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(54) Title: METHOD AND SYSTEM FOR OPERATING A RECEIVING CIRCUIT MODULE TO ENCODE A CHANNEL SIGNAL INTO MULTIPLE ENCODING FORMATS

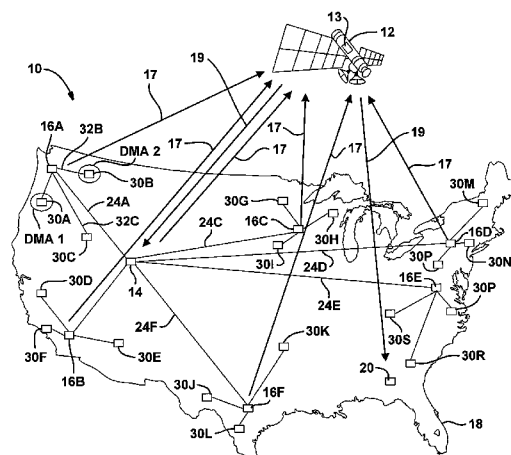


FIG. 1

(57) Abstract: A receiving circuit module and method for operating the same includes a housing receiving a first signal, a first encoder disposed within the housing encoding the first signal to form a first encoded signal and a second encoder disposed within the housing encoding the first signal to form a second encoded signal having a different format than the first signal.

METHOD AND SYSTEM FOR OPERATING A RECEIVING CIRCUIT MODULE TO ENCODE A CHANNEL SIGNAL INTO MULTIPLE ENCODING FORMATS

TECHNICAL FIELD

[0001] The present disclosure relates generally to communication systems and, more particularly, to a method and system for encoding a channel signal into multiple encoding formats.

BACKGROUND

[0002] The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

[0003] Satellite broadcasting of television signals has increased in popularity. Satellite television providers continually offer more and unique services to their subscribers to enhance the viewing experience. Providing reliability in a satellite broadcasting system is therefore an important goal of satellite broadcast providers. Providing reliable signals reduces the overall cost of the system by reducing the number of received calls at a customer call center.

[0004] In satellite broadcasting systems, users have come to expect the inclusion of local channels in addition to the channels broadcast for the entire Continental United States. Collecting the channels may be performed in various manners, including providing a manned station that receives the signals. The signals may be uplinked from various locations. Providing manned stations increases the labor costs and thus increases the overall cost of the service.

[0005] The Moving Pictures Expert Group (MPEG) sets standards for encoded video. The MPEG2 standard may be used for standard definition video. An MPEG4 encoding scheme has also been developed to support both high definition and standard definition video. MPEG4 is the latest standard and newer systems use the MPEG4 standard. However, providers of video service such as DIRECTV® also have customers that have set top boxes that only support the MPEG2 standard.

[0006] Typically, for each type of encoding, separate equipment is provided. Encoders for MPEG2 format and MPEG4 format must be provided along with any associated equipment prior to uplinking. Providing separate equipment increases the floor space and thus increases the cost of providing services.

SUMMARY

[0007] The present disclosure provides a receiving circuit module that can output two different encoded channel signals. The encoded channel signals may be output simultaneously. As user systems progress in technology, the older encoding format can be discontinued without having to physically replace components in the field.

[0008] In one aspect of the invention, a method includes receiving a first signal at the receiving circuit module, encoding the first signal within the receiving circuit module to form a first encoded signal, encoding the first signal within the receiving circuit module to form a second encoded signal, generating a first output signal at receiving circuit module corresponding to the first encoded signal and generating a second output signal at the receiving circuit module corresponding to the second encoded signal.

[0009] In another aspect of the invention, a system includes a housing receiving a first signal, a first encoder disposed within the housing encoding the first signal to form a first encoded signal and a second encoder disposed within the housing encoding the first signal to form a second encoded signal having a different format than the first signal.

[0010] Further areas of applicability will become apparent from the description provided herein. It should be understood that the description and specific examples are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0011] The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

[0012] Fig. 1 is an overall system view of a collection and communication system in the continental United States.

[0013] Fig. 2 is a system view at the regional level of the collection and communication system.

[0014] Fig. 3 is a detailed block diagrammatic view of a first embodiment of the collection and communication system illustrated in Figs. 1 and 2.

[0015] Fig. 4 is a detailed block diagrammatic view of a second embodiment of the collection and communication system illustrated in Figs. 1 and 2.

[0016] Fig. 5 is a block diagrammatic view of a receiving circuit module illustrated in Figs. 3 and 4.

[0017] Fig. 6 is a flowchart illustrating a method for operating the system.

[0018] Fig. 7 is a flowchart illustrating a method for controlling the parameters at the receiving circuit module.

[0019] Fig. 8 is a flowchart of a method for switching the receiving source of the receiving circuit module.

[0020] Fig. 9 is of a method for switching to a back-up receiver circuit module.

[0021] Fig. 10 is a flowchart of a method for switching to an engineering uplink signal processing system.

[0022] Fig. 11 is a block diagrammatic schematic view of a third embodiment of the collection and communication system.

[0023] Fig. 12 is a perspective view of a receiving device.

[0024] Fig. 13 is a view of the rear panel of the receiving device.

[0025] Fig. 14 is a high-level block diagrammatic view of the receiving device.

[0026] Fig. 15 is a flowchart of a method for operating the receiving device.

DETAILED DESCRIPTION

[0027] The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features.

[0028] As used herein, the term module, circuit and/or device refers to an Application Specific Integrated Circuit (ASIC), an electronic circuit, a processor (shared, dedicated, or group) and memory that execute one or more software or firmware programs, a combinational logic circuit, and/or other suitable components that provide the described

functionality. As used herein, the phrase at least one of A, B, and C should be construed to mean a logical (A or B or C), using a non-exclusive logical or. It should be understood that steps within a method may be executed in different order without altering the principles of the present disclosure.

[0029] The present disclosure is described with respect to a satellite television system. However, the present disclosure may have various uses including satellite data transmission and reception for home or business uses. The system may also be used in a cable system or wireless terrestrial communication system.

[0030] Referring now to Fig. 1, a collection and communication system 10 includes a satellite 12 that includes at least one transponder 13. Typically, multiple transponders are in a satellite. Although only one satellite is shown, more than one is possible or even likely.

[0031] The collection and communication system 10 includes a central facility or Network operations center (NOC) 14 and a plurality of regional or remote uplink facilities (RUF) 16A, 16B, 16C, 16D, 16E and 16F. In a non-satellite system the facilities may be referred to as a remote facility. The regional or remote uplink facilities 16A-16F may be located at various locations throughout a landmass 18 such as the continental United States, including more or less than those illustrated. The regional or remote uplink facilities 16A-16F uplink various uplink signals 17 to satellite 12. The satellites downlink signals 19 to various users 20 that may be located in different areas of the landmass 18. The users 20 may be mobile or fixed users. The uplink signals 17 may be digital signals such as digital television signals or digital data signals. The digital television signals may be high definition television signals, standard definition signals or combinations of both. Uplinking may be

performed at various frequencies including Ka band. The present disclosure, however, is not limited to Ka band. However, Ka band is a suitable frequency example used throughout this disclosure. The central facility or NOC 14 may also receive downlink signals 19 corresponding to the uplink signals 17 from the various regional or remote uplink facilities and from itself for monitoring purposes. The central facility 14 may monitor and control the quality of all the signals broadcast from the system 10.

[0032] The central facility 14 may also be coupled to the regional or remote uplink facilities through a network such as a computer network having associated communication lines 24A-24F. Each communication line 24A-F is associated with a respective regional or remote uplink site 16. Communication lines 24A-24F are terrestrial-based lines. As will be further described below, all of the functions performed at the regional or remote uplink facilities may be controlled centrally at the central facility 14 as long as the associated communication line 24A-F is not interrupted. When a communication line 24A-F is interrupted, each regional or remote uplink site 16A-F may operate autonomously so that uplink signals may continually be provided to the satellite 12. Each of the regional or remote uplink and central facilities includes a transmitting and receiving antenna which is not shown for simplicity in Fig. 1.

[0033] Each of the regional or remote uplink facilities 16A-16F may also be in communication with a local collection facility collectively referred to with reference numeral 30. As illustrated in Fig. 1, three local collection facilities are associated with each remote uplink facility 16. For example, remote uplink facility 16A has local collection facilities 30A, 30B and 30C associated therewith. Local collection facilities 30D-30S are associated with one of the other remote uplink facilities 16B-16F. Although only three local collection

facilities are illustrated for each remote uplink facility 16, numerous local collection facilities may be associated with each remote uplink facility 16. The number of local collection facilities 30 may be numerous, such as 40 for each remote uplink facility. The number of local collection facilities 30 is limited by the amount of equipment and the capabilities thereof associated with each remote uplink facility 16.

[0034] The local collection facilities 30 are used for collecting local television stations in various designated marketing areas (DMA). As is illustrated, local collection facility 30A is located in DMA1 and local collection facility 30B is located in DMA2. For simplicity, only two DMAs are illustrated. However, each local collection facility may be located in a DMA.

[0035] The local collection facilities 30 may be in communication with each remote uplink facility 16 through a communication network 32. As will be described below, the communication network 32 may be an internet protocol (IP) network. The signals from the local collection facilities 30 may thus be video-over-IP signals. Each of the remote uplink facilities 16 are in communication with each local collection facility 30 through the communication network 32. As is illustrated, local collection facility 30A is in communication with the remote uplink facility 16A through communication network 32A, while local collection facility 30B is in communication with the remote uplink facility 16A through communication network 32B, and so on.

[0036] Referring now to Fig. 2, the regional or remote uplink facilities 16A-16F of Fig. 1 are illustrated collectively as reference numeral 16. The regional facilities 16 may actually comprise two facilities that include a primary site 40 (such as the remote uplink facility 16 above) and a diverse site 42. The primary site 40 may be referred to as a primary

broadcast center (PBC). As will be described below, the central site 14 may also include a primary site and diverse site as is set forth herein. The primary site 40 and diverse site 42 of both the central and regional sites may be separated by at least 25 miles, or, more even more such as, at least 40 miles. In one constructed embodiment, 50 miles was used. The primary site 40 includes a first antenna 44 for transmitting and receiving signals to and from satellite 12. Diverse site 42 also includes an antenna 46 for transmitting and receiving signals from satellite 12.

[0037] Primary site 40 and diverse site 42 may also receive signals from GPS satellites 50. GPS satellites 50 generate signals corresponding to the location and a precision timed signal that may be provided to the primary site 40 through an antenna 52 and to the diverse site 42 through an antenna 54. It should be noted that redundant GPS antennas (52A,B) for each site may be provided. In some configurations, antennas 44 and 46 may also be used to receive GPS signals.

[0038] A precision time source 56 may also be coupled to the primary site 40 and to the diverse site 42 for providing a precision time source. The precision time source 56 may include various sources such as coupling to a central atomic clock. The precision time source 56 may be used to trigger certain events such as advertising insertions and the like.

[0039] The primary site 40 and the diverse site 42 may be coupled through a communication line 60. Communication line 60 may be a dedicated communication line. The primary site 40 and the diverse site 42 may communicate over the communication line using a video over internet protocol (IP).

[0040] Various signal sources 64 such as an optical fiber line, copper line or antennas may provide incoming signals 66 to the local collection facility 30. Incoming

signal 66, as mentioned above, may be television signals. The television signals may be over-the-air high-definition signals, over-the-air standard television signals, or high or standard definition signals received through a terrestrial communication line. The incoming signals 66 such as the television signals may be routed from the local collection facility 30 through the communication network 30 to the primary site 40, or the diverse site 42 in the event of a switchover. The switchover may be manual or a weather-related automatic switchover. A manual switchover, for example, may be used during a maintenance condition.

[0041] Users 20 receive downlink signals 70 corresponding to the television signals. Users 20 may include home-based systems, business-based systems or multiple dwelling unit systems. As illustrated, a user 20 has a receiving antenna 72 coupled to an integrated receiver decoder (IRD) 74 that processes the signals and generates audio and video signals corresponding to the received downlink signal 70 for display on the television or monitor 76. It should also be noted that satellite radio receiving systems may also be used in place of the IRD 74. The integrated receiver decoder 74 may be incorporated into or may be referred to as a set top box.

[0042] Of course, the system may include multiple users with different types of IRDs 74 capable of decoding signals encoded differently. Some older IRDs may be capable only decoding MPEG 2 encoded signals. Some newer IRDs may only be able to decode MPEG 4 encoded signals. Some IRDs may be capable of decoding both MPEG 2 and MPEG 4 encoded signals.

[0043] The user 20 may also be a mobile user. The user 20 may therefore be implemented in a mobile device or portable device 80. The portable device 80 may include

but are not limited to various types of devices such as a laptop computer 82, a personal digital assistant 84, a cellular telephone 86 or a portable media player 88. Of course, the mobile devices may be capable of decoding various types of encoded signals.

[0044] Referring now to Fig. 3, the local collection facility 30 is illustrated in more detail adjacent to the remote uplink facility (RUF) 16. As mentioned above, the local collection facility 30 is in communication with the remote uplink facility 16 through a network 32 such as an IP network. The local collection facility 30 is used for collecting signals in a designated marketing area or other area. The channel signals may be received as over-the-air television signals or through a direct local feed such as an optical fiber or wire. For an over-the-air signal, an antenna or plurality of antennas 100 are provided. The antenna channel signals are directed to a router 102. The router signals are communicated to a plurality of receiver circuit modules 104A-C (collectively referred to as 104). The number of receiver circuit modules 104 depends upon various design parameters such as how many channels the designated market includes. Various numbers of receiver circuit modules 104 may be provided.

[0045] In addition to the receiver circuit modules 104, a monitor receiver circuit module 106 may also be coupled to the RF router 102. Also, a back-up receiver circuit module 108 may be included at the local collection facility 108.

[0046] The details of the receiver circuit modules 104A-C, 106 and 108 will be further described below. However, the receiver circuit modules generally include a receiver module 110 and an encoder module 112. The receiver module 110 is used to tune, demodulate and decode the over-the-air signals. The decoder may decode from MPEG2 format. The receiver circuit module, as will be described below, includes an ATSC receiver

or an NTSC receiver. The receive signals are processed and encoded into a format such as an IP format in the encoder 112. The monitor receiver circuit module is used for generating monitor circuits for each of the receive channel signals. That is, although only one receiver module may be provided, the monitoring system may monitor one of the channel signals. This may be performed remotely through the network 32 from the remote uplink facility 16. The encoder 112 may encode into MPEG4 format.

[0047] A serial digital interface router 120 may also be provided. The serial digital interface router may be a high definition serial digital interface router. The serial digital interface (SDI) router 120 may receive local feeds directly from the local channel providers. These may be provided through a wire or optical fiber. The SDI router 120 routes the channel signals received from the local feeds 118 to the receiving circuit modules 104A-C, 106 and 108. The output of the receiving circuit modules 104A-C, 106 and 108 are in communication with a primary router 130 and a back-up router 132. A suitable example of a primary and back-up router is a Cisco® 7604. Preferably each of the receiving circuit modules 104, 106 and 108 are in communication with both the primary router 130 and the back-up router 132. An A-B switch 134 is used to generate an output signal corresponding to one of the primary router 130 or the back-up router 132. The routers 130, 132 route the IP signals through the switch 134 and through the network 32 which communicates the encoded channel signals to the remote uplink facility 16, diverse uplink facility and the network operation center. The routers 130, 132 and the switch 134 may be monitored and controlled by the compression system controlled or ABMS system described below.

[0048] The remote uplink facility 16 may include an uplink signal processing system (USPS) 200. In a constructed embodiment several uplink signal processing systems

200 may be provided. This may include a secondary or back-up USPS that will be referred to as an engineering USPS 200' described in FIG. 4 below. The encoded channel signals routed through the network 32 includes identification of the signal so that it may be properly routed to the proper uplink signal processing system. As described below, this may be done by multicasting. The uplink signal processing system 200 generates an output signal to an uplink RF system (URFS) 202 that includes a power amplifier 204. The output signal of each USPS 200 may correspond to one transponder of a satellite. The output signal is a multiplexed signal that may include both high definition television signals and standard definition television signals. The uplink signal processing system 200 may also provide redundant pairs to increase the reliability of the output signal.

[0049] The uplink signal processing system 200 may include a multiplexer 210, an advance transport processing system (ATPS) 212, and a modulator 214. Pairs of multiplexers 210, advance transport processing systems 212, and modulators 214 may be provided for redundancy. That is primary and back-up pairs of each may be provided.

[0050] The multiplexer 210 multiplexes the decoded channel signals from the local area network 32 into a multiplexed transport stream (MPTS). The multiplexer 210 may also act to insert advertising into the signal. Thus, the multiplexer 210 may act as a multiplexing module and as an ad insertion module. The multiplexer 210 may be a statistical multiplexer used to group signals from various local collection facilities. Various numbers of encoded channel signals may be multiplexed. In one constructed embodiment, eight channel signals were multiplexed at each multiplexer 210.

[0051] The advance transport processing system (ATPS) 212 converts the transport stream from the multiplexer 210 into an advanced transport stream such as the

DIRECTV® A3 transport stream. The ATPS 212 may support either ASI or MPEG output interface for the broadcast path. Thus, the ATPS 212 acts as an encryption module.

[0052] The modulators 214 modulate the transport stream from the ATPS 212 and generate an RF signal at a frequency such as an L-band frequency. An RF switch 216 is coupled to the primary modulator and back-up modulator 214. The RF switch provides one output signal to the uplink RF system 202. The USPS 200 may also be coupled to a quality control (QC) station console 250. The quality control station console 250 may be coupled directly to the RF switch 216. The quality control station console 250 may also be coupled to a communication monitoring bus 252. The bus 252 may be used to communicate between various components used for monitoring and controlling the various components in the remote uplink facility and the local collection facilities. The bus 252 may, for example, be in communication with a tech services monitor console 254. The bus 252 may also be coupled to an advance broadcast management system (ABMS) server 256. As is illustrated in Fig. 3, both a primary server and a back-up server 256 are illustrated.

[0053] A compression system controller 260 may also be coupled to the bus 252. As is illustrated, both a primary and back-up compression system controller 260 may be provided. The compression system controller 260 may be coupled to a broadcast management system 262 as will be further described below. The ABMS system 256 and the compression system controller 260 may be used to control various functions and monitor various functions of the remote uplink facility and the local collection facilities. These functions will be further described below.

[0054] The compression system controller 260 is a centralized server which is used to control and monitor the receiving circuit modules within the chain of a remote uplink

facility. The compression system controller 260 may be used to manage, configure, control and monitor the receiving circuit modules and the encoders therein. The compression system controller may also control the routers, switches and receivers within the receiving circuit modules. The compression system controller may be physically located within the remote uplink facility. However, web access may be provided through a standard web browser for allowing users to interface, configure and control the various systems. In addition to controlling the receiving circuit modules and the statistical multiplexers, the compression system controller 260 may be used to initiate a redundancy switch to a back-up receiving circuit module or encoder within the local collection facilities. The compression system controller may also be used to initiate a switch to a back-up statistical multiplexer within the remote uplink facility 16. The compression system controller may also be used to update the remote broadcast management system 262.

[0055] Each of the components of the USPS 200 may be coupled to the bus 252. That is, the primary and back-up multiplexers 210, the primary and back-up ATPS's 212, the primary and back-up modulators 214 and the RF switch 216 may all be coupled to the bus 252.

[0056] The ABMS system 256 may be used for various monitoring such as transport level errors, video outages, audio outages, loss of connection from a redundancy controller or a data source or a compression system controller 260.

[0057] The remote uplink facility may also include the diverse uplink facility or diverse site 42. The diverse site may receive signals from the primary ATPS 212 in the event of a modulator 214 or switch failure 216. The transport stream signals provided from the primary or back-up advanced transport processing system 212 are communicated to the

primary modulator or back-up modulator 214' of the diverse facility 42. An RF switch 216' may be used to couple the output of either the primary modulator or the back-up modulator 214' to the uplink RF system 202. The ABMS system 256' may also be used to monitor the output of the diverse uplink facility 256'.

[0058] The network operation center 14 may be coupled the IP network 32. The network operation center may also be coupled to the remote uplink facility through an ATM or IP network 280. The network operation center may have a monitor and control console 282 and a monitoring decoder 284 for monitoring and controlling various functions of the various remote uplink facilities. The network operation center monitor and control console 282 may also be used to control and monitor the various local collection facilities 30. This may be performed directly or through the compression system controller 260.

[0059] Referring now to Fig. 4, a system similar to that of Fig. 3 is illustrated. The common components will thus not be described further. The system of Fig. 4 illustrates that multiple USPS circuits may be included in the remote facility. The multiple USPS circuits are illustrated with the same reference numerals as the USPS chain with primed numbers. The functions are the same as the unprimed components. The USPS's 200-200" may be referred to as a production USPS.

[0060] The system of Fig. 4 also illustrates an engineering uplink signal processing system 200". The engineering uplink signal processing system 200" may be coupled to the network 32 and/or the bus 252. The engineering uplink signal processing system 200" may be at a same location as one of the remote uplink facilities or a different location than the remote uplink facilities. The engineering uplink signal processing system 200" may be used when one of the remote uplink facilities is under maintenance or if an error

occurs. Switching to the engineering uplink signal processing system 200" will be described below. The engineering uplink signal processing system 200" includes a primary and back-up MUX 210", a primary and back-up ATPS 212", a primary and back-up modulator 214" and an RF switch 216". The functioning of each of the components of the USPS is similar to those described above with respect to the production USPS 200 and thus will not be described. The output of the RF switch 216" is communicated to an uplink RF system 202" that includes an amplifier 204" for uplinking signals to a satellite. A compression system controller 260" may be in communication with the engineering USPS 200" through a bus 290.

[0061] Referring now to Fig. 5, the receiving circuit module 104 is illustrated in further detail. The receiving circuit module 104 includes a housing 300 that has an RF input 302 coupled to an antenna 312 or the like and an SDI input 304 coupled to a wire or optical fiber. The housing also includes an input/output interface 306 for coupling signals to an IP network.

[0062] The RF input 302 is in communication with an antenna 312 and an NTSC receiver module 314 and an ATSC receiver module 316. The NTSC receiver module 314 may include a tuner 320, a demodulator 322 and a decoder 324. The ATSC receiver module 316 may also include a tuner 330, a demodulator 332 and a decoder 334. Both receiver modules 314, 316 may tune to a particular channel and demodulate and decode the particularly formatted channel signal. Because the NTSC receiver module 314 is receiving an analog signal, the analog signal is converted to a digital signal and an analog-to-digital converter 340. The output of the analog-to-digital converter 340 and the ATSC receiver module 316 is communicated to a bus such as a peripheral component interconnect (PCI)

342. The PCI 342 may be coupled to a PCI 344 that is in communication with a control module 346 such as a mother board and an input/output (I/O) control module 348. The I/O control module 348 may control the communication into and out of the input/output interface 306. The control modules 346, 348 may also route input signals to the RF input module 300.

[0063] The I/O control module 348 may control incoming control signals from the network 32 which originate from the RUF. The control signals may be used to control and configure the encoder and receivers. The I/O control module 348 may also be used to generate an output signal with data for the compression system controller at the RUF to monitor. The data may include an indication as to the health and status of the various components.

[0064] An encoder 360 may also be included within the same housing 300. The encoder 360 may receive signals directly from the SDI input 304 or through an equalizer 361. Audio signals may also be received through the SDI input 304. The encoder 360 may comprise a field programmable gate array (FPGA) 362 that includes a video routing and scaling module 364 that provides signals to an ASSP main encoder 364 and an ASSP lookahead encoder 366. The encoders 364, 366 may include a DRAM 368 and 370, respectively. A flash memory 372 and flash memory 374 may also be associated with the respective encoders 364, 366. An input and output controller 376 may receive information or data from the encoders 364, 366 and provide the information or data to a direct memory access module 378. The DMA module 378 may also receive signals from an audio/advanced video coding/closed-captioning module 380. The function of the encoder 362 is to encode the signals into format responsive to transmission through the network 32. In this example, the format is an IP format. The signals from either the NTSC receiver module 314 or the

ATSC receiver module 316 may also be encoded. Each receiving circuit module 104 and thus each RF input module 314 and encoder 360 are used to process a single-receive channel. Encoding may be into MPEG4 format.

[0065] One advantage of the configuration of receiving circuit module 104 is that multiple sources can be used to receive a channel signal. Conventional standard definition over-the-air signals may be received with the NTSC receiver module 314. The ATSC receiver module 316 may be used to receive high definition over-the-air broadcast signals. The SDI input 304 may be used to receive standard definition signals received through a cable or optical fiber. Through the control module 348 which may be controlled from the remote uplink facility, the type of input may be selected. It should be noted that the switching from the various types of receiving sources may be performed remotely from the remote uplink facility or the network operation center. Thus, without local personnel the remote uplink facility can be configured for different channel types. This will be particularly useful when over-the-air standard definition signals are no longer broadcast.

[0066] Another advantage of the receiving circuit module 104 is that by combining the encoding and receiving functions together in one housing, the amount of rack space consumed is reduced.

[0067] Referring now to Fig. 6, a method of operating the system illustrated in Figs. 3 and 4 is illustrated. In step 610, the channel signals are received at the local collection facility through either an antenna or an over-the-air transmission. As mentioned above, the received channel signals may be standard definition (NTSC) or high definition signals (ATSC).

[0068] In step 612, the received channel signals are encoded into a format suitable for transmission to the remote uplink facility. In this example, IP signals are used. This may be MPEG4 format. That is, the received channel signals are converted into IP signals for each channel at the local collection facility. This may be performed using a separate receiving circuit module illustrated in Figs. 3, 4 and 5 corresponding to each of the channel signals.

[0069] In step 614, the channel IP signals that have been encoded are routed through the routers to the remote uplink facility.

[0070] In step 616, a statistical multiplexer in one of the USPS circuits at the remote uplink facility is controlled and receives the various signals. The statistical multiplexer is used to receive various signals to form an uplink signal for a transponder. The statistical multiplexer may receive signals from a number of different local collection facilities and assemble them into a multiplexed signal. The statistical multiplexers may change the channel allocation based upon the various parameters for the various signals. The compression system controller 260 illustrated in Figs. 3 and 4 may be used to control the allocation. Multicast addresses may be assigned to the channel IP signals so that the multiplexers receive the grouping of the signals.

[0071] In step 618, the statistical multiplexers receive the designated channel IP signals and form multiplexed signals. In step 620, a transport stream is formed in the ATPS. The ATPS may encode the signal.

[0072] In step 622, the modulator modulates the transport stream. In step 624, the RF switch 216 generates an output switch that is communicated to the uplink RF system. The uplink RF system generates the uplink signal based upon the output signal from the RF

switch. The uplink signal is then uplinked to a satellite. In a non-satellite system, the RF signal may be communicated through a terrestrial antenna or wired-type system.

[0073] Referring now to Fig. 7, a method for controlling the local collection facility is set forth. As mentioned above, the local collection facility may be controlled at a remote uplink facility or network operation center. In step 710, each of the local collection facilities has a receiving circuit module for each channel desired to be operated. In addition, a monitoring receiving circuit module may also be provided. The receiving circuit module may be controlled through control signals from the remote uplink facility. The desired channel to be monitored is routed through the monitoring receiving circuit module 106. The signals to be monitored are routed through the IP network 32 to the remote uplink facility or to the network operation center. Monitoring and control may be provided through the remote facility or through the network operation center in step 712.

[0074] In step 714, operational parameters (data) may be generated at the local collection facility. The operational parameter signals may include the channel signals themselves, the status of the encoder and the status of the receiver. In step 716, the operational parameter signals are communicated to the monitor and control system. As mentioned above, the operational parameter signals may be communicated through an IP network.

[0075] In step 718, control signals are generated at the remote uplink facility or network operation center in response to the operational parameter signals. In step 720, the control signals are communicated through the IP network to the receiving circuit module. The operating parameters of the receiving circuit modules are thus changed in response to the control signal.

[0076] Examples of changing the parameters of the encoders may include adjusting the audio and video parameters, enabling or disabling closed-captioning, initiating ghost cancelling, selecting a video output format regardless of the input format, resetting the encoder and controlling or adjusting the processing amplifier such as chroma, hue, timing, pedestal, test pattern availability and the like.

[0077] Examples of the operation parameter signals may include various types of operational parameter signals such as a test pattern status such as enabled or disabled, a closed-captioning status, a primary or secondary output stream status, an audio video status, an input signal alarm, a low bit error rate or modulation error ratio (MER) signal, a carrier lock alarm, a service lock alarm, an over temperature, power supply or fan alarm, a port failure or a buffer filled alarm. Each of these signals may be used as the operational parameter signals provided to the monitoring and control system from the local collection facility.

[0078] Referring now to Fig. 8, the receiving circuit module may also be remotely controlled to switch between various types of inputs. In step 810, the receiving device is provided with an NTSC input and an ATSC input through the RF input and an SDI input. In step 812, a control signal from the remote uplink facility or network operation center is generated. The control signal is communicated through the network to the local collection facility in step 812.

[0079] In step 814, the system is controlled to switch from a first input to a second input. That is, the RF input circuit may be switched to provide input signals from an NTSC source or an ATSC source. The system may also be changed to not use either of the NTSC or ATSC inputs but rather use the serial digital interface. The switching from one

input to another input may be controlled from the remote uplink facility or network operation center. Because several local collection facilities may be coupled to a single remote uplink facility, this allows greater flexibility for the system. When a particular television station changes from standard definition format to a high definition format, the change may be easily accommodated at the local collection facility through control at the remote uplink facility.

[0080] Referring now to Fig. 9, the local collection facilities may also include a back-up receiving circuit module. Several back-up receiving circuit modules may be included in a local collection facility. Preferably, one back-up receiving circuit module 108 is included for N number of receiving circuit modules. In one example, for receiving circuit modules correspond to one back-up receiving circuit module. The back-up receiving circuit module may be referred to as a “pooled” back-up receiving module. Of course, the present invention applies to the conditions where a receiving circuit module are composed of several circuits such as an individual encoder.

[0081] In step 910, an error signal may be received from a receiver circuit module at the local collection facility. The error signal may be one of the signals described above with respect to the operation of the encoder. The signals may be transmitted and an error determined at a monitoring facility. In step 912, the compression system controller sends a command to the local collection facility to route signals to the back-up receiver circuit module.

[0082] In step 914, the compression system controller commands the back-up receiver circuit module to use the configuration and operational parameters of the failed primary receiver circuit module without IP and multicast addresses. In this case, the receiver may be tuned and decoded according to the parameters of the primary channel. In step 916, a

mirror mode may be entered with the back-up receiver circuit module. The monitoring system may be used to monitor the channel signal through the back-up receiving circuit module prior to placing the back-up receiving circuit module on air. In step 918, the primary encoder is replaced with the back-up encoder in the multiplexing output stream. In step 920, the compression system controller commands the primary and back-up multiplexer to leave the multicast group of the failed primary receiving circuit module. The compression system controller then commands the multiplexer to remove the failed primary receiver circuit module from the pool and set it as an inactive in step 922. In step 924, a back-up receiver circuit module is switched to the statistical multiplexer and the primary and back-up multiplexers at the remote uplink facility are commanded to join the back-up receiver circuit module through the multicast address. Thus, the multiplexer is then able to receive the properly addressed signals from the back-up receiving circuit module. In step 926, the database of the compression system controller is updated to indicate that the back-up receiving circuit module has been placed on air.

[0083] Should the primary receiving circuit module become repaired or no longer has a problem, the back-up receiver circuit module may be released using steps 910 through 926.

[0084] As can be seen above, the manual switchover may be a look-before-leap-type system so that the accuracy and configuration of the back-up encoder may be verified before switching to it in an on-line or on-air fashion. It should be noted that the process may be a manual switchover or the process may provide automatic switchover based upon various signals received back from the local collection facility.

[0085] Referring now to Fig. 10, the remote uplink facility may also include a secondary or back-up remote uplink facility. This will be referred to as the engineering USPS. Several remote or local collection facilities may share the same engineering USPS. The output of a USPS corresponds to the signals for one transponder on one satellite for the case of the satellite system. In the case of a non-satellite system, the word “uplink” may be not be used to end the description.

[0086] Various channels are received at the local collection facility. In step 1012, the channel signals are received and encoded into IP signals by a respective receiving circuit module at each LCF. In step 1014, the channel’s IP signals are routed through the IP network to the remote uplink facility. In step 1016, the primary and back-up USPS’s are monitored. In step 1018, the USPS back-up is verified.

[0087] In step 1020, configuration data is exported to the engineering USPS from the compression system controller including the encoder, monitor and control data. In step 1022, the configuration data is loaded into the engineering compression system controller. In step 1024, an engineering standby mode is entered. The compression system controller may propagate configuration data from the internal database to both the statistical multiplexers to start receiving the IP packets multicast from the local collection facilities and perform a multiplexing operation. Since both the statistical multiplexers of the engineering USPS are in standby mode, they do not send out allocation messages and they share the same complexity messages sent by the encoders on the same multicast address as the production USPS. In step 1026, once the engineering USPS signal is confirmed, the engineering compression system controller communicates the configuration data from its internal database to all the encoders at the local collection facilities in step 1028. The statistical

multiplexers are commanded to change the multicast address in step 1030. The ATPS of the engineering multiplexer is thus configured. Also, the modulator of the engineering USPS is configured. In step 1036, the change to the engineering USPS is completed and the engineering USPS is on-air while the primary USPS at the remote uplink facility is disabled.

[0088] Referring now to Fig. 11, a local collection facility 30' is illustrated in further detail. The local collection facility 30' may be used as one or more of those illustrated in Fig. 1 or Fig. 2. The local collection facility 30' may also be used with one of the remote uplink facilities 16 and a diversity site 42 of Figs. 3 and 4.

[0089] The local collection facility 30' may include over-the-air antennas 100 that are coupled directly to receiving units 104A'-104G'. The RF router 102 and SDI router 120 of Figs. 3 and 4 may also be used in place of the configuration illustrated in Fig. 11. However, each of the receiving units 104' may be in communication with an antenna 100 or with a local feed through a local fiber 1100. Each of the receiving circuit modules 104' may include an 8VSB input and an ASI input. The 8VSB input is the 8-level vestigial sideband modulation scheme adopted for terrestrial broadcast of ATSC digital television standard in the United States.

[0090] As will be described further below, the output of the receiving circuit modules may include channels formatted or encoded into different encoding schemes. For example, the same channel may be encoded in MPEG2 and MPEG4 encoded signals.

[0091] A backup receiving circuit module 108' may also be provided. A monitor receiving circuit module 106' may also be provided. An RF switch 1110 and an ASI switch 1112 may be in communication with the ASI feed and the ATSC feed for feeding the backup receiving circuit 108'. Both the RF switch 1110 and the ASI switch 1112 can be switched to

provide redundant service for any receiving circuit module 104'. The RF switch 1110 and the ASI switch 1112 may be controlled through Advanced Broadcast Monitoring System (ABMS) control 1114. ABMS control is described in Figs. 3 and 4 as reference numeral 256. The control from the ABMS 1114 may be from a central location such as the remote uplink facility or network operations center that is not illustrated in Fig. 11.

[0092] The output of the receiving units 104', 106' and 108' may be provided to a primary multiplexer 1120 or a backup multiplexer 1122 through a virtual local area network 1124 or 1126. The multicast addresses and source addresses may be statistically assigned to each of the receiving circuit modules. Mirrored outputs of the receiving circuit module may be provided to the backup virtual LAN 1126 and the multiplexer 1122. Each of the receiving circuit modules may support IP bonding which is when each IP transport stream output interface may use the same MAC address, the source IP address and multicast. Only one port may be multicasting at a time and thus one port may be specified as a primary port. If a carrier is lost, automatic switching may be provided to a backup port. This may be performed autonomously and not involving a system controller.

[0093] When a multiplexer 1120 or 1122 is switched into a backup mode, the IP output may be turned off. However, if the control network connection to the multiplexer fails, the network control center will be unable to switch the IP output off. Control network redundancy may reduce the risk of doubling the bandwidth should both multiplexers be active. A new multicast may not transition down the link unless it is requested to do so by a control center. As mentioned above, the multiplexer may multiplex the same channel into MPEG2 format and MPEG4 format. The MPEG4 format may include both standard definition and high definition signals. The output of the multiplexers may also be provided

to a virtual local area network 1130 and 1132, respectively. The virtual LANs 1130 and 1132 communicate signals to the IP network 32 for ultimately uplinking to a satellite. The uplinking system is illustrated in further detail in Figs. 3 and 4 and is not set forth again here. The remote uplink facility 16, the network operation center 14, the diverse uplink facility 42 and the engineering USPS 200" may all be part of the uplink 1140 illustrated in Fig. 11.

[0094] Referring now to Fig. 12, one of the receiving circuit modules 104' illustrated in Fig. 11 is illustrated. The receiving circuit module 104' may have a housing 1210 with various controls 1212 on the front face 1214 thereof.

[0095] The receiving unit 104' allows a decoding process followed by an encoding process that encodes the channel signals into different format streams. The output stream formats may include different resolutions, bit rates, preprocessing and video and audio encoding parameters. The output stream formats may be independently configurable within the same housing 1210.

[0096] Referring now to Fig. 13, a rear view of the receiving circuit module 104' is illustrated. As is illustrated, the various outputs may include an RGB high definition port 1312, an alarm port 1314, an RS422 data port 1316, an RS232 data port 1320, a CVBS port 1322, a frame synch port 1324, a first audio port 1326, a second audio port 1328, a 10/100 base T port 1330 for connecting to a network, a remote control port 1332, a first primary control Ethernet 1338 output and a second backup Ethernet control port 1340, a first Ethernet port 1342, and a second Ethernet port 1344, a first ASI output 1346, a second ASI output 1348, a third ASI output 1350, an SDI input 1352, an H synch port 1354, a compressed video output 1356, an HD-SDI output 1357, an HD-SDI input 1358, a composite video input 1359, an HD-SDI secondary input 1360, an ASI/HD/SDI output 1362, an alarm relay 1364, an

auxiliary data output 1378, a data output 1366, an RS232 remote output 1365, an audio input 1367, an auxiliary RS232 port 1374, a power input 1376 and an auxiliary data input 1378.

[0097] Referring now to Fig. 14, a block diagrammatic view of the receiving circuit module 104' is illustrated in further detail. In this embodiment, a demodulator 1410 is provided. The demodulator 1410 may be an ATSC demodulator which is illustrated as an 8VSB demodulator 1410. The 8VSB demodulator receives over-the-air television signals from the antenna 100 illustrated in Figs. 3, 4 and 11. The internal demodulator 1410 may support various frequencies including 54 to 863 megahertz with 6 hertz bandwidth channel spacing. RF input may be an F-type connector input.

[0098] The demodulated signal from the demodulator 1410 is provided to the SV/HD MPEG2 decoder 1412 which may include a down convertor. That is, if an HD signal is received and a standard definition signal is desired to be output, the HD signal may be down converted to an SD signal. The output of the decoder may be provided to an MPEG2 encoder 1414 and to a standard definition/high definition MPEG4 encoder 1416. The decoded signal from the decoder 1412 may be provided to the MPEG4 encoder 1416 through an SD-SDI loop. The decoder 1412 may provide both HD and SD decoding. For MPEG2 decoding, horizontal lines of 50 megabits per second may be provided. For SD encoding, 15 megabits per second may be provided. The decoder 1412 may pass through the audio from the compressed input source. The encoder may also provide selectable letter box cut-out (pan and scan) conversion of 16:9 HD content using 4:3 standard definition selectable by a central control system. The MPEG2 encoder 1414 may provide 480 x 480 video resolution and may have selectable encoding parameters. The MPEG4 encoder 1416 may provide 1080i, 720p and 480i video formats that are user selectable.

[0099] The output of the MPEG2 encoder 1414 (which may include a host controller card) may be provided with close-captioning to the multiplexer 1120 as is illustrated in Fig. 11. While only one multiplexer is illustrated in this embodiment, a back-up multiplexer such as that illustrated as reference numeral 1122 of Fig. 11 may also be provided.

[00100] A standard definition (SD) link 1420 may also be provided between the MPEG2 encoder and the MPEG4 encoder.

[00101] One output of the MPEG4 encoder 1416 may be standard definition or high definition or both MPEG4 video. Closed captions may also be provided with the output of the MPEG4 encoder 1416. The standard definition and high definition MPEG 4 output may be communicated to the multiplexer 1120.

[00102] For the audio corresponding to the video, AC-3 audio may be provided to an audio encoder 1440. The audio encoder 1440 may provide Dolby Digital® AC-3 pass-through which glitch suppression for two audio services. Down mixing and transcoding of Dolby Digital® AC-3 into MPEG1 layer 2 audio may also be provided by the audio encoder 1440. AC-3 audio 1442 may be an output of the audio encoder. Also, MPEG1 layer 2 audio signals 1444 may also be output from the audio encoder. The output of the MPEG2 encoder 1414, the output of the MPEG4 encoder 1416 and the outputs of the audio encoder 1440 may all be provided to the multiplexer 1120. The output of the multiplexer 1120 may be provided to a dual gigabyte Ethernet GbE IP network interface card (NIC) 1450 and to an MPTS output 1452. The receiving circuit module 104' may have a control input 1460 for controlling the device by way of a control line from a remote controller.

[00103] The network interface card 1450 may provide different types of output, such as a primary output 1454 with a single MPTS multicast stream which is split at the multiplexer and a redundant output 1456.

[00104] Referring now to Fig. 15, a summary of a method for providing signals for uplink is set forth. In step 1510, a channel signal is received. In step 1512, the same channel signal is encoded into a first format and in step 1514 the same channel is encoded into a second format. The first format may be MPEG2 encoding and the second format may be MPEG4 encoding. In step 1516, the encoded signals are multiplexed. Either a primary or backup multiplexer may be used. In step 1518, the multiplexed signals are communicated to an uplink site. In step 1520, the multiplexed signals are ultimately transmitted to user devices. Thus, both different types of encoded signals are simultaneously multiplexed and provided to the uplink site and then communicated to various user devices. As mentioned above, various user devices may include standard definition and/or high definition signals. The various user devices may only be capable of receiving MPEG2 or MPEG4 signals. Thus, any of the receiving units or user devices may receive one of the encoded channel signals.

[00105] Those skilled in the art can now appreciate from the foregoing description that the broad teachings of the disclosure can be implemented in a variety of forms. Therefore, while this disclosure includes particular examples, the true scope of the disclosure should not be so limited since other modifications will become apparent to the skilled practitioner upon a study of the drawings, the specification and the following claims.

CLAIMS

What is claimed is:

1. A method of operating a receiving circuit module comprising:
receiving a first signal at the receiving circuit module;
encoding the first signal within the receiving circuit module to form a first encoded signal;
encoding the first signal within the receiving circuit module to form a second encoded signal;
generating a first output signal at receiving circuit module corresponding to the first encoded signal; and
generating a second output signal at the receiving circuit module corresponding to the second encoded signal.
2. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air signal.
3. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air television signal.
4. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air standard definition television signal.

5. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air high definition television signal.

6. A method as recited in claim 1 wherein receiving the first signal comprises decoding an over-the-air television signal.

7. A method as recited in claim 1 wherein encoding the first signal within the receiving circuit module to form a first encoded signal comprises encoding the first signal within the receiving circuit module to form an MPEG2 encoded signal and wherein encoding the first signal within the receiving circuit module to form a second encoded signal comprises encoding the first signal within the receiving circuit module to form an MPEG4 encoded signal.

8. A method as recited in claim 1 wherein receiving comprises receiving an over-the air signal and tuning, demodulating and decoding the over-the-air signal to form the first signal.

9. A method as recited in claim 1 further comprising communicating the first output signal and the second output signal to a satellite uplink facility.

10. A method as recited in claim 1 further comprising communicating the first output signal and the second output signal to a satellite uplink facility through an Internet Protocol network.

11. A method as recite in claim 1 simultaneously uplinking signals corresponding to the first output signal and the second output signal to the satellite.

12. A method as recite in claim 1 wherein generating a first output signal and generating a second output signal comprises simultaneously generating the first output signal and the second output signal.

13. A method as recited in claim 1 wherein generating first output signal and generating a second output signal comprises multiplexing the first output signal and the second output signal to form a multiplexed signal.

14. A method as recited in claim 13 further comprising communicating the multiplexed signal to a satellite uplink facility.

15. A method as recited in claim 1 wherein generating a first output signal and generating a second output signal comprises simultaneously generating the first output signal and the second output signal.

16. A receiving circuit module comprising:
- a housing having an input for a first signal;
 - a first encoder disposed within the housing encoding the first signal to form a first encoded signal; and
 - a second encoder disposed within the housing encoding the first signal to form a second encoded signal having a different format than the first signal.
17. A receiving circuit module as recited in claim 16 further comprising a decoder decoding the first signal.
18. A receiving circuit module as recited in claim 16 wherein the first encoded signal comprises an MPEG 2 encoded signal and the second encoded signal comprises an MPEG 4 encoded signal.
19. A receiving circuit module as recited in claim 16 further comprising a multiplexer simultaneously multiplexing the first encoded signal and the second encoded signal first.

20. A system comprising:

a first local collection facility having a first plurality of receiving circuit modules as recited in claim 16 generating a first plurality of output signals;

a second local collection facility having a second plurality of receiving circuit modules as recited in claim 16 generating a second plurality of output signals;

an IP network in communication with the first local collection facility and the second local collection facility;

a remote uplink facility communicating with the first local collection facility and the second local collection facility through the IP network and generating an uplink signals in response to the first plurality of output signals and the second plurality of output signals.

AMENDED CLAIMS

received by the International Bureau on 12 April 2010 (12.04.10).

1. A method of operating a receiving circuit module having a receiving circuit module housing comprising:
 - receiving a first signal at the receiving circuit module housing;
 - encoding the first signal within the receiving circuit module housing to form a first encoded signal having a first format;
 - encoding the first signal within the receiving circuit module housing to form a second encoded signal having a second format different than the first format;
 - multiplexing the first encoded signal and a second encoded signal at a first multiplexer within the receiving circuit module to form a first multiplexed output signal; and
 - generating a first output signal at the receiving circuit module housing corresponding to the first multiplexed output signal.
2. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air signal.
3. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air television signal.
4. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air standard definition television signal.
5. A method as recited in claim 1 wherein receiving the first signal comprises receiving an over-the-air high definition television signal.

6. A method as recited in claim 1 wherein receiving the first signal comprises decoding an over-the-air television signal.

7. A method as recited in claim 1 wherein encoding the first signal within the receiving circuit module housing to form a first encoded signal comprises encoding the first signal within the receiving circuit module housing to form an MPEG2 encoded signal and wherein encoding the first signal within the receiving circuit module housing to form a second encoded signal comprises encoding the first signal within the receiving circuit module housing to form an MPEG4 encoded signal.

8. A method as recited in claim 1 wherein receiving comprises receiving an over-the air signal and tuning, demodulating and decoding the over-the-air signal to form the first signal.

9. A method as recited in claim 1 further comprising communicating the multiplexed output signal to a satellite uplink facility.

10. A method as recited in claim 1 further comprising communicating the multiplexed output signal to a satellite uplink facility through an Internet Protocol network.

11. A method as recite in claim 1 further comprising simultaneously uplinking signals corresponding to the first output signal and the second output signal to the satellite.

12. A method as recited in claim 10 wherein communicating the multiplexed output signal comprises simultaneously communicating the multiplexed output signal to a second multiplexer outside the receiving unit prior to communicating through the Internet Protocol network.

13. A method as recited in claim 10 wherein communicating the multiplexed output signal comprises communicating the multiplexed output signal to a second multiplexer and a third multiplexer outside the receiving unit prior to communicating through the Internet Protocol network multiplexed output signal.

14. A method as recited in claim 13 further comprising communicating the multiplexed output signal to the satellite uplink facility.

15. A method as recited in claim 13 further comprising communicating the multiplexed output signal to the second multiplexer and third multiplexer through a virtual local area network.

16. A receiving circuit module comprising:

a housing having an input for a first signal;

a first encoder disposed within the housing encoding the first signal to form a first encoded signal;

a second encoder disposed within the housing encoding the first signal to form a second encoded signal having a different format than the first signal; and

a multiplexer disposed within the housing generating a first multiplexed signal by multiplexing the first encoded signal and the second encoded signal.

17. A receiving circuit module as recited in claim 16 further comprising a decoder decoding the first signal prior to the first encoder and second encoder.

18. A receiving circuit module as recited in claim 16 wherein the first encoded signal comprises an MPEG 2 encoded signal and the second encoded signal comprises an MPEG 4 encoded signal.

19. A receiving circuit module as recited in claim 16 further comprising a multiplexer simultaneously multiplexing the first encoded signal and the second encoded signal first.

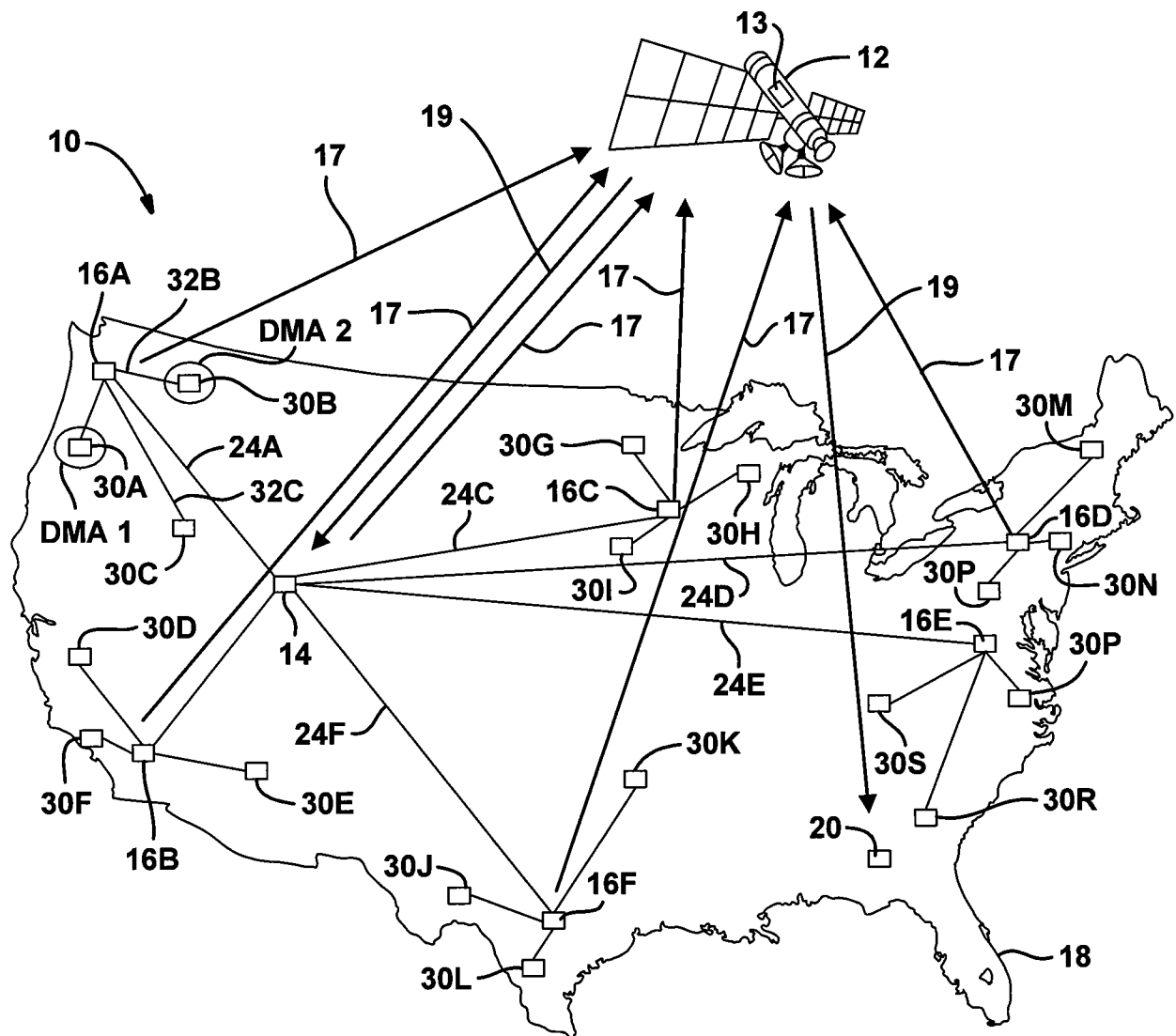
20. A system comprising:

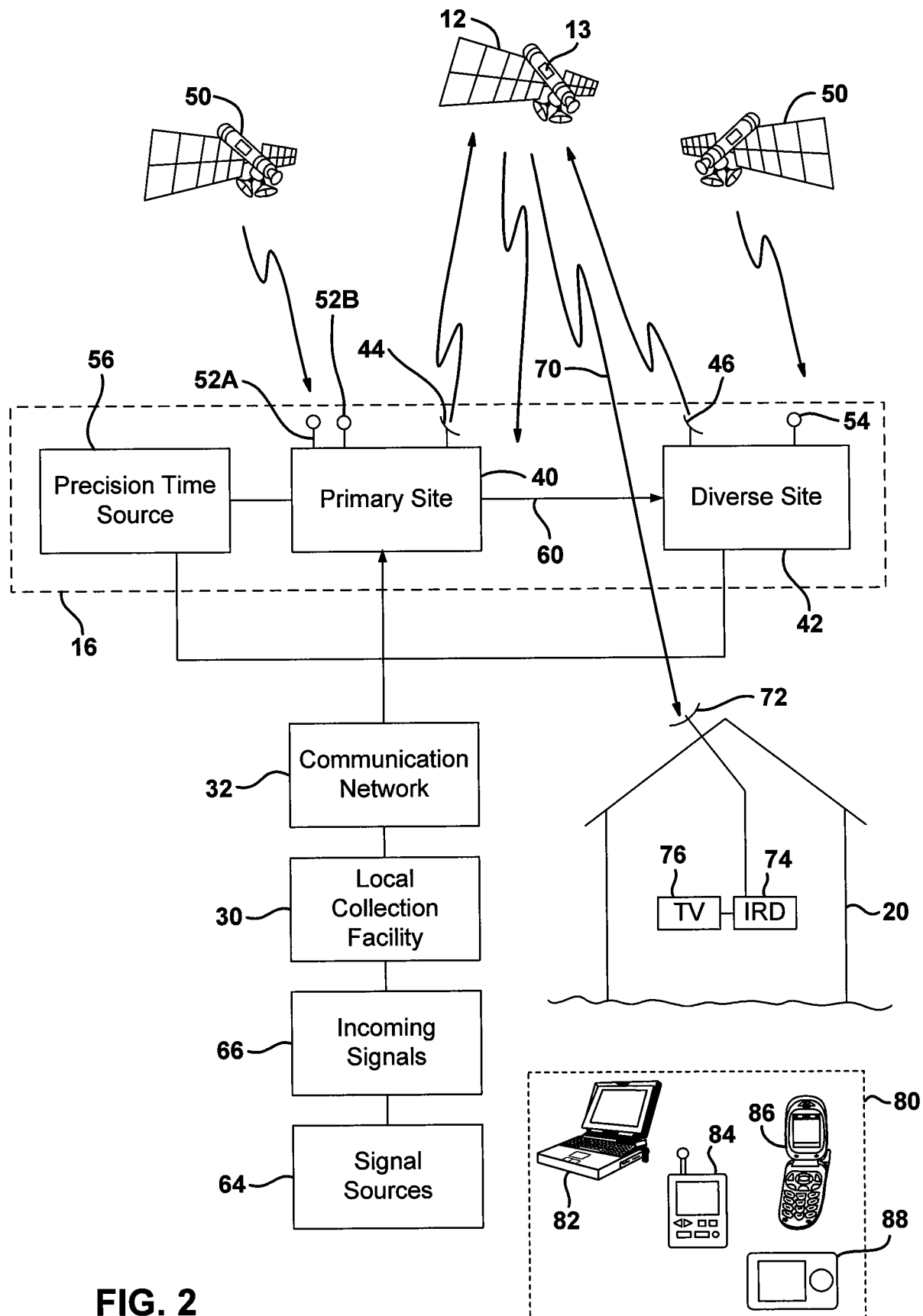
a first local collection facility having a first plurality of receiving circuit modules as recited in claim 16 in communication with a second multiplexer for generating a first plurality of first multiplexed signals, said second multiplexer multiplexing the plurality of first multiplexed signals to form a second multiplexed output signal;

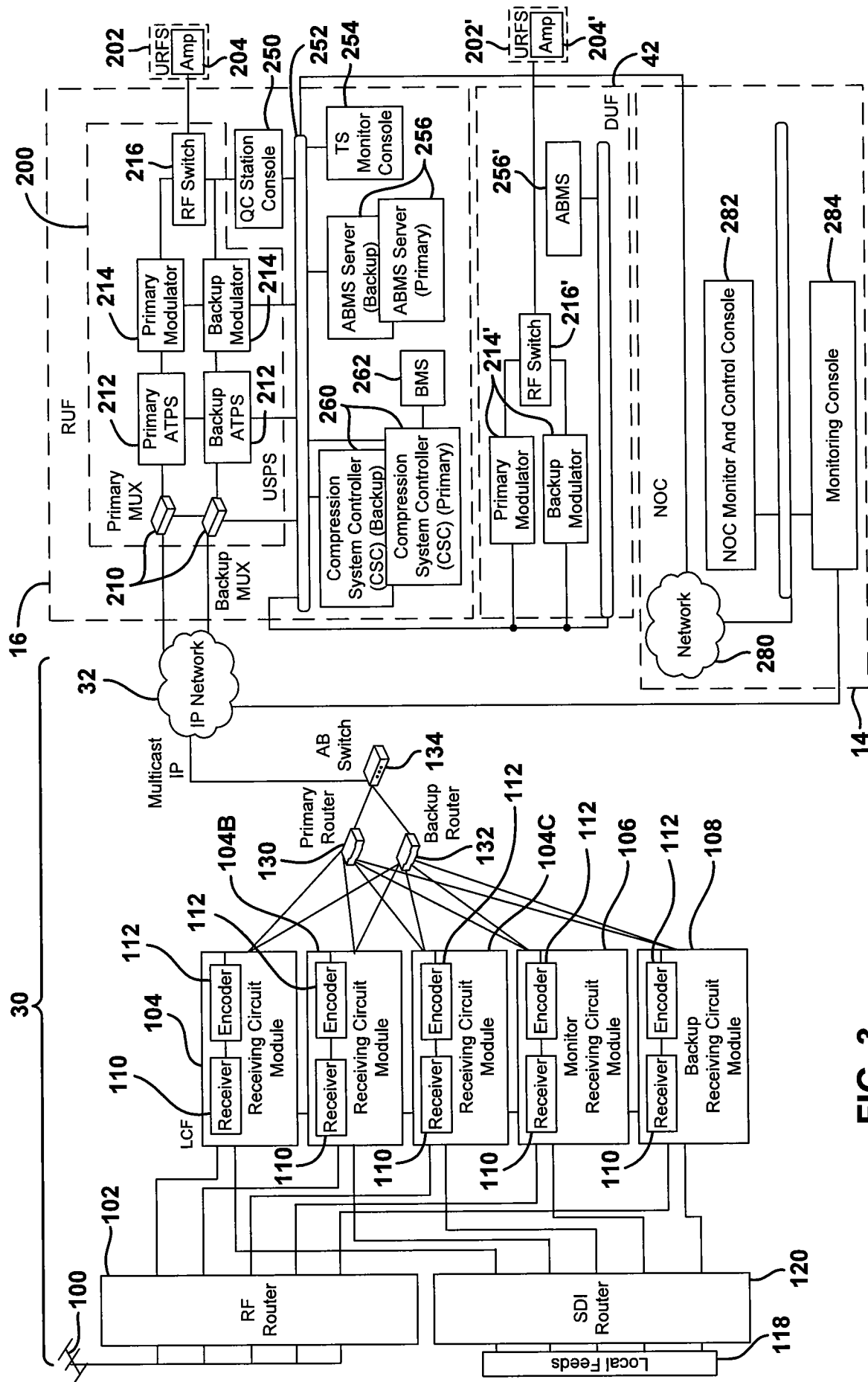
a second local collection facility having a second plurality of receiving circuit modules as recited in claim 16 in communication with a third multiplexer generating a second plurality of third multiplexed signals, said third multiplexer multiplexing the plurality of third multiplexed signals to form a third multiplexed output signal;

an IP network in communication with the first local collection facility and the second local collection facility;

a remote uplink facility communicating with the first local collection facility and the second local collection facility through the IP network and generating uplink signals in response to the third multiplexed output signal and the third multiplexed output signal.

**FIG. 1**

**FIG. 2**

**FIG. 3**

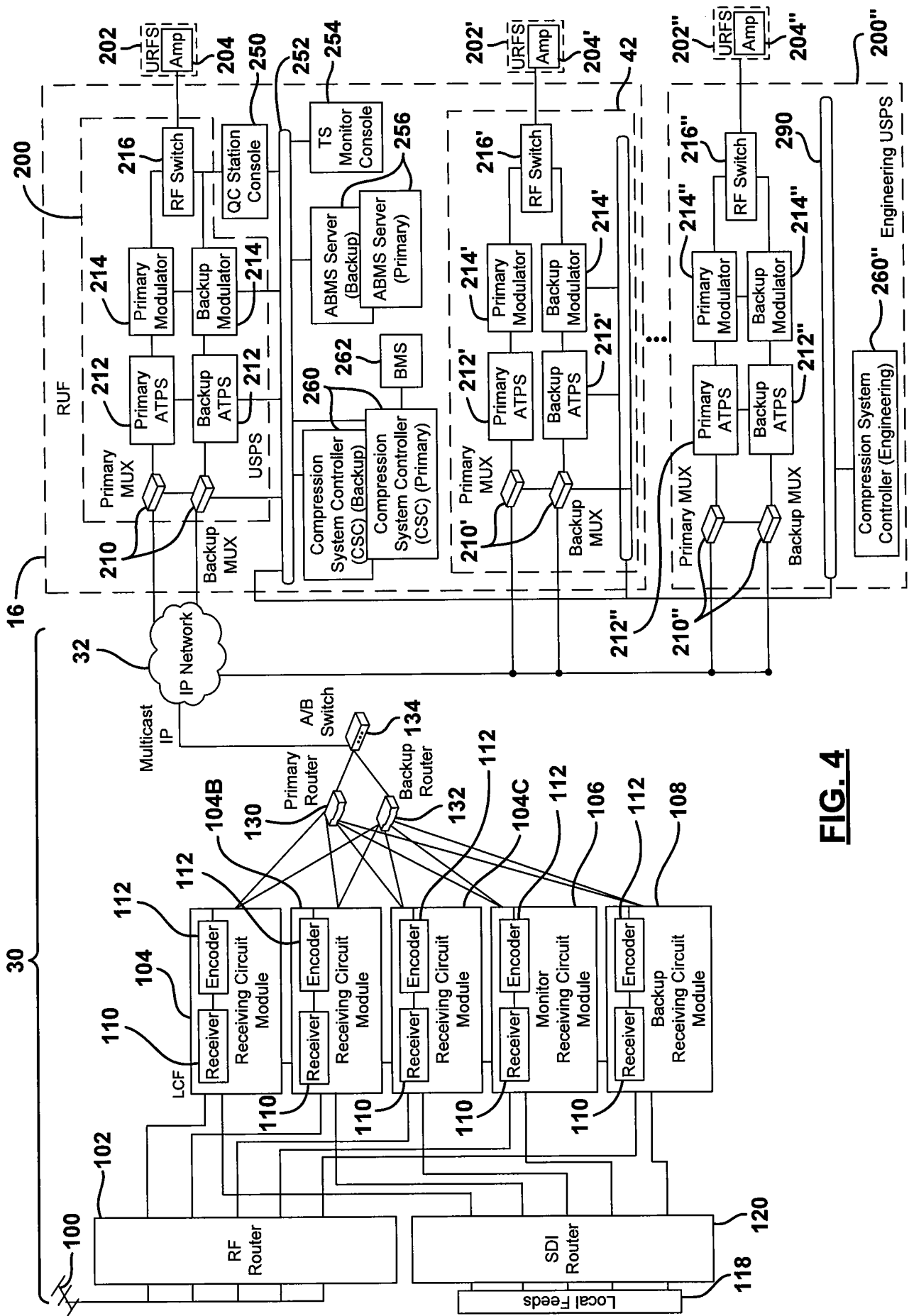


FIG. 4

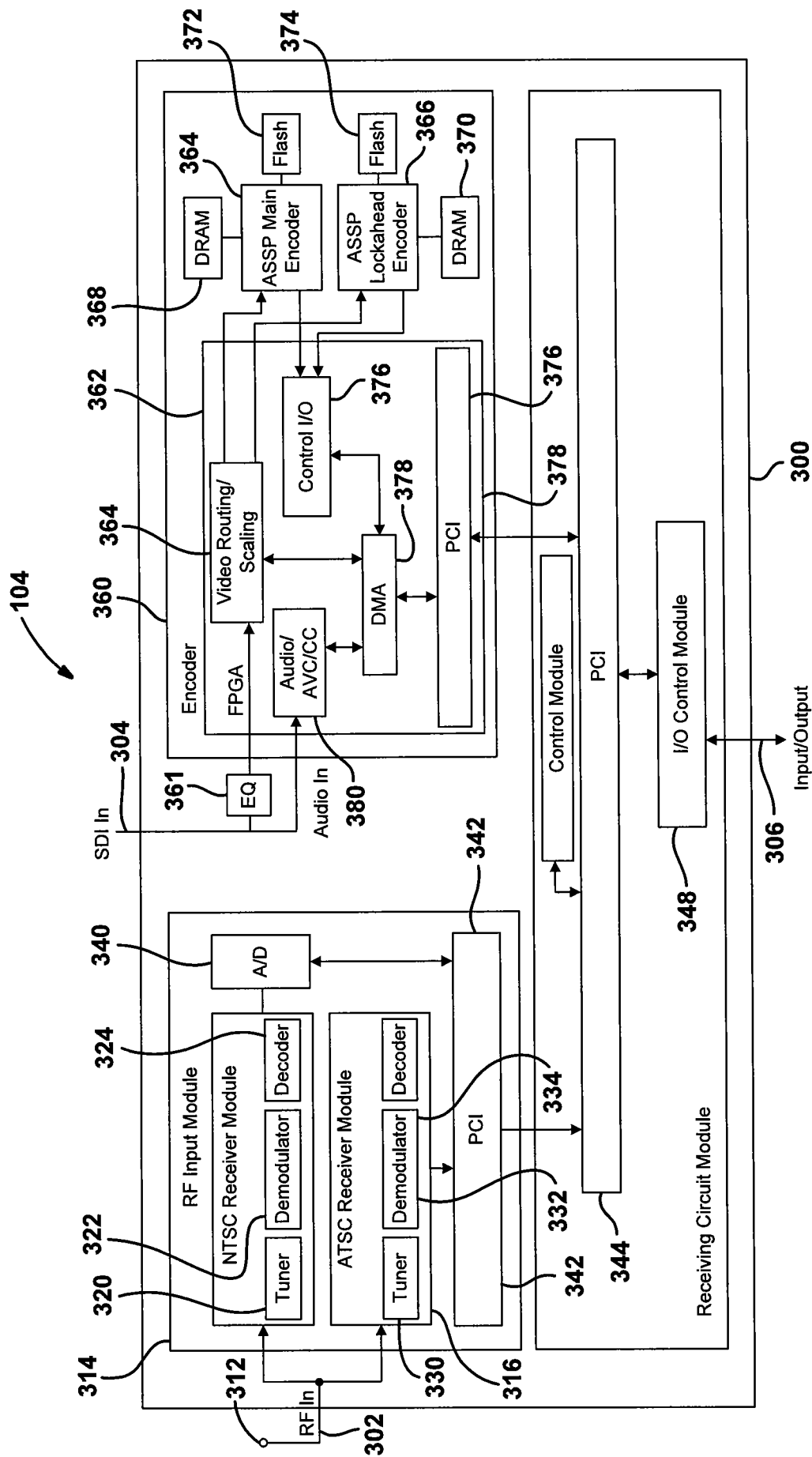
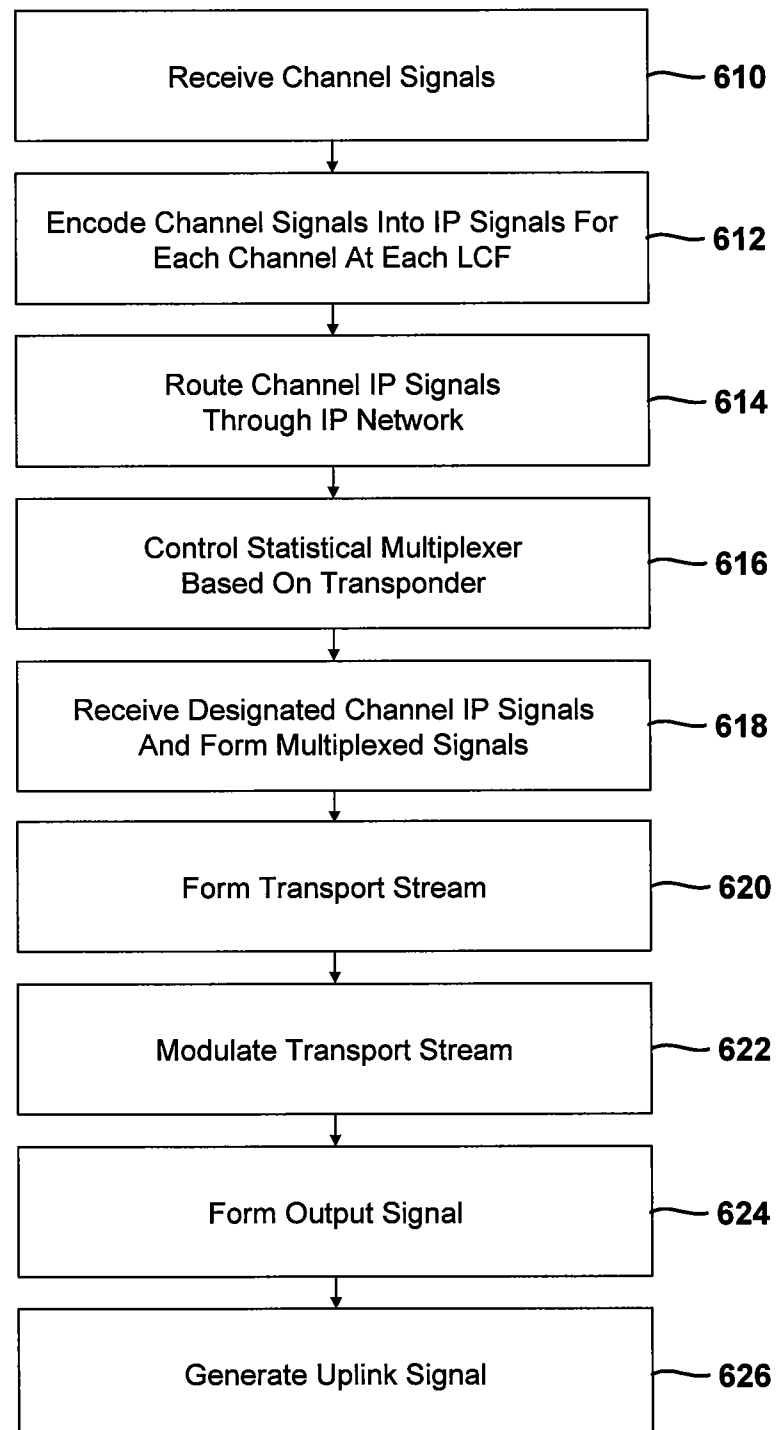
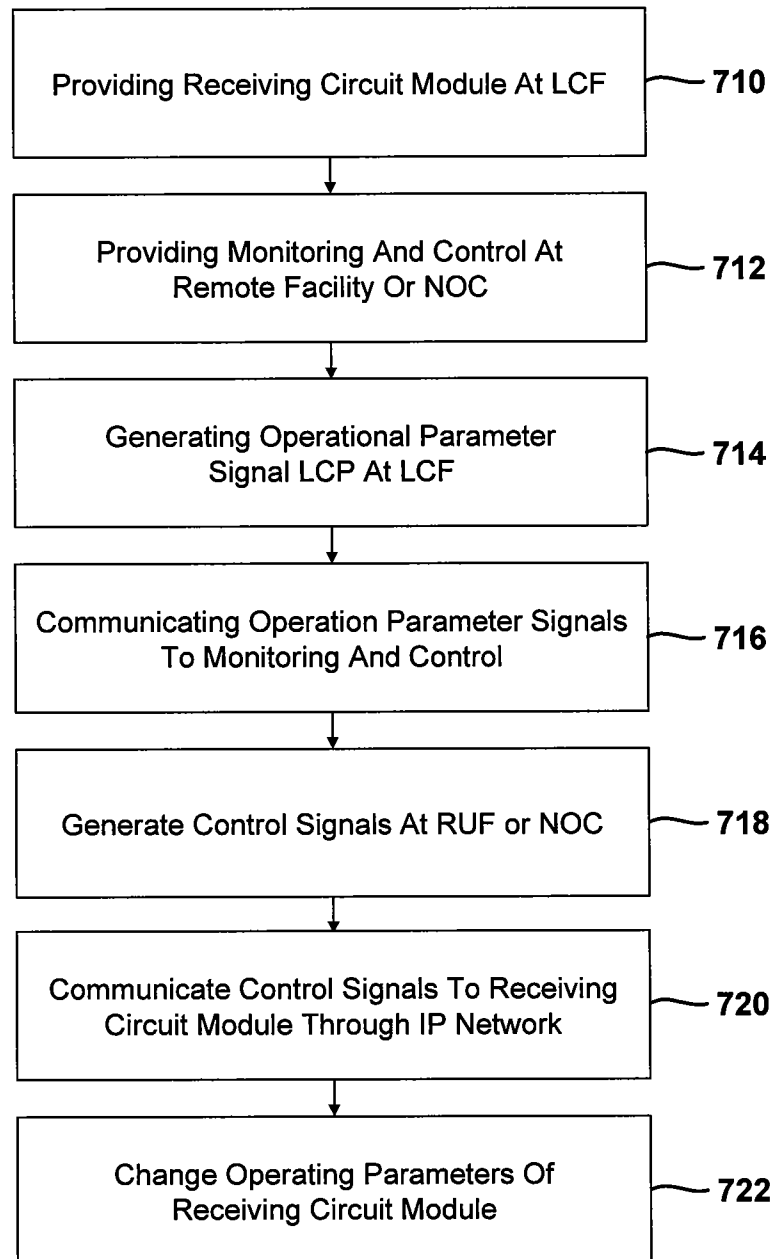


FIG. 5

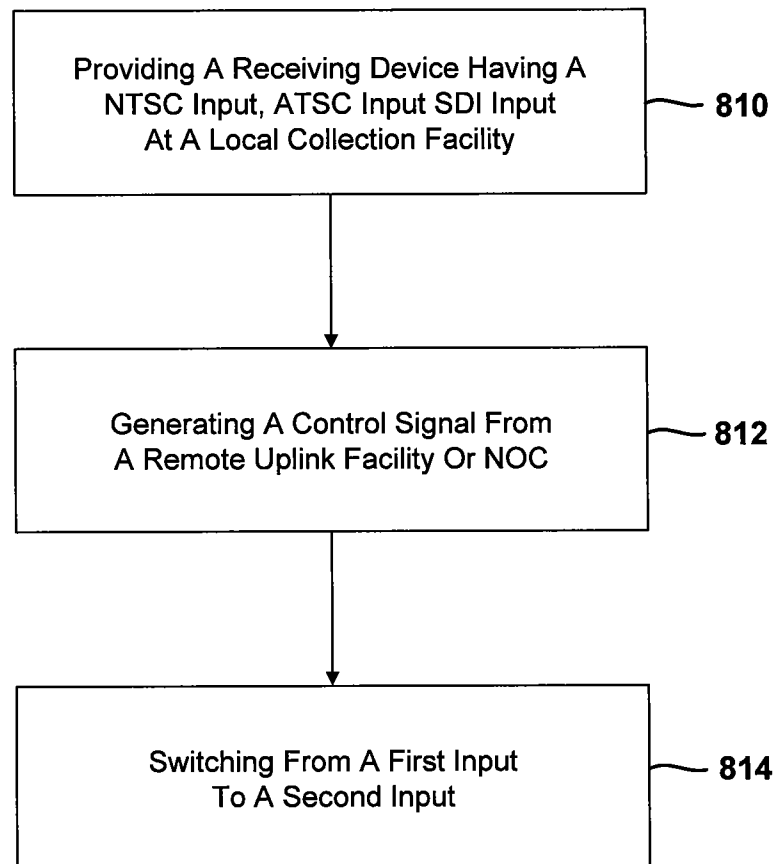
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**FIG. 6**

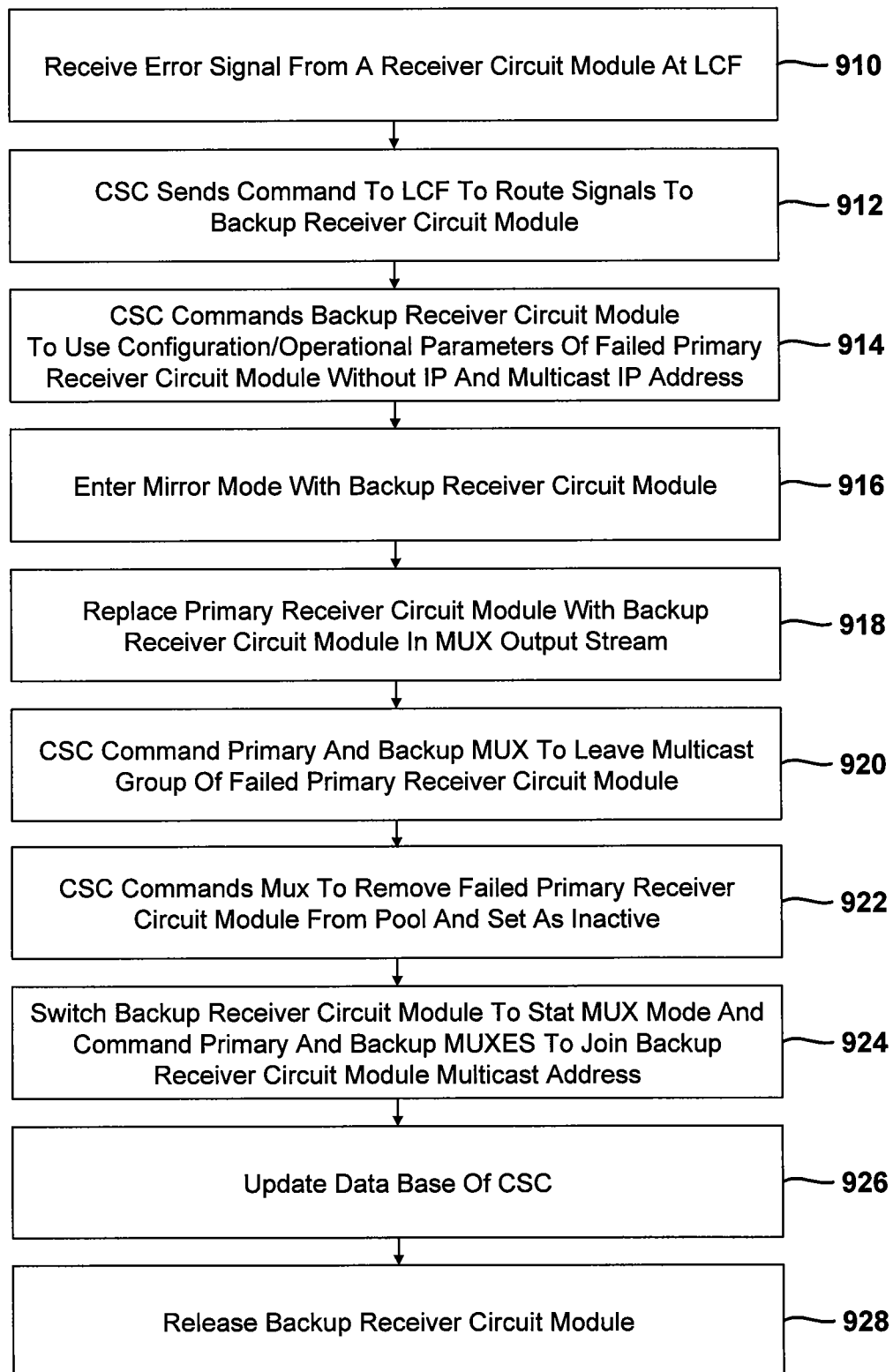
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**FIG. 7**

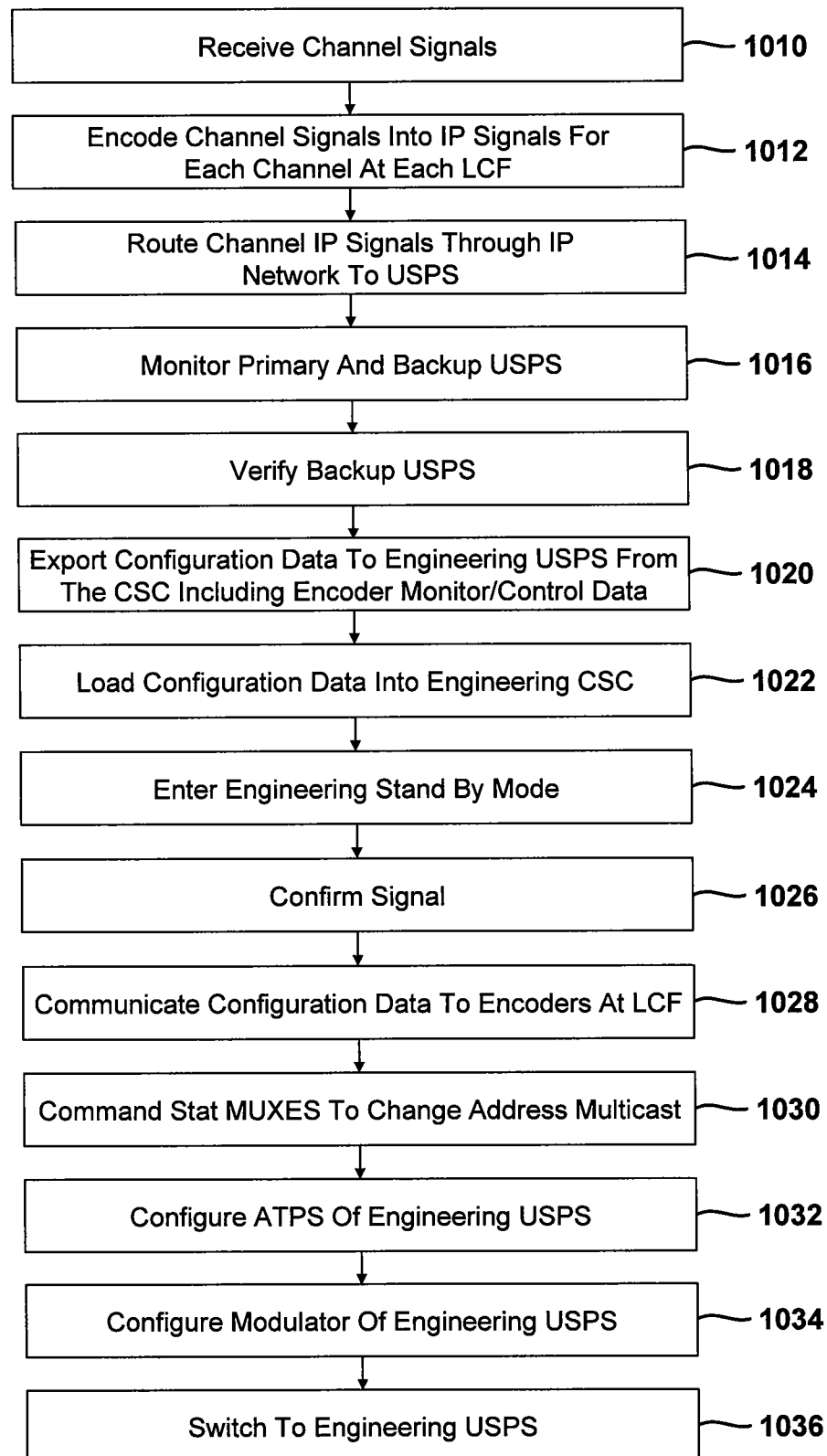
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**FIG. 8**

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**FIG. 9**

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**FIG. 10**

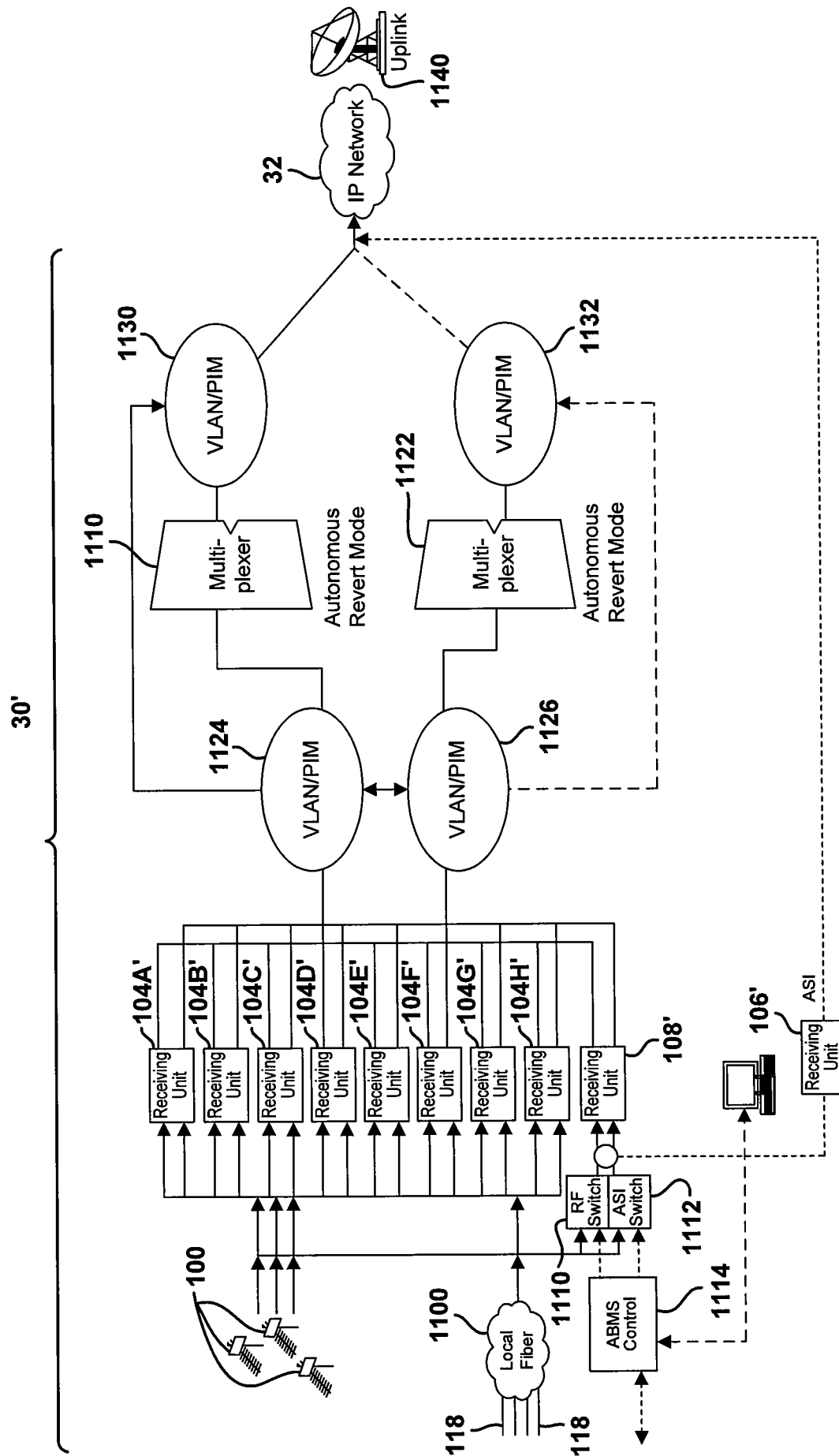


FIG. 11

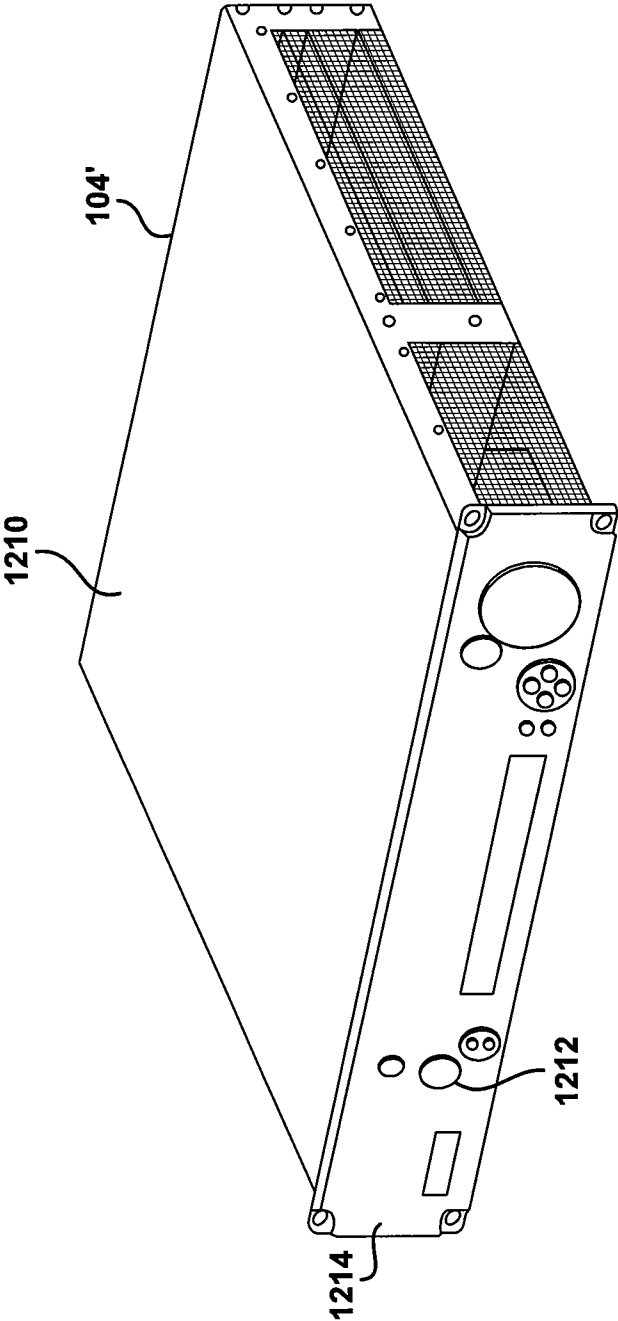


FIG. 12

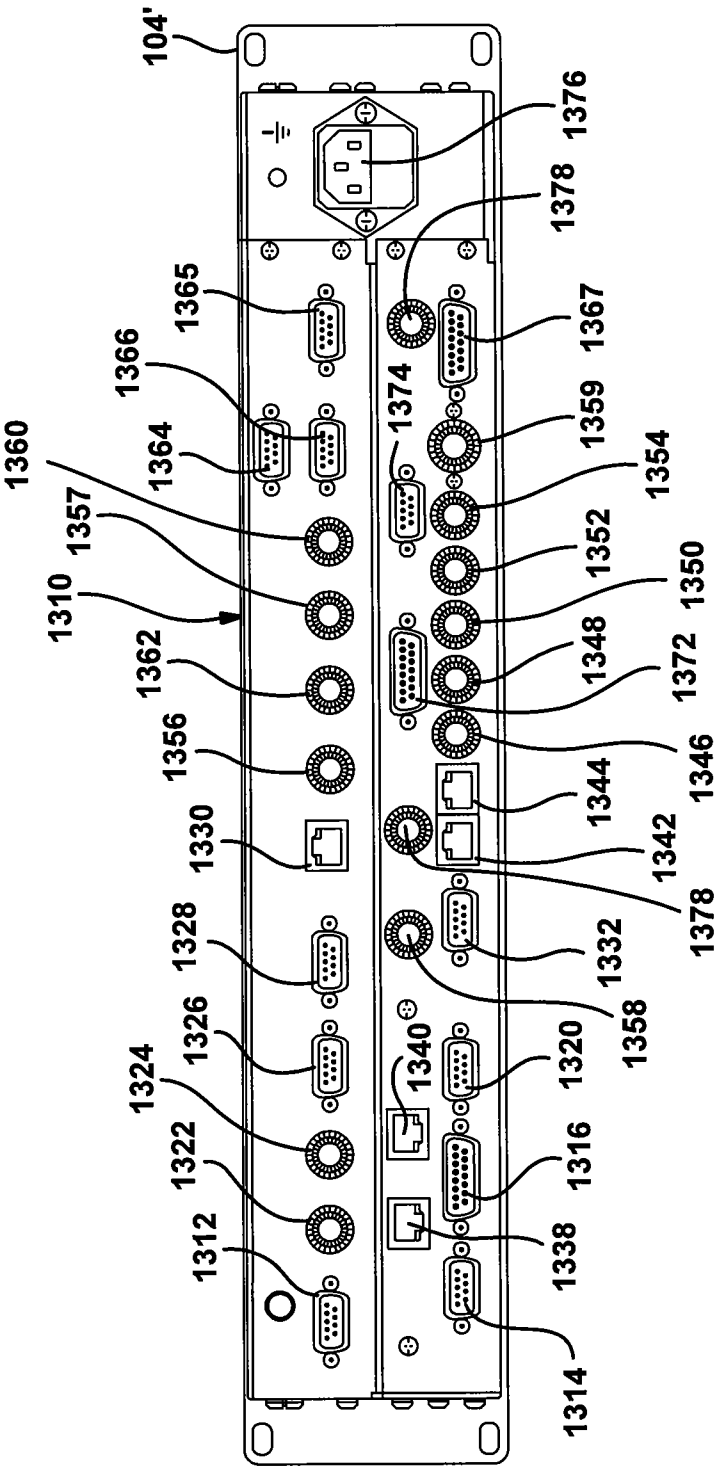


FIG. 13

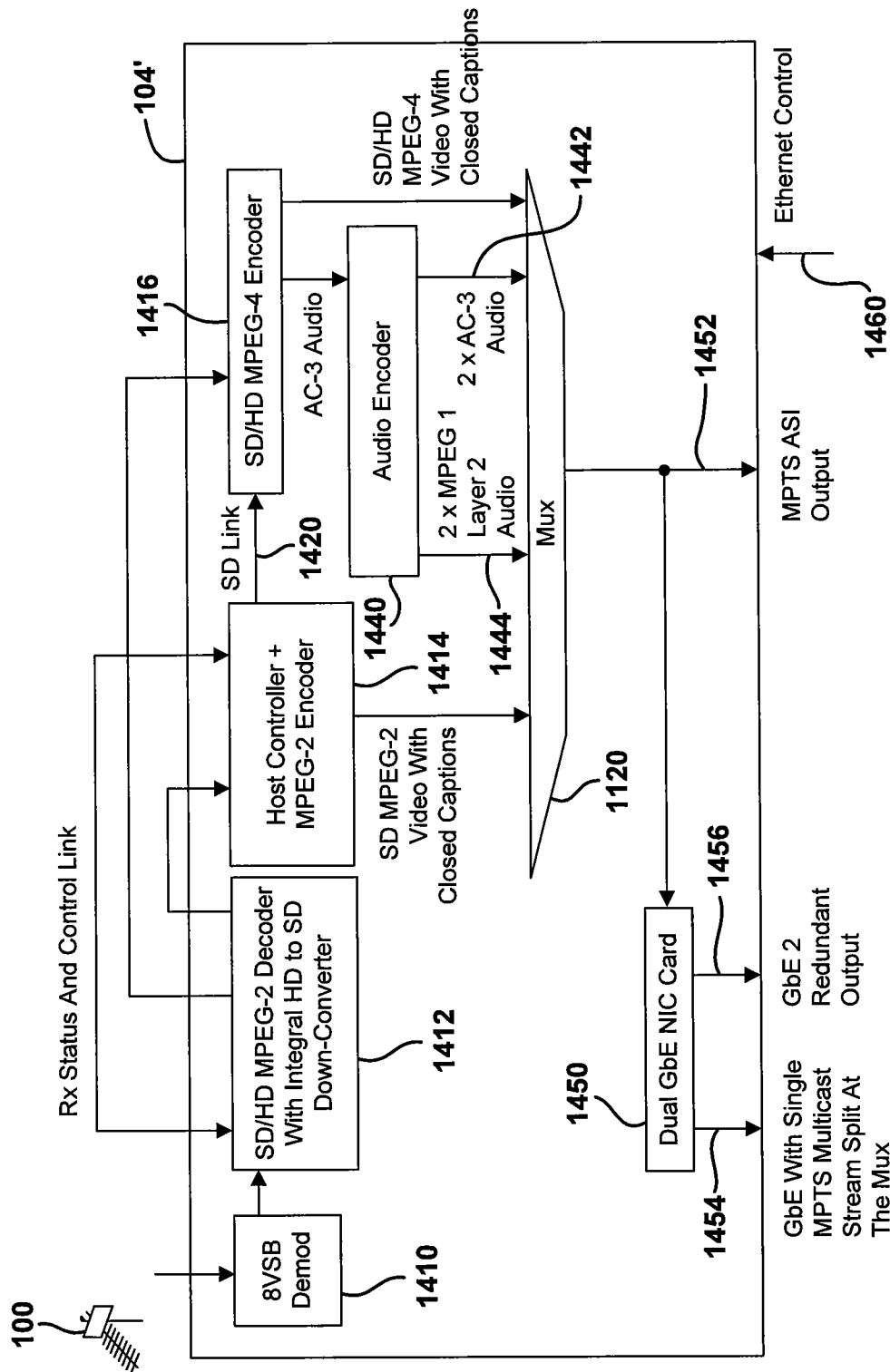
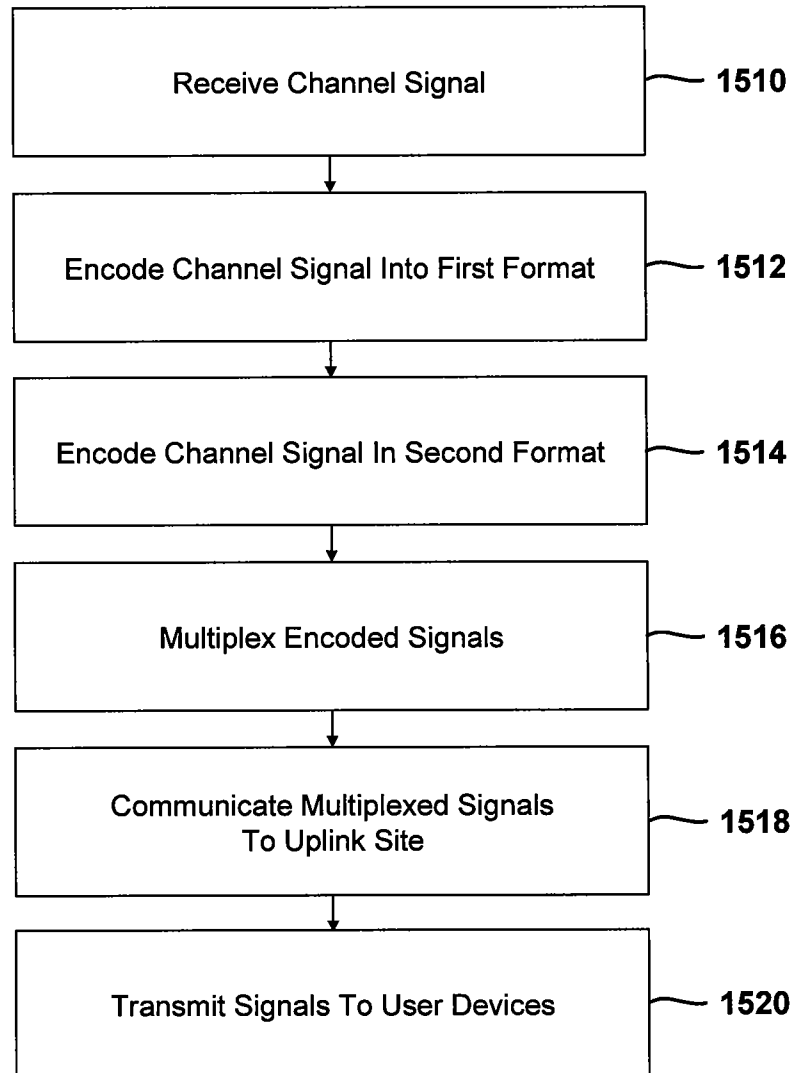


FIG. 14

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**FIG. 15**

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/063003

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N7/24 H04H20/74 H04H20/51

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)
H04N H04H

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)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 529 146 B1 (KOWALSKI STEPHEN FRANCIS [US] ET AL) 4 March 2003 (2003-03-04) column 1, line 55 - column 2, line 20 column 2, line 45 - line 61 column 3, line 25 - line 36 column 4, line 22 - line 29 column 5, line 20 - line 35 column 7, line 27 - line 39 column 8, line 50 - line 55	1-20
X	US 2004/234145 A1 (YATABE YUSUKE [JP] ET AL) 25 November 2004 (2004-11-25) paragraph [0010] paragraph [0018] - paragraph [0023] claim 1; figures 1,2 ----- -/--	1-20

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

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Date of mailing of the 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.
X	WO 03/058967 A1 (PEGASUS DEV CORP [US]) 17 July 2003 (2003-07-17) paragraphs [0002] - [0007] paragraphs [0027], [0031], [0034] paragraph [0066] - paragraph [0070] paragraph [0079] - paragraph [0080] paragraphs [0094], [0096] paragraphs [0105] - [0106] paragraphs [0126] - [0127] figure 11	1-20
X	US 2005/076134 A1 (BIALIK GIL [IL] ET AL) 7 April 2005 (2005-04-07) paragraph [0050] paragraph [0081] paragraph [0088] - paragraph [0090] paragraph [0107] - paragraph [0110] figure 4	1-6, 10, 12-17, 19
X	US 6 873 877 B1 (TOBIAS MARTIN [US] ET AL) 29 March 2005 (2005-03-29) column 2, line 17 - line 60 column 7, line 58 - column 8, line 5 column 8, line 57 - line 60	1, 15-17, 19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6529146	B1	04-03-2003	NONE
US 2004234145	A1	25-11-2004	CN 1551634 A 01-12-2004
			CN 1874513 A 06-12-2006
			CN 101018328 A 15-08-2007
			CN 1917640 A 21-02-2007
			JP 2004343576 A 02-12-2004
			US 2008111897 A1 15-05-2008
WO 03058967	A1	17-07-2003	AU 2002359882 A1 24-07-2003
			EP 1470715 A1 27-10-2004
US 2005076134	A1	07-04-2005	NONE
US 6873877	B1	29-03-2005	NONE