Title: AUTOMATIC FREQUENCY BANDWIDTH MATCHING AND NOISE FILTERING FOR INTERNET SERVICE OF MASTER ANTENNA TELEVISION NETWORK

Abstract: Disclosed is an apparatus for automatic matching and filtering of frequency bandwidths for Internet service using an MATV network, which includes a signal noise processing unit for eliminating noise signals introduced in Internet upstream/downstream signals transmitted from a user terminal, and a CMTS interface for receiving a change of an upstream signal frequency bandwidth of ISP (Internet Service Provider) from CMTS and then changing an upstream signal frequency of the signal noise processing unit. This apparatus may resolve the communication instability caused by the change of upstream frequency since it may automatically cope with the change of various upstream frequency bandwidths of ISPs.
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AUTOMATIC FREQUENCY BANDWIDTH MATCHING AND NOISE FILTERING FOR
INTERNET SERVICE OF MASTER ANTENNA TELEVISION NETWORK

5 TECHNICAL FIELD

The present invention relates to a filtering apparatus used for structuring an
Internet communication network by use of a master antenna television network (MATV
network) equipped during construction of a building such as an apartment, an office
building, a shopping building, a school, a hotel or an inn, which are commonly called a
complex building.

BACKGROUND ART

Generally, a complex building is provided with a master antenna television
network (MATV network) so that multiple households or dwellers may watch programs
of various channels. The MATV network is a single signal receiving system for
connecting a plurality of TV receivers in one building or dense building area. This
MATV network includes one main antenna and a cable network for distributing TV
signals from the main antenna to a plurality of TV receivers so as to watch TV.

In particular, an apartment in which many households are clustered frequently
uses the MATV network in connection to many regional cable TV service providers in
order to satisfy the desire of the households. The regional cable TV service providers
generally send TV signals through an optical cable from a cable radio relay station to
nodes close to the end users, and also send the TV signals through a coaxial cable from
the nods to a TV signal receiving set-top box of each user.

This technique enabling to use both of the optical cable and the coaxial cable in different parts of network in order to transmit TV signals composed of video and audio data to users is called “HFC (Hybrid Fiber Coaxial) communication technique”.

According to the HFC communication technique, a signal with trustworthy superior transmission property of the optical cable may be advantageously transmitted close to the users without changing the existing coaxial cable which is already installed in offices and houses.

In addition, since the optical cable is used as a backbone pipe, more data may be transmitted at a high bandwidth in the HFC technique than the case using only the coaxial cable. Thus, the HFC technique may support the mutual-directional data transmission service based on the server/client model. Moreover, since the infrastructure in which the optical cable is installed has better reliability than the coaxial cable, the HFC technique is efficient in mutually connecting networks of cable TV service providers or telephone service providers closely located. Thus, many cable TV service providers and telephone service providers are currently upgrading the existing network into the HFC network.

On the other hand, there is recently commonly used the technique for providing the high-speed Internet service using the HFC network, and the Internet service thereby spreads all over the country.

The process of transmitting Internet upward/downward signals through the HFC network in order to realize the high-speed Internet service is described below in detail with reference to FIG. 1.
At first, Internet data packets transmitted through the Internet network 5 pass a router 10, and the Internet data packets transmitted through the router 10 are converted through CMTS (Cable Modem Termination System) 20 into a data having a format receivable by a cable modem 60.

The converted Internet data is combined at a combiner 25 with cable TV signals sent from a CATV transmitting station 15 and then transmitted to an optical network 40 through an optical transmitter 30. This transmitted combined signal is also transmitted to a building, in which Internet service is willing to be provided, through a directional coupler 55 via an optical network unit 45 and a coaxial cable network 50.

The combined signal split in the directional coupler 55 is separated into an Internet signal and a cable TV signal at a signal separator 80, and then transmitted through individual cable lines, respectively. The Internet signal among the separated signals is converted into a signal recognizable by a user terminal 75 by means of a cable modem 60, and then input to the user terminal 75. The cable TV signal is also input to a TV receiver 70 via a converter 65.

On the other hand, the Internet upward signal transmitted from the user terminal 75 is firstly input to the optical network unit 45 via the cable modem 60 through the coaxial cable network 50. The Internet upward signal input to the optical network unit 45 is converted into an optical signal and then transmitted to the optical network 40.

After that, the Internet upward signal is input to the CMTS 20 through an optical receiver 35 so as to be converted into Internet data packets, and then transmitted to the Internet network 5 through the router 10.

However, if the Internet upward/downward signal transmission model using the
above-mentioned HFC network is applied to the MATV network constructed in a complex building such as an apartment, reliable transmission of Internet data may not be obtained due to the effects of various unnecessary noises introduced into the Internet upward signal transmitted through the MATV network. Thus, Internet service is provided to the complex building by use of ADSL, home LAN, outer wall-wired cable modem and so on, not using the MATV network.

The above-mentioned currently attempted methods nevertheless have various defects. For example, installation cost is increased in order to construct a new network. In addition, the installation construction is very sophisticated since there is required for finding out each line toward each household and applying signals to the line respectively, in case of a large apartment development. Moreover, extension of installations is impossible though subscribers increase. In addition, since the headend is positioned in a basement of the apartment development which having a limited space, the installation space of the headend continuously occupies the basement as subscribers increase.

Furthermore, the noise introduced into the Internet upward signal which give significant influences on the Internet communication is not effectively eliminated. In addition, the upward signal matching according to the change of frequency band of many Internet service providers is unstable.

DISCLOSURE OF INVENTION

The present invention is designed to solve the problems of the prior art, and therefore an object of the present invention is to provide apparatus and method for filtering noise and matching frequency band for Internet service using MATV network,
which is able to providing high quality of Internet service by use of the existing MATV network and automatically matching with the change of frequency band of Internet service providers.

In order to accomplish the above object, the present invention provides an apparatus for filtering noise and matching frequency band automatically for Internet service using an MATV network (master antenna television network) equipped in a complex building, which includes a signal noise processing unit for removing noise signals introduced into Internet upward/downward signals transmitted from/to a user terminal; and a CMTS (Cable Modem Termination System) interface for receiving a change of an upward signal frequency band of an Internet service provider from a CMTS and then changing the upward signal frequency of the signal noise processing unit.

Preferably, the signal noise processing unit include a high-pass filter for eliminating noise introduced into the downward signal; a band-pass filter for eliminating noise introduced into the upward signal; and an amplifier connected to a rear end of the band-pass filter for restoring a level of the filtered upward signal, which is attenuated through the band-pass filter, up to an original signal level.

In addition, the CMTS interface may include a demodulator for receiving and demodulating a control signal according to the change of the frequency band sent from the CMTS; and a modulator for modulating the demodulated control signal into a signal receivable by a level adjusting unit.

At this time, the modulation and demodulation of the control signal received from the CMTS are preferably conducted using a QAM (Quadrature Amplitude Modulation).
Modulation) communication method.

In addition, the signal noise processing unit is preferably provided with a plurality of band-pass filters and amplifiers.

Also preferably, the signal noise processing unit further includes a mixer provided at a front end of the band-pass filter for mixing the upward signal with an oscillating frequency generated by a local oscillator and then modulating the mixed signal in order to filter the upward signal at an intermediate frequency.

In addition, the signal noise processing unit may further include diplex filters provided at both ends of the high-pass filter and the band-pass filter for separating the upward/downward signals for the purpose of discriminatively filtering the noise added to the upward/downward signals.

Moreover, the signal noise processing unit may further include a level adjusting unit connected to a rear end of the amplifier for adjusting a frequency level of the upward signal into a frequency level received from the CMTS interface.

Furthermore, the level adjusting unit may include a level measuring unit for generating a signal showing an intensity of the upward signal so as to measure the upward frequency level; a control unit for comparing the upward signal level with an upward frequency level according to a frequency conversion control signal received from the CTMS interface; and a level converting unit for adjusting the frequency level of the upward signal into a conversion frequency by controlling an output frequency of a local oscillator based on the level control signal generated by the control unit.

According to another aspect of the invention, there is also provided a method for filtering noise and matching frequency bandwidth automatically for Internet service
using an MATV network (master antenna television network) equipped in a complex building, which includes the steps of: (a) recognizing a frequency change by an ISP server, and then modulating a frequency conversion control signal with a downward signal and sending the modulated downward signal; (b) a CMTS interface receiving the frequency conversion control signal and then sending a signal controllable by a control unit; (c) receiving the control signal, and then comparing an upward frequency according to the control signal with an existing upward frequency in order to determine the frequencies are different; and (d) adjusting an output frequency of a local oscillator by controlling a level converting unit when the frequencies are determined to be different, wherein in the (d) step, an upward frequency generated by adjusting the local oscillator is identical to the frequency changed by the ISP server.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of preferred embodiments of the present invention will be more fully described in the following detailed description, taken accompanying drawings. In the drawings:

FIG. 1 shows network architecture for illustrating the method for providing Internet service using a conventional HFC (Hybrid Fiber Coaxial) network;

FIG. 2 shows network architecture for providing Internet service by use of MATV network realized using a filtering apparatus according to the present invention;

FIG. 3 is a block diagram showing an apparatus for filtering noise and matching frequency band automatically for Internet service using the MATV network according to a preferred embodiment of the present invention;
FIG. 4 is a block diagram showing an automatic level adjusting unit equipped in the apparatus for filtering noise and matching frequency band automatically for Internet service using the MATV network according to a preferred embodiment of the present invention; and

FIG. 5 is a flowchart for illustrating the method for filtering noise and matching frequency band automatically for Internet service using the MATV network according to a preferred embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

Hereinafter, preferred embodiments of the present invention will be concretely described, particularly with reference to the accompanying drawings in order to help understanding the invention. However, the embodiments according to the invention may be modified in various other ways, and the scope of the invention should be not interpreted to be limited to the embodiments. The embodiments of the invention are provided for explaining this invention more definitely and easily to those having an ordinary knowledge in the art. The same reference numeral in the drawings designates the same element.

FIG. 2 shows network architecture for providing Internet service using the MATV network (the master antenna television network) realized using a filtering apparatus according to the present invention.

Referring to FIG. 2, the network architecture for realizing the present invention includes the above-mentioned conventional network architecture together with the filtering apparatus for achieving the technical object of the present invention.
Internet data packets transmitted through Internet network 5 pass through a router 10, and the data packets transmitted through the router 5 are converted through CMTS 20 into a data having a format receivable by a cable modem 60. The converted data packets are then mixed with a control signal for controlling a CMTS interface 135 described later. In order to mix the Internet data and the control signal, the CMTS 20 adopts a QAM (Quadrature Amplitude Modulation) method.

The converted Internet data and the control signal are combined with a cable TV signal at a combiner 25, and then transmitted to an optical network 40 through an optical transmitter 30. The transmitted combined signal passes through a directional coupler 55 via an optical network unit 40 and a coaxial cable network 50 by means of the HFC (Hybrid Fiber Coaxial) communication technique so that the control signal is transmitted to the CMTS interface 135 and the Internet data is transmitted through a signal noise processing unit 90 to a complex building to which Internet service is willing to be provided.

The CMTS interface 135 and the signal noise processing unit 90 configure the filtering apparatus according to the technical aspect of the present invention, of which configuration and operation will be described later.

The Internet data transmitted to the MATV network 85 is a downward signal of which noise is eliminated by the signal noise processing unit 90. This Internet data is transmitted to each household through the MATV network 85, and separated into the Internet signal and the cable TV signal at the signal separator 80.

The Internet signal separated at the signal separator 80 is converted through a cable modem 60 into a signal recognizable by a user terminal 75 so that the user
terminal may receive the downward signal of the Internet data.

In addition, an Internet upward signal transmitted from the user terminal 75 is transmitted in a reverse order to the Internet downward signal. In other words, the Internet upward signal passes through the cable modem 60 and then the signal noise processing unit 90 installed to the MATV network 85 so that various unnecessary noises introduced through the MATV network 85 are eliminated.

The upward signal in which the noises are eliminated is transmitted to the coaxial cable network 50, converted into an optical signal at the optical network unit 45, and then transmitted to an optical receiver 35 through the optical network 40. The upward signal input to the CMTS 20 through the optical receiver 35 is converted into Internet data packets, and then transmitted to the Internet network 5 through the router 10.

Now, the configuration of the filtering apparatus according to the present invention is described in detail with reference to FIG. 3.

FIG. 3 is a block diagram showing the apparatus for automatically filtering noise and matching frequency band for Internet service using the MATV network according to a preferred embodiment of the present invention.

Referring to FIG. 3, the filtering apparatus of the present invention includes the CMTS interface 135 and the signal noise processing unit 90.

The CMTS interface 135 includes a demodulator 135a for receiving a control signal according to the change of frequency band of Internet service signal provided by ISP from the directional coupler 55 and then demodulating the control signal by use of the QAM method, and a modulator 135b for modulating the demodulated control signal.
into a signal which is receivable by a micro controller unit (MCU) 155 of a level adjusting unit 130 described later. For the communication with the MCU 155, an asynchronous mode RS232 suitable for long distance transmission is preferably adopted.

On the other hand, the signal noise processing unit 90 includes a high-pass filter 100 for eliminating noise introduced in the Internet downward signal split from the directional coupler 55; a band-pass filter 115 for eliminating noise introduced in the Internet upward signal transmitted from the user terminal 75 through the MATV network 85; diplex filters 95a and 95b provided at both ends of the high-pass filter 100 and the band-pass filter 115 for separating upward signal and downward signal for the purpose of discriminatively filtering the noise introduced in the upward signal and the downward signal; a first mixer 105a for mixing the upward signal with a frequency generated by a local oscillator 125 at a front end of the band-pass filter 115 to convert the frequency band into intermediate frequency (IF) for the purpose of filtering the upward signal at an intermediate frequency; an amplifier 120 for restoring a signal level, which is attenuated while being modulated into an intermediate frequency by the first mixer 105a, up to the signal level before the modulation; a second mixer 105b for mixing the upward signal, of which noise is eliminated by the band-pass filter 115, with the frequency generated by the local oscillator 125 for the purpose of down-conversion of the frequency band so that the upward signal is converted into an original frequency band; an amplifier 110 connected to a rear end of the band-pass filter 115 for amplifying the level of the filtered upward signal in order to restore the attenuated upward signal level to an original signal level; and a level adjusting unit 130 for converting a frequency level of the upward signal output from the amplifier 120 according to the
frequency conversion control signal transmitted from the CMTS interface 135 by controlling an output frequency of the local oscillator 125.

The signal noise processing unit 90 according to the present invention is preferably provided with a plurality of band-pass filters and amplifiers for signal level compensation and more desirable noise filtering at the rear end of the band-pass filter 115 shown in FIG. 3. In this case, the signal noise processing unit 90 may eliminate the noise introduced in the upward signal more effectively.

By means of the signal noise processing unit 90, the downward signal is filtered into a predetermined frequency band, for example 55 ~ 750MHz, and the upward signal is filtered into a predetermined frequency band, for example 5 ~ 42MHz, through several times of filtering and amplifying.

The level adjusting unit 130 provides an upward frequency converting function and an upward signal level adjusting function so that the upward signal is automatically matched with various Internet upward signal frequency bands adopted by many ISPs, when Internet service is provided through the HFC network. This level adjusting unit 130 is described in detail with reference to FIG. 4.

FIG. 4 is a block diagram showing the automatic level adjusting unit equipped in the apparatus for filtering noise and matching frequency band automatically for Internet service using MATV network according to a preferred embodiment of the present invention.

Referring to FIG. 4, the level adjusting unit 130 includes a limiter 165 for blocking input of signals over a predetermined level; a detector 140 for receiving a signal output through the limiter 165 and generating a meta current signal which
expresses the intensity of the upward signal; a converter 145, which is configured with a resistor and an electrolytic condenser, for converting the meta current signal into a voltage signal at the output end of the detector 140; an A/D converter (or, analog to digital converter) 150 for receiving and converting the analog voltage signal into a digital upward signal level; an MCU 155 for comparing an upward frequency level according to the frequency conversion control signal transmitted from the CTMS interface 135 with a digital upward signal level, and then generating a level control signal when the levels are not coincident within an allowable error; and a level converting unit 160 for receiving the level control signal generated from the MCU 155 and controlling an output frequency of the local oscillator 125 in order to adjust the level of the filtered upward signal to a conversion frequency signal level, and then outputting it to the diplex filter 95b.

The operation of the filtering apparatus configured as above is now described in more detail with reference to FIGs. 3 and 4.

At first, the process for eliminating noise signals from the upward/downward signal received/transmitted through the MATV network 85 from/to the user terminal 75 is described as follows.

Since the upward/downward signals are transmitted through one coaxial cable in different frequency bands, the upward signal and the downward signal are separated each other in the diplex filters 95a and 95b in order to eliminate noise discriminatively in each signal.

The separated downward signal is filtered at the high-pass filter 100 to eliminate noise except downward signal. The noise-eliminated downward signal is transmitted
to the user terminal 75 through the MATV network 85.

In addition, when the upward signal is transmitted through the MATV network 85 composed of coaxial cable, noises generated by various electric equipments or electronic wave generating devices are introduced into the upward signal. This significantly lowers a signal to noise ratio (S/N ratio) and thus abruptly increases data loss, so reliable signal transmission through the MATV network 85 is substantially not easy. Due to this problem, the upward signal is separated by the diplex filter 95a and then filtered by the band-pass filter 115 to eliminate the noises introduced into the upward signal while being transmitted through the MATV network 85.

To explain the process of eliminating noise of the upward signal in more detail, the upward signal separated by the diplex filter 95a is mixed at the fist mixer 105a with frequency component provided from the local oscillator 125 so that the frequency is up-converted into an intermediate frequency band. If noises are filtered after converting the upward signal into the intermediate frequency band, the filtering process is more easily and accurately conducted.

The upward signal of which a signal level is attenuated while being converted into the intermediate frequency is amplified by the amplifier 120 to restore the signal level before the modulation, and noise of this upward signal is filtered through the band-pass filter 115. This band-pass filter 115 preferably adopts an SAW filter, which may realize high-quality signal passing, effective noise elimination and perfect signal cutoff of unnecessary band.

The upward signal of which noise is eliminated by the band-pass filter 115 is again mixed at the second mixer 105b with the frequency provided from the local
oscillator 125 so that its frequency is down-converted into the original frequency band. The upward signal of which noise is eliminated through the band-pass filter 115 and is demodulated into the original frequency band, is amplified by the amplifier 120 once more in order to restore the signal level attenuation caused by the second mixer 105b, and then this upward signal is transmitted to the coaxial cable network 50 through the level adjusting unit 130 and the diplexer filter 95b.

Now, the operation for automatically matching the frequency band of the upward signal with the frequency band of ISP is described below.

In order to match the frequency band of the upward signal with the frequency band of ISP, the CMTS 20 generates a frequency conversion control signal for controlling the signal noise processing unit 90 to adjust a frequency into a conversion frequency.

The control signal of the CMTS 20 generated as above is mixed with an Internet downward signal and modulated using the QAM method, and then transmitted to the directional coupler 55 through the coaxial cable network 50.

The directional coupler 55 splits the transmitted signal into the Internet downward signal and the control signal, in which the Internet downward signal is transmitted to the signal noise processing unit 90 and the control signal is transmitted to the CMTS interface 135. The demodulator 135a of the CMTS interface 135 receiving the control signal demodulates the control signal by use of the QAM method, and the modulator 135b modulates the demodulated signal into a control signal receivable by the MCU 155 of the level adjusting unit 130 and then transmits the control signal. Thus, the MCU 155 controls the level converting unit 160 according to the frequency
band information included in the control signal so as to convert the frequency output
from the local oscillator 125 for the purpose of converting the frequency of the upward
signal.

Accordingly, the upward signal output from the signal noise processing unit 90
is automatically matched with the frequency of ISP, so data communication between the
user terminal 75 and a server of ISP (not shown) becomes possible through the Internet
network 5.

In the signal noise processing unit 90 of the present invention, the first and
second mixers 105a and 105b preferably adopt DBM (Double Balanced Mixer), which
minimizes noise of the local oscillator 125 and shows excellent RF(Radio
Frequency)/IF(Intermediate Frequency)/LO(Local Oscillator) isolation property.

In addition, the signal noise processing unit 90 of the present invention may
further include at least one amplifier/band-pass filter pair at the output end of the
band-pass filter 115. In this case, the S/N ratio may be kept higher while filtering the
upward signal to eliminate noise, so the noise introduced in the upward signal may be
more reliably eliminated.

Moreover, in case of constructing Internet network by use of the MATV network
of a complex building, the filtering apparatus of the present invention is preferably
installed at a headend of the MATV network.

Now, the method for filtering noise and matching frequency band automatically
for Internet service using the MATV network is described with reference to FIG. 5.

FIG. 5 is a flowchart for illustrating the method for filtering noise and matching
frequency band automatically for Internet service using the MATV network according to
a preferred embodiment of the present invention.

Referring to FIG. 5, the ISP server connected to the Internet network converts an upward frequency (S10).

If the ISP server converts the upward frequency, the CMTS 20 recognizes the converted frequency (S20).

In this step, the CMTS 20 is equipped with a frequency meter (not shown), which is capable of recognizing the frequency by itself. Thus, if the ISP server conducts the upward frequency conversion, the CMTS 20 recognizes the converted frequency.

The CMTS 20 then modulates a frequency conversion control signal with a downward signal in correspondence with the converted frequency in the QAM method, and then transmits the modulated signal to the HFC network (S30).

The CMTS 20 is provided with a modulator/demodulator (not shown), which may modulate or demodulate upward/downward signals.

The directional coupler 55 receives the frequency conversion control signal through the coaxial cable network 50 and then transmits this control signal to the CMTS interface 135 (S40).

The demodulator 135a of the CMTS interface 135 demodulates the frequency conversion control signal by use of the QAM method (S50).

The modulator 135b of the CMTS interface 135 then modulates the frequency conversion control signal into a signal which may be received by the MCU 155 of the level adjusting unit 130, and then transmits the modulated signal (S60).

The MCU 155 compares the upward frequency according to the frequency
conversion control signal with the existing upward frequency in order to determine whether the frequencies are different or not (S70).

If the frequencies are determined to be identical, the process is repeated from the step S20 recognizing the frequency.

If the frequencies are different, the MCU 155 adjusts the output frequency of the local oscillator 125 by controlling the level converting unit 160 so that the upward frequency is coincident with the frequency which is changed by the ISP server (S80).

If passing through all of the above configurations and steps, the upward signal band may be automatically tuned to an Internet upward signal frequency band adopted by the ISP which operates the Internet network, by the apparatus and method for filtering noise and matching frequency band automatically for Internet service using the MATV network according to the present invention.

The present invention has been described in detail. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

INDUSTRIAL APPLICABILITY

According to an aspect of the present invention, since the MATV network installed in an apartment or a building may be used as an Internet network, it is possible to provide Internet service without installing any separate Internet network in an area where the MATV network is already installed.
According to another aspect of the present invention, since various noises generated on the lead-in line or the connection line are eliminated from the upward signal, more qualified Internet communication service may be provided.

According to still another aspect of the present invention, communication instability caused by the upward frequency change may be solved since it is possible to automatically cope with the change of various upward frequency bands of ISP.
What is claimed is:

1. An apparatus for filtering noise and matching frequency band automatically for Internet service using an MATV network (master antenna television network) equipped in a complex building, comprising:
   a signal noise processing unit for removing noise signals introduced into Internet upward/downward signals transmitted from/to a user terminal; and
   a CMTS (Cable Modem Termination System) interface for receiving a change of an upward signal frequency band of an Internet service provider from a CMTS and then changing the upward signal frequency of the signal noise processing unit.

2. An apparatus for filtering noise and matching frequency band automatically for Internet service using an MATV network according to claim 1, wherein the signal noise processing unit includes:
   a high-pass filter for eliminating noise introduced into the downward signal;
   a band-pass filter for eliminating noise introduced into the upward signal; and
   an amplifier connected to a rear end of the band-pass filter for restoring a level of the filtered upward signal, which is attenuated through the band-pass filter, up to an original signal level.

3. An apparatus for filtering noise and matching frequency band automatically for Internet service using an MATV network according to claim 1, wherein the CMTS interface includes:
a demodulator for receiving and demodulating a control signal according to the
change of the frequency band sent from the CMTS; and
a modulator for modulating the demodulated control signal into a signal
receivable by a level adjusting unit.

4. An apparatus for filtering noise and matching frequency band
automatically for Internet service using an MATV network according to claim 1,
wherein the modulation and demodulation of the control signal received from
the CMTS are conducted using a QAM (Quadrature Amplitude Modulation)
communication method.

5. An apparatus for filtering noise and matching frequency band
automatically for Internet service using an MATV network according to claim 2,
wherein the signal noise processing unit is provided with a plurality of band-pass
filters and amplifiers.

6. An apparatus for filtering noise and matching frequency band
automatically for Internet service using an MATV network according to claim 2,
wherein the signal noise processing unit further includes:

   a mixer provided at a front end of the band-pass filter for mixing the upward
signal with an oscillating frequency generated by a local oscillator and then modulating
the mixed signal in order to filter the upward signal at an intermediate frequency.
7. An apparatus for filtering noise and matching frequency band automatically for Internet service using an MATV network according to claim 2, wherein the signal noise processing unit further includes:

diplex filters provided at both ends of the high-pass filter and the band-pass filter for separating the upward/downward signals for the purpose of discriminatively filtering the noise added to the upward/downward signals.

8. An apparatus for filtering noise and matching frequency bandwidth automatically for Internet service using an MATV network according to claim 2, wherein the signal noise processing unit further includes:

a level adjusting unit connected to a rear end of the amplifier for adjusting a frequency level of the upward signal into a frequency level received from the CMTS interface.

9. An apparatus for filtering noise and matching frequency bandwidth automatically for Internet service using an MATV network according to claim 8, wherein the level adjusting unit includes:

a level measuring means for generating a signal showing an intensity of the upward signal so as to measure the upward frequency level;

a control means for comparing the upward signal level with an upward frequency level according to a frequency conversion control signal received from the CTMS interface; and

a level converting unit for adjusting the frequency level of the upward signal into
a conversion frequency by controlling an output frequency of a local oscillator based on the level control signal generated by the control means.

10. A method for filtering noise and matching frequency bandwidth automatically for Internet service using an MATV network (master antenna television network) equipped in a complex building, comprising the steps of:

(a) recognizing a frequency change by an ISP server, and then modulating a frequency conversion control signal with a downward signal and sending the modulated downward signal;

(b) a CMTS interface receiving the frequency conversion control signal and then sending a signal controllable by a control means;

(c) receiving the control signal, and then comparing an upward frequency according to the control signal with an existing upward frequency in order to determine the frequencies are different; and

(d) adjusting an output frequency of a local oscillator by controlling a level converting unit when the frequencies are determined to be different,

wherein in the (d) step, an upward frequency generated by adjusting the local oscillator is identical to the frequency changed by the ISP server.
FIG. 5

START

S10 - CONVERT ISP FREQUENCY

S20 - RECOGNIZE FREQUENCY CONVERSION

S30 - MODULATE FREQUENCY CONVERSION CONTROL SIGNAL

S40 - TRANSMIT FREQUENCY CONVERSION CONTROL SIGNAL

S50 - DEMODULATE FREQUENCY CONVERSION CONTROL SIGNAL

S60 - MODULATE FREQUENCY CONVERSION CONTROL SIGNAL

S70 - IS DIFFERENT FROM THE EXISTING UPWARD FREQUENCY?

NO

YES

S80 - CHANGE OSCILLATOR FREQUENCY

END
## INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

**IPC7** H04B 3/00, H04J 1/00, H04L 1/00

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)
H04B H04J H04L H04N G06F

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
KIPONET: (CMTS)(cable and modem) or internet) and noise

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>US 6,385,773 (Cisco Technology, Inc.) May 7, 2002</td>
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<tr>
<td>A</td>
<td>US 6,137,793 (COM21, Inc.) Oct. 24, 2000</td>
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<tr>
<td>A</td>
<td>US 6,065,061 (Lucent Technologies, Inc.) May 16, 2000</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

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