Apparatus, and an associated method (500), for a multi-branch receiver (10). A receive signal (12) is received at various receiver branches (14) of the multi-branch receiver (10). Subsequent to selected processing stages (28, 44, 56) of processing of the receive signal (12), determinations (34) are made of the signal quality of the signal in the receiver branches (14). When determinations (34) are made that the signal quality of the signal of a particular receiver branch (14) is of poor quality, further processing of the signal (12) in the branch is squelched (38, 52, 64).
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SQUELCH APPARATUS, AND ASSOCIATED METHOD, FOR
A MULTI-BRANCH RECEIVER

The present invention relates generally to a multi-branch receiver having multiple receiver branches for receiving and processing a receive signal. More particularly, the present invention relates to squelch apparatus, and an associated method, for a multibranch receiver.

Processing of the receive signal received at different ones of the branches of the multi-branch receiver is selectively squelched at selected processing stages of the receiver branches. The number of receiver branches in which subsequent receiver-stage processing of a receive signal is performed is gradually reduced. Thereby, gradual squelching of the receive signal occurs. Such gradual squelching of further processing of the receive signal received at the different ones of the receiver branches reduces the processing required to be performed by the multi-branch receiver.

BACKGROUND OF THE INVENTION

A multi-branch receiver is sometimes utilized in radio communication systems to receive a receive signal. A multi-branch receiver includes a plurality of receiver branches. Each receiver branch of a multi-branch receiver includes circuitry, or other functionality, of at least significant portions of a radio receiver. The receiver branches are coupled to a signal combiner. The signal combiner selectively combines together a receive signal received at selected ones of the receiver branches.

Improved reception of the receive signal is permitted by appropriate combination of the receive signal received at one or more of the signal branches. For instance, the receive signal received at certain of the various receiver branches might, for instance, be of better signal characteristics than the receive signal received at certain others of the receiver branches. Selective combination of the receive signal received at the receiver branches exhibiting good quality permits a combined signal to be formed.
As signal characteristics of the receive signal change at the various receiver branches, the receiver branches selected from which to combine the receive signal can be changed, as appropriate.

A multi-branch receiver is advantageously utilized in a fixed-infrastructure, base station of a cellular communication system. When forming a portion of a cellular base station, an uplink signal transmitted to the base station by a mobile terminal forms the receive signal received at various branches of the multi-branch receiver.

An antenna matrix, such as a Butler matrix, for instance, can be used in conjunction with the multi-branch receiver. Different ones of the receiver branches are connected to the antenna matrix.

A receiver having two or more separate branches can sometimes provide improved receiver performance. The receive signal received at different ones of the receiver branches is not necessarily of identical characteristics. A receive signal received at one receiver branch might exhibit better characteristics than the receive signal received at another signal branch. The signal characteristics of the receive signals received at the various receiver branches might change over time. By selectively combining the receive signal received at various ones of the receiver branches, the resultant signal sometimes permits a more accurate recreation of the signal transmitted to the receiver.

Different antenna patterns formed by different configurations of the antenna matrix cause the receive signals applied to the different receiver branches to be of different characteristics. The signal characteristics of the receive signal received at certain of the receiver branches are likely to be better than the signal characteristics of the receive signal received at others of the receiver branches. As a mobile terminal moves throughout an area encompassed by the cellular base station, uplink signals transmitted by the subscriber unit form the receive signal which is received at different signal strengths, and other signal qualities, at different ones of the receiver branches.

While use of a multi-branch receiver improves the possibility of accurately recreating a signal transmitted thereto, the, receive signal received at each receiver branch must be separately processed. Substantial amounts of processing are required to process the receive signal in each receiver branch. The processing power required
of a multi-branch receiver can become quite significant, particularly when the number of branches of which the multi-branch receiver is formed is large. Such processing power requires the allocation of significant resources to process the separate signals and to selectively combine signals from various ones of the receiver branches.

A manner by which the processing required of a multi-branch receiver can be reduced while maintaining the improved receiver operation permitted of a multi-branch receiver would be advantageous.

It is in light of this background information relating to multi-branch receivers that the significant improvements of the present invention have evolved.

SUMMARY OF THE INVENTION

The present invention, accordingly, advantageously provides squelch apparatus, and an associated method, for a multi-branch receiver. Operation of an embodiment of the present invention reduces the amounts of processing required to process a receive signal received at a multi-branch receiver.

Further processing of a receive signal received at selected receiver branches is selectively squelched. Signal-quality determinations are made subsequent to selected receiver processing stages at selected ones of the receiver branches. If the receive signal received in a receiver branch is determined to be of poor quality, further processing of the receive signal in that branch is squelched.

Additional signal-quality determinations are made subsequent to successive stages of processing of the various receiver branches. Responsive to such determinations, decisions are made to squelch further processing of the receive signal in additional ones of the receiver branches. The number of receiver branches in which the receive signal is processed at successive receiver processing stages is successively, and gradually, reduced. Because of such reduction, the processing power required to operate a multi-branch receiver is reduced.

In one aspect of the present invention, a cellular base station includes a multi-branch receiver for receiving uplink signals transmitted thereto by a mobile terminal. An adaptive antenna, such as an antenna including a Butler matrix, is coupled by way of a multiplexer, or the like, to the different receiver branches of the multi-branch
receiver. Sequences of the receive signal applied to the different receiver branches undergo various stages of signal processing. Determinations are made subsequent to selected signal processing stages of the quality of the receive signal received at respective ones of the receiver branches. If a determination is made that the receive signal is of poor quality, further processing of the receive signal in that receiver branch is squelched. Squelching of further processing of selected ones of remaining receiver branches occurs after successive stages of signal processing in remaining ones of the receiver branches. Gradual squelching of the receive signal is thereby effectuated. Because further processing of the receive signal is gradually squelched, after different processing stages of different ones of the receiver branches, the amount of processing required to process a receive signal at a multi-branch receiver is reduced.

In another aspect of the present invention, an indoor, cordless telephone system includes a multi-branch receiver for receiving uplink signals transmitted thereto by mobile terminals. Distributed elements of an antenna device are coupled to the different receiver branches of the multi-branch receiver. Sequences of the receive signal applied to the different receiver branches undergo various stages of signal processing. Determinations are made subsequent to selected signal processing stages of the quality of the receive signal received at respective ones of the receiver branches. If a determination is made that the receive signal is of poor quality, further processing of the receive signal in that receiver branch is squelched. Squelching of further processing of selected ones of the remaining receiver branches occurs after successive stages of signal processing in such branches. Gradual squelching of the receive signal in various branches is thereby effectuated. Because further processing of the receive signal is gradually squelched, after different processing stages of different ones of the receiver branches, the amount of processing required to process a receive signal and a multi-branch receiver is reduced.

In these and other aspects, therefore, apparatus, and an associated method, selectively squelches processing of signals at selected stages of selected ones of the receiver branches of a multi-branch receiver device. Each receiver branch of the receiver device receives a receive signal and each receiver branch has a first receiver stage, a second receiver stage, and at least a third receiver stage. A first squelch
element is positioned between the first receiver stage and the second receiver stage of
at least selected ones of the receiver branches. Each of the first squelch elements, when
actuated, squelches processing of the receive signal beyond the first receiver stage of
the receiver branch at which the first squelch element is positioned. A second squelch
element is positioned between the second receiver stage and the at least third receiver
stage of at least selected ones of the receiver branches. Each of the at least second
squelch elements, when actuated, squelches processing of the receive signal beyond the
second receiver stage of the receiver branch at which the second squelch element is
positioned. A controller is coupled to the first squelch elements, to the at least second
squelch elements, and to receive at least indications of operation of the first and second
receiver stages, respectively, of the receiver branches. The controller selectively
actuates the first squelch elements and the second squelch elements responsive to
reception of the at least indications of the operation of the first and second receiver
stages.

A more complete appreciation of the present invention and the scope thereof
can be obtained from the accompanying drawings which are briefly summarized below,
the following detailed description of the presently preferred embodiments of the
invention, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a functional block diagram of a multi-branch receiver which
includes an embodiment of the present invention as a portion thereof.

Figure 2 illustrates a functional block diagram of a multi-branch receiver
including another embodiment of the present invention as a portion thereof.

Figure 3 illustrates a partial, functional block and partial schematic diagram of
an embodiment of the present, invention operable in a cellular communication system.

Figure 4 illustrates a partial functional block, partial schematic diagram of a
cordless telephone system in which an embodiment of the present invention is operable.

Figure 5 illustrates a functional block diagram of a multi-branch receiver in
which an embodiment of the present invention is operable.
Figure 6 illustrates a method flow diagram listing the method steps of the method of an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

Referring first to Figure 1, a multi-branch receiver, shown generally at 10, in which an embodiment of the present invention is operable, is shown. The receiver 10 is here operable to receive a receive signal 12 transmitted to the receiver 10 by a remotely-positioned transmitter (not shown). The receiver 10 includes a plurality of m receiver branches 14, of which two are illustrated in the figure.

Each of the m receiver branches 14 includes circuitry, or provides other functionality, to permit recreation of the informational content of the signal actually transmitted by the remotely-positioned transmitter. Each of the receiver branches 14 is selectively coupled to a signal combiner 18.

The signal combiner 18 is operable to combine the signals processed in selected ones of the receiver branches 14. Appropriate combination of the receive signal received at selected ones of the receiver branches 14 permits a combined signal to be formed which better permits the informational content of the signal transmitted by the remotely positioned transmitter to be recreated.

Operation of an embodiment of the present invention facilitates operation of the multi-branch receiver. Signal-quality determinations are made of the receive signal received in the various receiver branches 14 during their processing. When a determination is made that the receive signal received in a particular receiver branch 14 is of poor signal quality, further processing of the receive signal in that receiver branch is squelched. Processing of the receive signal at all of the stages of each of the receiver branches is not required. If a determination is made after an early processing stage of the receiver branch that the signal-quality of the receive signal received thereat is of poor quality, further signal processing of the receive signal in that branch is squelched.

Each receiver branch 14 includes a transducer 22 for converting the receive signal 12 from electromagnetic energy-form into electrical energy. The transducers 22 are each coupled to digitizers and down-converters 24, operable in conventional manner to digitize and down-convert the signals applied thereto by the transducers 22.
In the illustrated embodiment, down-converted signals formed by the converters 24 are applied by way of lines 26 to signal strength detectors 28. The signal strength detectors detect, or otherwise measure, the signal strengths of the signals applied thereto. Indications of the detected, or otherwise measured, signal strengths are applied by way of lines 32 to a controller 34.

The controller 34 is operable to compare the signal strengths of the receive signals received upon each of the receiver branches 14 and to selectively squelch further processing of the receive signal in selected ones of the receiver branches 14. In one embodiment, the controller compares the values of the indications of the signal strengths applied thereto by way of lines 32 and squelches further processing of the receive signal in a selected n number of receiver branches having the lowest signal strength values. Thereby, further processing of the receive signal occurs in only a selected subset, formed of (m-n.) receiver branches 14.

The controller generates signals on lines 36 which, when applied to squelch elements 38 squelch further processing of the receive signal in the selected branches. In another embodiment, the controller 34 squelched further processing of the receive signal in branches in which the signal strengths of the receive signal are less than a selected threshold level.

Further processing of the receive signal occurs in the subset of (m-n) subset of receiver branches. In the exemplary embodiment, the receive signal is applied by way of lines 42 to correlators 44. The correlators 44 are operable to correlate the receive signal. In one embodiment, the receive signal includes a training sequence, and the training sequence is correlated.

Indications of the values of the correlations performed by the correlators 44 are provided to the controller 34 by way of lines 46. The controller is operable to compare values of the indications provided thereto. Responsive to such comparisons, the controller permits further processing of the receive signal in a subset of the (m-n) remaining receiver branches 14. In one embodiment, the controller 34 prevents further processing of the receive signal in receiver branches which exhibit the lowest o correlation values. Thereby, further processing of the receive signal is permitted in a second subset formed of (m-n-o) receiver branches. In another embodiment, the
controller prevents further processing of the receive signal in receiver branches 14 in
which the correlation values are less than a selected threshold.

To squelch further processing of the receive signal in the o receiver branches
14, signals are generated by the controller on lines 48 to the appropriate squelch
elements 52 to squelch further processing of the receive signal in the selected receiver
branches 14.

Thereafter, the receive signal in the second subset of (m-n-o) receiver branches
14 are applied by way of lines 54 to demodulators 56. The demodulators 56
demodulate the receive signal received thereat. Indications of the quality of the
demodulation of the receive signal are applied to the controller 34 by way of lines 58.
In one embodiment, the indications of the demodulation quality are values generated
by decoders forming portions of the demodulators 56.

The controller 34 is operable to compare the values of the indications of the
demodulation qualities applied thereto. In one embodiment, the controller permits
continued processing of the receive signal in only a third subset of (m-n-o-p) receiver
branches 14. In one embodiment, the controller prevents further processing of the
receive signal in the receiver branches 14 which exhibit the lowest p demodulation
qualities. In another embodiment, the controller 34 prevents further processing of the
receive signal in receiver branches in which the indications of the demodulation quality
levels are less than a threshold level.

The controller 34 generates signals on line 62 which are applied to squelch
element 64 to prevent further processing of the receive signal in the p receiver
branches. The receive signal in the third subset of (m-n-o-p) receiver branches is
applied to the signal combiner 18 to be combined thereat. A combined signal generated
on line 68 is thereafter processed by additional receiver circuitry, not shown.

Squelching of further processing of a receive signal received at the receiver
branches 14 occurs subsequent to various stages of processing of the receive signal.
If a determination is made that the signal quality of the receive signal received at a
selected receiver branch 14 is of low signal quality, further processing of the receive
signal is squelched. Additional processing of the receive signal in such signal lines is
thereby avoided. Reduction in processing required of a multi-branch receiver is thereby possible.

Figure 2 illustrates a multi-branch receiver 100 in which an embodiment of the present invention is also operable. The receiver 100 also includes a plurality of m signal branches for receiving a receive signal 12. Each of the m receiver branches includes a transducer 122 for converting the electromagnetic energy of which the receive signal 12 is formed into electrical energy.

Sequences of the receive signal are then applied to a first-stage processor 128. The first-stage processor processes the sequences of the receive signal detected by each of the transducers 122. First-stage processing is performed by the processor 128. Such processing, for instance, comprises measuring the signal strengths of the receive signals of the plurality of signal branches. Comparisons between the first-stage, processed values of the receive signal received at the various receiver branches are compared by the flat squelcher 132.

The first squelcher 132 is coupled to the first-stage processor 128 by way of lines 134. The first squelcher compares values of the first-stage, processed signals. Responsive to such comparison, the squelcher 132 squelches further processing of the receive signal on n receiver branches. The receive signal received at a first subset of (m-n) receiver branches is provided to a second-stage processor, 136 by way of lines 138.

The second-stage processor 136 second-stage processes the receive signals of the first subset of (m-n) receiver branches. The second-stage processor, for example, correlates training sequences of the receive signal.

A second squelcher 142, coupled to the second-stage processor 136 by way of lines 144, receives indications of the second-stage, processed signals processed by the processor 136. Comparisons of values of such indications are made by the second squelcher 142. Responsive to such comparisons, the second squelched 142 squelches further processing of the receive signal in o branches of the receiver. The second squelcher permits further processing of the receive signal on a second subset of (m-n-o) branches of the receiver.
The receive signal received at the second subset of (m-n-o) receiver branches is applied to a third-stage processor 146 by way of lines 148. The third-stage processor third-stage processes the receive signals applied thereto. In one embodiment, the third-stage processor demodulates the receive signal received on the second subset of receiver branches.

A third squelcher 152 is coupled to the third-stage processor 146 by way of lines 154. The third squelcher compares the third-stage processed signals applied thereto and squelches further processing of the receive signal on p receiver branches. Thereby, the third squelcher permits further processing of a third subset of (m-n-o-p) receiver branches.

Not separately illustrated additional receiver-stage processors and squelchers can also form portions of the receiver 10. Such additional processors and squelchers are further operable to gradually squelch processing of the receive signal received on various receiver branches. As the processing of the receive signal is squelched after various processing stages of the receiver instead of after complete processing of the receive signal at each receiver branch, processing required to process a receive signal at a multi-branch receiver is reduced.

Figure 3 illustrates a cellular communication system 200 in which a multi-branch receiver 10 forms a portion. The multi-branch receiver 10 forms a portion of a base transceiver station 204. The base station 204 is operable to transceive communication signals with a remotely-positioned mobile subscriber unit 206.

Transmitter circuitry 208 of the base station 204 generates downlink signals that are transmitted to the mobile subscriber unit 206. And, the multi-branch receiver 10 is operable to receive uplink signals transmitted by the mobile subscriber unit 206.

The cellular communication system 200 is exemplary of a communication system constructed according to the specifications of a GSM (Global System for Mobile communications) system. The base station 204 is coupled to a base station controller (BSC) 212. The BSC 212 is coupled, in turn, to a mobile switching center (MSC) 214. And, in turn, the MSC 214 is coupled to a public switched telephone network (PSTN) 216. The PSTN 216 permits connection to a remote communication station 218.
In the exemplary embodiment of the Figure, the multi-branch receiver includes an antenna matrix 222 coupled to each of the receiver branches 14 of the multi-branch receiver. The antenna matrix, such as a Butler matrix, forms a plurality of antenna patterns 226. The antenna patterns 226 are selected such that the antenna coverage provided by such patterns encompass a cell 228 defined by the base station 204.

When a mobile terminal 206 is positioned at a location in the cell 228, the receive signal formed of an uplink transmission by the terminal 206 will be of better signal quality in some of the receiver branches than in others of the receiver branches. As the receive signal is processed in various receiver branches, determinations are made of the signal quality of the receive signal received in such signal branches. Further processing of the receive signal is selectively squelched, as described above. Thereby, the amounts of processing required to process the receive signal in the various receiver branches is reduced.

Figure 4 illustrates a cordless telephone system 300 in which an embodiment of the present invention is operable. The cordless telephone system 300 is here illustrated to be constructed in a multi-story building structure 302. Antenna devices 322 are distributed upon the floors of the multi-story structure. A separate receiver branch of the multi-branch receiver 100 is coupled to a separate antenna device 322. When uplink signals are transmitted by a mobile terminal 306 positioned within the building structure, the receive signal is detected in certain of the receiver branches more strongly than in others of the receiver branches.

In the illustration of the Figure, the two antenna devices 322 positioned on the top floor of the building structure 302 are positioned to detect best the uplink signal generated by a mobile terminal positioned upon the top floor of the building structure. Receiver branches to which the two antenna devices 322 positioned on the top floor are coupled exhibit the best signal characteristics. During operation of an embodiment of the present invention, as described above, the receive signal applied on such two receiver branches are processed while processing of receive signals on the others of the receiver branches are squelched. Thereby, the advantages of utilization of a multi-branch receiver are provided while reducing the amount of processing required to permit operation of the receiver.
Figure 5 illustrates a multi-branch receiver, again having \( m \) branches for receiving a receive signal 12 at transducers 442 of the respective receiver branches. The transducers 442 convert the receive signal into electrical form. The receive signals are digitized, down-converted and synchronized by a signal converter 444.

Sequences of the receive signal received at the respective receiver branches are provided to a processor 446 which stores the sequences in a memory element 448. The processor 446 thereafter selectively retrieves the stored sequences, thereby to permit the processing device to retrieve stored sequences of the receive signal. The processor 446 is operable to perform the processing, such as that described above with respect to the processors 128, 136, and 146, shown in Figure 2. The processor is further operable to perform the functions of the squelchers 132, 142, and 152. And, the processor is further operable to combine the receive signal of the selected receiver branches. Successive sequences of the receive signal are processed by the processing device. And, during processing of each sequence of the receive signal, further processing of a sequence of a receive signal on selected receiver branches is selectively squelched, as described above. A combined signal is generated on the line 456 and is applied to other receiver circuitry (not shown).

Figure 6 illustrates a method, shown generally at 500, listing the method steps of the method of an embodiment of the present invention. The method 500 may, for example, be carried out by the processing device 432, shown in Figure 5.

The method selectively squelches processing of a receive signal at selected stages of selected ones of receiver branches of a multi-branch receiver. In one exemplary embodiment, the method is operable in a base station of a cellular communication system. In another embodiment, the method is operable in a cordless telephone system. The method is analogously operable in other communication systems.

First, and as indicated by the block 502, the receive signal is processed at the first receiver stages of the receiver branches. Then, and as indicated by block 504, further processing of the receive signal is selectively squelched in at least one receiver branch subsequent to processing thereof at the first receiver stage. Thereby, further processing of the receive signal is permitted in a first subset of the receiver branches.
Then, and as indicated by the block 506, the receive signal is processed at the second receiver stages of the first subset of the receiver branches. And, as indicated by the block 508, further processing of the receive signal is selectively squelched in at least one additional receiver branch subsequent to processing thereof at the second receiver stage. Thereby, further processing of the receive signal is permitted in a second subset of the receiver branches. The second subset forms a subset of the first subset of receiver branches.

Operation of the various embodiments of the present invention permit a reduction in the processing required of a multi-branch receiver to process a receive signal in the receiver branches of the receiver. Determinations are made of the signal qualities of the receive signal at various stages of processing in the receiver branches. When a determination is made that the receive signal received at a particular receiver branch is of poor quality, further processing of the receive signal in such branch is squelched.

Presently-preferred embodiments of the present invention have been described with a degree of particularity. The previous descriptions are of preferred examples for implementing the invention, and the scope of the invention should not necessarily be limited by this description. The scope of the present invention is defined by the following claims.

The previous description is of a preferred embodiment for implementing the invention, and the scope of the invention should not necessarily be limited by this description. The scope of the present invention is instead defined by the following claims.
WHAT IS CLAIMED IS:

1. In a multi-branch receiver device, each receiver branch of the receiver device for receiving a receive signal and each receiver branch having a first receiver stage, a second receiver stage, and at least a third receiver stage, an improvement of an apparatus for selectively squelching processing of signals at selected stages of selected ones of the receiver branches, said apparatus comprising:
   a first squelch element positioned between the first receiver stage and the second receiver stage of at least selected ones of the receiver branches, each of said first squelch elements, when actuated, for squelching processing of the receive signal beyond the first receiver stage of the receiver branch at which said first squelch element is positioned;
   at least a second squelch element positioned between the second receiver stage and the at least third receiver stage of at least selected ones of the receiver branches, each of said at least second squelch elements, when actuated, for squelching processing of the receive signal beyond the second receiver stage of the receiver branch at which said second squelch element is positioned; and
   a controller coupled to said first squelch elements, to said at least second squelch elements, and to receive at least indications of operation of the first and second receiver stages, respectively, of the receiver branches, said controller for selectively actuating said first squelch elements and said second squelch elements responsive to reception of the at least indications of the operation of the first and second receiver stages.

2. The apparatus of claim 1 wherein the first receiver stages of the receiver branches of the multi-branch receiver comprise signal strength measurers for measuring signal strengths of the receive signal received at the receiver branches, wherein said controller receives indications of the signal strengths of the receive signal measured by the signal strength measurers, and wherein said controller compares values of the indications of the signal strengths measured by the signal strength measurers.
3. The apparatus of claim 2 wherein said controller selectively actuates said first squelch elements responsive to comparisons of the values of the indications of the signal strengths.

4. The apparatus of claim 3 wherein said controller actuates selected ones of said first squelch elements, thereby to permit further processing of the receive signal at a first receiver-branch subset of the receiver branches.

5. The apparatus of claim 4 wherein the selected ones of said first squelch elements actuated by said controller are selected to exclude from further processing of the receive signal at least one receiver branch having a signal strength measurer which provides indications of a smallest signal strength.

6. The apparatus of claim 4 wherein the second receiver stages of the receiver branches of the multi-branch receiver comprise correlators for correlating the receive signal received at the receiver branches, wherein said controller receives indications of levels of correlation correlated by the correlators, and wherein said controller compares values of the indications of the levels of correlation correlated by said correlators.

7. The apparatus of claim 6 wherein said controller selectively actuates said second squelch elements responsive to comparisons of the values of the indications of the correlations.

8. The apparatus of claim 7 wherein said controller actuates selected ones of said second squelch elements, thereby to permit further processing of the receive signal at a second receiver-branch subset of the receiver branches, the second receiver-branch subset also a subset of the first receiver-branch subset.

9. The apparatus of claim 8 wherein the selected ones of said second squelch elements actuated by said controller are selected to exclude from further
processing of the receive signal at least one receiver branch having a correlator which provides indications of a lowest level of correlation.

10. The apparatus of claim 8 wherein the receiver device further comprises a signal combiner selectively coupled to the receiver branches for combining the receive signal received and processed at the receiver branches, wherein the at least third receiver stages of the receiver branches comprise demodulators for demodulating the receive signal received at the receiver branches and wherein said at least the second squelch element comprises a third squelch element positioned between the demodulator of the at least selected ones of the receiver branches and the signal combiner.

11. The apparatus of claim 10 wherein said controller further receives indications of demodulation qualities of demodulations performed by the demodulators, and wherein said controller further compares values of the indications of the demodulation qualities provided thereto by the demodulation.

12. The apparatus of claim 1 wherein said controller selectively actuates said third squelch elements responsive to comparisons of the values of the indications of the demodulation qualities.

13. The apparatus of claim 12 wherein said controller actuates selected ones of said third squelch elements, thereby to permit application of the receive signal processed by selected ones of the receiver branches to the signal combiner.

14. The apparatus of claim 13 wherein the selected ones of the third squelch elements actuated by said controller are selected to exclude from application to the signal combiner of the receive signal processed by the selected ones of the receiver branches having values of demodulation qualities of lowest quality levels.

15. The apparatus of claim 1 wherein the first receiver stages of the receiver branches of the multi-branch receiver comprise correlators for correlating the receive
signal received at the receiver branches, wherein said controller receives indications of correlations performed by the correlators, and wherein said controller compares values of the correlations performed by the correlators.

16. The apparatus of claim 15 wherein the second receiver stages comprise demodulators for demodulating the receive signal received at the receiver branches and wherein said controller further receives indications of demodulation qualities of demodulations performed by the demodulators and compares values of the indications of the demodulation qualities provided thereto by the demodulators.

17. In a method for receiving a receive signal at a multi-branch receiver, each branch of the multi-branch receiver having a first receiver stage, a second receiver stage, and at least a third receiver stage, an improvement of a method for selectively squelching processing of the receive signals at selected stages of selected ones of the receiver branches, said method comprising the steps of:

processing the receive signal at the first receiver stages of the receiver branches;

selectively squelching further processing of the receive signal subsequent to processing thereof at the first receiver stage, thereby to permit further processing of the receive signal in a first subset of the receiver branches;

processing the receive signal at the second receiver stages of the first subset of the receiver branches; and

selectively squelching further processing of the receive signal subsequent to processing thereof at the second receiver stage, thereby to permit further processing of the receive signal in a second subset of the receiver branches, the second subset forming a subset of the first subset of receiver branches.

18. In a multi-branch receiver device, each receiver branch of the receiver device for receiving a receive signal and each receiver branch having a first receiver stage, a second receiver stage, and at least a third receiver stage, an improvement of
an apparatus for selectively squelching processing of signals at selected stages of selected ones of the receiver branches, said apparatus comprising:

a first receiver-stage processor coupled to receive indications of the receive signal received at the receiver branches, said first receiver-stage processor for first-stage-processing of the receive signal received at the receiver branches;

a first squelcher operative responsive to processing of the receive signal by said first receiver-stage processor, said first squelcher for selectively squelching further processing of the receive signal subsequent to processing thereof at the first receiver stage, thereby to permit further processing of the receive signal in a first subset of the receiver branches;

a second receiver-stage processor coupled to receive indications of the receive signal received at the first subset of receiver branches, once processed by said first receiver-stage processor, said second receiver-stage processor for second-stage processing of the receive signal received at the receiver branches;

a second squelcher operative responsive to processing of the receive signal by said second receiver-stage processor, said second squelcher for selectively squelching further processing of the receive signal subsequent to processing thereof at the second receiver stage, thereby to permit further processing of the receive signal in a second subset of the receiver branches, the second subset forming a subset of the first subset of receiver branches.

19. The apparatus of claim 18 wherein said first receiver-stage processor comprises a processing device and a first signal-processing algorithm executable in said processing device and wherein said second receiver-stage processor comprises a second signal-processing algorithm executable in said processing device.

20. The apparatus of claim 19 wherein said first squelcher comprises a first squelch algorithm executable in said processing device and wherein said second squelcher comprises a second squelch algorithm executable in said processing device.
21. The apparatus of claim 18 wherein said first receiver-stage processor measures signal strengths of the receive signal received at the receiver branches.

22. The apparatus of claim 21 wherein said first squelcher squelches further processing of the receive signal in at least the receiver branch having a signal strength, as measured by said first receiver-stage processor, of a smallest signal strength level.

23. The apparatus of claim 18 wherein said second receiver stage processor correlates the receive signal received at the first subset of the receiver branches.

24. The apparatus of claim 23 wherein said second squelcher squelches further processing of the receive signal in at least the receiver branch of the first subset of receiver branches which exhibits a lowest level of correlation, determined by said second receiver stage processor.

25. The apparatus of claim 18 wherein said apparatus further comprises a third receiver-stage processor coupled to receive indications of the receive signal received at the second subset of receiver branches, once processed by the second receiver-stage processor, said third receiver-stage processor for third-stage processing of the receive signal received at the receiver branches.

26. The apparatus of claim 25 further comprising a third squelcher operative responsive to processing of the receive signal by said third receiver-stage processor, said third squelcher for selectively squelching further processing of the receive signal in a third subset of the receiver branches, the third subset forming a subset of the second subset of receiver branches.

27. The apparatus of claim 26 wherein said third receiver-stage processor comprises a processing device and a third signal-processing algorithm executable in said processing device and wherein said third squelcher comprises a third squelch algorithm executable in said processing device.
28. The apparatus of claim 26 wherein said third receiver-stage processor demodulates the receive signal received at the third subset of the receiver branches.

29. The apparatus of claim 28 wherein said squelcher squelches further processing of the receive signal in at least the receiver branch of the third subset of receiver branches which exhibits a demodulation quality of lowest quality levels.
FIG. 2

100

FIRST STAGE PROCESSOR

FIRST SQUELCHER

SECOND STAGE PROCESSOR

SECOND SQUELCHER

THIRD STAGE PROCESSOR

THIRD SQUELCHER

FIG. 5

SIGNAL CONVERTER

PROCESSOR

MEMORY

FIG. 6

PROCESS THE RECEIVE SIGNAL AT THE FIRST RECEIVER STAGES

SELECTIVELY SQUELCH FURTHER PROCESSING

PROCESS THE RECEIVE SIGNAL AT THE SECOND RECEIVER STAGES

SELECTIVELY SQUELCH FURTHER PROCESSING
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

| IPC   | H03G3/34 |

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

| IPC   | H03G |

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

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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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**Data of the actual completion of the international search**

30 January 1998

**Date of mailing of the international search report**

06/02/1998

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Blaas, D-L

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