message **412** can be either a well known selective call message, or an external authorization response message in accordance with the present invention. When the outbound message **412** is an external authorization response message, the message received by the portable communication device **122** is an encrypted message **414**. The encrypted message **414** comprises an authorization command **416**, a process name **418** and, optionally, an expiration time **420**. When the authorization command **416** is an authorization command denying authorization for utilization of a requested process, then the expiration time **420** is not included in the encrypted external authorization response message. It will be appreciated that the outbound external authorization response message can be extended to include multiple authorizations and/or denials by sending a plurality of authorization commands **416**, associated process names **418** and, optionally, expiration times **420**.

Similarly, the inbound sync **426** provides the base stations **116** a means for synchronization utilizing techniques well known in the art. The inbound message **428** can be either a well known acknowledge-back response message, or an external authorization request message in accordance with the present invention. When the inbound message **428** is an external authorization request message, the message transmitted by the portable communication device **122** is an encrypted message **430**. The encrypted message **430** comprises an authorization request command **432**, an address **434** corresponding to the portable communication device **122**, a process name **436**, a process size **438** and a secure CRC **440**. The secure CRC is determined, as described above, using the secure polynomial **311** over the hardware or software module's process executable **398**. It will be appreciated that the authorization request command **432** can be included as part of the field of the address **434**. It will also be appreciated that multiple authorization requests can be included within the same inbound message by sending a plurality of process names **436** and process sizes **438** with their associated secure CRCs **440**.

During selective call messaging between the base stations **116** and the portable communication devices **122**, the communication system protocol described above begins with an outbound message which delivers a message to a portable communication device **122**. The portable communication device **122** can, optionally, acknowledge reception of the message on the inbound channel. Acknowledgment messages from the portable communication device **122** are transmitted on the inbound channel during a scheduled period which is referenced to the time boundary **403** described above. Scheduled inbound messages are preferably reserved for acknowledgment messaging from the portable communication devices **122**. However, when a user invokes a process which requires transmitting an external authorization request message to the base stations **116**, the portable communication device **122** uses an unscheduled time period (slot) referenced to the time boundary **403** for unscheduled messaging to the base stations **116**. Note that during inbound messaging, a time period referenced to the time boundary **403** is reserved for both scheduled and unscheduled inbound messages. Therefore, there is no contention between scheduled and unscheduled inbound messages. Since the number of unscheduled time slots is limited, it is possible for contention to exist among a plurality of portable communication devices **122** transmitting unscheduled inbound messages. To resolve contention with unscheduled inbound messages, the present invention preferably utilizes ALOHA protocol as is well known by one of ordinary skill in the art.

When the preferred embodiment of the present invention is acquiring authorization of hardware and software modules remotely as just described, it will be appreciated that message transactions originate first from the portable communication device **122** as unscheduled inbound messages. Subsequent responses from the fixed portion **102** of the communication system are received on the outbound channel. When the preferred embodiment of the present invention is performing auditing and message sending operations of the fixed portion **102**, it will be appreciated that the message transactions originate first from the fixed portion **102** as outbound messages, with subsequent responses from the portable communication device **122** received on the inbound channel, as described further herein below. It will be further appreciated that, alternatively, other communication protocols which support two-way communication can be used.

Referring to FIG. **6**, a flow chart **500** depicting an authorization operation of the fixed portion **102** in response to a message originated by the portable communication device **122** in accordance with the preferred embodiment of the present invention begins with step **502** where the controller **112** receives an encrypted external authorization request message. In step **504** the controller **112** deciphers the encrypted message using the secure encryption key **231** stored in the ROM **228**. In step **506** the controller **112** identifies the portable communication device **122** requesting the authorization by the address **434** received. Additionally, the controller **112** reads the process verification elements included in the external authorization request message. In step **508** the controller **112** checks for a match between the process verification elements received and the list of process records **220** corresponding to the portable communication device **122**. If a match is found, then in step **510** an external authorization response message is constructed authorizing utilization of the process. The external authorization response message comprising the authorization command **416** allowing utilization of the process, the process name **418** of the process authorized and an expiration time **420** for the process. Before sending the message to the base stations **116** for transmission, the external authorization response message is encrypted using the secure encryption key **231** as described above. When a match is not found, then in step **512** an external authorization response message with an "authorization denied" command is constructed. The external authorization response message then comprises the authorization command **416** for denying authorization to the requested process, and the associated process name **418**. The denial message, as described above, is encrypted by the controller **112** using the secure encryption key **231**. Once either type of the external authorization response message is constructed, then in step **514** the message is sent to the transmitter **202** of the base station **116** where it is transmitted to the portable communication device **122**. In step **516** the controller **112** checks for a message acknowledgment response from the portable communication device **122** acknowledging reception of the external authorization response message. If no acknowledgment is received, then the controller **112** resends the message in step **514**. The controller **112**, preferably, has an option to limit the number of re-transmissions by using, for example, a maximum resend count programmed by the system provider. Once an acknowledgment is received, the controller **112** returns to step **502** where it processes subsequent external authorization request messages from the portable communication devices **122**.

Referring to FIG. **7**, a flow chart **600** depicting an authorization operation of the portable communication device **122** as it attempts to obtain authorization to use a process in accordance with the preferred embodiment of the present invention begins with any one of steps **602**, **604** and **606**. In step **602** the user installs a hardware or software module and registers the hardware or software module by sending preferably an authorization medium **375** comprising a registration form and proof of purchase receipt. In step **606** the user can receive over-the-air (OTA) programming of a software process. The request for an OTA software download can be performed by the user by way of a conventional telephone **124** call to the system provider. It will be appreciated that other ways can be used for requesting OTA programming of a software process, such as by the use of appropriate functions provided by the user controls **364**, in the portable communication device **122** for requesting software processes. Once a software or hardware module has been added to the portable communication device **122** by way of OTA programming or userinstallation, the user can request execution of the process in step **604**. In step **610** the process is immediately executed without initial authorization. It will be appreciated that the portable communication device **122**, optionally, can be programmed by the system provider to skip step **610**. In step **612** the processor **308** of the portable communication device **122** checks for the presence of an internal authorization record **382** in the authorization records **380** stored in the RAM **378**. Each internal authorization record **382** is decrypted using the secure encryption key **312** stored in the ROM **310**. A match is checked between the process name **386** of the internal authorization record **382** and the process name of the requested process. If a match is not found, the processor **308** proceeds to step **614** where an encrypted external authorization request message is constructed comprising the authorization request command **432**, the address **434** of the portable communication device **122**, the process name **436**, the process size **438**, and the secure CRC **440** of the process executable **398** requested. In step **616** the encrypted external authorization request is transmitted to the base stations **116**. In step **618** the processor **308** waits for an external authorization response message from the base stations **116**. If no external authorization response message has been received, then in step **628** a time-out (TMO) indicator is checked. If the TMO indicator has expired, then in step **630** a resend counter is checked for re-transmission requests. If re-transmission requests of the encrypted external authorization request message have been exceeded, then in step **632** the process execution is denied and the user is alerted by the alerting device **366** and display **368** of the portable communication device **122**. If the resend counter has not been exceeded, then the processor **308** resends the encrypted external authorization message in step **614**. If in step **628** the TMO indicator has not expired, then the processor **308** continues to wait for an external authorization response message from the base stations **116**. If an external authorization response message is received, then step **620** checks if the requested process has been authorized for execution. If the requested process has been denied authorization, then step **640** is invoked, where the process is denied execution, and subsequently discarded in step **642** alerting the user to authorization denial. If the requested process has been authorized for execution, then in step **622** preferably two bytes are chosen from within the process executable **398** of the hardware or software module to create a 16 bit random polynomial generator. The random bytes are chosen using the real-time clock **399** and user controls **364** as described above. In step **624**, the processor **308** generates a random CRC over the process executable **398** of the authorized hardware or software module. In step **626**, an internal authorization record **382** is created comprising the random address pointers **384**, the process name **386**, the process size **387**, the random CRC **388**, and the expiration time **390** of the authorized process. The internal authorization record **382** is encrypted with the secure encryption key **312** stored in the ROM **310**. Once the internal authorization record **382** has been created, the processor **308** continues to step **638** where process execution is invoked if it has not already been invoked by step **610**.

In the case where in step **612** an internal authorization record **382** is found, the processor **308** continues to step **636** where the process verification elements are decrypted and then checked against the requested process executable **398**. If the process verification elements are determined to be valid, then in step **638** process execution is invoked if it has not already been invoked by step **610**. Validation of the process verification elements consists of matching the random CRC generated over the process executable **398** of the requested hardware or software module with the random CRC found in the internal authorization record. If the process verification elements are determined to be invalid, then in step **640** process execution is denied, and in step **642** the process is discarded from memory (for a software module) and an alert signal is created. The alert signal is preferably an audible and visual alert signal using the alerting device **366** and display **368** of the portable communication device **122**. Optionally, an alert signal can be sent to the controller **112** alerting the communication system that an attempt to use an invalid hardware or software module has been detected.

Thus, it should be apparent by now that the present invention provides a method and apparatus for controlling utilization of a hardware or software process added to a portable communication device **122**. In particular, the present invention provides a novel method and apparatus for remotely authorizing software and hardware modules added to a portable communication device **122**. With the present invention, the authenticity of process executables **398** used by software and hardware modules can advantageously be validated by the fixed portion **102** of the communication system. In addition, the fixed portion **102** of the communication system can keep track of unauthorized installations and can act upon unauthorized additions of software and hardware modules to the portable communication devices **122** by disabling operation of a portable communication device **122** using OTA techniques. Another advantage of the present invention is the option for the system provider to program the portable communication device **122** to execute a hardware or software process without receiving immediate authorization. This option provides a user immediate access to a hardware or software process without burdening the user with the delay of receiving authorization for the process. The present invention also provides an authorization method which is secure for both inbound and outbound messaging by using a message encryption technique described above.

What is claimed is:

**1**. An apparatus at a fixed portion of a communication system for authorizing utilization of software in a portable portion of the communication system, the apparatus comprising:

a processor;

a memory coupled to the processor for maintaining a list of authorized software corresponding to the portable portion;

a request receiver element coupled to the processor for receiving a request from the portable portion, the request including an address identifying the portable portion, and a software name;

a list checker element coupled to the processor for checking the list of authorized software corresponding to the portable portion identified by the address, to determine whether the software corresponding to the software name is authorized; and

an external authorization element coupled to the processor for transmitting the external authorization to the portable portion in response to the software being authorized for the portable portion.

2. The apparatus of claim 1 in which the request includes a secure checksum.

3. The apparatus of claim 2 in which the secure checksum is a secure cyclic redundancy check of the software for which the portable portion is requesting authorization.

4. The apparatus of claim 3 in which the apparatus uses a secure polynomial stored in the memory of the apparatus to calculate the secure cyclic redundancy check.

5. The apparatus of claim 1 in which the request includes a software size.

6. A portable communication device in a communication system having a fixed portion, the portable communication device comprising:

a processor;

an authorization element coupled to the processor for obtaining usage authorization for utilizing software in the portable communication device, in which the authorization element generates an external authorization request, and in which the authorization element communicates with the fixed portion to obtain the usage authorization in response to the external authorization request, and in which the external authorization request includes a secure checksum; and

a second authorization element coupled to the processor for allowing utilization of the software, in response to usage authorization being obtained from the fixed portion.

7. The portable communication device of claim 6 in which the secure checksum is a secure cyclic redundancy check of the software for which the portable communication device is requesting authorization.

8. The portable communication device of claim 7 in which the secure cyclic redundancy check is generated by the portable communication device by using a secure polynomial stored in the portable communication device.

9. A portable communication device in a communication system having a fixed portion, the portable communication device comprising:

a processor;

an authorization element coupled to the processor for obtaining usage authorization for utilizing software in the portable communication device, in which the authorization element generates an external authorization request, and in which the authorization element communicates with the fixed portion to obtain the usage authorization in response to the external authorization request, and in which the external authorization request includes at least one of: an address identifying the portable communication device, a software name and a size of the software; and

a second authorization element coupled to the processor for allowing utilization of the software, in response to usage authorization being obtained from the fixed portion.

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