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(54) **WIRELESS COMMUNICATIONS SYSTEMS AND METHODS USING SATELLITE-LINKED REMOTE TERMINAL INTERFACE SUBSYSTEMS**

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H04W 84/06 (2006.01)

(52) **U.S. Cl.** **455/12.1**; 455/3.02; 455/15; 455/21; 455/427

(58) **Field of Classification Search** 455/12.1, 455/13.1, 427–430, 7, 9, 10, 15–25
See application file for complete search history.

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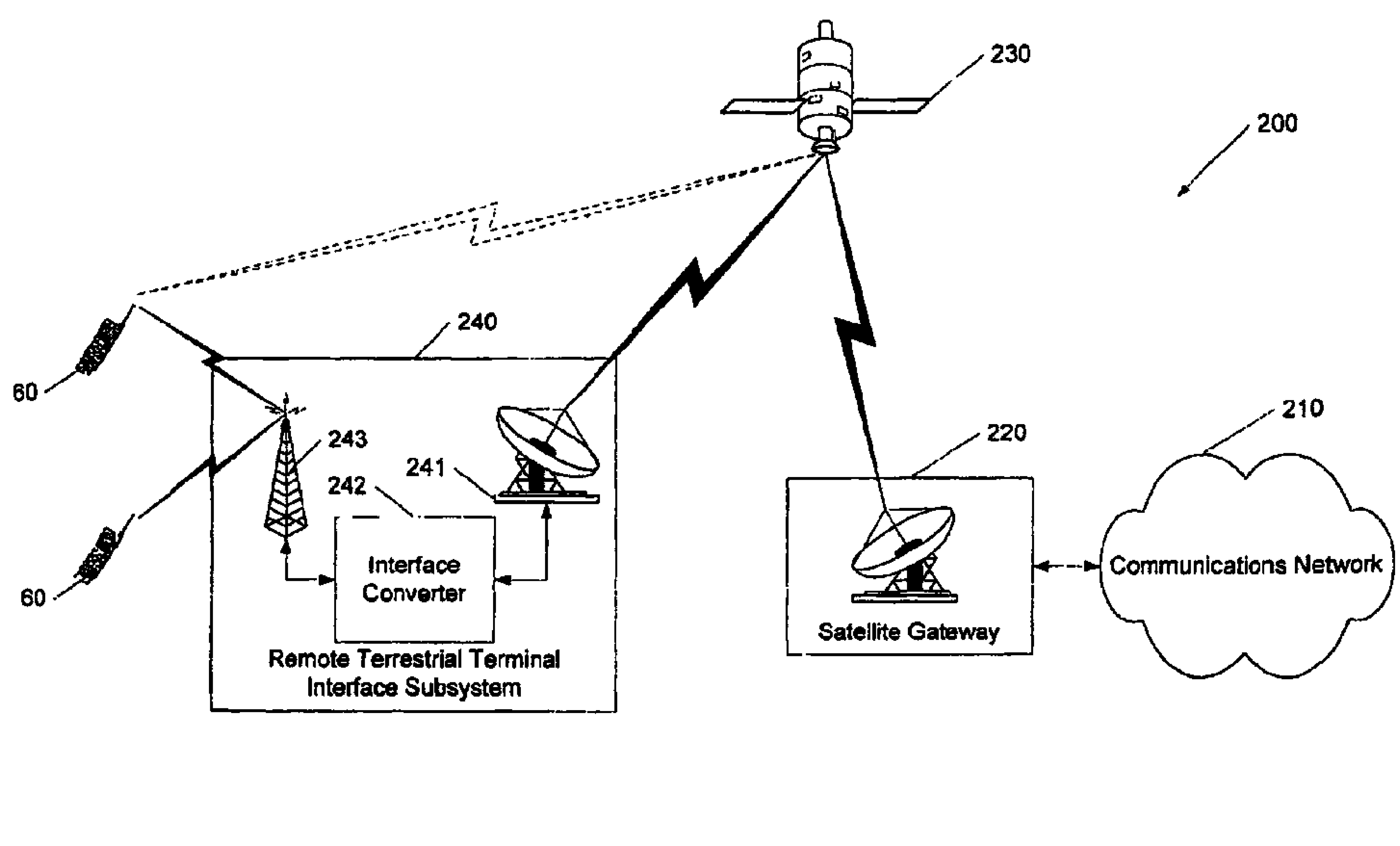
(57) **ABSTRACT**

A satellite gateway is coupled to a communications network and is operative to communicate with a communications satellite. A terrestrial terminal interface subsystem is operative to communicate with the satellite gateway via the communications satellite using a first radio interface and to communicate with terminals over a geographic area using a second radio interface. The communications network may be a wireless communications network, and the satellite gateway is configured to communicate with a base station controller of the wireless communications network, such that the terrestrial terminal interface subsystem may provide one or more satellite-linked terrestrial base stations.

127 Claims, 7 Drawing Sheets



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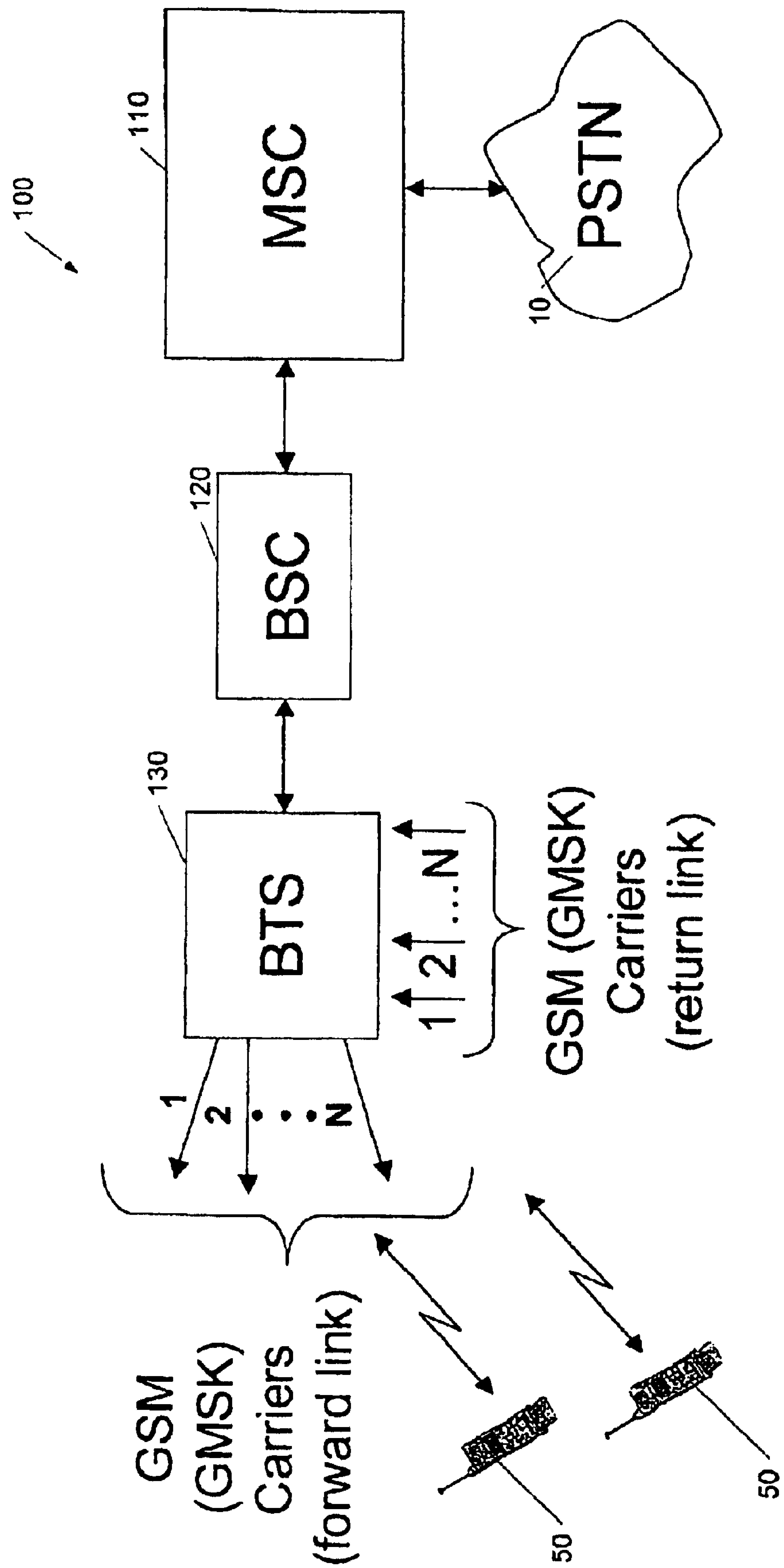

100
110
MSC
PSTN
10
120
BSC
130
BTS
1
2
N
GSM (GMSK)
Carriers
(return link)
GSM
(GMSK)
Carriers
(forward link)
50
50

FIG. 1

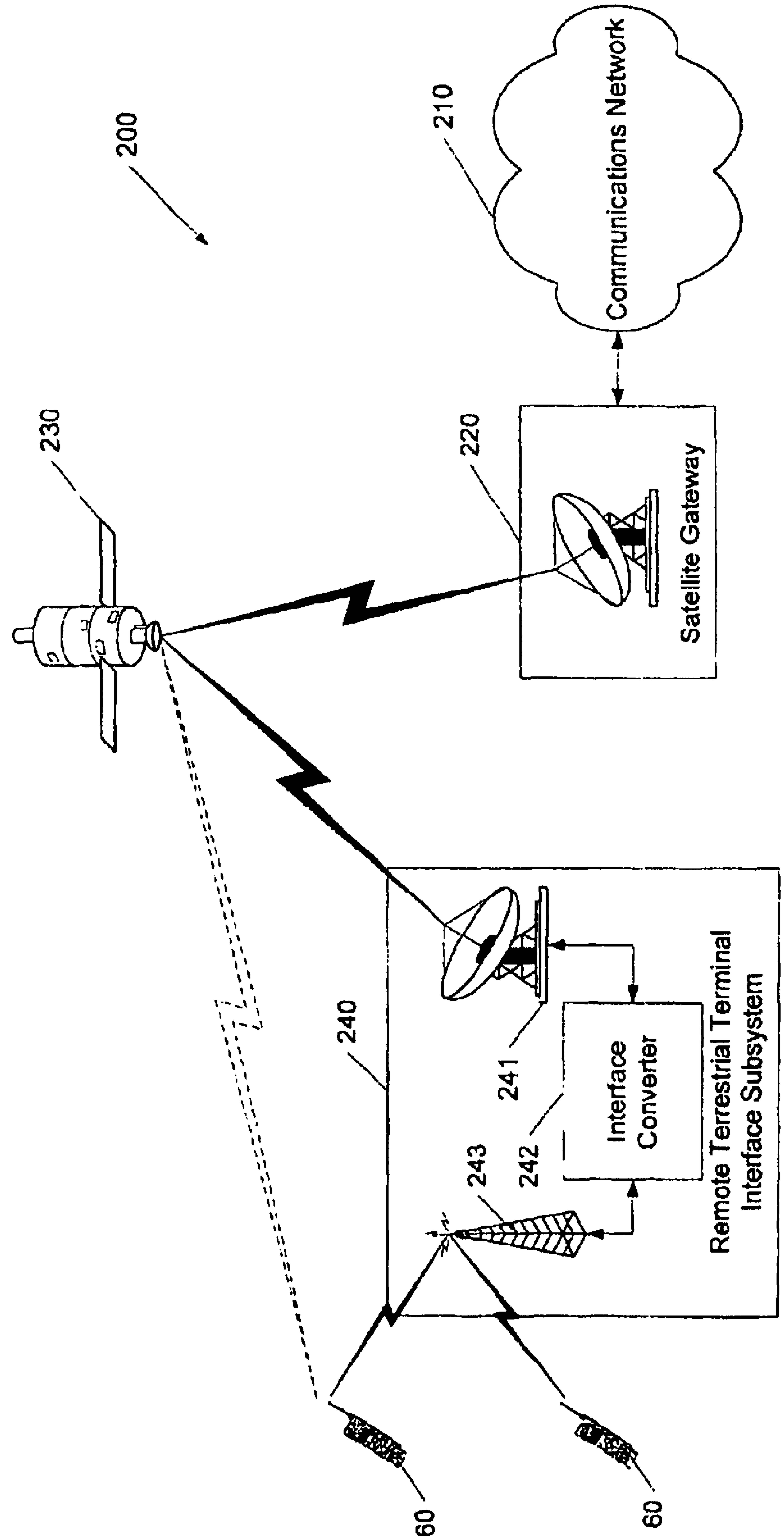

200
210
Communications Network
230
220
Satellite Gateway
240
241
242
243
Interface Converter
Remote Terrestrial Terminal Interface Subsystem
60
60

FIG. 2

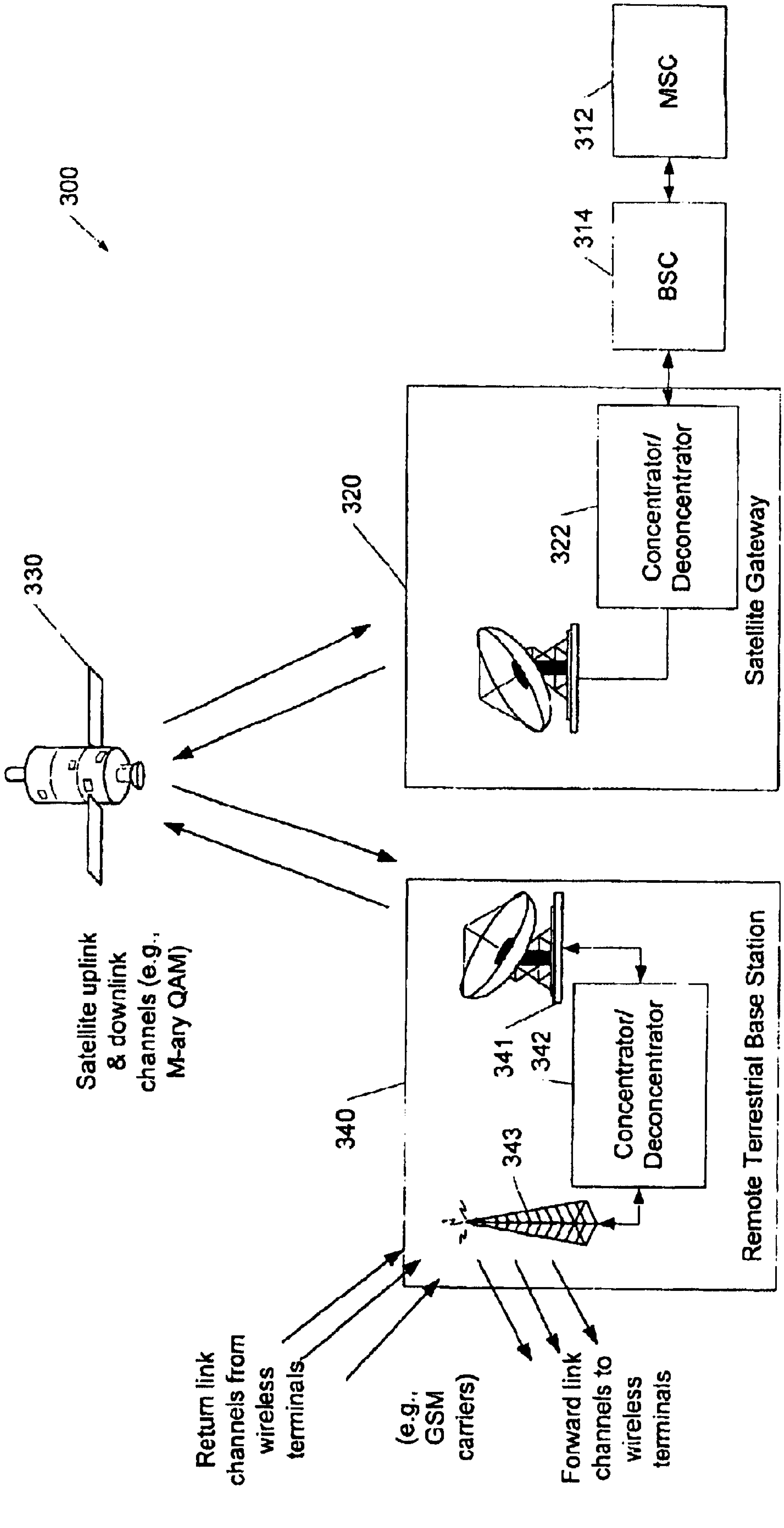

300
MSC
312
BSC
314
320
Concentrator/
Deconcentrator
322
Satellite Gateway
330
Satellite uplink
& downlink
channels (e.g.,
M-ary QAM)
340
341
342
Concentrator/
Deconcentrator
343
Remote Terrestrial Base Station
Return link
channels from
wireless
terminals
(e.g.,
GSM
carriers)
Forward link
channels to
wireless
terminals

FIG. 3

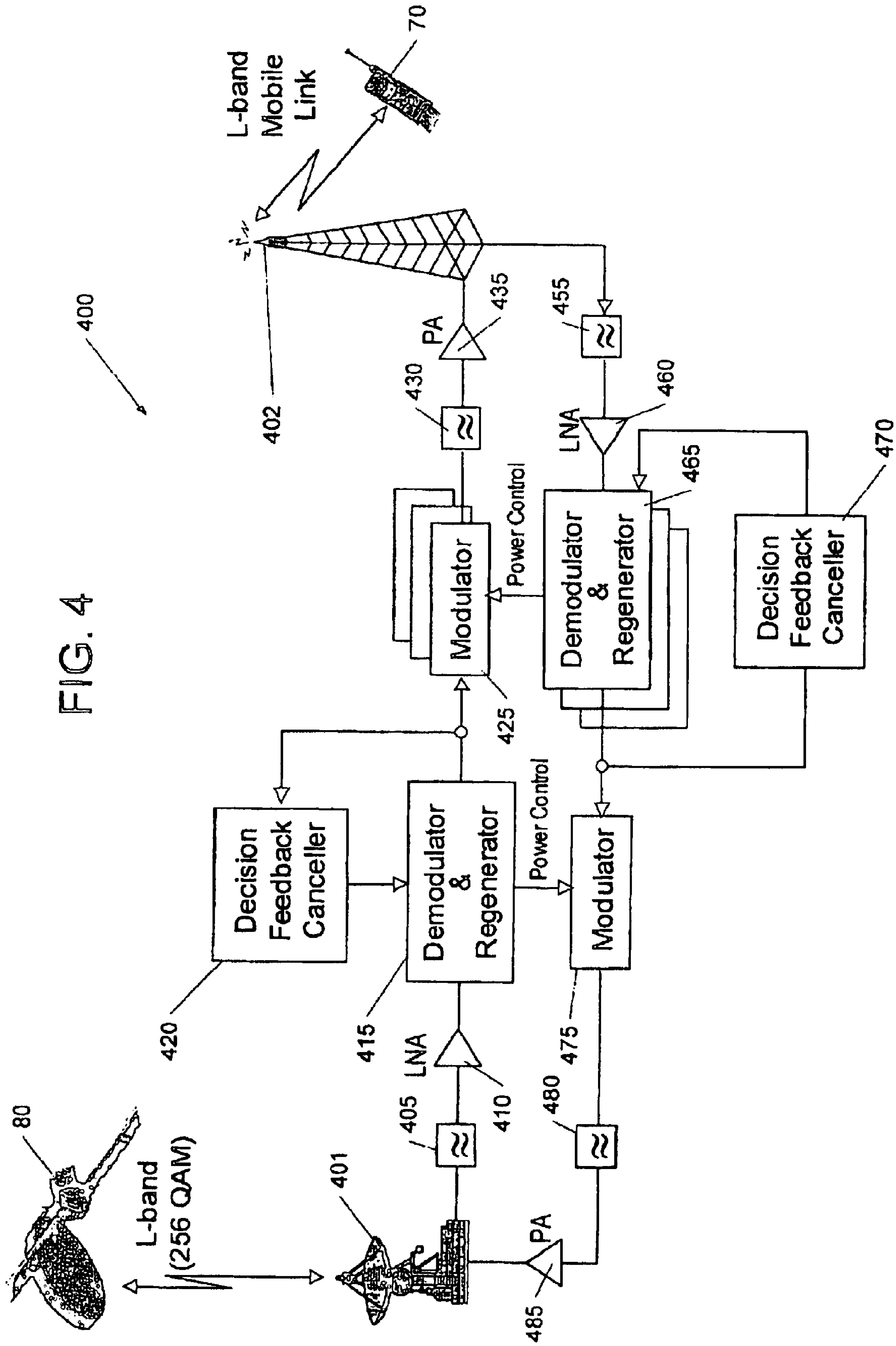

400
L-band Mobile Link
70
402
PA
435
430
455
460
LNA
465
470
Power Control
Modulator
Demodulator & Regenerator
Decision Feedback Canceller
425
Decision Feedback Canceller
Demodulator & Regenerator
Power Control
Modulator
420
415
475
LNA
410
405
480
80
L-band (256 QAM)
401
PA
485

FIG. 4

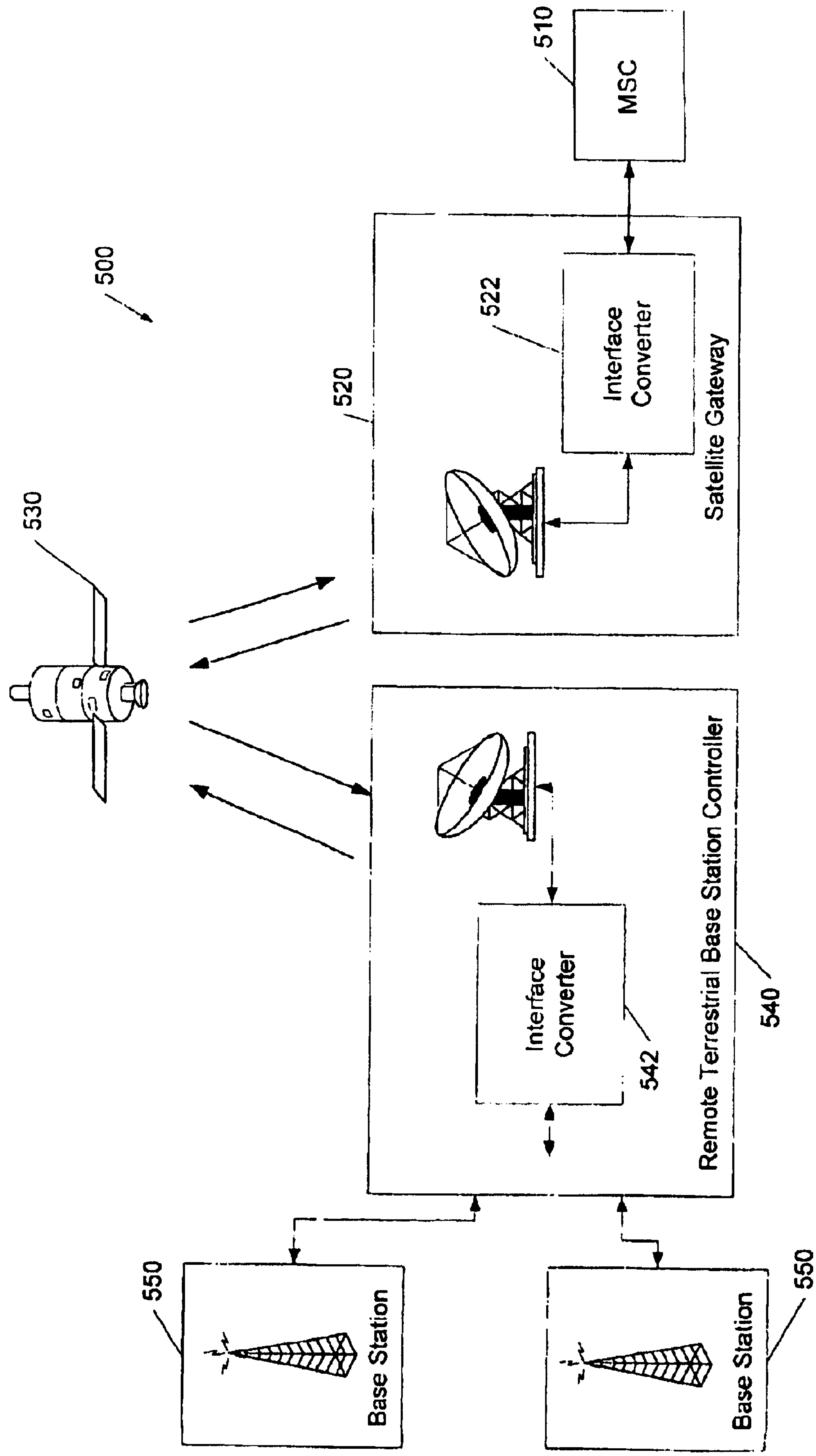

500
510
MSC
520
522
Interface Converter
Satellite Gateway
530
Remote Terrestrial Base Station Controller
540
Interface Converter
542
550
Base Station
550
Base Station

FIG. 5

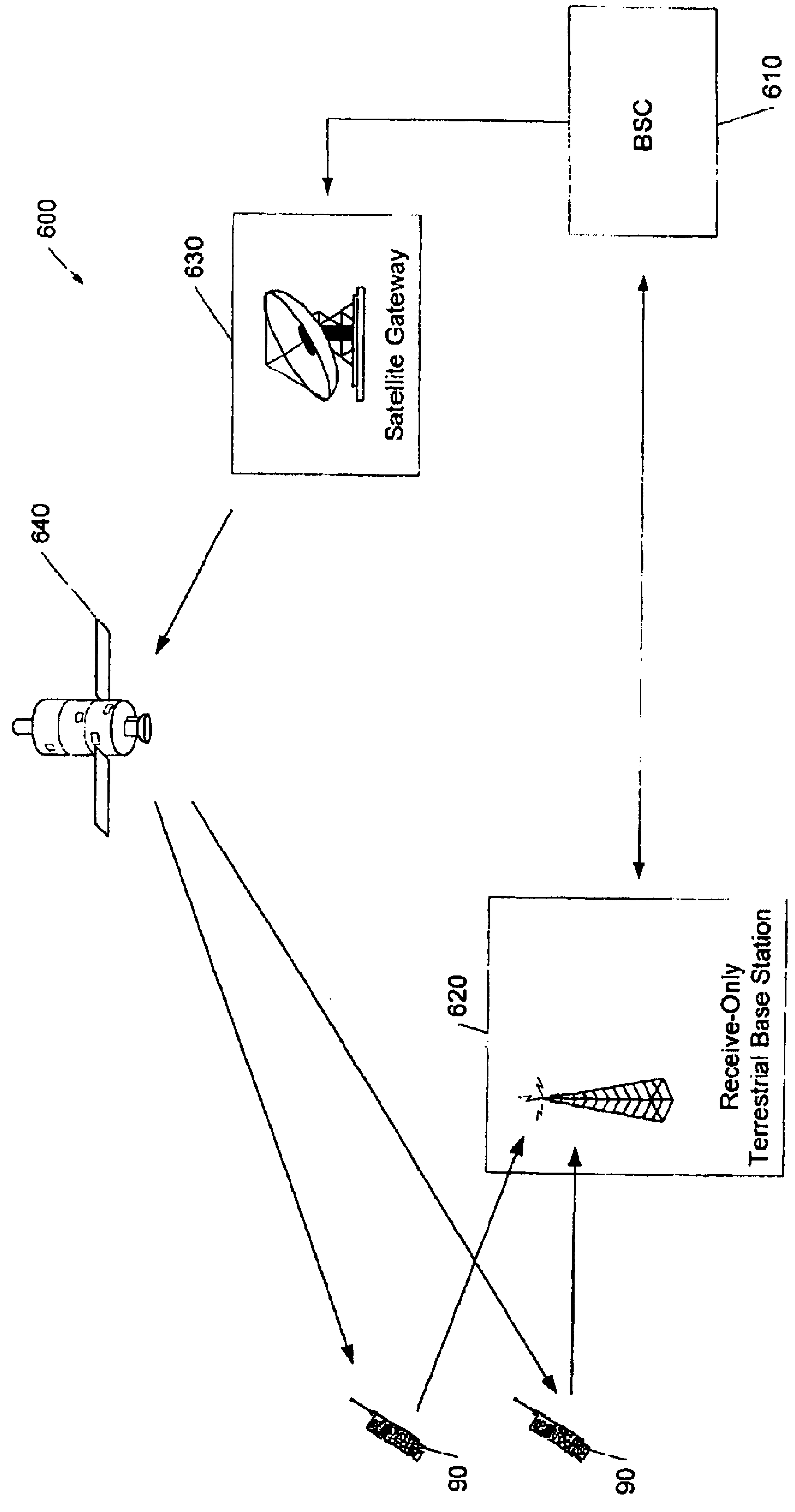
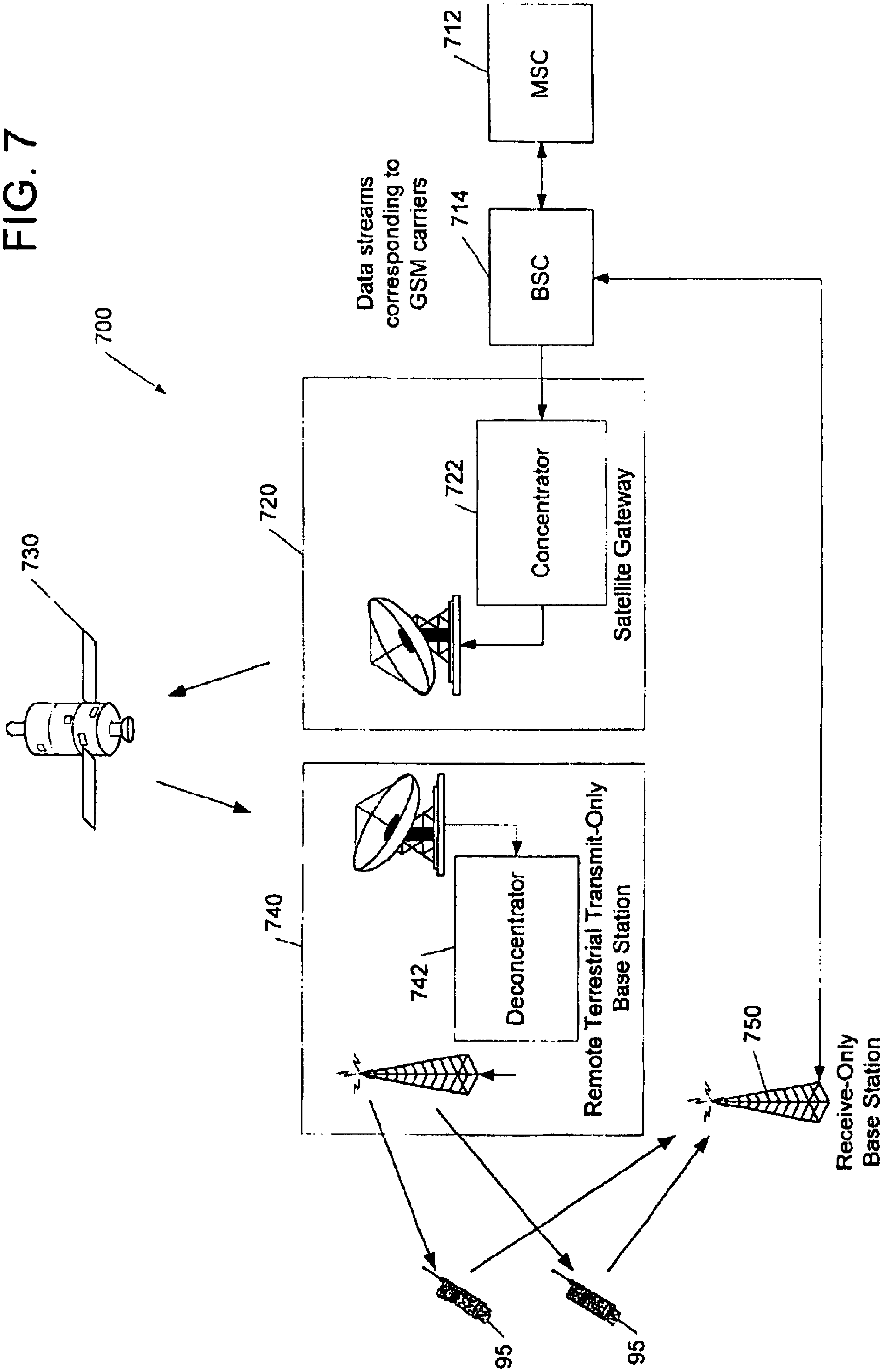

600
610
BSC
630
Satellite Gateway
640
620
Receive-Only
Terrestrial Base Station
90
90

FIG. 6

FIG. 7


700
712
MSC
714
BSC
Data streams corresponding to GSM carriers
720
722
Concentrator
Satellite Gateway
730
740
742
Deconcentrator
Remote Terrestrial Transmit-Only Base Station
750
Receive-Only Base Station
95
95

WIRELESS COMMUNICATIONS SYSTEMS AND METHODS USING SATELLITE-LINKED REMOTE TERMINAL INTERFACE SUBSYSTEMS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

Notice: More than one reissue application has been filed for the reissue of U.S. Pat. No. 6,856,787. The reissue applications are application Ser. No. 11/431,160 (the present application), application Ser. No. 12/266,713 (a first divisional of the present application) and application Ser. No. 12/329,137 (a second divisional of the present application).

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims priority to U.S. Provisional Application Ser. No. 60/356,264 entitled "WIRELESS COMMUNICATIONS SYSTEMS AND METHODS USING SATELLITE-LINKED REMOTE TERMINAL INTERFACE SUBSYSTEMS," filed Feb. 12, 2002, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

The present invention relates to wireless communications apparatus and methods, and more particularly, to wireless communications system and methods using satellite and terrestrial components.

FIG. **1** illustrates a conventional terrestrial wireless communications system **100**, and more particularly, a system conforming to the GSM standards. The system **100** includes a mobile switching center (MSC) **110**, a base station controller (BSC) **120**, and at least one base transceiver station (BTS) **130**. The BTS **130** includes radio transceivers that communicate with cellular terminals **50**, while the BSC **120** manages radio resources for one or more BTSs and provides a connection between the BTSs and the MSC **110**. The MSC **110** typically acts like a telephone switching node, and typically provides additional functions related to registration and mobility management for the cellular terminals **50**. The MSC **110** is typically coupled to a public switched telephone network (PSTN) **10**, which provides communications links between the cellular terminals **50** served by the wireless system **100** and other terminals (e.g., landline telephones). It will be appreciated that other wireless communications systems may provide similar functionality, but may, for example, use other groupings of functions referred to by different nomenclature.

Cellular satellite communications systems and methods are also widely used to provide wireless communications. Cellular satellite communications systems and methods generally employ at least one space-based component, such as one or more satellites that are configured to wirelessly communicate with a plurality of radiotelephones or other types of cellular terminals. The overall design and operation of cellular satellite communications systems and methods are well known to those having skill in the art, and need not be described further herein.

Hybrids of satellite and terrestrial systems may also be used. For example, as is well known to those having skill in the art, terrestrial networks can enhance cellular satellite communications system availability, efficiency and/or economic viability by terrestrially reusing at least some of the frequency bands that are allocated to cellular satellite communications systems. In particular, it is known that it may be difficult for cellular satellite communications systems to reliably serve densely populated areas, because the satellite signal may be blocked by high-rise structures and/or may not penetrate into buildings. As a result, the satellite spectrum may be underutilized or unutilized in such areas. The use of terrestrial retransmission can reduce or eliminate this problem.

Moreover, the capacity of the overall system can be increased significantly by the introduction of terrestrial retransmission, since terrestrial frequency reuse can be much denser than that of a satellite-only system. In fact, capacity can be enhanced where it may be mostly needed, i.e., densely populated urban/industrial/commercial areas. As a result, the overall system can become much more economically viable, as it may be able to serve a much larger subscriber base. One example of terrestrial reuse of satellite frequencies is described in U.S. Pat. No. 5,937,332 to the present inventor Karabinis entitled Satellite Telecommunications Repeaters and Retransmission Methods.

SUMMARY OF THE INVENTION

According to some embodiments of the present invention, a wireless communications system includes a satellite gateway coupled to a communications network and operative to communicate with a communications satellite. The system further includes a terrestrial terminal interface subsystem operative to communicate with the satellite gateway via the communications satellite using a first radio interface and to communicate with wireless terminals over a geographic area using a second radio interface. For example, in some embodiments, the communications network comprises a wireless communications network, and the satellite gateway is configured to communicate with a base station controller of the wireless communications network, such that the terrestrial terminal interface subsystem may provide one or more satellite-linked terrestrial base stations.

In some embodiments, the terrestrial terminal interface subsystem comprises an interface converter operative to convert between the first and second radio interfaces. The interface converter may be operative to transfer information from a plurality of terrestrial wireless communications channels to a lesser number of satellite communications channels. The interface converter may also be operative to transfer information from a single satellite communication channel to a plurality of terrestrial wireless communications channels.

According to further embodiments of the present invention, the terrestrial terminal interface subsystem includes a satellite radio antenna and a terrestrial radio antenna co-located at a single terrestrial base station. The terrestrial terminal interface subsystem may also comprise a plurality of terrestrial base stations located at respective ones of a plurality of geographically distributed sites and served by a single satellite link.

In yet additional embodiments, the communications satellite is further operative to communicate with wireless terrestrial terminals without use of the terrestrial terminal interface subsystem. In particular, the terrestrial terminal interface subsystem or the satellite or both may communicate with wireless terminals. For example, in some embodiments, the communications satellite is operative to receive information intended for wireless terminals from the satellite gateway and to convey the received information to the wireless terminals without use of the terrestrial terminal interface subsystem, while the terrestrial terminal interface subsystem is operative to receive information from wireless terminals and to convey the received information to the communications network without use of the communications satellite. In this manner, for example, "receive only" terrestrial base stations may be used to provide uplinks from wireless terminals to a communications network, while downlinks are provided directly from the satellite to the wireless terminals. In other embodiments, the communications satellite is operative to receive information from wireless terminals without use of the terrestrial terminal interface subsystem and to convey the received information to the satellite gateway, while the terrestrial terminal interface subsystem is operative to receive information intended for wireless terminals from the communications satellite and to convey the received information to terrestrial terminals. In this manner, for example, "transmit-only" terrestrial base stations may be used to provide downlinks from a communications network to wireless terminals, while uplinks may be provided directly from the wireless terminals to the satellite.

According to some method embodiments of the present invention, communications between a communications network and a plurality of wireless terminals served by a terrestrial base station may be provided by conveying terminal communications between the communications network and the terrestrial base station via a communications satellite. The communication via the satellite can be bidirectional or unidirectional.

The present invention may be embodied in variety of forms, including, but not limited to, wireless communications systems, components of wireless communications systems, combinations of components of wireless communications systems, and wireless communications methods. For example, the present invention may be embodied as earth-based components and combinations thereof configured to interoperate with space-based components, as spaced-based components, and as combinations of earth-based and space-based components.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a conventional terrestrial wireless communications system.

FIG. **2** is a schematic diagram illustrating a wireless communications systems and methods according to some embodiments of the present invention.

FIG. **3** is a schematic diagram illustrating a wireless communications system and methods according to further embodiments of the present invention.

FIG. **4** is a schematic diagram illustrating a terrestrial terminal interface subsystem and methods according to some embodiments of the present invention.

FIG. **5** is a schematic diagram illustrating a wireless communications system and methods according to further embodiments of the present invention.

FIG. **6** is a schematic diagram illustrating a wireless communications system and methods according to still further embodiments of the present invention.

FIG. **7** is a schematic diagram illustrating a wireless communications system and methods according to additional embodiments of the present invention.

DETAILED DESCRIPTION

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which typical embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

As used herein, the term "cellular terminal" refers to wireless terminals including, but not limited to: radiotelephone terminals ("cell phones") with or without a multi-line display; Personal Communications System (PCS) terminals that may combine a radiotelephone with data processing, facsimile and/or data communications capabilities; Personal Digital Assistants (PDA) that can include a radio frequency transceiver and a pager, Internet/intranet access, Web browser, organizer, calendar and/or a global positioning system (GPS) receiver; and/or conventional laptop and/or palmtop computers or other appliances, which include a radio frequency transceiver. These devices may be capable of wireless voice and/or data communications.

FIG. **2** conceptually illustrates a wireless communications system **200** according to embodiments of the present invention. The system **200** includes a satellite gateway **220** that is coupled to a communications network **210** (which may be a portion of the system **200** or an external network), which may include, but is not limited to, wireless network control components, such as BSCs and MSCs, and other gateways similar to the gateway **220**. The system **200** further includes one or more remote terrestrial terminal interface subsystems **240** that communicate with the gateway **220** via a satellite **230**. In particular, the terrestrial terminal interface subsystem **240** provides communications between cellular terminals **60** served by the terrestrial terminal interface subsystem **240** and the other portions **210** of the communications system **200** via the satellite **230** and the gateway **220**.

As shown, the terrestrial terminal interface subsystem **240** includes a satellite antenna **241** and a terrestrial antenna **243** that are connected to an interface converter **242**. The interface converter **242** is configured to receive information from cellular terminals **60** according to a first radio interface and to transmit the received information to the satellite **230** according to a second radio interface, and to receive information from the satellite **230** according to the second radio interface and to transmit the received information to the cellular terminals **60** according to the first radio interface. For example, the first radio interface may conform to a conventional standard, such as a GSM standard that uses Gaussian minimum shift keying (GMSK) modulation. The second radio interface may support a higher data rate using, for example, M-ary quadrature amplitude modulation (QAM), such that information received from or intended for cellular terminals **60** may be "concentrated" for transmission over the satellite link. In other embodiments, the first and second radio interfaces may be the same or substantially similar.

It will be appreciated that the interface converter **242** may include a variety of different components. For example, in embodiments described below with reference to FIGS. **3** and **4**, the interface converter may be positioned at a remote base station and may include components to convert signals received over the satellite link into radio signals for transmission to cellular terminals, as well as components for performing complementary conversion of signals received from cellular terminals. In embodiments described below with reference to FIG. **5**, the interface converter **242** may comprise components distributed among a remote BSC and base stations connected thereto. In such embodiments, the interface converter **242** may include, for example, components configured to convert between the satellite link signaling format and, for example, landline signaling formats used to communicate between the BSC and the base stations, as well as components for converting between the signaling format used for the links between the BSC and the base stations and the radio signaling format used to communicate with cellular terminals.

As also shown in FIG. **2**, the remote terrestrial terminal interface subsystem **240** may serve as part of an ancillary terrestrial component of the wireless communications system **200**, e.g., may function as a base station of an ancillary terrestrial network (ATN) of a satellite mobile communications system in a manner similar to that of the terrestrial base stations described in a United States Provisional Patent Application entitled "SYSTEMS AND METHODS FOR TERRESTRIAL REUSE OF MOBILE SATELLITE SPECTRUM," U.S. Pat. No. 60/322,240, filed Sep. 14, 2001, and U.S. Patent Application entitled "SYSTEMS AND METHODS FOR TERRESTRIAL RE-USE OF MOBILE SATELLITE SPECTRUM," U.S. Ser. No. 10/074,097, filed Feb. 12, 2002, the disclosure of each of which is incorporated herein by reference in its entirety. In particular, cellular terminals **60** may be operative to communicate with the system **200** directly through the satellite **230**, or may indirectly communicate with the system **200** via the remote terrestrial terminal interface subsystem **240**. It will be understood, however, that the present invention is also applicable to systems and methods in which communications between cellular terminals **60** and the satellite **230** are limited to communications via terrestrial terminal interface subsystems such as the remote terrestrial terminal interface subsystem **240**, i.e., without direct communication between the cellular terminals **60** and the satellite **230**.

FIG. **3** illustrates a "repeater" configuration for a wireless communications system **300** according to further embodiments of the present invention. The system **300** includes an MSC **312** and a BSC **314** that communicate with a remote terrestrial terminal interface subsystem, here a remote terrestrial base station **340**, via a "repeater" including a gateway **320** and a satellite **330**. The remote terrestrial base station **340** includes a first concentrator/deconcentrator **342** that sends and receives signals to and from the satellite **330** via a satellite antenna **341** over, for example, an L-band satellite link using, for example, M-ary quadrature amplitude modulation (QAM). The first concentrator/deconcentrator **342** converts signals received over the satellite link to, for example, GSM-format signals transmitted to cellular terminals via a terrestrial antenna **343** using GMSK modulation, and converts GSM format signals from the cellular terminals to M-ary QAM signals that are transmitted to the satellite **330**. The gateway **320** includes a second concentrator/deconcentrator **322** that performs conversion functions complementary to those of the first concentrator/deconcentrator **342**.

It will be appreciated that the satellite link through the satellite **330** may generally support a higher data rate than radio links to individual cellular terminals, due to, for example, a less obstructive radio signal propagation environment and/or less interference and/or higher available transmit power. The concentrator/deconcentrator **342**, **322** takes advantage of this higher data rate capability by combining information received from or intended for terminals in a signal formatted according to a higher data rate signaling format for transfer through the satellite link.

FIG. **4** illustrates a remote terrestrial base station **400** that may be used with a wireless communication system, such as the communications system **300** of FIG. **3**, according to further embodiments of the present invention. The base station **400** includes a satellite antenna **401** and a terrestrial antenna **402**. Signals received from a satellite **80** via the satellite antenna **401** are processed by a bandpass filter **405** and a low noise amplifier (LNA) **410**. The signal produced by the LNA **410** is processed by a demodulator & regenerator component **415** to recover information in a format, e.g., a bitstream or other datastream, suitable for remodulation and transmission to a cellular terminal **70**. The demodulator & regenerator component **415** may, for example, produce decoded datastreams that correspond to GSM carriers that are to be transmitted from the terrestrial antenna **402**. As shown, the demodulator & regenerator component **415** may be operatively associated with an interference reducer, such as a decision feedback canceller **420**, that cancels interference in the signals received by the satellite antenna **401**, e.g., interference generated by transmissions from the terrestrial antenna **402**. For example, an interference reducer along the lines described in the aforementioned U.S. Ser. No. 60/322,240 and U.S. Ser. No. 10/074,097 may be used.

The information recovered from the demodulator & regenerator component **415** may then be reformatted and remodulated by a modulator component **425**. The remodulated signal is then filtered and amplified by a filter **430** and a power amplifier **435** to produce a signal for transmission to the cellular terminal **70** via the terrestrial antenna **402**. Power information obtained by the demodulator & regenerator component **415** may be used by a modulator component **475** to control the power of a signal transmitted to the satellite **80**.

Signals received from the cellular terminal **70** via the terrestrial antenna **402** are processed by a bandpass filter **455** and an LNA **460**. The signal produced by the LNA **460** is processed by a demodulator & regenerator component **465** to recover information in a format suitable for remodulation and transmission to the satellite **80**. The demodulator & regenerator component **465** may, for example, produce respective datastreams that correspond to respective GSM carriers received from the terrestrial antenna **402**. As shown, the demodulator & regenerator component **465** may be operatively associated with an interference reducer, such as a decision feedback canceller **470**, that cancels interference in the signals received by the terrestrial antenna **402**, e.g., interference generated by transmissions from the satellite antenna **401**. For example, an interference reducer along the lines described in the aforementioned U.S. Ser. No. 60/322,240 and U.S. Ser. No. 10/074,097 may be used.

The information recovered from the demodulator & regenerator component **465** is remodulated in a modulator component **475**, producing a remodulated signal corresponding to the multiple GSM carriers. This signal is then filtered and amplified by a filter **480** and a power amplifier **485** to produce a signal for transmission to the satellite **80** via the satellite antenna **401**. As described above with reference to FIG. **3**, the signal may be conveyed via the satellite **80** to a gateway, which may include a complementary radio interface conversion architecture. Power information obtained by the demodulator & regenerator component **465** may be used by the modulator component **425** to control the power of the signal transmitted to the cellular terminal **70**.

FIG. **5** illustrates an alternative configuration for a wireless communications and methods system **500** according to further embodiments of the present invention. The system **500** includes an MSC **510** that is linked via a gateway **520** and a satellite **530** to a remote terrestrial terminal interface subsystem, here shown as including a remote terrestrial base station controller **540** connected to base stations **550**. The remote BSC **540** is operative to control and communicate cellular terminal information with terrestrial base stations **550**. The remote BSC **540** and the gateway **520** include first and second interface converters **542**, **522** that provide appropriate conversion between the signaling format(s) used by the MSC **510** and base stations **550** and the signaling format used by the satellite **530**. For example, the first and second interface converters **542**, **522** may comprise respective concentrator/deconcentrator components.

It will be appreciated that the embodiments of FIGS. **3**–**5** are provided as examples of possible system and method configurations, and that other configurations also fall within the scope of the invention. In particular, it will be understood that wireless network functionality described above may be distributed in other ways among network components such as satellites, BSCs, MSCs, and base stations.

FIG. **6** illustrates a wireless communications system **600** and methods according to still further aspects of the present invention. The system **600** includes one or more receive-only terrestrial base stations **620** that receive information from terminals **90** over return service links. Information received by the base station **620** is conveyed to a BSC **610** using, for example, landline and/or radio links (e.g., microwave or satellite links). Forward service links to the terminals **90** are provided via a satellite **640** and a satellite gateway **630** that are linked to the BSC **610**. The forward service links and the return service links to and from the terminals **90** may use the same frequency bands and/or signaling protocols (e.g., GSM data format with GMSK modulation), or may use respective different frequency bands and/or signaling protocols. It will be appreciated that embodiments of the present invention may use a structure complementary to that of FIG. **6**. For example, transmit-only base stations fed by conventional landlines (e.g., from a BSC) could be used to provide downlinks to terminals, while uplinks from terminals are provided via a communications satellite.

FIG. **7** illustrates another "repeater" configuration for a wireless communications system **700** according to further embodiments of the present invention. The system **700** includes an MSC **712** and a BSC **714** that communicates with a remote terrestrial terminal interface subsystem, here including a remote transmit-only terrestrial base station **740**, via a repeater including a gateway **720** and a satellite **730**. The remote terrestrial transmit-only base station **740** includes a deconcentrator **742** that receives signals from the satellite **730** and converts the signals received over the satellite link to, for example, GSM-format signals transmitted to cellular terminals **95**. The gateway **720** includes a concentrator **722** that performs conversion functions complementary to those of the deconcentrator **742**. The BSC **714** is also connected to one or more receive-only base stations **750** that receive signals from terminals **95** and convey information therein to the BSC **714** using, for example, conventional cable, fiber or terrestrial microwave links. A combination of the terrestrial transmit-only base station **740** and the receive-only base station **750** may be viewed as forming a satellite-linked terrestrial terminal interface subsystem.

In the drawings and foregoing description thereof, there have been disclosed exemplary embodiments of the invention. Terms employed in the description are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

That which is claimed is:

1. A wireless communications system, comprising:

a satellite gateway coupled to a communications network and operative to communicate with a mobile communications satellite; and

a [terrestrial] terminal interface subsystem operative to communicate with the satellite gateway via the mobile communications satellite using a first radio interface over a first frequency band and to communicate with wireless [terminal over a geographic area] *terminals* using a second radio interface over substantially the first frequency band,

wherein the terminal interface subsystem comprises an interface converter operative to convert between the first and second radio interfaces; and

wherein the interface converter is operative to transfer information from a plurality of wireless communications channels to a lesser number of satellite communications channels.

2. A system according to claim **1**, wherein the first and second radio interfaces are different.

3. A system according to claim **1**, wherein the first and second radio interfaces are the same.

4. A system according to claim **1**, further comprising the *mobile* communications satellite.

5. A system according to claim **1**, wherein the communications network comprises a wireless communications network, and wherein the satellite gateway is configured to communicate with a base station controller of the wireless communications network.

[**6**. A system according to claim **1**, wherein the terrestrial terminal interface subsystem comprises an interface converter operative to convert between the first and second radio interfaces.]

[**7**. A system according to claim **6**, wherein the interface converter is operative to transfer information from a plurality of terrestrial wireless communications channels to a lesser number of satellite communications channels.]

8. A system according to claim [**7**] *1*, wherein the interface converter is operative to transfer information from a single satellite communication channel to a plurality of [terrestrial] wireless communications channels.

9. A system according to claim [**6**] *1*, wherein the interface converter provides unidirectional communications.

10. A system according to claim [**6**] *1*, wherein the interface converter provides bidirectional communications.

11. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem includes a satellite radio antenna and a [terrestrial] *wireless communications* radio antenna co-located at a single [terrestrial] base station.

12. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem includes a satellite radio antenna and a [terrestrial] *wireless communications* radio antenna located at [geographically] separate [sites] *locations*.

13. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem comprises a plurality of [terrestrial] base stations located at respective ones of a plurality of [geographically] distributed [sites] *locations*.

14. A system according to claim [**1**] *4*, wherein the *mobile* communications satellite is further operative to communicate with [terrestrial] terminals without use of the [terrestrial] terminal interface subsystem.

15. A system according to claim [**1**] *4*:

wherein the *mobile* communications satellite is operative to receive information intended for wireless terminals from the satellite gateway and to convey the received information to the wireless terminals without use of the [terrestrial] terminal interface subsystem; and

wherein the [terrestrial] terminal interface subsystem is operative to receive information from wireless terminals and to convey the received information to the communications network without use of the *mobile* communications satellite.

16. A system according to claim [**1**] *4*:

wherein the *mobile* communications satellite is operative to receive information from wireless terminals without use of the [terrestrial] terminal interface subsystem and to convey the received information to the satellite gateway; and

wherein the [terrestrial] terminal interface subsystem is operative receive information intended for wireless terminals from the *mobile* communications satellite and to convey the received information to [terrestrial] *wireless* terminals.

17. A system according to claim **1**,

wherein the [terrestrial] terminal interface subsystem is operative *to* receive information intended for wireless terminals from the *mobile* communications satellite and to convey the received information to [terrestrial] *wireless* terminals; and

wherein the [terrestrial] terminal interface subsystem is operative to receive information from wireless terminals and to convey the received information to the communications network without use of the *mobile* communications satellite.

18. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem is operative to control transmission power [for] *of* signals transmitted to the *mobile* communication satellite *responsive* to signals received from the *mobile* communication satellite.

19. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem is operative to control transmission power [for] *of* signals transmitted to wireless [terminal] *terminals* responsive to signals received from wireless terminals.

20. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem comprises:

a satellite radio, antenna;

a first [low-noise] *low noise* amplifier coupled to the satellite radio antenna;

a first demodulation and regeneration unit having an input coupled to an output of the first low noise amplifier;

a first modulator having an input coupled to an output of the first demodulation and regeneration unit;

a first power amplifier having an input coupled to an output of the first modulator; and

a [terrestrial] *wireless communications* radio antenna coupled to the output of the first power amplifier.

21. A system according to claim **20**, further comprising a first interference reducer coupled to the first demodulation and regeneration unit.

22. A system according to claim **20**, wherein the [terrestrial] terminal interface subsystem further comprises:

a second low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a second demodulation and regeneration unit having an input coupled to an output of the second low noise amplifier;

a second modulator having an input coupled to an output of the second demodulation and regeneration unit; and

a second power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

23. A system according to claim **22**, further comprising a second interference reducer coupled to the second demodulation and regeneration unit.

24. A system according to claim **22**, wherein the second modulator is operative to control power of a signal transmitted from the satellite radio antenna responsive to the first demodulation and regeneration unit.

25. A system according to claim **22**, wherein the first modulator is operative to control power of a signal transmitted from the [terrestrial] *wireless communications* radio antenna responsive to the second demodulation and regeneration unit.

26. A system according to claim **1**, wherein the [terrestrial] terminal interface subsystem comprises:

a [terrestrial] *wireless communications* radio antenna;

a low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a demodulation and regeneration unit having an input coupled to an output of the low noise amplifier;

a modulator having an input coupled to an output of the demodulation and regeneration unit;

a power amplifier having an input coupled to an output of the second modulator; and

a satellite radio antenna coupled to an output of the power amplifier.

27. A system according to claim **1** further comprising a wireless terminal.

28. The system according to claim **1**, wherein the frequency band is the L band.

29. A [terrestrial] terminal interface subsystem for a wireless communications system, the subsystem comprising:

a satellite radio antenna;

a [terrestrial] *wireless communications* radio antenna; and

an interface converter operative to communicate with a mobile communications satellite via the satellite radio antenna using a first radio interface over a first frequency band and to communicate with wireless terminals [over a geographic area] via the [terrestrial] *wireless communications* radio antenna using a second radio interface over substantially the same first frequency band*,*

wherein the interface converter is operative to transfer information from a single satellite communication channel to a plurality of wireless communications channels.

30. [A subsystem according to claim **29**,] *A terminal interface subsystem for a wireless communications system, the subsystem comprising:*

a satellite radio antenna;

a wireless communications radio antenna; and

an interface converter operative to communicate with a mobile communications satellite via the satellite radio antenna using a first radio interface over a first frequency band and to communicate with wireless terminals via the wireless communications radio antenna using a second radio interface over substantially the same first frequency band,

wherein the interface converter is operative to transfer information from a plurality of [terrestrial] wireless *terminal* communications channels to a lesser number of satellite communications channels.

[**31**. A subsystem according to claim **29**, wherein the interface converter is operative to transfer information from a single satellite communication channel to a plurality of terrestrial wireless communications channels.]

32. A subsystem according to claim **29**, wherein the [terrestrial] *wireless communications* radio antenna, the satellite radio antenna, and the interface converter are co-located at a single [terrestrial] base station.

33. A subsystem according to claim **29**, wherein the [terrestrial] *wireless communications* radio antenna and the satellite radio antenna are positioned at [geographically] separate locations.

34. A subsystem according to claim **29**, wherein the [terrestrial] *wireless communications* radio antenna comprises a plurality of [terrestrial] radio antennas located at respective ones of a plurality of [second geographically] distributed [second terrestrial sites] *locations*.

35. A subsystem according to claim **29**, wherein the interface converter provides unidirectional communications.

36. A subsystem according to claim **29**, wherein the interface converter provides bidirectional communications.

37. A subsystem according to claim **29**, comprising:

a first [low-noise] *low noise* amplifier coupled to the satellite radio antenna;

a first demodulation and regeneration unit having an input coupled to an output of the first low noise amplifier;

a first modulator having an input coupled to an output of the first demodulation and regeneration unit;

a first power amplifier having an input coupled to an output of the first modulator and an output coupled to the [terrestrial] *wireless communications* radio antenna.

38. A subsystem according to claim **37**, further comprising a first interference reducer coupled to the first demodulation and regeneration unit.

39. A subsystem according to claim **37**, comprising:

a second low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a second demodulation and regeneration unit having an input coupled to an output of the second low noise amplifier;

a second modulator having an input coupled to an output of the second demodulation and regeneration unit; and

a second power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

40. A subsystem according to claim **39**, further comprising a second interference reducer coupled to the second demodulation and regeneration unit.

41. A subsystem according to claim **39**, wherein the second modulator is operative to control power of a signal transmitted from the satellite radio antenna responsive to the first demodulation and regeneration unit.

42. A subsystem according to claim [**37**] *39*, wherein the first modulator is operative to control power of a signal transmitted from the [terrestrial] *wireless communications* radio antenna responsive to the second demodulation and regeneration unit.

43. A subsystem according to claim **29**, wherein the [terrestrial] terminal interface subsystem further comprises:

a [lownoise] *low noise* amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a demodulation and regeneration unit having an input coupled to an output of the low noise amplifier;

a modulator having an input coupled to an output of the demodulation and regeneration unit; and

a power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

44. An apparatus, comprising:

a satellite gateway operative to communicate with a communications network and to communicate via a mobile communications satellite with a [terrestrial] terminal interface system that serves wireless terminals [in a geographic area], wherein communication between the [terrestrial] terminal interface *system* and the mobile communications satellite[,] and communication between the [terrestrial] terminal interface *system* and wireless terminals [occurs] *occur* over substantially the same frequency band*, and wherein the terminal interface system is operative to transfer information from a plurality of wireless communications channels to a lesser number of satellite communications channels*.

45. An apparatus according to claim **44**, wherein the communications network comprises a wireless communications network, and wherein the satellite gateway is configured to communicate with a base station controller of the wireless communications network.

46. An apparatus, comprising:

a mobile communications satellite operative to convey terminal communications between an earth-based communications network and a [terrestrial] wireless base station that communicates with wireless terminals [in a geographic area], wherein communication between the [terrestrial] wireless base station and the mobile communications satellite[,] and communication between the wireless base station and the wireless terminals [occurs] *occur* over substantially the same frequency band*, and wherein the wireless base station is operative to transfer information from a plurality of wireless communications channels to a lesser number of satellite communications channels*.

47. An apparatus according to claim **46**, wherein the *mobile* communications satellite is further operative to communicate with wireless terminals without use of the [terrestrial] wireless base station.

48. A method of providing communications between a communications network and a plurality of wireless terminals served by a [terrestrial] base station, the method comprising: conveying terminal communications between the communications network and the [terrestrial] base station via a mobile communications satellite, wherein communication between the [terrestrial] base station and the mobile communications satellite[,] and communication between the [terrestrial] base station and wireless terminals served by the [terrestrial] base station [occurs] *occur* over substantially the same frequency band*, wherein conveying terminal communications between the communications network and the base station via a mobile communications satellite comprises transferring information from a plurality of wireless communications channels to a lesser number of satellite communications channels*.

49. A method according to claim **48**, wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises:

conveying a first radio signal from the *mobile* communications satellite to [earth] *the base station* using a first radio interface; and

conveying a second radio signal [from the first radio signal] from the [terrestrial] base station to a wireless terminal using a second radio interface, the second radio signal including information from the first radio signal.

50. A method according to claim **49**, wherein the first and second radio interfaces are the same.

51. A method according to claim **48**, wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises:

conveying a first radio signal from a wireless terminal to the [terrestrial] base station using a first radio interface; and conveying a second radio signal from [earth] *the base station* to the *mobile* communications satellite using a second radio interface, the second radio signal including information from the first radio signal.

52. A method according to claim **51**, wherein the first and second radio interfaces are the same.

53. A method according to claim **48**, wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises conveying the terminal communications via a satellite antenna co-located with the [terrestrial] base station.

54. A method according to claim **48**, wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises conveying terminal communications between the communications network and a plurality of [terrestrial] base stations [via a single satellite link].

55. A method according to claim **48**, wherein the communications network comprises a wireless communications network, and wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises conveying the terminal communications between the *mobile* communications satellite and a satellite gateway coupled to a base station controller of the wireless communications network.

[**56**. A method according to claim **48**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises transferring information from a plurality of terrestrial wireless communications channels to a lesser number of satellite communications channels.]

57. [A method according to claim **48**,] *A method of providing communications between a communications network and a plurality of wireless terminals served by a base station, the method comprising: conveying terminal communications between the communications network and the base station via a mobile communications satellite, wherein communication between the base station and the mobile communications satellite and communication between the base station and wireless terminals served by the base station occur over substantially the same frequency band, and*

wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises transferring information from a single satellite communication channel to a plurality of [terrestrial] wireless communications channels.

58. A method according to claim **48**, further comprising communicating between the *mobile* communications satellite and wireless terminals without use of a [terrestrial] base station.

59. A method according to claim **48**:

wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises conveying terminal communications from the [terrestrial] base station to the *mobile* communications satellite; and

wherein the method further comprises conveying terminal communications from the *mobile* communications satellite to wireless terminals without use of a [terrestrial] base station.

60. A method according to claim **48**:

wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises conveying terminal communications from the *mobile* communications satellite to the [terrestrial] base station; and

wherein the method further comprises conveying terminal communications from wireless terminals to the *mobile* communications satellite without use of a [terrestrial] base station.

61. A method according to claim **48**, further comprising controlling transmission power [for] *of* signals transmitted to the *mobile* communications satellite responsive to signals received from the *mobile* communications satellite.

62. A method according to claim **48**, further comprising controlling transmission power [for] *of* signals transmitted to wireless terminals responsive to signals received from wireless terminals.

63. A method according to claim **48**, wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises:

receiving a signal from the *mobile* communications satellite at [an earth-based] *a* satellite radio antenna;

[low-noise] *low noise* amplifying the received signal;

demodulating the amplified signal and generating a signal from the demodulated signal in a format suitable for transmission to a wireless terminal;

modulating the demodulated and regenerated signal;

amplifying the modulated signal; and

transmitting the amplified signal from a [terrestrial] *wireless communications* radio antenna to a wireless terminal.

64. A method according to claim **48**, wherein conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite comprises:

receiving a radio signal from a wireless terminal at the [terrestrial] *wireless communications* radio antenna;

low noise amplifying the received radio signal;

demodulating the amplified radio signal and generating a signal from the demodulated signal in a format suitable for transmission to the *mobile* communications satellite;

modulating the generated signal;

amplifying the modulated signal; and

transmitting the amplified signal from [an earth-based] *a* satellite radio antenna.

65. An apparatus for providing communications between a communications network and a plurality of wireless terminals served by a [terrestrial] base station, the apparatus comprising:

means for conveying terminal communications between the communications network and the [terrestrial] base station via a mobile communications satellite using a first radio interface; and

means for conveying the terminal communications between the [terrestrial] base station and wireless terminals using a second radio interface, wherein [at least part of the] terminal communications [occurs] *between the communications network and the base station via the mobile communications satellite and communications between the base station and wireless terminals occur* over substantially the same frequency band*,*

wherein the means for conveying terminal communications between the communications network and the *base station via a mobile communications satellite using a first radio interface comprises means for conveying terminal communications between the communications network and a plurality of base stations, and*

wherein the means for conveying terminal communications between the communications network and the base station via a mobile communications satellite using a first radio interface comprises means for transferring information from a plurality of wireless communications channels to a lesser number of satellite communications channels.

[**66**. An apparatus according to claim **65**, wherein the means for conveying terminal communications between the communications network and the terrestrial base station via a communications satellite using a first radio interface comprises means for conveying terminal communications between the communications network and a plurality of terrestrial base stations via a single satellite link.]

[**67**. An apparatus according to claim **66**, wherein the means for conveying terminal communications between the communications network and the terrestrial base station via a communications satellite using a first radio interface comprises means for transferring information from a plurality of terrestrial wireless communications channels to a lesser number of satellite communications channels.]

68. [An apparatus according to claim **65**,] *An apparatus for providing communications between a communications network and a plurality of wireless terminals served by a base station, the apparatus comprising:*

means for conveying terminal communications between the communications network and the base station via a mobile communications satellite using a first radio interface; and

means for conveying the terminal communications between the base station and wireless terminals using a second radio interface, wherein terminal communications between the communications network and the base station via the mobile communications satellite and communications between the base station and wireless terminals occur over substantially the same frequency band, and

wherein the means for conveying terminal communications between the communications network and the [terrestrial] base station via a *mobile* communications satellite using a first radio interface comprises means for transferring information from a single satellite communication channel to a plurality of [terrestrial] wireless communications channels.

69. An apparatus according to claim **65**, further comprising means for communicating between the *mobile* communications satellite and wireless terminals without use of a [terrestrial] base station.

70. A wireless communications system, comprising:

a satellite gateway coupled to a communications network and operative to communicate with a *mobile* communications satellite; and

a [terrestrial] terminal interface subsystem operative to communicate with the satellite gateway via the *mobile* communications satellite using a first radio interface and to communicate with wireless terminals [over a geographic area] using a second radio interface,

wherein the *mobile* communications satellite is operative to receive information intended for wireless terminals from the satellite gateway and to convey the received information to the wireless terminals without use of the [terrestrial] terminal interface subsystem; and

wherein the [terrestrial] terminal interface subsystem is operative to receive information from wireless terminals and to convey the received information to the communications network without use of the *mobile* communications satellite,

wherein the terminal interface subsystem comprises an interface converter operative to convert between the first and second radio interfaces, and

wherein the interface converter is operative to transfer information from a plurality of wireless communications channels to a lesser number of satellite communications channels.

71. A system according to claim **70**, wherein the first and second radio interfaces are different.

72. A system according to claim **70**, wherein the first and second radio interfaces are the same.

73. A system according to claim **70**, further comprising the *mobile* communications satellite.

74. A system according to claim **70**, wherein the communications network comprises a wireless communications network, and wherein the satellite gateway is configured to communicate with a base station controller of the wireless communications network.

[**75**. A system according to claim **70**, wherein the terrestrial terminal interface subsystem comprises an interface converter operative to convert between the first and second radio interfaces.]

[**76**. A system according to claim **75**, wherein the interface converter is operative to transfer information from a plurality of terrestrial wireless communications channels to a lesser number of satellite communications channels.]

77. [A system according to claim **75**,] *A wireless communications system, comprising:*

a satellite gateway coupled to a communications network and operative to communicate with a mobile communications satellite; and

a terminal interface subsystem operative to communicate with the satellite gateway via the mobile communications satellite using a first radio interface and to communicate with wireless terminals using a second radio interface,

wherein the mobile communications satellite is operative to receive information intended for wireless terminals from the satellite gateway and to convey the received information to the wireless terminals without use of the terminal interface subsystem; and

wherein the terminal interface subsystem is operative to receive information from wireless terminals and to convey the received information to the communications network without use of the mobile communications satellite,

wherein the terminal interface subsystem comprises an interface converter operative to convert between the first and second radio interfaces; and

wherein the interface converter is operative to transfer information from a single satellite [communication] *communications* channel to a plurality of [terrestrial] wireless communications channels.

78. A system according to claim [**75**] *70*, wherein the interface converter provides unidirectional communications.

79. A system according to claim [**75**] *70*, wherein the interface converter provides bidirectional communications.

80. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem includes a satellite radio antenna and a [terrestrial] *wireless communications* radio antenna co-located at a single [terrestrial] base station.

81. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem includes a satellite radio antenna and a [terrestrial] *wireless communications* radio antenna located at [geographically] separate [sites] *locations*.

82. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem comprises a plurality of [terrestrial] base stations located at respective ones of a plurality of [geographically] distributed [sites] *locations*.

83. A system according to claim **70**, wherein the *mobile* communications satellite is further operative to communicate with [terrestrial] terminals without use of the [terrestrial] terminal interface subsystem.

84. A system according to claim **70**:

wherein the *mobile* communications satellite is operative to receive information from wireless terminals without use of the [terrestrial] terminal interface subsystem and to convey the received information to the satellite gateway; and

wherein the [terrestrial] terminal interface subsystem is operative receive information intended for wireless terminals from the *mobile* communications satellite and to convey the received information to [terrestrial] *wireless* terminals.

85. A system according to claim **70**,

wherein the [terrestrial] terminal interface subsystem is operative to receive information intended for wireless terminals from the *mobile* communications satellite and to convey the received information to [terrestrial] *wireless* terminals; and

wherein the [terrestrial] terminal interface subsystem is operative to receive information from wireless terminals and to convey the received information to the communications network without use of the *mobile* communications satellite.

86. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem is operative to control transmission power [for] *of* signals transmitted to the *mobile* communications satellite responsive to signals received from the *mobile* communications satellite.

87. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem is operative to control transmission power [for] *of* signals transmitted to wireless terminals responsive to signals received from wireless terminals.

88. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem comprises:

a satellite radio antenna;

first [low-noise] *low noise* amplifier coupled to the satellite radio antenna;

a first demodulation and regeneration unit having an input coupled to an output of the first low noise amplifier;

a first modulator having an input coupled to an output of the first demodulation and regeneration unit;

a first power amplifier having an input coupled to an output of the first modulator; and

a [terrestrial] *wireless communications* radio antenna coupled to the output of the first power amplifier.

89. A system according to claim **88**, further comprising a first interference reducer coupled to the first demodulation and regeneration unit.

90. A system according to claim **88**, wherein the [terrestrial] terminal interface subsystem further comprises:

a second low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a second demodulation and regeneration unit having an input coupled to an output of the second low noise amplifier;

a second modulator having an input coupled to an output of the second demodulation and regeneration unit; and

a second power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

91. A system according to claim **90**, further comprising a second interference reducer coupled to the second demodulation and regeneration unit.

92. A system according to claim **90**, wherein the second modulator is operative to control power of a signal transmitted from the satellite radio antenna responsive to the first demodulation and regeneration unit.

93. A system according to claim **90**, wherein the first modulator is operative to control power of a signal transmitted from the [terrestrial] *wireless communications* radio antenna responsive to the second demodulation and regeneration unit.

94. A system according to claim **70**, wherein the [terrestrial] terminal interface subsystem comprises:

a [terrestrial] *wireless communications* radio antenna;

a low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a demodulation and regeneration unit having an input coupled to an output of the low noise amplifier;

a modulator having an input coupled to an output of the demodulation and regeneration unit;

a power amplifier having an input coupled to an output of the modulator; and

a satellite radio antenna coupled to an output of the power amplifier.

95. A system according to claim **70**, further comprising a wireless terminal.

96. A [terrestrial] terminal interface subsystem for a wireless communications system, the subsystem comprising:

a satellite radio antenna;

a [terrestrial] *wireless communications* radio antenna;

an interface converter operative to communicate with a *mobile* communications satellite via the satellite radio antenna using a first radio interface and to communicate with wireless terminals [over a geographic area] via the [terrestrial] *wireless communications* radio antenna using a second radio interface;

a first [low-noise] *low noise* amplifier coupled to the satellite radio antenna;

a first demodulation and regeneration unit having an input coupled to an output of the first low noise amplifier;

a first modulator having an input coupled to an output of the first demodulation and regeneration unit; and

a first power amplifier having an input coupled to an output of the first modulator and an output coupled to the [terrestrial] *wireless communications* radio antenna,

wherein the interface converter is operative to transfer information from a single satellite communications channel to a plurality of wireless terminal communications channels.

97. [A subsystem according to claim **96**,] *A terminal interface subsystem for a wireless communications system, the subsystem comprising:*

a satellite radio antenna;

a wireless communications radio antenna;

an interface converter operative to communicate with a mobile communications satellite via the satellite radio *antenna using a first radio interface and to communicate with wireless terminals via the wireless communications radio antenna using a second radio interface;*

a first low noise amplifier coupled to the satellite radio antenna;

a first demodulation and regeneration unit having an input coupled to an output of the first low noise amplifier;

a first modulator having an input coupled to an output of the first demodulation and regeneration unit; and

a first power amplifier having an input coupled to an output of the first modulator and an output coupled to the wireless communications radio antenna,

wherein the interface converter is operative to transfer information from a plurality of [terrestrial] wireless *terminal* communications channels to a lesser number of satellite communications channels.

[**98**. A subsystem according to claim **96**, wherein the interface converter is operative to transfer information from a single satellite communication channel to a plurality of terrestrial wireless communications channels.]

99. A subsystem according to claim **96**, wherein the [terrestrial] *wireless communications* radio antenna, the satellite radio antenna, and the interface converter are co-located at a single [terrestrial] base station.

100. A subsystem according to claim **96**, wherein the [terrestrial] *wireless communications* radio antenna and the satellite radio antenna are positioned at [geographically] separate locations.

101. A subsystem according to claim **96**, wherein the [terrestrial] *wireless communications* radio antenna comprises a plurality of [terrestrial] radio antennas located at respective ones of a plurality of [second geographically] distributed [second terrestrial sites] *locations*.

102. A subsystem according to claim **96**, wherein the interface converter provides unidirectional communications.

103. A subsystem according to claim **96**, wherein the interface converter provides bidirectional communications.

104. A subsystem according to claim **96**, further comprising a first interference reducer coupled to the first demodulation and regeneration unit.

105. A subsystem according to claim **96**, comprising:

a second low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a second demodulation and regeneration unit having an input coupled to an output of the second low noise amplifier;

a second modulator having an input coupled to an output of the second demodulation and regeneration unit; and

a second power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

106. A subsystem according to claim **105**, further comprising a second interference reducer coupled to the second demodulation and regeneration unit.

107. A subsystem according to claim **105**, wherein the second modulator is operative to control power of a signal transmitted from the satellite radio antenna responsive to the first demodulation and regeneration unit.

108. A subsystem according to claim **99**, wherein the first modulator is operative to control power of a signal transmitted from the [terrestrial] *wireless communications* radio antenna responsive to the second demodulation and regeneration unit.

109. A subsystem according to claim **96**, wherein the [terrestrial] terminal interface subsystem further comprises:

a low noise amplifier coupled to the [terrestrial] *wireless communications* radio antenna;

a demodulation and regeneration unit having an input coupled to an output of the low noise amplifier;

a modulator having an input coupled to an output of the demodulation and regeneration unit; and

a power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

[**110**. A method of providing communications between a communications network and a plurality of wireless terminals served by a terrestrial base station, the method comprising:

conveying terminal communications between the communications network and the terrestrial base station via a communications satellite,

wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises:

receiving a signal from the communications satellite at an earth-based satellite radio antenna;

low-noise amplifying the received signal;

demodulating the amplified signal and generating a signal from the demodulated signal in a format suitable for transmission to a wireless terminal;

modulating the demodulated and regenerated signal;

amplifying the modulated signal; and

transmitting the amplified signal from a terrestrial radio antenna to a wireless terminal.]

[**111**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises:

conveying a first radio signal from the communications satellite to earth using a first radio interface; and

conveying a second radio signal from the first radio signal from the terrestrial base station to a wireless terminal using a second radio interface, the second radio signal including information from the first radio signal.]

[**112**. A method according to claim **111**, wherein the first and second radio interfaces are the same.]

[**113**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises:

conveying a first radio signal from a wireless terminal to the terrestrial base station using a first radio interface; and

conveying a second radio signal from earth to the communications satellite using a second radio interface, the second radio signal including information from the first radio signal.]

[**114**. A method according to claim **113**, wherein the first and second radio interfaces are the same.]

[**115**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises conveying the terminal communications via a satellite antenna co-located with the terrestrial base station.]

[**116**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises conveying terminal communications between the communications network and a plurality of terrestrial base stations via a single satellite link.]

[**117**. A method according to claim **110**, wherein the communications network comprises a wireless communications network, and wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises conveying the terminal communications between the communications satellite and a satellite gateway coupled to a base station controller of the wireless communications network.]

[**118**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises transferring information from a plurality of terrestrial wireless communications channels to a lesser number of satellite communications channels.]

[**119**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises transferring information from a single satellite communication channel to a plurality of terrestrial wireless communications channels.]

[**120**. A method according to claim **110**, further comprising communicating between the communications satellite and wireless terminals without use of a terrestrial base station.]

[**121**. A method according to claim **110**:

wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises conveying terminal communications from the terrestrial base station to the communications satellite;and

wherein the method further comprises conveying terminal communications from the communications satellite to wireless terminals without use of a terrestrial base station.]

[**122**. A method according to claim **110**:

wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises conveying terminal communications from the communications satellite to the terrestrial base station; and

wherein the method further comprises conveying terminal communications from wireless terminals to the communications satellite without use of a terrestrial base station.]

[**123**. A method according to claim **110**, further comprising controlling transmission power for signals transmitted to the communications satellite responsive to signals received from the communications satellite.]

[**124**. A method according to claim **110**, further comprising controlling transmission power for signals transmitted to wireless terminals responsive to signals received from wireless terminals.]

[**125**. A method according to claim **110**, wherein conveying terminal communications between the communications network and the terrestrial base station via a communications satellite comprises:

receiving a radio signal from a wireless terminal at the terrestrial radio antenna;

low noise amplifying the received radio signal;

demodulating the amplified radio signal and generating a signal from the demodulated signal in a format suitable for transmission to the communications satellite;

modulating the generated signal;

amplifying the modulated signal; and

transmitting the amplified signal from an earth-based satellite radio antenna.]

126. A terminal interface subsystem comprising:

a satellite radio antenna;

a wireless communications radio antenna; and

an interface converter operative to communicate with at least one satellite via the satellite radio antenna using frequencies of a predetermined frequency band and to communicate with wireless terminals via the wireless communications radio antenna using frequencies of the predetermined frequency band, wherein the interface converter is operative to transfer information from a single satellite communications channel to a plurality of wireless communications channels and wherein the predetermined frequency band is a mobile satellite frequency band.

127. A terminal interface subsystem comprising:

a satellite radio antenna;

a wireless communications radio antenna; and

an interface converter operative to communicate with at least one satellite via the satellite radio antenna using frequencies of a predetermined frequency band and to communicate with wireless terminals via the wireless communications radio antenna using frequencies of the predetermined frequency band, wherein the interface converter is operative to transfer information from a plurality of wireless communications channels to a lesser number of satellite communications channels and wherein the predetermined frequency band is a mobile satellite frequency band.

128. A terminal interface subsystem according to claim 127, wherein the wireless communications radio antenna and the satellite radio antenna are substantially co-located.

129. A terminal interface subsystem according to claim 127, wherein the wireless communications radio antenna and the satellite radio antenna are located at substantially separate locations.

130. A terminal interface subsystem according to claim 127, wherein the wireless communications radio antenna comprises a plurality of wireless communications radio antennas.

131. A terminal interface subsystem according to claim 127, wherein the interface converter provides unidirectional communications.

132. A terminal interface subsystem according to claim 127, wherein the interface converter provides bidirectional communications.

133. A terminal interface subsystem according to claim 127, further comprising:

a first low noise amplifier coupled to the satellite radio antenna;

a first demodulation and regeneration unit having an input coupled to an output of the first low noise amplifier;

a first modulator having an input coupled to an output of the first demodulation and regeneration unit; and

a first power amplifier having an input coupled to an output of the first modulator and an output coupled to the wireless communications radio antenna.

134. A terminal interface subsystem according to claim 133, further comprising a first interference reducer coupled to the first demodulation and regeneration unit.

135. A terminal interface subsystem according to claim 133, further comprising:

a second low noise amplifier coupled to the wireless communications radio antenna;

a second demodulation and regeneration unit having an input coupled to an output of the second low noise amplifier;

a second modulator having an input coupled to an output of the second demodulation and regeneration unit; and

a second power amplifier having an input coupled to an output of the second modulator and an output coupled to the satellite radio antenna.

136. A terminal interface subsystem according to claim 135, further comprising a second interference reducer coupled to the second demodulation and regeneration unit.

137. A terminal interface subsystem according to claim 135, wherein the second modulator is operative to control power of a signal transmitted from the satellite radio antenna responsive to the first demodulation and regeneration unit.

138. A terminal interface subsystem according to claim 133, wherein the first modulator is operative to control power of a signal transmitted from the wireless communications radio antenna responsive to the second demodulation and regeneration unit.

139. A terminal interface subsystem according to claim 127, further comprising:

a low noise amplifier coupled to the wireless communications radio antenna;

a demodulation and regeneration unit having an input coupled to an output of the low noise amplifier;

a modulator having an input coupled to an output of the demodulation and regeneration unit; and

a power amplifier having an input coupled to an output of the modulator and an output coupled to the satellite radio antenna.

140. A method of providing communications between a communications network and a plurality of wireless terminals served by a base station, the method comprising:

conveying terminal communications between the communications network and the base station via a communications satellite,

wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises:

receiving a signal from the communications satellite at a satellite radio antenna;

low-noise amplifying the received signal;

demodulating the amplified signal and regenerating the demodulated signal to recover a bitstream or other datastream in a format suitable for modulation and transmission to a wireless terminal;

modulating the bitstream or datastream;

amplifying the modulated signal; and

transmitting the amplified signal from a wireless communications radio antenna to a wireless terminal.

141. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises:

conveying a first radio signal from the communications satellite to the base station using a first radio interface; and

conveying a second radio signal from the first radio signal from the base station to a wireless terminal using a second radio interface, the second radio signal including information from the first radio signal.

142. A method according to claim 141, wherein the first and second radio interfaces are the same.

143. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises:

conveying a first radio signal from a wireless terminal to the base station using a first radio interface; and

conveying a second radio signal from the base station to the communications satellite using a second radio interface, the second radio signal including information from the first radio signal.

144. A method according to claim 143, wherein the first and second radio interfaces are the same.

145. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises conveying the terminal communications via a satellite antenna co-located with the base station.

146. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises conveying terminal communications between the communications network and a plurality of base stations.

147. A method according to claim 140, wherein the communications network comprises a wireless communications network, and wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises conveying the terminal communications between the communications satellite and a satellite gateway coupled to a base station controller of the wireless communications network.

148. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises transferring information from a plurality of wireless communications channels to a lesser number of satellite communications channels.

149. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises transferring information from a single satellite communication channel to a plurality of wireless communications channels.

150. A method according to claim 140, further comprising controlling transmission power for signals transmitted to the communications satellite responsive to signals received from the communications satellite.

151. A method according to claim 140, further comprising controlling transmission power for signals transmitted to wireless terminals responsive to signals received from wireless terminals.

152. A method according to claim 140, wherein conveying terminal communications between the communications network and the base station via a communications satellite comprises:

receiving a radio signal from a wireless terminal at the wireless communications radio antenna;

low noise amplifying the received radio signal;

demodulating the amplified radio signal and regenerating the demodulated signal to recover a bitstream or other datastream in a format suitable for modulation and transmission to the communications satellite;

modulating the bitstream or datastream;

amplifying the modulated signal; and

transmitting the amplified signal from the satellite radio antenna.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : RE42,261 E
APPLICATION NO. : 11/431160
DATED : March 29, 2011
INVENTOR(S) : Karabinis

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page:
Item (75) Inventor: Please correct "Peter D. Karabinis, Reston, VA"
to read -- Peter D. Karabinis, Cary, NC --

Please add the following to the Title Page
-- (*) Notice: This patent is subject to a terminal disclaimer. --

Item (56) References Cited, Other Publications. Line 6:
Please correct "globalstar$_{13}$terrestrial$_{13}$"
to read -- globalstar_terrestrial_ --

Column 9, Claim 20, Line 38: Please correct "radio, antenna;"
to read -- radio antenna --

Column 14, Claim 65, Line 61: Please correct "[occurs] between"
to read -- between --
Line 65: Please correct "occur over"
to read -- [occurs] occur over --

Signed and Sealed this
Twenty-second Day of November, 2011

David J. Kappos
Director of the United States Patent and Trademark Office