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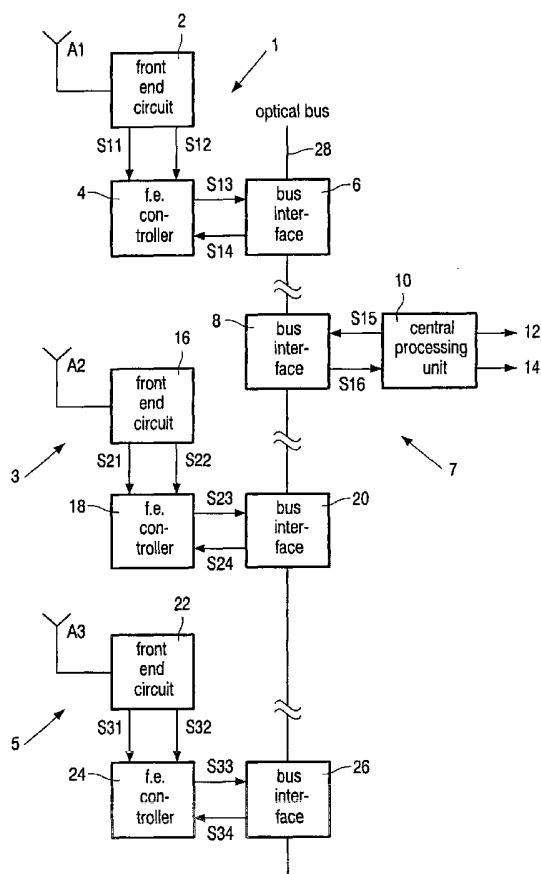
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[Continued on next page]

(54) Title: RADIO FREQUENCY RECEIVING AND PROCESSING SYSTEM



(57) Abstract: The invention relates to a system and method for receiving radio frequency signals. The system comprises a plurality of front-end receiving units, a processing unit, and a bus system coupling the front-end receiving units to the processing unit. The front-end receiving units are coupled to antennas for receiving radio frequency signals and are arranged for demodulating and digitizing the received radio frequency signals to digitized demodulated signals. Furthermore the front-end receiving units are arranged for transmitting the digitized demodulated signals to the processing unit. The processing unit is arranged to generate an output signal either in dependence on a combination of the digitized demodulated signals or in dependence on a selected digitized demodulated signal. Preferably the digitized demodulated signal with the best quality signal is selected. For this purpose the front-end receiving units are arranged to generate the quality signal in dependence of the received RF-signal, while the processing unit is arranged to select the front-end receiving unit, providing the quality signal representing the radio-frequency signal with the best quality, to transmit the digitized intermediate signal.

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Radio frequency receiving and processing system

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The invention relates to a radio frequency receiving and processing system comprising a plurality of front-end receiving units, a processing unit, and a bus system coupling the front-end receiving units to the processing units.

10 The invention further relates to a method for receiving and processing radio frequency signals by means of a radio frequency receiving and processing system, comprising a plurality of front-end receiving units, a processing unit, and a bus system coupling the front-end receiving units to the processing unit.

15

European patent application EP 0 952 674 A2 discloses a system as described in the opening paragraph for use in automobiles. It includes tuners for a plurality of receivers for receiving various types of signals including an AM/FM broadcast signal, a TV broadcast signal and a GPS signal. The tuners are separated from receiver bodies and integrally incorporated in an antenna section (a plurality of antenna elements and an AM/FM reception circuit and a TV reception circuit) including a plurality of antenna elements. The tuners are controlled by a digital control signal via a local access network (LAN) provided in an automobile for controlling reception of radio frequency signals. To avoid the usage of a separate coaxial cable for every system, it is proposed to demodulate the received signal at the receiving unit and to transmit the demodulated information via an optical bus to the places where the signals are further processed, i.e. an amplifier for FM radio reception. Such optical bus systems are in the form of the MOST system or IDB-1394, which will be hereinafter described in detail.

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In the system disclosed in EP 0 952 674 A2 the reception of wireless signals is improved by the usage of antenna diversity. Antenna diversity means that the same radio frequency signal is received in multiple places. Through combining the received signals, the improvement in signal reception quality takes place. The advantage obtained from antenna diversity is highest if the signals received at the different antennas are uncorrelated. The correlation between signals received on different antennas decreases with the distance between the antennas. Therefore, the antennas should be placed at least a quarter of a

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wavelength apart from each other. Preferably the distance between the antennas is a multiple of a wavelength. For FM radio systems, this results in a distance in the range of meters. A disadvantage of the system disclosed in EP 0 952 674 A2 is that this involves expensive wiring of the individual antennas to the other components of the receiving unit for instance
5 by means of coaxial cables.

It is inter alia an objective of the present invention to provides a radio frequency receiving and processing system with an improved performance by means of
10 antenna diversity.

To this end the invention provides a radio frequency receiving and processing system as defined in the opening paragraph, which is characterized in that

each of the front-end receiving units is coupled to a separate antenna, and is arranged for converting a radio frequency signal received at the antenna to a digitized
15 demodulated signal and for transmitting the digitized demodulated signal to the processing unit via the bus system; and

the processing unit is arranged for generating an output signal in dependence on digitized demodulated signals received via the bus system.

An advantage of the system according to the invention is that the main part of
20 the received signals is processed after transmission via the bus system. Each of the front-end receiving units only needs to convert a radio frequency signal of one antenna into a digitized demodulated signal. This reduces the required processing power of the front-end receiving units. A further advantage of the system according to the invention is that antenna diversity may be applied more effectively, since individual antennas may be placed as far apart as
25 required without requiring extensive wiring, because the front-end receiving units locally convert received radio frequency signals to digitized demodulated signals and digitized demodulated signals require less bandwidth than unprocessed radio frequency signals.

A method according to the invention for receiving and processing radio frequency signals as described in the second paragraph, is characterized in that

30 each of the front-end receiving units receives a radio frequency signal at a separate antenna, converts the received radio frequency signal to a digitized demodulated signal, and transmits the digitized demodulated signal to the processing unit via the bus system; and

the processing unit generates an output signal in dependence on digitized demodulated signals received via the bus system.

5 The above and other objects and advantageous features of the present invention will become more apparent from the following detailed description considered in connection with the accompanying drawings in which:

Fig. 1 is an embodiment of an radio frequency receiving and processing system according to the invention;

10 Fig. 2 is a block diagram of an embodiment of a front receiver unit for use in a radio frequency receiving and processing system according to the invention;

Fig. 3 is a block diagram of an embodiment of a quality controller for use in a radio frequency receiving and processing system according to the invention.

15 Fig. 1 shows an overview of an embodiment of an radio frequency (RF) receiving and processing system according to the invention. The RF receiving and processing system comprises antennas A1, A2, and A3, front-end circuits 2, 16, 22, front-end controllers 4, 18 and 24, bus interfaces 6, 8, 20 and 26, an optical bus system 28 and a central processing unit 10.

In this embodiment, each of the front-end receiving units 1, 3 and 5 comprises an antenna A1, A2, and A3, a front-end circuit 2, 16, 22, a front-end controller 4, 18, 24 and a bus interface 6, 20, 26, respectively. For example, the antenna A1 is connected to the front-end circuit 2. The front-end circuit 2 transmits two signals S11 and S12 to the front-end controller 4. Signal S11 represents all control signals coming from the front-end circuit 2 and S12 represents all data-information signals (like audio-signals and radio data (RDS) signals) coming from the front-end circuit 2. The front-end controller 4 transmits a signal S13 to the bus interface 6 and receives a signal S14 from the bus interface 6. The signal S13 is a multiplexed signal generated from the signals S11 and S12. In other words, the signal S13 comprises the information signal and the control signal indicating the quality of the received signal. The signal S14 comprises a control signal coming from the central processing unit 10. The bus interface 6 connects the front-end receiving unit 1 to the optical bus system 28.

The optical bus system 28 transmits the information from the front-end receiving units 1, 3, 5 to the central processing unit 10, or vice versa. The bus interface 8

connects the central processing unit 10 to the optical bus 28. The bus interface 8 receives the signal S15 from the central processing unit 10. The signal S15 is the same signal as S14. The signal S16 which is transmitted from the bus interface 8 to the central processing unit 10 contains the information signal to be transmitted to the central processing unit. The terminals 5 12 and 14 output the processed signals for further processing, for example amplification, of the received and processed signals. In principle the other two front-end receiver units 3, 5 shown in Fig. 1 are the same as the described front-end receiver unit 1. Signals S21 and S31 represent all control signals coming from front-end controllers 16 and 22, respectively. Signals S22 and S32 represent all data information signals coming from front-end controllers 10 16 and 22, respectively. The front-end controllers 18 and 24 transmit the respective signals S23 and S33 to the respective signals S23 and S33 to the respective bus interfaces 20 and 26. The front-end controllers 18 and 24 receive the respective signals S24 and S34 from the respective bus interfaces 20 and 26.

The optical bus system may be the media oriented systems transfer MOST 15 system or the IDB-1394. The MOST is a serial network with a maximum of 64 devices. Data transmission is organized in blocks. Every block contains 16 frames. A frame consists of 64 bytes. The first byte is used for a preamble and a boundary descriptor and is followed by the data information. A maximum of 60 bytes can be transported in one frame. The data information itself can be split up in a first part reserved for synchronous transmission and a 20 second part for asynchronous transmission. The last three bytes of a frame are dedicated to two control bytes and some frame, status and parity bits. If no central system controller is present for instance in the form of a computer, one device of the network is the timing master providing the generation and transport of the system clock, the frames, and the blocks. All other devices are slaves. The slaves derive their clock from the MOST network. The frame 25 rate can be chosen between 30 and 50 kHz (certain devices prefer certain frame rates – e.g. 44.1 kHz for CD-ROM). The advantage of having a synchronous network is that expensive buffering in the devices is avoided. For a frame rate of 44.1 kHz the bit error rate BER should be less than 10^{-10} . The function of the different fields of is explained hereafter briefly. The preamble contains four bits and is needed for synchronization of the devices to the bit stream.

30 The boundary descriptor also contains four bits and indicates how many bits are transmitted synchronously. The boundary descriptor represents an integral number N of the set $\{0, 6, \dots, 15\}$. Multiplied by four, the number of synchronously transmitted bytes in a frame is obtained. The number of synchronously transmitted bytes therefore equals $4N$. The maximum number of asynchronous bytes is given by $36 (N=4)$. For $N=0$, zero synchronous

bytes and 15 asynchronous bytes are transmitted. $N=15$ leads to the maximum number of synchronous (16) and the minimum number of asynchronous (0) bytes.

All other bits, frame control, status and parity bit (3 bytes), within the frame are for management purposes on the network level. The first two bytes of these fields are reserved for a control channel. The parity bit indicates reliable data content and is used for error detection and phase loop operation.

The protocol for data transmission will now be described. The synchronous data field is used to set up static physical channels. For $N=15$, 15 stereo channels of uncompressed CD-quality audio can be transmitted at a frame rate of 44.1 kHz. This is also equal to 15 uncompressed MPEG1 audio-video channels. The synchronous data field is then shared by different devices through time division multiple access (TDMA). This means that e.g. device A always uses the first four bytes, device B the second four bytes, etc..

The asynchronous data field is organized in a token ring manner. The objective of the asynchronous data field is to provide packet-oriented data transmission. The bandwidth of this channel is controlled, as already explained, by the boundary descriptor. The device which owns the token is always allowed to send its information. The maximum packet length, given by 48 bytes (and therefore spreading one packet over more than one frame) is possible. By providing these two transmission schemes, latency-sensitive and latency-insensitive transmission is possible with MOST.

The protocol for controlled transmission is next described. The protocol on the control channel runs in a carrier sense multiple access (CSMA) manner. Two kinds of control messages are possible: normal messages, for the remote control of devices and system messages, and handling system (MOST) related operations. A control data message is 32 bytes long and hence again spreading of one message over several frames is possible.

The bus standard IDB-1394 will now be described. The IDB-1394 standard offers the same features as MOST but offers with a maximum of 400 Mbyte/s it provides a much larger bandwidth. For a detailed description, see D. Anderson, "Fire Wire System Architecture", 2nd edition, 1999, Mindshare, Inc.. By employing an optical bus for the transmission of the received signals, the gain obtained through the diversity system due to an increase of distance between the antennas is maximized while no extra wiring is required which keeps costs low.

To allow the transmission via the bus system, the received signals have to be demodulated to a certain extent prior to transmission via the bus system. To which extent the

demodulation has to be effected depends on the used diversity combining method.

Combining of the different signals takes place, for example, in a central unit.

Selection combining means that the signal offering the best received signal quality is transmitted via the optical bus and further processed by the central receiver unit. In this case, any front-end receiver has to demodulate the received signal completely. For example, in the case of FM radio, this is equal to demodulation until the audio and data signals of the received signals. The audio and data signals are then digitized and sent via the optical bus. Besides this, every receiver has to generate a quality indication signal providing information about the received signal quality. This may be a simple received signal strength indicator of a signal indicating the distortion of the channel introduced by multi-path propagation. This detection signal has to be transmitted from any receiver constantly via the optical bus to the central processing unit. Based on the receive quality signals, the central processing unit decides which front-end receiver unit has to transmit its received information (e.g. audio, data signals) via the optical bus to the central processing unit. The content of the different signals shown in Fig. 1 for the selection combining is clarified in table 1 and table 2.

Table 1 shows the function of each signal for selection combining when A_x ($x = 1, 2, \text{ or } 3$) is the antenna being selected for transmission via the bus.

Table 1 – function of each signal for selection combining when A_x is the antenna being selected for transmission via the bus.

	Sx1	Sx2	Sx3	Sx4	S15	S16
Function	Fully demodulated received signal (in the case of FM radio e.g. the audio signals and the RDS signal)	Control signal indicating the quality of the received signal	Multiplex signal consisting of Sx1 and Sx2	Control signal coming from the central processing unit telling the receiver to start/stop transmission via the bus	Same as Sx4 used to start/stop transmission from A_x via the bus	Time multiplexed signal containing S13 as well as all $Sy3$ (see next table)

Table 2 shows the function of each signal for selection combining for all other Antennas A_y (x not equal to y).

5 Table 2 – function of each signal for selection combining for all other Antennas A_y (x not equal to y).

	Sy1	Sy2	Sy3	Sy4		
Function	Fully demodulated received signal (in the case of FM radio e.g. the audio signals and the RDS signal)	Control signal indicating the quality of the received signal	Equal to Sy2	Silent		

A simplified version of selection combining is switched combining. In this case, only one receiver sends a control signal as well as one or multiple information signals via the bus to the central processing unit. If the quality of the control signals drops below a given threshold, the central processing unit stops the transmission of the active front-end receiver unit via the bus and initiates the transmission from another one, until the quality level drops again below the threshold.

10

Compared to selection combining, switched combining saves bandwidth on the optical bus, because the number of transmitted control signals is reduced to one. The content of the different signals for switched combining is clarified in tables 3 and 4.

15

Table 3 shows the function of each signal for switched combining when A_x is the antenna being selected for transmission via the bus.

Table 3 – function of each signal for switched combining when Ax is the antenna being selected for transmission via the bus.

	Sx1	Sx2	Sx3	Sx4	S15	S16
Function	Fully demodulated received signal (in the case of FM radio e.g. the audio signals and the RDS signal)	Control signal indicating the quality of the received signal	Multiplex signal consisting of Sx1 and Sx2	Control signal coming from the central processing unit telling the receiver to start/stop transmission via the bus	Same as Sx4 used to start/stop transmission from Ax via the bus	Time multiplexed signal containing Sx3

5 Table 4 shows the function of each signal for switched combining for all other non-selected Antennas Ay (x not equal to y).

Table 4 – function of each signal for switched combining for all other non-selected Antennas Ay (x not equal to y).

	Sy1	Sy2	Sy3	Sy4		
Function	Fully demodulated received signal (in the case of FM radio e.g. the audio signals and the RDS signal)	Control signal indicating the quality of the received signal	Silent	Silent		

With maximum ratio combining (MRC), several signals have to be combined in the central processing unit. Demodulation to baseband of the received signals for transmission via the optical bus is at least required. If a received signal at the antenna of the front-end receiving unit is given by S_{RF} , where RF denotes radio frequency, it is possible to write $S_{RF} = \text{re}\{S_{BB} \cdot \exp(-j2\pi \cdot f_c \cdot t)\}$, where $\text{re}\{\}$ denotes the real part, f_c the carrier frequency and S_{BB} the baseband signal. The demodulation of the signal has to be accomplished before transmission via the bus in the sense that S_{BB} becomes available.

In the central processing unit the different received signals are weighted with a complex factor and added up afterwards. The amplitude of these complex factors results from the energy of the received signals, being equal for the signal S_{BB} to $a = \sqrt{E\{|S_{BB}|^2\}}$, where $\sqrt{}$ denotes the square root and $E\{\}$ the expected value, and the phase of these factors from the phase of the received signals. The phase of one signal follows from $p = E\{\arg(S_{BB})\}$, where $\arg()$ is the function deriving the argument (phase) of a complex signal. The weighting factor for one signal then results in $f = a \cdot \exp(-j \cdot p)$. If $S_{BB1}, S_{BB2}, \dots$ are the received signals, the combined signal S_{COMB} is given by $S_{COMB} = f_1 \cdot S_{BB1} + f_2 \cdot S_{BB2} + \dots$.

Since all signals are always combined, additional control signals do not have to be transmitted along with the received signals.

The function of the different signals for maximum ratio combining is clarified in table 5.

Table 5 shows the function of each signal for maximum ration combining when all antennas are active.

Table 5 – function of each signal for maximum ration combining when all antennas are active.

	Sx1	Sx2	Sx3	Sx4	S15	S16
Function	Signal demodulated to the baseband signal	Silent	Sx1	Silent	Silent	Time multiplexed signal containing all Sx3

Since MRC requires amplitude weighting which is costly with respect to an implementation, the weighting can be reduced to a phase correction, being easier to

implement by a tunable delay element. Equal gain combining is therefore equal to the combination of the different received signals in the central processing unit, which signals are corrected with respect to their phase differences. Since only the phase is relevant, further demodulation of the signal S_{BB} in the receiver prior to transmission via the optical bus can take place if a modulation type is employed which only makes use of the phase information like phase or frequency modulation (FM). In FM radio, it is therefore useful to derive the signal $p = E\{\arg(S_{BB})\}$ prior to transmission via the optical bus. Then only the real signal p has to be transmitted via the bus and not the complex signal S_{BB} . This saves bandwidth on the bus compared to maximum ratio combining. The correction factor then results in $f = \exp(-j.p)$. If S_{BB1} , S_{BB2} , ... are the received signals, the combined signal S_{COMB} is given by $S_{COMB} = f_1.S_{BB1} + f_2.S_{BB2} + \dots$

The function of the different signals for equal gain combining is clarified in table 6.

Table 6 shows the function of each signal for equal gain combining when all antennas are active.

Table 6 – function of each signal for equal gain combining when all antennas are active.

	Sx1	Sx2	Sx3	Sx4	S15	S16
Function	Signal demodulated to the baseband signal (or in case of the phase or frequency modulation, demodulation also down to the phase)	Silent	Sx1	Silent	Silent	Time multiplexed signal containing all Sx3

In digital systems (digital here means that the transmitted information is already digitally encoded in the transmitter) another form of combining is possible. The received signals are fully demodulated prior to transmission via the optical bus in the sense

that the demodulated signals consist of bits. These bits are transmitted via the optical bus to the central processing unit. If an odd amount of signals is received, the central processing unit can easily decide which bit has been transmitted by counting the number of equal bit reception (three received signals, two indicating a transmitted 1 and one indicating a 0 leads to the decision of a transmitted 1). No transmission of control signals is required.

The function of the different signals for other forms of combining is clarified in table 7.

Table 7 shows the function of each signal for other forms of combining when all antennas are active.

Table 7 – function of each signal for other forms of combining when all antennas are active.

	Sx1	Sx2	Sx3	Sx4	S15	S16
Function	Signal demodulated to the bits (digital modulation only)	Silent	Sx1	Silent	Silent	Time multiplexed signal containing all Sx3

Fig. 2 is a block diagram of an embodiment of a front receiver unit for use in a radio frequency receiving and processing system according to the invention. Fig. 2 shows an embodiment of a front-end circuit 2 as used in, for example, FM car radio. The signal 30 is first passed through an antenna filter 32. After passing through the antenna filter 32, the signal is amplified by a low noise amplifier (LNA) 34 and the signal is then supplied to the input terminal of the automatic gain control circuit (AGC) 36. The automatic gain control circuit 36 provides a signal with a stable power level at its output terminal. The signal is then mixed by a mixer 38 with a signal coming from a voltage-controlled oscillator (VCO) 40. By mixing the signal of the automatic gain control circuit 36 with the signal of the voltage-controlled oscillator 40, the received signal of the antenna is shifted from the radio frequency to an intermediate frequency by the mixer 38.

Subsequently, the intermediate frequency signal is filtered by the channel filter 42. The filtered intermediate frequency signal is then digitized by the analog to digital converter (A/D) 44. The digitized intermediate frequency signal is then mixed in a second mixer 46 with a signal coming from the voltage-controlled oscillator 48 down to the

baseband. In a last step, the baseband signal is demodulated by the demodulator 50. The output terminals 54, 56, 58 of the demodulator 50 provide the demodulated baseband signal to the bus and to the quality controller 52. For example in a FM radio system the demodulated signals 54, 56 and 58 could be, the audio signals of the left and right side as well as the radio data signal (RDS). It is assumed that all signals 54, 56, 58 are digital. This includes the case where they represent digitized analog signals as they occur in FM radio.

The quality controller 52 receives the signals 54, 56, 58 and the input signal of the demodulator 50 at its input terminals. The output signal of the quality controller 52 is provided at the output terminal 60. The function of the quality controller 52 is described in Fig. 3.

Fig. 3 is a block diagram of an embodiment of a quality controller for use in a radio frequency receiving and processing system according to the invention. Fig. 3 is a block diagram of the quality controller 52. In the simplest case, the quality controller 52 carries out an estimation of the average power of the input signal of the demodulator 50 of Fig. 2 by passing the input signal 62 representing at least one input signal in the block 64 and filtering the passed signal by the low-pass filter 66. The output signal 68 of the quality controller in Fig. 3 is identical to the output signal 60 of Fig. 2.

Additionally, the quality controller can make use of other input signals such as the output signals 54, 56, 58 of the demodulator. This may be the case, if the audio signal of a FM demodulator comprises high frequency components above the wanted audio frequencies this may serve as an indication of multi-path propagation.

In summary, the invention relates to a system and method for receiving radio frequency signals. The system comprises a plurality of front-end receiving units, a processing unit, and a bus system coupling the front-end receiving units to the processing unit. The front-end receiving units are coupled to antennas for receiving radio frequency signals and are arranged for demodulating and digitizing the received radio frequency signals to digitized demodulated signals. Furthermore the front-end receiving units are arranged for transmitting the digitized demodulated signals to the processing unit. The processing unit is arranged to generate an output signal either in dependence on a combination of the digitized demodulated signals or in dependence on a selected digitized demodulated signal. Preferably the digitized demodulated signal with the best quality signal is selected. For this purpose the front-end receiving units are arranged to generate the quality signal in dependence of the received RF-signal, while the processing unit is arranged to select the front-end receiving unit, providing

the quality signal representing the radio-frequency signal with the best quality, to transmit the digitized intermediate signal.

The embodiments of the present invention described herein are intended to be taken in an illustrative and not a limiting sense. Various modifications may be made to these
5 embodiments by persons skilled in the art without departing from the scope of the present invention as defined in the appended claims.

CLAIMS:

1. A radio frequency receiving and processing system comprising a plurality of front-end receiving units, a processing unit, and a bus system coupling the front-end receiving units to the processing units, characterized in that

each of the front-end receiving units is coupled to a separate antenna, and is
5 arranged for converting a radio frequency signal received at the antenna to a digitized demodulated signal and for transmitting the digitized demodulated signal to the processing unit via the bus system; and

the processing unit is arranged for generating an output signal in dependence on digitized demodulated signals received via the bus system.

10

2. A radio frequency receiving and processing system as claimed in claim 1, characterized in that the processing unit is arranged for generating the output signal in dependence on the digitized demodulated signal received from one front-end receiving unit.

15 3. A radio frequency receiving and processing system as claimed in claim 1, characterized in that the processing unit is arranged for generating the output signal in dependence on a combination of digitized demodulated signals received from several front-end receiving units.

20 4. A radio frequency receiving and processing system as claimed in claim 1, 2, or 3, characterized in that the front-end receiving units are arranged for transmitting the digitized demodulated signals upon receiving a control signal from the processing unit.

5. A radio frequency receiving and processing system as claimed in claim 4,
25 characterized in that the processing unit is arranged for generating control signals for respective front-end receiving units in dependence of quality signals derived from respective digitized demodulated signals received from the front-end receiving units.

6. A radio frequency receiving and processing system as claimed in claim 5, characterized in that:

each front-end receiving unit is arranged for deriving a quality signal from the received radio frequency signal and is further arranged for transmitting the quality signal to the processing unit; and

the processing unit is arranged for generating control signals for the respective front-end receiving units in dependence of the quality signals received from the respective front-end receiving units.

7. A method for receiving and processing radio frequency signals by means of a radio frequency receiving and processing system, comprising a plurality of front-end receiving units, a processing unit, and a bus system coupling the front-end receiving units to the processing unit, characterized in that

each of the front-end receiving units receives a radio frequency signal at a separate antenna, converts the received radio frequency signal to a digitized demodulated signal, and transmits the digitized demodulated signal to the processing unit via the bus system; and

the processing unit generates an output signal in dependence on digitized demodulated signals received via the bus system.

20

8. A method as claimed in claim 7, characterized in that the processing unit generates the output signal from the digitized demodulated signal received from one selected front-end receiving unit out of the plurality of front-end receiving units.

9. A method as claimed in claim 8, characterized in that quality signals derived from the radio frequency signals received by the respective front-end receiving units are used by the processing unit for selecting the selected front-end receiving unit.

10. A method as claimed in claim 9, characterized in that if the quality signal received from the selected front-end receiving unit drops below a threshold level, the processing unit terminates transmission of the digitized demodulated signal by the selected front-end receiving unit and initiates transmission of the digitized demodulated signal by another front-end receiving unit out of the plurality of front-end receiving units.

30

11. A method as claimed in claim 7, characterized in that the processing unit generates the output signal in dependence of combined digitized demodulated signals received from several front-end receiving units via the bus system.
- 5 12. A method as claimed in claim 11, characterized in that the digitized demodulated signals are digitized base-band signals, whereby the combining of the digitized demodulated signals comprises multiplying each received digitized base-band signal with its own factor, and adding up the multiplied digitized base-band signals.
- 10 13. A method as claimed in claim 12, characterized in that the respective factors are determined in dependence on the energy and the phase of the respective digitized base-band signals.

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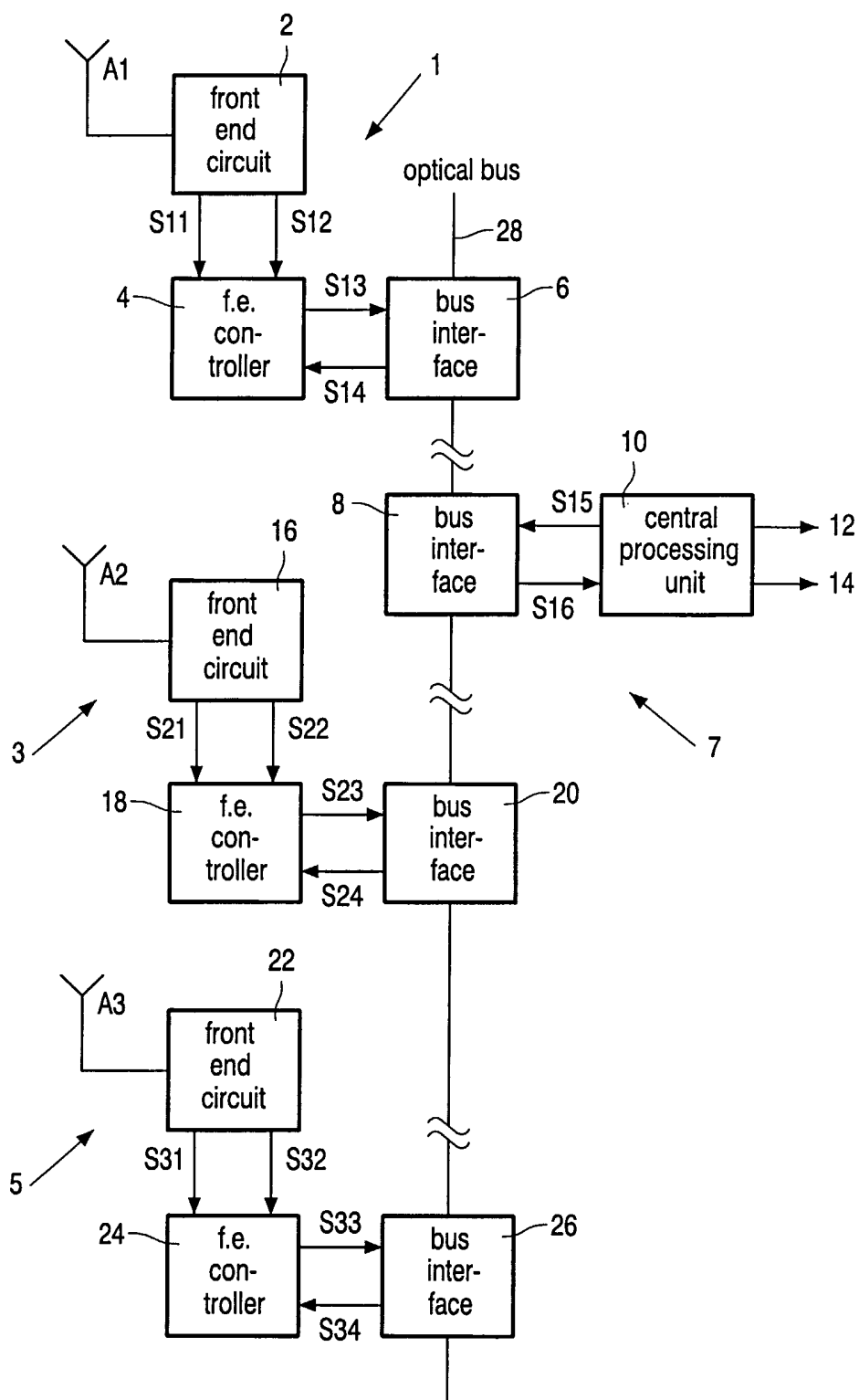


FIG. 1

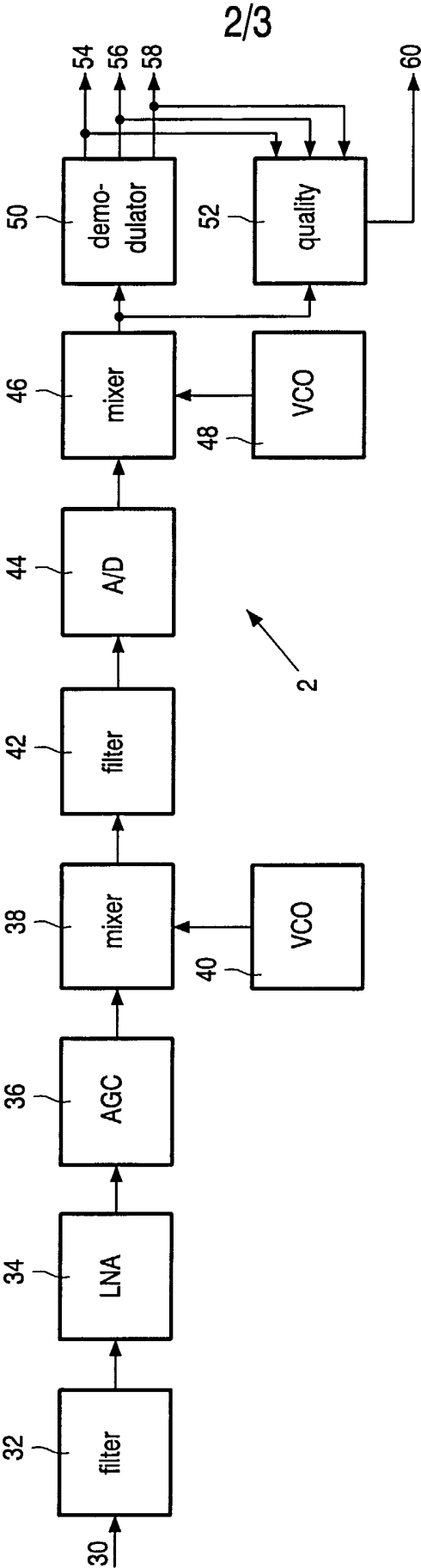


FIG. 2

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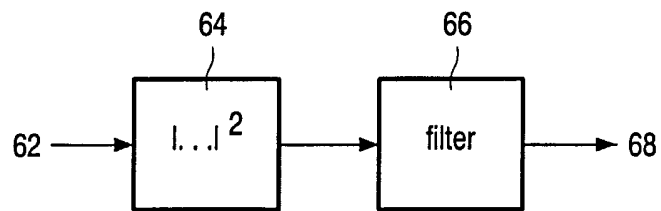


FIG. 3