

RECEIVERS

This invention relates to receivers and, in particular but not exclusively, to broadcast receivers such as satellite broadcast receivers intended for use in combination with external appliances, such as video tape recorders.

There has been increasing interest in satellite broadcasting in recent years. Since satellite broadcasting of television programmes may be conducted throughout the entire day, that is for 24 hours, so as to make efficient use of the limited number of satellites and their channels available for that purpose, it may be desired that at least the television programmes broadcast during off-hours, that is during working or sleeping hours, be recorded by a timer-controlled video tape recorder (VTR) for subsequent playback and viewing. However, VTRs generally do not include an interlocking power source terminal or socket in which the plug of the power supply cord of a receiver can be inserted for interlocking operation of such receiver with the VTR under the control of the built-in timer of the VTR. Therefore, either a built-in timer of the receiver or tuner or an external timer for controlling the receiver or tuner, and the built-in timer of the VTR, have to be set independently of each other. In addition to the setting of the built-in timer of the VTR and of the external or built-in timer of the tuner or receiver, a tape loading operation is performed and the VTR is then placed in its stand-by condition immediately before the time at which recording of the broadcast television signal is to commence, which time is hereinafter referred to as a "reserved picture recording time". In such a case, at the reserved picture recording time, operation of the tuner for receiving and demodulating the broadcast signal and the recording operation of the VTR are simultaneously commenced. Then, after the lapse of a predetermined interval of time, the operation of the tuner and the recording operation of the VTR are similarly halted. However, since the built-in or external timer for the tuner and the built-in timer of the VTR have to be set independently, the setting operations are undesirably complicated, and are susceptible to errors.

In accordance with an aspect of the present invention there is provided a receiver comprising:

a power source circuit;

a tuner circuit;

power switching means for controlling supply of a power source voltage from said power source circuit to said tuner circuit;

5 coupling means for connecting an external appliance to said power source circuit of the receiver;

detecting means for detecting values of power consumption by the external appliance connected through said coupling means to said power source circuit; and

10 controlling means responsive to said values of power consumption detected by said detecting means to close said power switching means and thereby enable operation of said tuner circuit, when the detected value of power consumption exceeds by a predetermined amount a previously detected value of power consumption of the external
15 appliance in a stand-by condition.

In a preferred embodiment of the invention, to be described in greater detail hereinafter, the detected value of power consumption which exceeds by the predetermined amount the previously detected value of power consumption is characteristic of an operating condition of the
20 external appliance, such as a VTR, so that the tuner circuit and the external appliance are operative in an interlocking manner, for example, under the control of a built-in timer of the external appliance.

In accordance with another aspect of the present invention there
25 is provided a video system comprising a video recorder including a timer for determining a period of operation thereof, and a receiver including a power source circuit, a tuner circuit operative to receive a broadcast signal and to provide a video signal to said video recorder, power switching means for controlling supply of a power
30 source voltage from said power source circuit to said tuner circuit, coupling means connecting said video recorder to said power source circuit, detecting means for detecting values of power consumption by said video recorder connected through said coupling means to said power source circuit, and controlling means responsive to said values of
35 power consumption detected by said detecting means to close said power switching means and thereby enable operation of said tuner circuit when the detected value of power consumption is characteristic of an

operating condition of said video recorder so that operation of said tuner circuit is made to be simultaneous with said period of operation of the video recorder as determined by said timer of the video recorder.

5 In the preferred embodiment of this invention, mode selecting means are connected with the receiver controlling means and are selectively operative to establish an interlocking mode in which the tuner circuit is operative simultaneously with the external appliance, and a non-interlocking mode in which the tuner circuit is operative
10 independently of the external appliance.

 Start-stop means are preferably associated with the mode selecting means and are operative, in the non-interlocking mode, to cause the controlling means to close the power switching means for operating the tuner circuit in response to an initial actuation of the
15 start-stop means and to open the power switching means for halting operation of the tuner circuit in response to a subsequent or second actuation of the start-stop means.

 The preferred embodiment of this invention accordingly provides a receiver which can be interlocked with an external appliance, such as
20 a VTR, the receiver having a built-in timer, so as to make the receiver operative simultaneously with the external appliance in response to the simple setting of the timer in the external appliance.

 The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts
25 are referred to by like references, and in which:

 Figure 1 is a perspective view of a broadcast satellite receiver in accordance with an embodiment of this invention, and which is shown as viewed from the front;

 Figure 2 is a perspective view of the broadcast satellite
30 receiver of Figure 1 as viewed from the rear;

 Figure 3 is a rear elevational view of a video system embodying this invention, and which includes the broadcast satellite receiver of Figures 1 and 2 connected with external appliances in the form of a VTR and a monitor;

35 Figure 4 is a block diagram showing the circuit arrangement of the broadcast satellite receiver of Figures 1 and 2; and

Figure 5 illustrates a flow chart to which reference will be made in explaining the program of a microprocessor included in the circuit arrangement of Figure 4.

Referring to the drawings in detail, and initially to Figures 1 and 2 thereof, it will be seen that a satellite broadcast receiver 1 in accordance with an embodiment of this invention may include a housing 2 of generally thin box-like configuration having a front wall or panel 2a at which there are provided an array of channel selection buttons 3 arranged to be selectively depressed or actuated so as to select a desired channel from among the odd-numbered channels "1", "3", "5", --- "15". An indicator 4 is disposed on the panel 2a and displays the number of the channel selected for reception by selective actuation of the buttons 3. A plurality of mode indicating devices 5 are also provided on the front panel 2a of the housing 2 for indicating the mode of the audio (A or B mode) signal being received as part of the broadcast television signal and which is selected by actuation of an audio mode change-over button (not shown), and further for indicating whether the received audio signal is a stereo, monaural or bilingual signal.

The broadcast satellite receiver 1 also includes a mode selecting or change-over switch 6 mounted on the front panel 2a of the housing 2, including a control button 6' which is laterally movable with respect to the panel 2a. More specifically, the control button 6' is movable between the position shown in Figure 1 for selecting an interlocking mode of the receiver 1 when it is intended to operate the broadcast tuner 1 in an interlocking relationship with an external appliance, as hereinafter described in detail, and the position indicated at 6'' when it is desired to change over the receiver 1 to a non-interlocking mode in which the receiver 1 can be operated independently of the external appliance connected thereto.

Also mounted on the front panel 2a of the housing 2 is a stand-by power detecting switch 7 which, as hereinafter described in detail, is actuable to cause detection of the stand-by power consumption of an external appliance connected to the receiver 1.

Referring now to Figure 2, it will be seen that an interlocking socket or receptacle 8 is provided on a rear wall 2b of the housing 2 for supplying a power source voltage to an external appliance. Also

mounted on the rear wall 2b is a broadcast satellite-IF input terminal 9 which, as hereinafter described, may be connected to a broadcast satellite converter of a broadcast satellite antenna for receiving the first intermediate frequency of the 1 GHz band, that is the so-called BS-IF signal. A television output terminal 10 is provided on the rear wall 2b of the housing 2 so that, when the terminal 10 is connected to a VHF/UHF antenna input terminal of a television receiver, a satellite broadcast programme can be viewed on the television receiver. A video output terminal 11 and a pair of audio output terminals 12 are provided on the rear wall 2b for delivering video and audio output signals from the broadcast satellite receiver 1 to an associated external appliance, such as a VTR, as hereinafter described in detail.

An automatic gain control (AGC) output terminal 13 is provided on the rear wall 2b of the housing 2 for providing a DC voltage corresponding to the magnitude of the BS-IF signal delivered to the input terminal 9, and this DC voltage from the AGC output terminal 13 can be utilised, in a known manner, to adjust automatically the orientation of a broadcast satellite antenna so as to maximise the magnitude of the input signal to the terminal 9.

A power lead or cord 14 extends out of the rear wall 2b and terminates in a plug 14a for engagement in a standard receptacle or socket (not shown) supplied with household AC current.

Referring now to Figure 3, it will be seen that the BS receiver 1 embodying this invention is desirably associated with a broadcast satellite antenna 15 in the form of a so-called parabolic antenna having a reflector 16 constituted by a parabolic dish, and a broadcast satellite converter 17 for amplifying a radio signal received by the antenna 15 and converting the signal into a BS-IF signal. A primary radiator 18 is mounted at an end of the BS converter 17 so as to be positioned at a focus of the reflector 16. A coaxial cable 19 is connected, at one end, to an output terminal of the converter 17 and, at the other end, to the BS-IF input terminal 9 of the receiver 1.

The receiver 1 according to the present embodiment is further shown in Figure 3 to be associated with an external appliance in the form of a VTR 20 for recording a television programme received by the receiver 1 from a broadcast satellite by way of the antenna 15. The VTR 20 is shown to have radio frequency (RF) input terminals 20a

arranged to be connected to a VHF/UHF antenna 21 by way of a coaxial cable 22 so that a television signal received by the antenna 21 in a VHF or UHF channel can also be recorded by the VTR 20.

5 The VTR 20 is also shown to have a video input terminal 20b connected by way of a cable 23a with the video signal output terminal 11, and audio input terminals 20c connected by way of cables 23b with the audio output terminals 12 of the receiver 1 so that the video and audio signals can be transmitted to and recorded by the VTR 20.

10 A power lead or cord 24 extends from the VTR 20 and terminates in a plug 24a which is insertable in the interlocking socket or receptacle 8 of the receiver 1 for receiving a power supply voltage, for example, of 100 volts AC, via the receiver 1.

15 A television monitor 25 is also connected to the VTR 20 by means of a cable 26a connected, at one end, to a video input terminal 25a provided on the television monitor 25 and, at the other end, to a video output terminal 20d provided on the VTR 20. Similarly, cables 26b are connected, at one end, to audio input terminals 25b on the monitor 25 and, at the other end, to audio output terminals 20e on the VTR 20. Thus, a radio signal broadcast by satellite and received by the antenna 20 15 is transmitted as a BS-IF signal from the BS converter 17 to the receiver 1 by way of the coaxial cable 19, and the BS-IF signal is then suitably processed by the receiver 1 to provide a corresponding video signal and audio signal or signals which are transmitted to the VTR 20 and, from the latter, to the television monitor 25.

25 Referring now to Figure 4, it will be seen that the BS receiver 1 has a circuit arrangement 27 generally comprising a power source circuit 28, a tuner circuit 29, a power consumption detecting circuit 30 and a controlling circuit 31.

30 The power source circuit 28 is shown to include a power source transformer 32 having a primary winding 32a connected through lines 33 and 33' to the power cord 14, and through the latter to a 100 V AC power source. A fuse 34 is desirably interposed in the line 33'. A rectifying circuit 35, which may be composed of a diode bridge, a regulator, and the like (not shown), has its input terminals connected 35 to the opposite ends of a secondary winding 32b of the transformer 32. The rectifying circuit 35 has a pair of output terminals respectively connected to ground and to a movable contact 36a of a power source

switch 36. The output terminal of the rectifying circuit 35 which is connected to the switch 36 is also connected through a line 37 to a power input terminal of the controlling circuit 31 so that stand-by power (+Vcc) is supplied, at all times, from the rectifying circuit 35 through the line 37 to the controlling circuit 31. As hereinafter described in detail, the power source switch 36 is associated with the controlling circuit 31 so that the switch 36 is opened and closed in response to respective signals from the controlling circuit 31.

The tuner circuit 29 is shown to be connected with a fixed contact 36b of the power source switch 36 so that, when the latter is closed, a suitable power source voltage, for example, of 15 V, is supplied from the power source circuit 28 through the switch 36 to the tuner circuit 29 for operating the various circuits of the latter. The tuner circuit 29 is shown to include a channel selection and demodulating circuit 38 having an input connected to the terminal 9 for receiving a BS-IF signal from the latter, a video signal processing circuit 39 and an audio pulse code modulation (PCM) signal processing circuit 40 connected to an output of the circuit 38. An output of the video signal processing circuit 39 is connected to the video output terminal 11, and a pair of stereo outputs of the audio PCM signal processing circuit 40 are connected to the audio output terminals 12. The tuner circuit 29 is further shown to include an RF-modulator 41 having inputs respectively connected to the output of the video signal processing circuit 39 and to a monaural audio output of the audio PCM signal processing circuit 40 for providing a television signal to the output terminal 10. Further, an AGC output signal to be provided at the output terminal 13 for controlling the orientation of the antenna 15 may be derived from the channel selection and demodulating circuit 38, as shown in Figure 4.

The power source voltage of 15 V obtained at the output of the rectifying circuit 35 of the power source circuit 28 may also be supplied to the broadcast satellite converter 17.

The power consumption detecting circuit 30 is shown to include a detecting transformer 42 having a primary winding 42a connected, at one end, to the line 33 extending from the power cord 14 to the primary winding 32a of the power source transformer 32 and, at its other end, to a contact 8a of the interlocking socket or receptacle 8. The socket

or receptacle 8 is shown to have another contact 8b connected directly to the line 33' extending between the power cord 14 and the primary winding 32a. A rectifying circuit 43 has a pair of input terminals respectively connected to the opposite ends of a secondary winding 42b of the detecting transformer 42. The rectifying circuit 43 has a pair of output terminals, one of which is connected directly to ground, while the other output terminal is connected to ground through a capacitor 44. A resistor 45 is connected, at one end, to a junction between the capacitor 44 and the respective output of the rectifying circuit 43 so as to form an integrating circuit with the capacitor 44. The other end of the resistor 45 is connected to the cathode of a zener diode 46 which has its anode connected to ground. An analog-to-digital (A/D) converting circuit 47 has its input connected to a junction between the resistor 45 and the zener diode 46 for converting a voltage level at this junction into a digital signal, for example, of 6 bits. The digital output of the converting circuit 47 represents a detected value of the power being consumed by an external appliance, for example, the VTR 20 having its plug 24a engaged in the interlocking receptacle 8 so as to draw its power from the latter, and hence through the primary winding 42a of the transformer 42.

It is to be noted that a voltage comparator (not shown) may be used in place of the A/D converting circuit 47 for comparing the voltage level at the junction between the resistor 45 and the zener diode 46 with a predetermined reference voltage, and for providing an output corresponding to the result of such comparison and which indicates the detected value of power consumption.

It will be appreciated that stand-by power consumption of an external appliance connected with the interlocking receptacle 8 may vary substantially in accordance with the nature of the external appliance. Therefore, in order to make the BS receiver 1 embodying this invention suitable for use with various types of external appliances, it may be desirable to provide a plurality of resistors (not shown) having respectively different resistance values and being selectively interposed between the zener diode 46 and the A/D converting circuit 47 by means of a change-over switch (also not shown) for suitably changing the range of voltages to be detected.

The controlling circuit 31 may be in the form of a microprocessor or central processing unit (CPU) that typically includes an input/output (I/O) unit 31a, a memory 31b, a control unit 31c and an arithmetic logic unit 31d, which are mutually connected to each other.

5 The mode selecting or change-over switch 6 is shown to include a common fixed contact 6a disposed midway between fixed contacts 6b and 6c so that a movable contact connected to the control button 6' may selectively bridge the fixed contacts 6a and 6b or the fixed contacts 6a and 6c. The fixed contact 6b is connected through a resistor 6d to
10 a suitable voltage source, for example, the line 37 extending from the output terminal of the rectifying circuit 35 to a power input terminal of the controlling circuit 31. The common contact 6a of the mode selecting switch 6 is connected to an input port of the I/O unit 31a, while the remaining contact 6c is connected to ground.

15 The stand-by power detecting switch 7 is shown in Figure 4 as including fixed contacts 7a and 7b respectively connected to an input port of the I/O unit 31a and to ground, and a movable contact 7c normally spaced from the fixed contact 7a and 7b, and being arranged to bridge the contacts 7a and 7b when an associated push-button is
20 manually depressed.

The I/O unit 31a of the controlling circuit 31 is shown to have another input port receiving the digital output of the A/D converting circuit 47, and an output port from which a line 48 extends to the power source switch 36 for controlling the latter in response to a
25 control signal from the controlling circuit 31.

It will be appreciated that, when the control button 6' of the mode selecting switch 6 is laterally disposed in the position shown in Figure 4 and then manually depressed to engage or bridge the fixed contacts 6a and 6b, a signal S1 having the logic level "1" or "H" is
30 provided to the respective input port of the I/O unit 31a of the controlling circuit 31 thereby to indicate selection of the interlocking mode of operation. On the other hand, when the control button 6' of the mode selecting switch 6 is laterally displaced to the position for bridging the fixed contacts 6a and 6c, and then depressed
35 so as to engage the contacts 6a and 6c, a signal S1 having the logic level "0" or "L" is provided to the unit 31a for indicating that the non-interlocking mode of operation is selected. Similarly, when the

push button of the switch 7 is manually depressed to cause the respective movable contact 7c to engage the fixed contacts 7a and 7b, a signal S2 of logic level "0" or "L" is applied to the respective input port of the I/O unit 31a. The signal S2 of the level "L" indicates to the controlling circuit 31 that the value of the power consumption of the VTR 20 or other external appliance in its stand-by condition is to be detected, and that the corresponding output of the A/D converting circuit 47 is to be stored in the memory 31b.

The operation of the BS receiver 1 in accordance with this embodiment will now be described with reference to the flow chart of Figure 5 which illustrates the program of the microprocessor constituting the controlling circuit 31 for both the interlocking mode and the non-interlocking mode. Prior to the start of the program at a step (100), the VTR 20 or other external appliance has the plug 24a of its power cord 24 engaged in the interlocking receptacle 8 of the BS receiver 1, and the plug 14a of the power cord 14 of the BS receiver is engaged in a household electrical receptacle or other suitable source of AC current. Furthermore, if the interlocking mode of operation is to be selected, a tape is loaded in the VTR 20, the VTR 20 is placed in its stand-by condition, and the built-in timer of the VTR is set for the commencement of recording at a selected time, that is at the reserved picture recording time. Thereafter, in a step (101), the control button 6' of the mode selecting switch 6 is shifted or displaced to either the position for selecting the interlocking mode, or to the position for selecting the non-interlocking mode. After such selection of the interlocking or non-interlocking mode, the control button 6' of the switch 6 is depressed in a step (102), and the resulting signal S1 provided from the mode-selecting switch 6 to the I/O unit 31a of the controlling circuit 31 is either at the logic level "H", in the case where the interlocking mode has been selected, or at the logic level "L", in the case where the non-interlocking mode has been selected. In the next step (103), it is determined whether or not the signal S1 is at the logic level "H". If the signal S1 is not at the logic level "H", that is if the signal S1 is at the logic level "L", the program passes to a step (104) in which the non-interlocking mode is established. Thereupon, as in the following step (105), the controlling circuit 31 provides a signal through the line 48 to the

power source switch 36 for closing the switch and thereby supplying a power source voltage from the power source circuit 28 through the closed switch 36 to the tuner circuit 29 so as to operate the tuner circuit.

5 Upon such operation of the tuner circuit 29, the channel selection and demodulating circuit 38 thereof selects, from a BS-IF signal applied to the input terminal 9 from the BS converter 17, the signal of a desired channel selected by actuation of a corresponding one of the channel selection buttons 3 so that the received BS-IF
10 signal is converted into a second intermediate frequency. Thereupon, the circuit 38 effects FM demodulation of the BS-IF signal for extracting therefrom a video signal and an audio PCM sub-carrier signal. Finally, the channel selection and demodulating circuit 38 effects separation, in known manner, of the video signal from the audio
15 PCM sub-carrier signal, and the separated video signal is supplied to the video signal processing circuit 39 in which de-emphasis is effected and energy dispersal signals are removed from the video signal. The resulting video signal is then supplied from the processing circuit 39 to the video output terminal 11. Simultaneously, the separated audio
20 PCM sub-carrier signal is converted or decoded and then PCM demodulated in the audio PCM signal processing circuit 40 which finally converts the digital audio signal to analog stereo audio signals which are applied to the audio output terminals 12. Thus, the video signal and the audio signals are transmitted from the output terminals 11 and 12
25 of the tuner circuit 29 to the input terminals 20b and 20c of the VTR 20 by way of the connecting cables 23a and 23b, respectively.

During operation of the BS receiver 1 in its non-interlocking mode, the VTR 20 connected therewith may be made operative either by operation of its built-in timer, or by suitable manual actuation of the
30 controls of the VTR 20 so as to record the video and audio signals being applied to the input terminals 20b and 20c, respectively. Further, at such time, the monitor 25 may be made operative to reproduce the video and audio signals being applied to the VTR 20 from the BS receiver 1.

35 At any time during the operation of the BS receiver 1 in its non-interlocking mode, the depressing of the control button 6' provides a second signal S1 of the logic level "L" to the respective input port of

the I/O unit 31a and the microprocessor or CPU constituting the controlling circuit 31 responds to the second signal S1 of the logic level "L" by supplying a suitable control signal through the line 48 to the power source switch 36 for opening the switch, in a step (107).

5 Thus, in response to the second actuation of the control button 6' of the switch 6 in its condition for selecting the non-interlocking mode of the BS receiver 1, the operation of the tuner circuit 29 is halted and the program returns or is recycled to the step (102).

10 If the switch 6 has been conditioned for selecting the interlocking mode of operation of the BS receiver 1 at the time when the control button 6' is initially depressed in the step (102), it is determined, in the succeeding step (103), that the resulting signal S1 is at the logic level "H" and the microprocessor or CPU forming the controlling circuit 31 responds thereto in a step (108) by establishing
15 the interlocking mode. With the plug 24a of the VTR 20 engaged in the interlocking receptacle 8 of the BS receiver 1, and with the VTR 20 in its stand-by condition in which it typically has a power consumption of approximately 5 W, the electric current drawn by the VTR 20 in its stand-by condition flows through the primary winding 42a of the
20 detecting transformer 42 and is converted into a corresponding DC voltage by way of the rectifying circuit 43, the integrating circuit constituted by the capacitor 44 and the resistor 45, and the zener diode 46. This DC or analog voltage is converted into corresponding digital data by the A/D converting circuit 47. When the stand-by power
25 detecting switch 7 is depressed or actuated, it is determined, in a step (109), that the signal S2 is at the logic level "L", and the signal S2 applied to the respective input port of the I/O unit 31a causes the control unit 31c to store the data then being received from the A/D converting circuit 47 in the memory 31b, in a step (110). In
30 other words, at the time of the actuation of the switch 7 with the receiver 1 in its interlocking mode, the controlling circuit 31 stores in the memory 31b the data from the converting circuit 47 which corresponds to the value "A" of the power consumption of the VTR 20 in its stand-by condition.

35 It will be noted that, during the detecting of the power consumption by the VTR 20 in its stand-by condition and the storing of the corresponding value "A" in the memory 31b, the controlling circuit

31 maintains the power source switch 36 in its open condition so that the tuner circuit 29 remains inoperative. After storing in the memory 31b of the value "A" characteristic of the stand-by condition of the VTR 20, the A/D converting circuit 47 continues to supply to the
5 respective input port of the I/O unit 31a data representing the instantaneous value "B" of the power consumption by the VTR 20, and the control unit 31c enters this value "B" in the arithmetic logic unit 31d, in a step (111). In the following step (112), it is continuously determined whether or not the instantaneous value "B" of power
10 consumption being entered from the converting circuit 47 is greater than the previously stored value "A" by at least a predetermined amount "C", as is the case when the value "B" is characteristic of the power consumption by the VTR 20 in its operating condition. In other words, at the reserved picture recording time for which the built-in timer of
15 the VTR 20 has been set, the VTR is changed over from its stand-by condition to its operating condition. The resulting substantial increase in the power consumption of the VTR 20 is detected by the power consumption detecting circuit 30 so that the value "B" of the data then being supplied from the circuit 30 to the I/O unit 31a of the
20 controlling circuit 31 exceeds the previously stored value "A" by at least the predetermined amount "C". In response to the foregoing determination by the arithmetic logic unit 31d in the step (112), the control unit 31c provides a suitable control signal through the line 48 to the power source switch 36 for closing the switch, in a step (113).
25 Such closing of the switch 36 causes operation of the tuner circuit 29 substantially in the same manner as has been described above for the non-interlocking mode of the receiver 1.

The predetermined amount "C" by which the value "B" has to exceed the previously stored value "A" in order to achieve closing of the
30 power source switch 36 in the step (113) is selected to ensure that the closing of the switch 36, and the consequent operation of the tuner circuit 29 in the interlocking mode of the receiver, occurs only when the value "B" is truly characteristic of the operation of the VTR 20. Thus, the closing of the switch 36 in response to a voltage fluctuation
35 or surge or any condition other than the operation of the VTR 20 is avoided.

After the switch 36 has been closed so as to initiate the operation of the tuner circuit 29 in the interlocking mode of the receiver 1, the instantaneous value "B" of the data output from the detecting circuit 30 is continuously compared in a step (114) with the previously stored value "A". So long as the value "B" is determined, in the step (114), to be greater than the stored value "A" by at least the predetermined amount "C", the controlling circuit 31 maintains the power source switch 36 in its closed condition so as to continue the operation of the tuner circuit 29. However, when the built-in timer of the VTR 20 halts the operation of the VTR so that its power consumption is reduced, for example, to approximately the value "A" characteristic of the stand-by condition of the VTR 20, the fact that the value "B" is no longer greater than the stored value "A" by at least the predetermined amount "C" is determined in the step (114) and, in response to such determination, the power source switch 36 is opened in a step (115) thereby halting the operation of the tuner circuit 29, and the program of the controlling circuit 31 is brought to an end.

It will be appreciated from the foregoing that, in the BS receiver 1 embodying this invention, the operation of the tuner circuit 29 is automatically controlled in response to the operation of the associated VTR 20 or other external appliance when the receiver 1 is in its interlocking mode. Although the invention has been described and illustrated as being applied to a broadcast satellite receiver, it will be apparent that the invention can be similarly applied to other types of receivers for association with a VTR or other external appliance.

CLAIMS

1. A receiver comprising:
a power source circuit;
5 a tuner circuit;
power switching means for controlling supply of a power source voltage from said power source circuit to said tuner circuit;
coupling means for connecting an external appliance to said power source circuit of the receiver;
10 detecting means for detecting values of power consumption by the external appliance connected through said coupling means to said power source circuit; and
controlling means responsive to said values of power consumption detected by said detecting means to close said power switching means
15 and thereby enable operation of said tuner circuit, when the detected value of power consumption exceeds by a predetermined amount a previously detected value of power consumption of the external appliance in a stand-by condition.
- 20 2. A receiver according to claim 1, wherein said detected value of power consumption which exceeds by the predetermined amount said previously detected value of power consumption is characteristic of an operating condition of said external appliance so that said tuner circuit and said external appliance are operative in an interlocking
25 manner.
3. A receiver according to claim 2, comprising mode selecting means connected to said controlling means and being selectively operative to establish an interlocking mode in which said tuner circuit is operative
30 in said interlocking manner with said external appliance, and a non-interlocking mode in which said tuner circuit is operative independently of said external appliance.
4. A receiver according to claim 3, comprising start-stop means
35 associated with said mode selecting means and being operative, in said non-interlocking mode, to cause said controlling means to close said power switching means thereby to enable operation of said tuner circuit



in response to an initial actuation of said start-stop means and to open said power switching means to halt operation of said tuner circuit in response to a subsequent actuation of said start-stop means.

5 5. A receiver according to any one of the preceding claims, comprising means actuatable to cause said controlling means to store said value of power consumption of the external appliance in said stand-by condition.

10 6. A receiver according to any one of the preceding claims, wherein said power source circuit includes an AC source, and said detecting means includes transformer means connected between said AC source and said coupling means for converting electric current supplied from said AC source through said coupling means to an external appliance into a
15 voltage signal, rectifying means for converting said voltage signal into a DC voltage signal, integrating means for integrating said DC voltage signal, and analog-to-digital converting means for converting the integrated DC voltage signal into a digital signal supplied to said controlling means.

20

7. A receiver substantially as hereinbefore described with reference to the accompanying drawings.

25 8. A video system comprising a video recorder including a timer for determining a period of operation thereof, and a receiver including a power source circuit, a tuner circuit operative to receive a broadcast signal and to provide a video signal to said video recorder, power switching means for controlling supply of a power source voltage from said power source circuit to said tuner circuit, coupling means
30 connecting said video recorder to said power source circuit, detecting means for detecting values of power consumption by said video recorder connected through said coupling means to said power source circuit, and controlling means responsive to said values of power consumption detected by said detecting means to close said power switching means
35 and thereby enable operation of said tuner circuit when the detected value of power consumption is characteristic of an operating condition of said video recorder so that operation of said tuner circuit is made



to be simultaneous with said period of operation of the video recorder as determined by said timer of the video recorder.

9. A video system according to claim 8, wherein said receiver
5 includes means for initially storing in said controlling means a detected value of power consumption characteristic of a stand-by condition of said video recorder, and said controlling means is operative to close said power switching means thereby operating said
10 tuner circuit when the detected value of power consumption exceeds by a predetermined amount the initially stored value of power consumption in said stand-by condition.

10. A video system according to claim 9, wherein said receiver
15 includes mode selecting means connected to said controlling means and being selectively operative to establish an interlocking mode in which said tuner circuit is operative with said video recorder during said period of operation determined by said timer, and a non-interlocking mode in which said tuner circuit is operative independently of said
20 video recorder.

11. A video system according to claim 10, wherein said receiver
includes start-stop means associated with said mode selecting means and being operative, in said non-interlocking mode, to cause said
25 controlling means to close said power switching means thereby to enable operation of said tuner circuit in response to an initial actuation of said start-stop means and to open said power switching means to halt operation of said tuner circuit in response to a subsequent actuation of said start-stop means.

12. A video system according to any one of claims 8 to 11, wherein
30 said power source circuit includes an AC source, and said detecting means includes transformer means connected between said AC source of the power source circuit and said coupling means for converting electric current supplied from said AC source through said coupling
35 means to the video recorder into a voltage signal, rectifying means for converting said voltage signal into a DC voltage signal, integrating means for integrating said DC voltage signal, and analog-to-digital



converting means for converting the integrated DC voltage signal into a digital signal supplied to said controlling means.

13. A video system substantially as hereinbefore described with
5 reference to the accompanying drawings.
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