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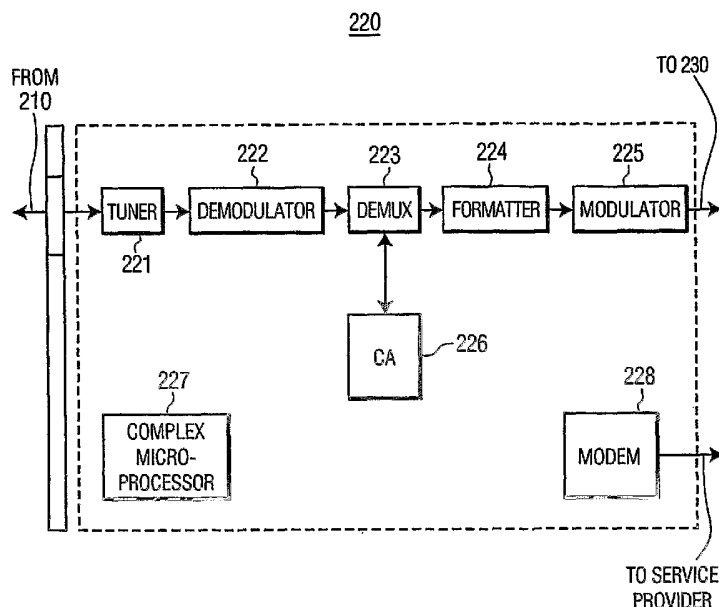
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(54) Title: INTERFACE APPARATUS FOR A TELEVISION SIGNAL RECEIVER



(57) Abstract: Interface apparatuses (220) enable television signal receivers that are compliant with a digital cable ready standard to receive digital satellite broadcast signals. According to an exemplary embodiment, interface apparatuses (220) include an input operative to receive satellite broadcast signals. Signal processing elements (221-225) process the digital satellite broadcast signals to generate processed satellite signals conforming to the digital cable ready standard without decoding the satellite broadcast signals. The processed satellite signals are provided to a television signal receiver (20, 230) that is compliant with a digital cable ready standard.



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INTERFACE APPARATUS FOR A TELEVISION SIGNAL RECEIVER

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority to and all benefits accruing from two (2)
5 provisional applications filed in the United States Patent and Trademark Office
on March 11, 2003, and having assigned serial numbers 60/453,502 and
60/453,508.

BACKGROUND OF THE INVENTION**Field of the Invention**

10 The present invention generally relates to television signal receivers,
and more particularly, to interface apparatuses, which enable television signal
receivers that are compliant with a digital cable ready standard to also receive
satellite broadcast signals.

Background Information

15 The cable television industry and consumer electronics manufacturers
have recently entered into negotiations to create a digital cable ready
standard for digital television signal receivers. In particular, the digital cable
ready standard would enable consumer electronics manufacturers to integrate
sufficient functionality into a digital television signal receiver to allow reception
20 of digital signals including digital video signals through a coaxial cable
connection.

While television signal receivers compliant with a digital cable ready
standard are advantageous in that they can receive digital cable broadcast
signals, they are also disadvantageous in that they are unable to receive other
25 types of signals such as satellite broadcast signals. This disadvantage,
however, is significant since a large number of television subscribers receive
signals via a satellite broadcast system. Moreover, the number of satellite
subscribers is expected to increase in the coming years. At present, a
satellite ready standard for television signal receivers does not exist.
30 Accordingly, it is desirable to provide a means by which digital cable ready

television signal receivers may also receive other signals including satellite broadcast signals.

SUMMARY OF THE INVENTION

5 In accordance with an aspect of the present invention, an interface apparatus for a video signal processing apparatus supporting digital signals in a first digital format and modulated using a first type of modulation is disclosed. According to an exemplary embodiment, the interface apparatus comprises input means for receiving satellite broadcast signals in a second
10 digital format different from the first digital format. Processing means process the satellite broadcast signals to generate first digital signals in the first digital format without decoding the satellite broadcast signals. A modulator then modulates the first digital signals using the first type of modulation, and provides the modulated signals to the video signal processing apparatus. In
15 one embodiment, the video signal processing apparatus is a television signal receiver that is compliant with a digital cable ready standard.

In accordance with another aspect of the present invention, a method for providing digital signals to a video signal processing apparatus supporting digital signals in a first digital format and modulated using a first type of
20 modulation is disclosed. According to an exemplary embodiment, the method comprises steps of receiving satellite broadcast signals in a second digital format different from said first digital format, processing the satellite broadcast signals to generate first digital signals in the first digital format without decoding the second digital signals, and modulating the first digital signals
25 using the first type of modulation, and passing the modulated signals to the video signal processing apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and
30 the invention will be better understood by reference to the following

description of embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a diagram of an environment according to an exemplary embodiment of the present invention;

5 FIG. 2 is a block diagram of an interface apparatus of the television signal receiver of FIG. 1 according to an exemplary embodiment of the present invention;

FIG. 3 is a diagram of an environment according to another exemplary embodiment of the present invention;

10 FIG. 4 is a block diagram of the interface apparatus of FIG. 3 according to an exemplary embodiment of the present invention;

FIG. 5 is a flowchart illustrating steps according to an exemplary embodiment of the present invention;

15 FIG. 6 is a flowchart illustrating further details regarding one of the steps of FIG. 5 according to the exemplary embodiment of FIGS 1 and 2; and

FIG. 7 is a flowchart illustrating further details regarding one of the steps of FIG. 5 according to the exemplary embodiment of FIGS. 3 and 4.

20 The exemplifications set out herein illustrate preferred embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and more particularly to FIG. 1, a diagram of an environment 100 according to an exemplary embodiment of the present invention is shown. In FIG. 1, environment 100 comprises a signal
25 receiving element 10 and a television signal receiver 20. According to an exemplary embodiment, signal receiving element 10 is operatively coupled to television signal receiver 20 via a coaxial cable connection comprised of RG-6 type coaxial cable, although other types of coaxial cable may also be used.

30 Signal receiving element 10 is operative to receive signals including satellite broadcast signals representing audio, video, and/or data content from a satellite broadcast system. According to an exemplary embodiment, signal

receiving element 10 is embodied as an antenna such as a satellite receiving dish, but may also be embodied as any type of signal receiving element such as an input terminal and/or other element.

Television signal receiver 20 is operative to receive and process
5 signals including the satellite broadcast signals provided from signal receiving element 10 and thereby provide corresponding aural and/or visual outputs. According to an exemplary embodiment, television signal receiver 20 is compliant with any digital cable ready standard. As referred to herein, a
10 "digital cable ready standard" may refer to any standard and/or specification which, when implemented, enables a digital television signal receiver to receive digital signals including digital video signals via a coaxial cable connection. Moreover, television signal receiver 20 includes an integrated interface apparatus (not expressly shown in FIG. 1), which enables it to also receive satellite broadcast signals, notwithstanding its compliance with a
15 digital cable ready standard.

Referring to FIG. 2, a block diagram of the interface apparatus of television signal receiver 20 of FIG. 1 according to an exemplary embodiment of the present invention is shown. In FIG. 2, interface apparatus of television signal receiver 20 comprises tuning means such as tuner 21, Demodulating
20 means such as demodulator 22, demultiplexing means such as demultiplexer 23, decoding means such as decoder 24, power supply means such as low noise block (LNB) power supply 25, conditional access (CA) means such as CA module 26, complex processing means such as complex microprocessor 27, and modulating/demodulating means such as modem 28. The foregoing
25 elements of FIG. 2 may be embodied using integrated circuits (ICs), and any given element may for example be included on one or more ICs. For clarity of description, certain conventional elements associated with the interface apparatus of television signal receiver 20 such as certain control signals, power signals and/or other elements may not be shown in FIG. 2.

30 Tuner 21 is operative to perform a channel tuning function of the interface apparatus of television signal receiver 20. According to an

exemplary embodiment, tuner 21 receives satellite broadcast signals from signal receiving element 10, and converts the satellite broadcast signals from a relatively high frequency band (e.g., greater than 1 GHz) to baseband, or near baseband, to thereby generate frequency converted signals. The tuning
5 function performed by tuner 21 may for example be performed responsive to a channel change command (e.g., via remote control, etc.) from a user of television signal receiver 20.

Demodulator 22 is operative to perform various functions of the interface apparatus of television signal receiver 20 including analog-to-digital
10 (A/D) conversion, demodulation, and Forward Error Correction (FEC) decoding functions. According to an exemplary embodiment, demodulator 22 converts the frequency converted (i.e., tuned) signals provided from tuner 21 to digital signals, which are then demodulated. According to this exemplary embodiment, demodulator 22 may be operative to demodulate various types
15 of signals such as Quadrature Amplitude Modulated (QAM) signals, Phase Shift Keyed (PSK – e.g., QPSK) signals, and/or signals having other types of modulation. The FEC decoding function is then applied to thereby generate demodulated signals. According to an exemplary embodiment, the FEC decoding function of the interface apparatus of television signal receiver 20
20 may include Reed-Solomon (R-S) FEC, de-interleaving, Viterbi and/or other functions. The demodulated signals generated by demodulator 22 may include a plurality of time-division multiplexed broadcast programs.

Demultiplexer 23 is operative to perform demultiplexing functions of the interface apparatus of television signal receiver 20. According to an
25 exemplary embodiment, demultiplexer 23 demultiplexes the demodulated signals into one or more digital transport streams, where each digital transport stream may include one given broadcast program. In the aforementioned manner, tuner 21, demodulator 22, and demultiplexer 23 function as a means for generating digital transport streams. Each digital transport stream
30 includes satellite data packets in a first format used for satellite broadcast signals.

Decoder 24 is operative to perform decoding functions of the interface apparatus of television signal receiver 20. According to an exemplary embodiment, decoder 24 is operative to decode the digital transport streams provided from demultiplexer 23 using various types of signal decoding including Moving Picture Expert Group (MPEG) decoding such as MPEG-2 and/or MPEG-4 types of decoding.

LNB power supply 25 is operative to provide power for an LNB of signal receiving element 10. According to an exemplary embodiment, LNB power supply 25 extends the existing power supply of television signal receiver 20 to support control voltages for the LNB of signal receiving element 10. LNB power supply 25 may also include a mechanism to control the LNB.

CA module 26 is operative to perform CA functions of the interface apparatus of television signal receiver 20 by decrypting the digital transport streams provided from demultiplexer 23. According to an exemplary embodiment, CA module 26 provides CA functions in accordance with a POD-HOST interface specification, which is generally known in the art, although other types of CA may also be used by CA module 26.

Complex microprocessor 27 is operative to perform various processing functions of the interface apparatus of television signal receiver 20. According to an exemplary embodiment, complex microprocessor 27 provides various control signals, which control the functions of the other elements of the interface apparatus of television signal receiver 20. For clarity of description, such control signals are not expressly shown in FIG. 2.

Modem 28 is operative to provide signals representing information such as billing, pay-per-view, and/or other information to a service provider. According to an exemplary embodiment, modem 28 may be coupled to a transmission medium such as a telephone line, and may be programmed to provide such information to the service provider in accordance with a predetermined schedule (e.g., every other Tuesday at 2:00 am, etc.).

Referring to FIG. 3, a diagram of an environment 300 according to another exemplary embodiment of the present invention is shown. In FIG. 3,

environment 300 comprises a signal receiving element 210, interface apparatus 220, and a television signal receiver 230. According to an exemplary embodiment, signal receiving element 210 is operatively coupled to interface apparatus 220 via a coaxial cable connection comprised of RG-6 type coaxial cable, and interface apparatus 220 is operatively coupled to television signal receiver 230 via a coaxial cable connection comprised of RG-59 type coaxial cable, although other types of coaxial cable may also be used.

Signal receiving element 210 is substantially identical to signal receiving element 10 of FIG. 1. Accordingly, signal receiving element 210 is operative to receive signals including satellite broadcast signals representing audio, video, and/or data content from a satellite broadcast system, and may be embodied as an antenna such as a satellite receiving dish, or any type of signal receiving element such as an input terminal and/or other element.

Interface apparatus 220 is operative to receive signals including the satellite broadcast signals provided from signal receiving element 10, and process those received signals to thereby generate processed satellite signals. As indicated in FIG. 3, interface apparatus 220 is not integrated into television signal receiver 230 like the embodiment of FIG. 1, but rather is embodied as a separate device, such as a set top box.

Television signal receiver 230 is operative to provide aural and/or visual outputs corresponding to the processed satellite signals provided from interface apparatus 220. According to an exemplary embodiment, television signal receiver 20 is compliant with any digital cable ready standard, and is capable of receiving satellite broadcast signals notwithstanding its compliance with a digital cable ready standard due to the signal processing functions of interface apparatus 220.

Referring to FIG. 4, a block diagram of interface apparatus 220 of FIG. 3 according to an exemplary embodiment of the present invention is shown. In FIG. 4, interface apparatus 220 comprises tuning means such as tuner 221, demodulating means such as demodulator 222, demultiplexing means such as demultiplexer 223, formatting means such as formatter 224, modulating

means such as modulator 225, CA means such as CA module 226, complex processing means such as complex microprocessor 227, and modulating/demodulating means such as modem 228. The foregoing elements of FIG. 4 may be embodied using integrated circuits (ICs), and any
5 given element may for example be included on one or more ICs. For clarity of description, certain conventional elements associated with interface apparatus 220 such as certain control signals, power signals and/or other elements may not be shown in FIG. 4.

In FIG. 4, tuner 221, demodulator 222, demultiplexer 223, complex
10 microprocessor 227, and modem 228 are substantially identical to tuner 21, demodulator 22, demultiplexer 23, complex microprocessor 27, and modem 28 of FIG. 2, respectively. Accordingly, for clarity of description, these common elements will not be described again, and the reader may refer to the descriptions of these elements previously provided herein.

15 Formatter 224 is operative to perform various signal formatting functions of interface apparatus 220, including digital reformatting and digital-to-analog (D/A) conversion functions. According to an exemplary embodiment, formatter 224 performs a digital reformatting function by converting satellite data packets in the digital transport streams provided from
20 demultiplexer 223 from the first format used for satellite broadcast signals to digital cable ready data packets in a second format used for digital cable broadcast signals to thereby generate reformatted digital signals without decoding the digital transport streams. Formatter 224 then sends the digital cable ready data packets to a modulator 225.

25 Illustratively, satellite data packets include a header section (24 bits or 3 bytes) and a payload section (1,016 bits or 127 bytes). Within the header section are several fields with the following names and sizes:

Packet framing (1 bit)
Reserved (1 bit)
30 Control flag (1 bit)
Control sync (1 bit)

Service channel identifier (12 bits)

Continuity counter (4 bits)

Header designator (4 bits)

Each of these fields contain values that identify what the payload section of
5 the same data packet contains and how that payload section content should
be interpreted. The payload section of satellite data packets can be partially
or completely filled with non-zero values. Typical contents for the payload
sections are MPEG-2 or MPEG-4 encoded video, MPEG or AC-3 audio,
program guide, interactive data, program entitlement, program description, or
10 other service streams.

Illustratively, digital cable ready data packets consist of a header
section (32 bits or 4 bytes) and a payload section (1472 bits or 184 bytes).
Within this digital cable ready data packet header section are several fields
with the following names and sizes:

15 Sync byte (8 bits)
 Transport error indicator (1 bit)
 Payload unit start indicator (1 bit)
 Transport priority (1 bit)
 Packet identifier (13 bit)
20 Transport scrambling control (2 bits)
 Adaptation field control (2 bits)
 Continuity counter (4 bits)

Each of these fields contain values that identify what the payload section of
the same data packet contains and how that payload section content should
25 be interpreted. The payload section of digital cable ready data packets can
be partially or completely filled with non-zero values. Typical contents for the
payload sections are MPEG-2 video, MPEG or AC-3 audio, and PSIP or other
program guide streams. The digital cable ready packets may also contain
interactive data, program entitlement, program description, or other service
30 streams.

The payload sections of satellite data packets and digital cable ready data packets include data that may be designated as time-critical or non-time-critical with respect to the accuracy with which they are received in the interface apparatus 220 or television signal receiver 20. Generally, the vast majority of the payload sections contain data that are non-time-critical. The time-critical payload sections contain data that includes time values accurate to nanoseconds. The time values indicate the relative time between consecutive time-critical data elements broadcast by the satellite service, digital cable service, or other service broadcaster.

Upon receiving a data packet having time-critical payload, the interface apparatus 220 or receiver 20 must deliver the time-critical payload sections with the same accuracy and relative timing as originally broadcast, or adjust the time values in the time-critical payload sections to the same accuracy and by the amount of time that passed between when the time-critical data sections should be passed and when they are passed to the modulator 225.

As an alternative, new time values with the same accuracy and precision can be generated in the interface apparatus 220 and inserted in the digital cable ready data packets created by the interface apparatus 220. All time-critical payload sections are designated as such by specific values in the packet's header section fields.

The number of satellite data packets transmitted per second and the number of digital cable ready data packets transmitted per second are usually different. The total number of bits transmitted per second in satellite data packets and in digital cable ready data packets are usually different. The number of satellite data packets and bits transmitted per second can always be greater than the number of digital cable ready data packets and bits transmitted per second, because the satellite data packets will contain multiple programs, i.e. multiple viewer channels, but the digital cable ready packets need to contain only the one program, i.e. one viewer channel selected by a user, and a relatively small number of program guide packets.

The formatter 224 performs the reformatting operation from the first digital format to the second digital format as appropriate according to the section being reformatted, header or payload. The content of the various fields in the header data section of each satellite data packet can be copied or transcribed into the analogous fields in the digital cable ready header section fields. For example, the content of the continuity counter field content in the satellite data header section can be copied into the digital cable ready data packet's header section's continuity counter field; similarly, the value expressed in the service channel identifier field can be copied, or transcribed according to a known technique, into the packet identifier field; the sync field value has an MPEG-defined standard value; the control sync field value and the control flag field values can be transcribed into the transport scrambling control field. Values for the other digital cable ready packet's header section's fields can be created and inserted as appropriate.

The content of the satellite data payload sections can be read from the payload section and then written into digital cable ready data packet's payload sections in accordance with any algorithm that maintains the ordering of the content of the payload sections in the satellite data packets and that ensures that every byte read from a satellite data packet is subsequently written to a digital cable ready data packet. If the writing operation results in the filling of the entire payload section of the digital cable ready packet, that packet may be forwarded to the modulator (225). If the writing operation does not fill the payload section, that packet must be "held" until additional content is available. Any content not written to the n-th digital cable ready data packet's payload section must be saved and written into the next available payload section.

Under control of the complex processor 227, a modulator 225 receives each packet sent from the formatter 224. The modulator 225 is responsible for transmitting a constant number of packets per second in accordance with digital cable ready standards. Depending on implementation, the formatter 224 is responsible for generating that constant number of packets per second

and sending them to the modulator 225, or the modulator 225 is responsible for sending all packets received from the formatter 224, and inserting and sending extra or "null" packets if a packet is to be sent but none has been received from the formatter 224.

5 When a satellite data packet containing a time-critical data section is received in the formatter 224, the formatter's reformatting process as described above can be modified to deliver the time-critical content to the modulator 225 with minimal delay. In one embodiment, the formatter 224 creates a new or "extra" packet and inserting the time-critical data into that
10 packet, creating the packet's header section as described above but setting the Adaptation field's bits to indicate a time-critical data value is in the payload section, then preparing to send the packet to the modulator 225. Just before the packet is sent to the modulator 225, the time-critical data value in the packet is updated, maintaining the accuracy of the time value but adjusting it
15 for the delay between receiving the time-critical data packet in the formatter 224 and actually sending the extra packet to the modulator 225.

In addition, the modulator 225 is operative to perform modulation functions of interface apparatus 220. According to an exemplary embodiment, modulator 225 modulates the digital data ready data packets
20 provided from formatter 224 to thereby generate processed satellite signals, which are provided to television signal receiver 230 via the coaxial cable connection. According to this exemplary embodiment, modulator 225 modulates the digital data ready data packets using a type of modulation (e.g., 256 QAM) that is prescribed by a digital cable ready standard. The
25 modulation scheme may be different from modulation schemes used by the transmitting the satellite broadcast signals.

CA module 226 is operative to perform CA functions of interface apparatus 220 by decrypting the digital transport streams provided from demultiplexer 223. According to an exemplary embodiment, CA module 226
30 may include a smart card and/or other elements, which enable the CA function.

To facilitate a better understanding of the inventive concepts of the present invention, an example will now be provided. Referring to FIG. 5, a flowchart 500 illustrating steps according to an exemplary embodiment of the present invention is shown. For purposes of example and explanation, the steps of FIG. 5 will be described with reference to the previously described elements of environments 100 and 300 of FIGS. 1 and 3, respectively. The steps of FIG. 5 are merely exemplary, and are not intended to limit the present invention in any manner.

At step 510, interface apparatus 20/220 receives satellite broadcast signals from signal receiving element 10/210. At step 520, interface apparatus 20/220 processes the satellite broadcast signals to generate processed satellite signals. As indicated in FIG. 5, step 520 includes two different exemplary embodiments, referred to as steps 520A and 520B. Step 520A refers to the exemplary embodiment of FIGS. 1 and 2, and step 520B refers to the exemplary embodiment of FIGS. 3 and 4.

Referring now to FIG. 6, further details regarding step 520A of FIG. 5 are provided. The details of FIG. 6 are merely exemplary, and are not intended to limit the present invention in any manner. As indicated in FIG. 6, step 520A of FIG. 5 includes steps 521A to 524A.

At step 521A, interface apparatus of television signal receiver 20 converts the satellite broadcast signals received at step 510 from a first frequency band to a second frequency band to thereby generate frequency converted signals. According to an exemplary embodiment, tuner 21 converts the satellite broadcast signals received at step 510 from a relatively high frequency band (e.g., greater than 1 GHz) to baseband, or near baseband, to thereby generate the frequency converted signals at step 521A. As previously indicated herein, this tuning function of tuner 21 may for example be performed responsive to a channel change command (e.g., via remote control, etc.) from a user of television signal receiver 20.

At step 522A, interface apparatus of television signal receiver 20 generates demodulated signals from the frequency converted signals

generated at step 521A. According to an exemplary embodiment, demodulator 22 generates the demodulated signals at step 522A by performing the previously described A/D conversion, demodulation, and FEC decoding functions. As previously indicated herein, the demodulated signals
5 generated by demodulator 22 may include a plurality of time-division multiplexed broadcast programs.

At step 523A, interface apparatus of television signal receiver 20 demultiplexes the demodulated signals generated at step 522A to thereby generate one or more digital transport streams, which include data packets in
10 a first format. According to an exemplary embodiment, demultiplexer 23 demultiplexes the demodulated signals to thereby generate the one or more digital transport streams at step 523A. As previously indicated herein, each digital transport stream may include a given broadcast program.

At step 524A, interface apparatus of television signal receiver 20
15 decodes the one or more digital transport streams generated at step 523A to thereby generate the processed satellite signals. According to an exemplary embodiment, decoder 24 generates the processed satellite signals at step 524A by decoding the digital transport stream(s) using MPEG-2 and/or MPEG-4 decoding techniques.

Referring now to FIG. 7, further details regarding step 520B of FIG. 5
20 are provided. The details of FIG. 7 are merely exemplary, and are not intended to limit the present invention in any manner. As indicated in FIG. 7, step 520B of FIG. 5 includes steps 521B to 525B. Steps 521B to 523B of FIG. 7 are substantially identical to steps 521A to 523A of FIG. 6.
25 Accordingly, for clarity of description, these common steps will not be described again and the reader may refer to the description of these steps previously provided herein.

At step 524B, interface apparatus 220 processes the one or more digital transport streams generated at step 523B to thereby generate
30 reformatted digital signals without decoding the one or more digital transport streams. According to an exemplary embodiment, formatter 224 generates

the reformatted digital signals at step 524B by performing the previously described digital reformatting functions. As previously indicated herein, formatter 224 performs a digital reformatting function by converting data packets in the one or more digital transport streams provided from demultiplexer 223 from a first format used for satellite broadcast signals to data packets included in the reformatted digital signals in a second format used for digital cable broadcast signals to thereby generate reformatted digital signals. Formatter 224 then forwards the reformatted digital signals to the modulator 225.

At step 525B, interface apparatus 220 modulates the reformatted digital signals generated at step 524B to thereby generate the processed satellite signals. According to an exemplary embodiment, modulator 225 modulates the analog signals using a type of modulation (e.g., 256 QAM) that is prescribed by a digital cable ready standard.

Referring now back to FIG. 5, at step 530, the processed satellite signals generated at step 520A/520B are provided to television signal receiver 20/230 which is a digital cable ready television. According to the exemplary embodiment of FIGS. 1 and 2, decoder 24 simply outputs the processed satellite signals to the rest of television signal receiver 20 at step 530 since the interface apparatus is integrated into television signal receiver 20. According to the exemplary embodiment of FIGS. 3 and 4, the processed satellite signals generated by modulator 225 are provided to television signal via the coaxial cable connecting interface apparatus 220 and television signal receiver 230.

The term "television signal receiver" as used herein includes video signal processing apparatus such as TV receivers having a display screen (commonly called TV sets), TV receivers without a display screen such as VCRs, VCPs (videocassette players), set-top boxes (such as cable boxes and satellite receivers), and Videodisk players.

As described herein, the present invention provides an interface apparatus, which enables a television signal receiver that is compliant with a

digital cable ready standard to receive satellite broadcast signals. While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or
5 adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

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CLAIMS:

1. An interface apparatus (220) for a video signal processing apparatus (230) supporting digital signals in a first digital format and modulated using a first type of modulation, the interface apparatus (220) comprising:

input means for receiving second digital signals in a second digital format different from the first digital format;

signal processing means (221-225) for processing said second digital signals to generate first digital signals in the first digital format without decoding the second digital signals; and

a modulator for modulating the first digital signals using the first type of modulation and providing the modulated first digital signals to the video signal processing apparatus.

2. The interface apparatus (220) of claim 1, wherein said interface apparatus (220) is integrated into said video signal processing apparatus (220).

3. The interface apparatus (220) of claim 1, wherein said signal processing means (221-225) comprises:

transport generating means (221-223) for generating a digital transport stream from said second digital signals;

formatting means (224) for converting said digital transport stream from the second digital format to the first digital format to generate reformatted digital signals; and

modulating means (225) for modulating said reformatted digital signals to generate said first digital signals.

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4. The interface apparatus (220) of claim 3, wherein said transport generating means (221-223) comprises:

tuning means (221) for converting said second digital signals from a first frequency band to a second frequency band to generate frequency converted signals;

demodulating means (222) for generating demodulated signals from said frequency converted signals; and

demultiplexing means (223) for demultiplexing said demodulated signals to generate said digital transport stream.

5. The interface apparatus (220) of claim 4, wherein said interface apparatus (220) is embodied as a set top box.

6. The interface apparatus (220) of claim 1, wherein the second digital signals are modulated using a second type of modulation, and the second type of modulation is different from the first type of modulation.

7. The interface apparatus (220) of claim 1, wherein the first and second digital signals respectively have first and second frequency bands, and the second frequency band is higher than the first frequency band.

8. The interface apparatus (220) of claim 7, wherein said first digital signals are transmitted via first transmission medium including a RG-6 cable.

9. The interface apparatus (220) of claim 1, wherein said second digital signals include packets in the second digital format and the signal processing means process the packets in the second digital format to generate packets in the first digital format included in the first digital signals.

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10. The interface apparatus (220) of claim 9, wherein the signal processing means process more than one packet in the second digital format to generate a packet in the first digital format.

11. The interface apparatus (220) of claim 9, wherein if a data packet in the second digital format is time-critical, the signal processing means process the data packet to generate a packet in the first digital format and send the generated packet in the first digital format to the modulator without waiting for other data packets in the second digital format to arrive.

12. A method (500) for providing digital signals to a video signal processing apparatus (220) supporting digital signals in a first digital format and modulated using a first type of modulation, the method comprising the steps of:

receiving second digital signals in a second digital format different from said first digital format (510);

processing said second digital signals to generate first digital signals in the first digital format without decoding the second digital signals (520A/520B); and

modulating the first digital signals using the first type of modulation and providing the modulated first digital signals to the video signal processing apparatus.

13. The method (500) of claim 12, wherein said processing step (520B) comprises the steps of:

generating a digital transport stream from said second digital signals (521B-523B);

converting said digital transport stream from the second digital format to the first digital format to generate reformatted digital signals (524B); and

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modulating said reformatted digital signals to generate said first digital signals (525B).

14. The method (500) of claim 13, wherein said generating step (521B-523B) comprises the steps of:

converting said second digital from a first frequency band to a second frequency band to generate frequency converted signals (521B);

generating demodulated signals from said frequency converted signals (522B); and

demultiplexing said demodulated signals to generate said digital transport stream (523B).

15. The method (500) of claim 12, wherein said second digital signals include packets in the second digital format and the processing step processes the packets in the second digital format to generate packets in the first digital format included in the first digital signals.

16. The method (500) of claim 15, wherein the processing step processes more than one packet in the second digital format to generate a packet in the first digital format.

17. The method (500) of claim 15, wherein if a data packet in the second digital format is time-critical, the processing step processes the data packet in the second digital format to generate a packet in the first digital format without waiting for other data packets in the second digital format to arrive.

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18. An interface apparatus (220) for a video signal processing apparatus (230) supporting digital signals in a first digital format and modulated using a first type of modulation, the interface apparatus (220), comprising:

an input operative to receive second digital signals in a second digital format different from the first digital format;

signal processing elements (221-225) for processing said second digital signals to generate first digital signals in the first digital format without decoding the second digital signals; and

a modulator for modulating the first digital signals using the first type of modulation and providing the modulated first digital signals to the video signal processing apparatus.

19. The interface apparatus (220) of claim 18, wherein said interface apparatus (220) is integrated into said television signal receiver (220).

20. The interface apparatus (220) of claim 18, wherein said signal processing elements (221-225) comprise:

a transport generator (221-223) operative to generate a digital transport stream from said second signals;

a formatter (224) operative to convert said digital transport stream from the second digital format to the first digital format to generate reformatted digital signals; and

a modulator (225) operative to modulate said reformatted digital signals to generate said first digital signals.

21. The interface apparatus (220) of claim 20, wherein said transport generator (221-223) comprises:

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a tuner (221) operative to convert said second digital signals from a first frequency band to a second frequency band to generate frequency converted signals;

a demodulator (222) operative to generate demodulated signals from said frequency converted signals; and

a demultiplexer (223) operative to demultiplex said demodulated signals to generate said digital transport stream.

22. The interface apparatus (220) of claim 21, wherein said interface apparatus (220) is not integrated with said television signal receiver (230).

24. The interface apparatus (220) of claim 18, wherein said interface apparatus (220) is embodied as a set top box.

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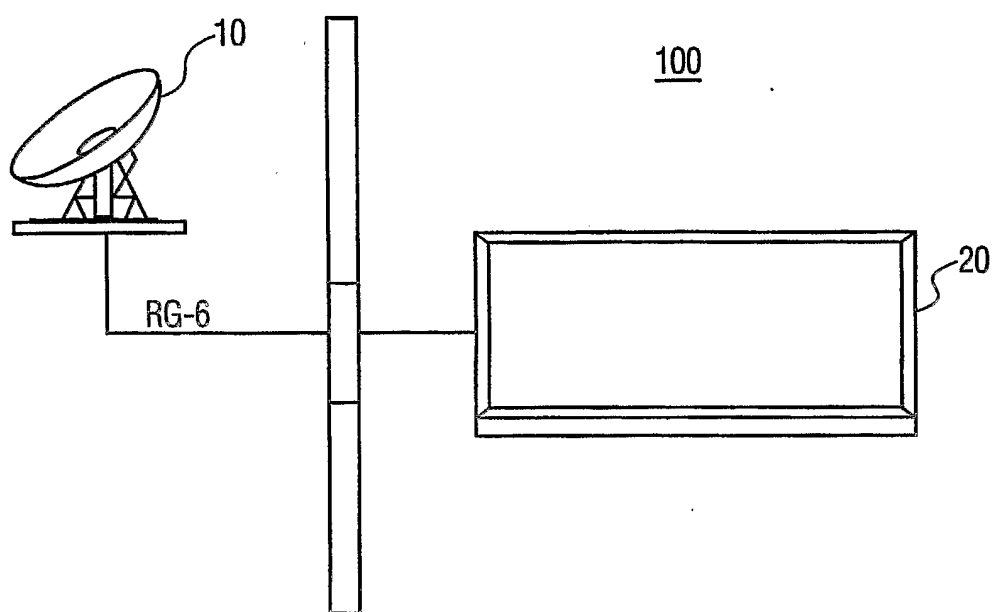
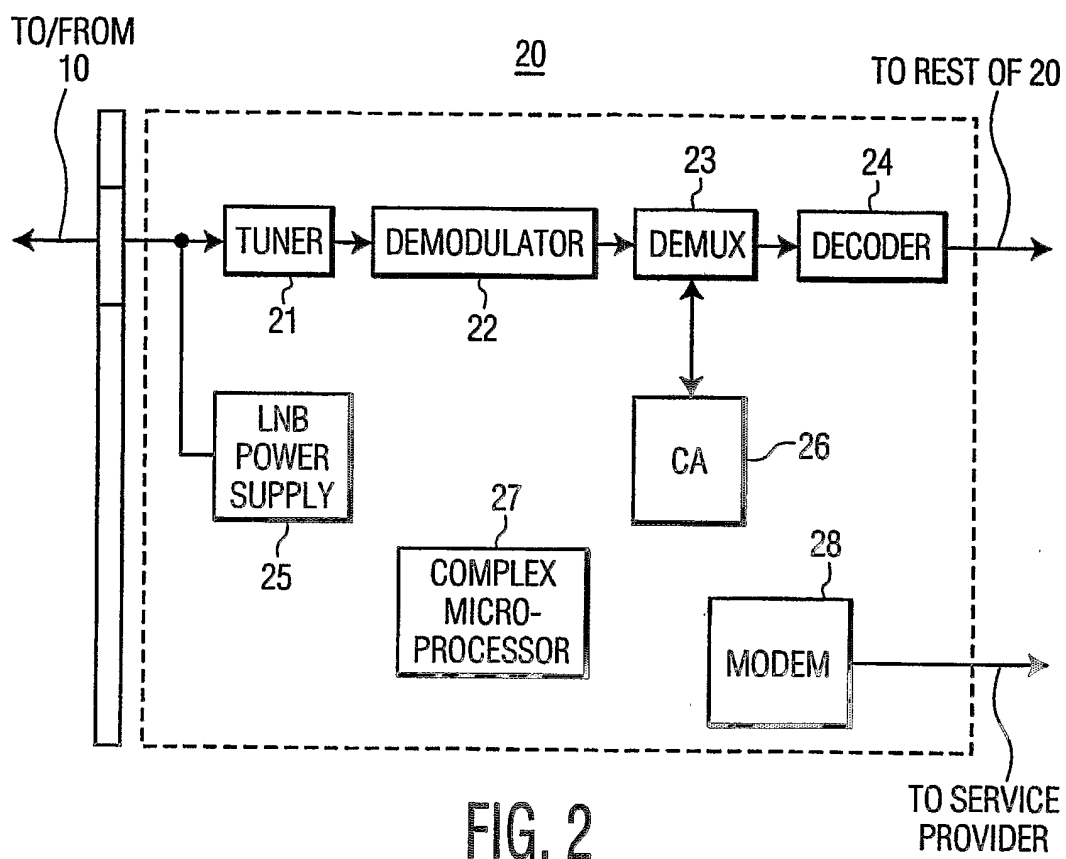


FIG. 1

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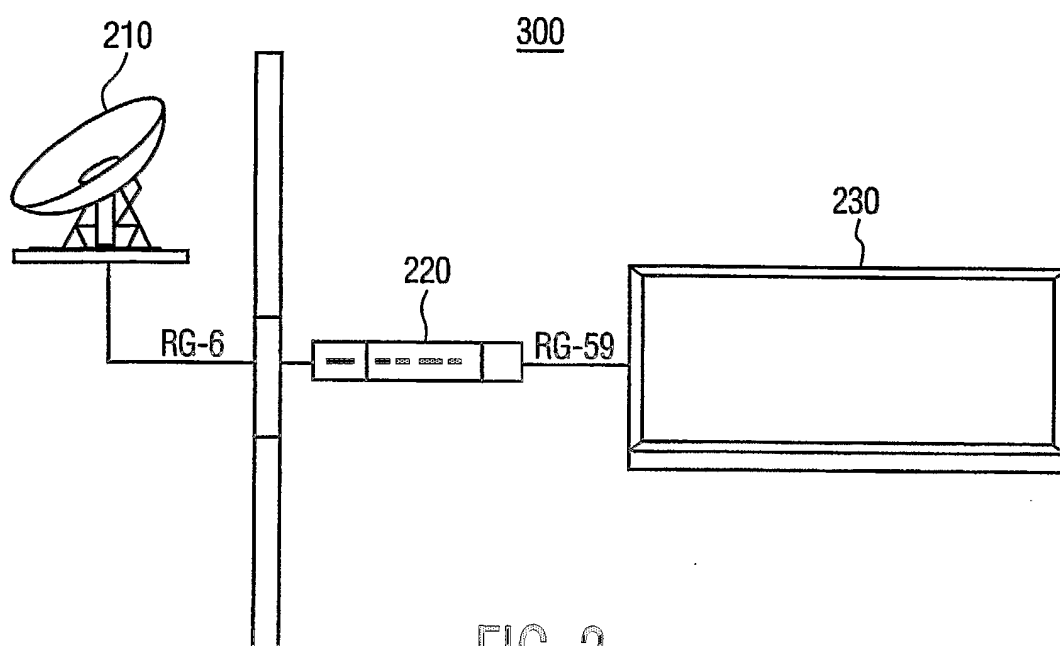
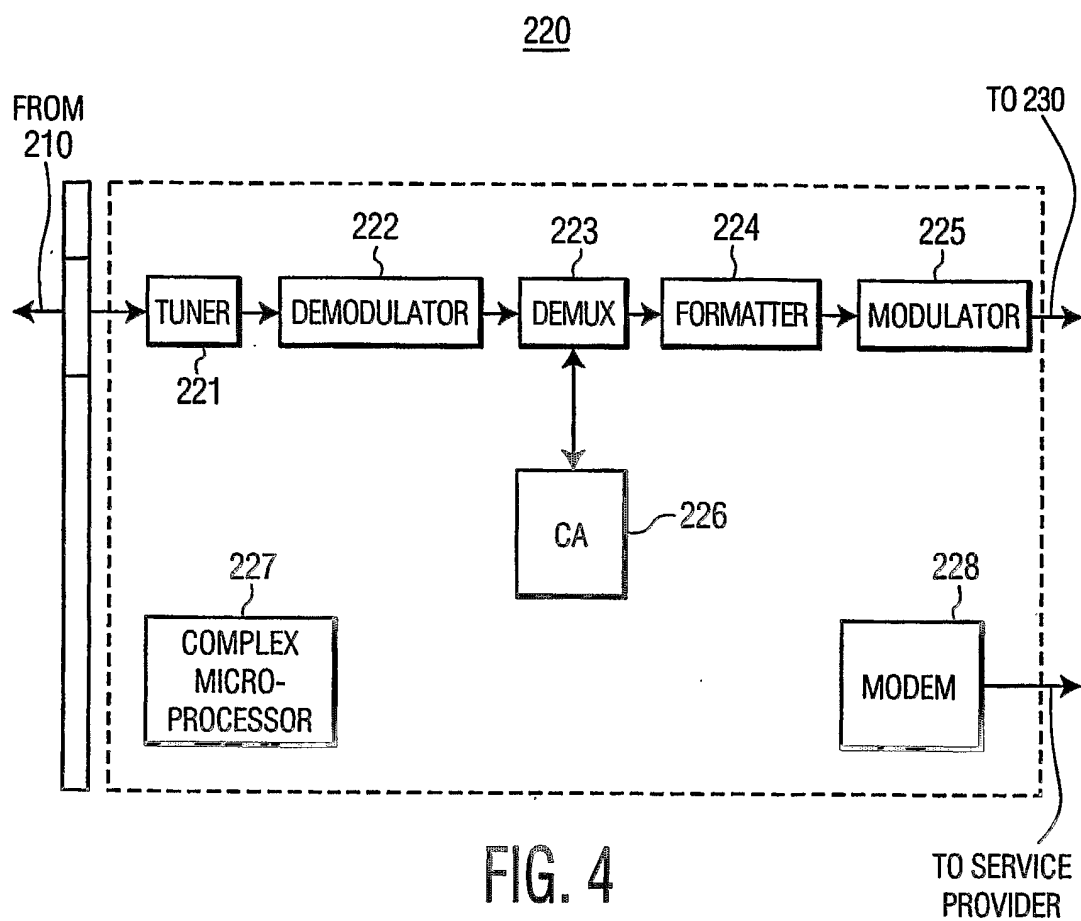


FIG. 3

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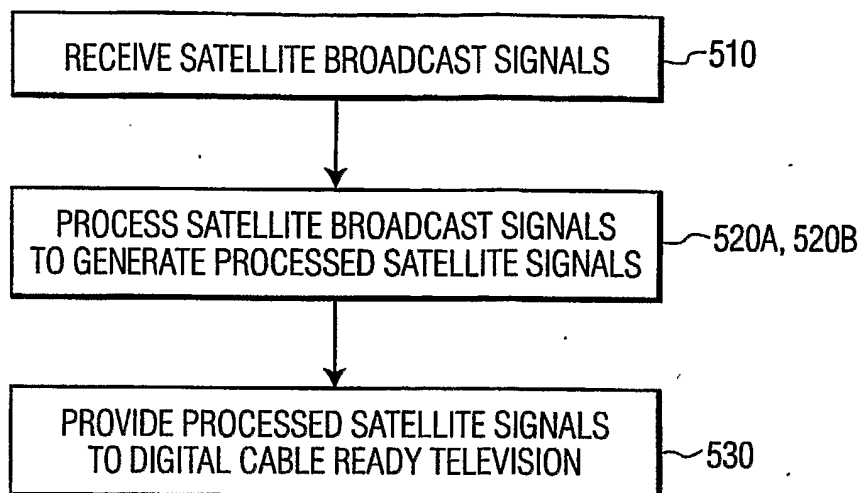
500

FIG. 5

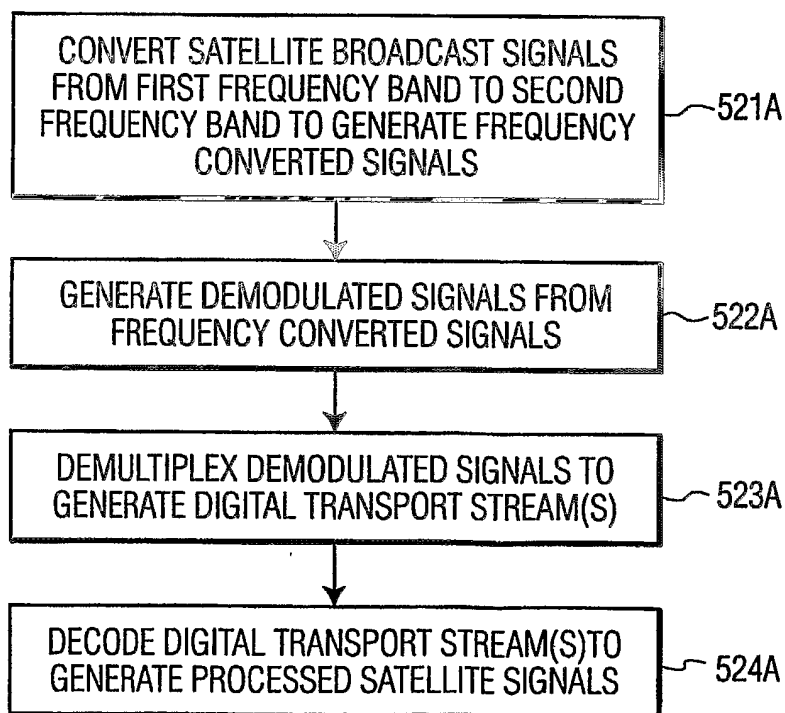
520A

FIG. 6

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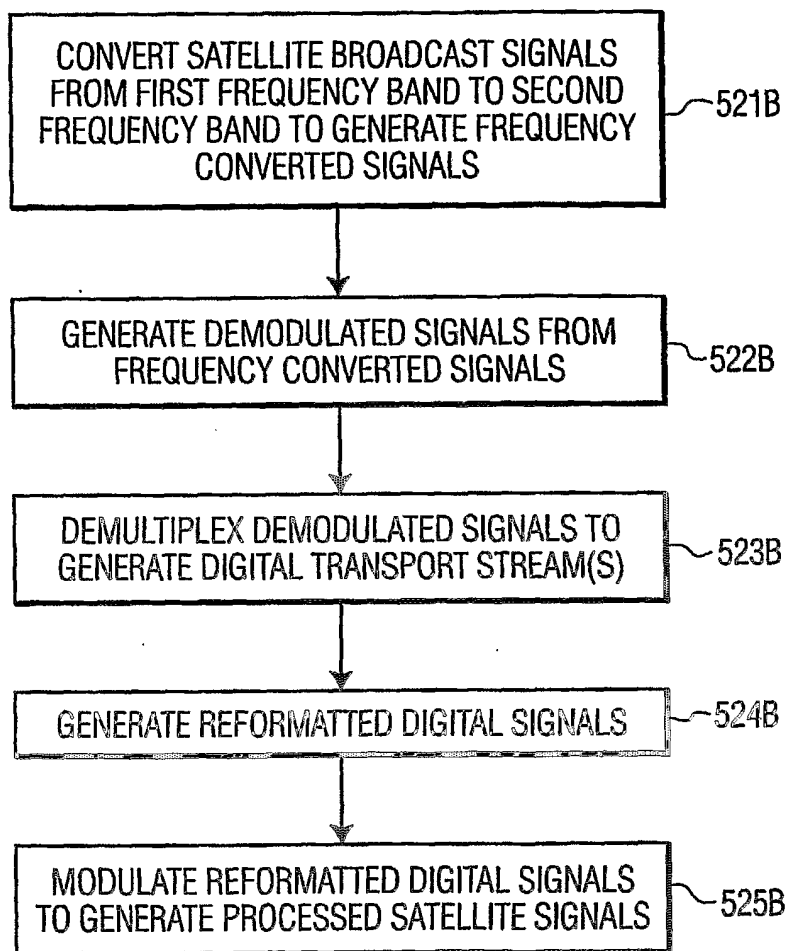
520B

FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/007404

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/096098 A (A NOVO) 28 November 2002 (2002-11-28) the whole document	1-10, 12-16, 18-22, 24
X	GB 2 336 276 A (SGS-THOMSON MICROELECTRONICS) 13 October 1999 (1999-10-13) abstract; figures 3,4 page 2, line 13 - page 5, line 5 page 10, line 22 - page 12, line 25 page 13, line 34 - page 20, line 12 page 27, line 26 - line 32 ----- -/--	1-22, 24

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	column 5, line 26 - column 10, line 27 column 11, line 44 - column 12, line 57 figures 4-6 -----	4,14,21

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/007404

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