What is claimed is:

1. A method comprising:

receiving a radio signal including a digital portion modulated by a series of symbols each including a plurality of samples;

computing correlation points between endpoint samples in cyclic-prefix regions of adjacent symbols; and

using the correlation points to produce a digital signal quality metric.

2. The method of claim 1, further comprising:

using the signal quality metric to select one or more antenna elements to be connected to a receiver input.

3. The method of claim 1, wherein the radio signal includes upper and lower sidebands and the step of computing correlation points comprises:

placing the endpoint samples for symbols received on the upper and lower sidebands in vectors;

frequency shifting the sideband vectors to center them at 0 Hz;

lowpass filtering the vectors;

performing a conjugate multiply and fold operation on the vectors to produce correlation vector results for the upper and lower sidebands;

normalizing the correlation results to produce normalized correlation results;

using the correlation vector results and the normalized correlation results to produce a quality value for the upper and lower sidebands; and

using the quality value for the upper and lower sidebands to produce a digital signal quality metric.

4. The method of claim 3, wherein the digital signal quality metric has a value between 0 and 1.

5. The method of claim 1, wherein the correlation points are computed for 6 endpoint samples in the symbols.

6. An apparatus comprising:

a radio receiver including an input for receiving a radio signal having a digital portion modulated by a series of symbols, each including a plurality of samples, and a

processor for computing correlation points between samples in cyclic-prefix regions of the symbols to produce a digital signal quality metric.

7. The apparatus of claim 6, further comprising:

a plurality of antenna elements for receiving the radio signal; and

a switch for connecting one or more of the antenna elements to the receiver input in response to the digital signal quality metric.

8. The apparatus of claim 6, wherein the processor places the endpoint samples for symbols received on the upper and lower sidebands in vectors; frequency shifts the sideband vectors to center them at 0 Hz; lowpass filters the vectors; performs a conjugate multiply and fold operation on the vectors to produce correlation vector results for the upper and lower sidebands; normalizes the correlation results to produce normalized correlation results; uses the correlation vector results and the normalized correlation results to produce a quality value for the upper and lower sidebands; and uses the quality value for the upper and lower sidebands to produce a digital signal quality metric.

9. The apparatus of claim 8, wherein the digital signal quality metric has a value between 0 and 1.

10. The apparatus of claim 8, wherein the correlation points are computed for 6 endpoint samples in the symbols.

11. A method comprising:

receiving a radio signal including an analog modulated portion;

digitally sampling an analog modulated portion of the radio signal to produce a plurality of samples;

using a ratio between an average magnitude and an RMS magnitude of a block of the samples to compute an analog signal quality metric.

12. The method of claim 11, wherein the radio signal further includes a digitally modulated portion and the block of samples spans about 1 OFDM symbol in the digitally modulated portion.

13. The method of claim 12, wherein the analog signal quality metric is determined using samples from 16 symbols.

14. The method of claim 11, wherein the ratio is raised to a power p such that subsequent averaging of analog signal quality metric values over time is not biased from the nominal threshold of about 0.5.

15. The method of claim 14, wherein the value of p is 8.

16. The method of claim 11, wherein the analog signal quality metric (*ASQM*) is calculated as:

$$ASQM = \left(\frac{2 \cdot \left(\sum_{k=0}^{K-1} |x_k| \right)^2}{K \cdot \sum_{k=0}^{K-1} |x_k|^2} \right)^p$$

where x_k is the k^{th} sample of the block of samples, and k is sample index from 0 to K-1.

17. The method of claim 11, wherein the analog signal quality metric has a value in a range of 0 to 1.

18. An apparatus comprising:

a radio receiver including an input for receiving a radio signal having an analog modulated portion; and a processor for digitally sampling the analog modulated portion to produce a plurality of samples, and using a ratio between an average magnitude and an RMS magnitude of a block of the samples to compute an analog signal quality metric.

19. The apparatus of claim 18, further comprising:

a plurality of antenna elements for receiving the radio signal; and

a switch for connecting one or more of the antenna elements to the receiver input in response to the analog signal quality metric.

20. The apparatus of claim 18, wherein the radio signal further includes a digitally modulated portion and the block of samples spans about 1 OFDM symbol in the digitally modulated portion.

21. The apparatus of claim 20, wherein the analog signal quality metric is determined using samples from 16 symbols.

22. The apparatus of claim 18, wherein the ratio is raised to a power p such that subsequent averaging of analog signal quality metric values over time is not biased from the nominal threshold of about 0.5.

23. The apparatus of claim 22, wherein the value of p is 8.

24. The apparatus of claim 18, wherein the analog signal quality metric (*ASQM*) is calculated as:

$$ASQM = \left(2 \cdot \frac{\left(\sum_{k=0}^{K-1} x_k \cdot x_{k+1} \right)}{K \cdot \sum_{k=0}^{K-1} x_k^2} \right)$$

where x_k is the k^{th} sample of the block of samples, and k is sample index from 0 to K-1.

25. The apparatus of claim 18, wherein the analog signal quality metric has a value in a range of 0 to 1.

26. A method comprising:

(a) receiving a radio signal on a plurality of antenna elements;

(b) computing a signal quality metric for the signal received on each of the antenna elements;

(c) determining a difference value between the signal quality metric for the currently selected antenna element and the signal quality metric for each of the other antenna elements;

(d) finding the minimum difference value;

(e) determining (1) if a dwell value is greater than a multiple of the minimum difference value and (2) if the signal quality metric for first antenna element is less than a threshold value; and

(f) if either or both of (1) or (2) in step (e) is true, then switching from the currently selected element to one of the other antenna elements for supplying the radio signal to a receiver and repeating steps (b) through (e).

27. The method of claim 26, further comprising:

producing a switch control signal computed in software in the receiver baseband processor, then generate hardware signal output to an external hardware switch; and

connecting one or more of the antenna elements to an input of a receiver in response to the switch control signal.

28. The method of claim 26, wherein the threshold value is about 0.5.

29. The method of claim 26, wherein the dwell value is adjusted based on the signal quality metric for the currently selected antenna element.

30. The method of claim 26, wherein the dwell value is adaptively increased as a function of the signal quality metric.

31. An apparatus comprising:

a plurality of antenna elements for receiving a radio signal;

a switch for connecting one or more of the antenna elements to an input of a receiver; and

a processor for (a) computing a signal quality metric for the signal received on each of the antenna elements, (b) determining a difference value between the signal quality metric for the currently selected antenna element and the signal quality metric for each of the other antenna elements, (c) finding the minimum difference value, (d) determining (1) if a dwell value is greater than a multiple of the minimum difference value and (2) if the signal quality metric for first antenna element is less than a threshold value, and (e) if either or both of (1) or (2) in step (e) is true, then controlling the switch to switch from the currently selected element to one of the other antenna elements for supplying the radio signal to the receiver and repeating steps (a) through (d).

32. The apparatus of claim 31, wherein the processor computes a switch control signal in software and generates a hardware signal output to control the switch.

33. The apparatus of claim 31, wherein the threshold value is about 0.5.

34. The apparatus of claim 31, wherein the dwell value is adjusted based on the signal quality metric for the currently selected antenna element.

35. The apparatus of claim 31, wherein the dwell value is adaptively increased as a function of the signal quality metric.

36. A method comprising:

receiving a radio signal on a plurality of antenna elements;

computing a signal quality metric for the signal received on each of the antenna elements;

using the signal quality metric for an antenna element currently supplying the radio signal to a receiver to determine if diversity switching is desired; and

producing a proxy control signal that causes a diversity switch control to implement a desired switching of the antenna elements.

37. The method of claim 36, wherein the proxy control signal comprises:

an unmodulated FM intermediate frequency carrier signal when no switching is desired; or

a noise-like FM intermediate frequency signal when switching is desired.

38. A method comprising:

receiving a radio signal on a plurality of antenna elements, wherein the radio signal includes an analog modulated portion and a digitally modulated portion;

computing an analog signal quality metric for the analog modulated portion of the received radio signal;

computing a digital signal quality metric for the digital modulated portion of the received radio signal; and

using either the analog signal quality metric or the digital signal quality metric to select one or more of the antenna elements to be connected to a receiver input, wherein a reaction time for selecting the antenna elements based on the analog signal quality metric is shorter than a reaction time for selecting the antenna elements based on the digital signal quality metric.

39. An apparatus comprising:

a plurality of antenna elements for receiving a radio signal, wherein the radio signal includes an analog modulated portion and a digitally modulated portion;

a switch for connecting one or more of the antenna elements to an input of a receiver; and

a processor for computing an analog signal quality metric for the analog modulated portion of the received radio signal, computing a digital signal quality metric for the digital modulated portion of the received radio signal, and using either the analog signal quality metric or the digital signal quality metric to produce a switch control signal for selecting one or more of the antenna elements to be connected to a receiver input; wherein a reaction time for selecting the antenna elements based on the analog signal quality metric is shorter than a reaction time for selecting the antenna elements based on the digital signal quality metric.

Claims

1. A method comprising:

(a) receiving a radio signal on a plurality of antenna elements;

(b) computing a signal quality metric for the signal received on each of the antenna elements;

(c) determining a difference value between the signal quality metric for a currently selected antenna element and the signal quality metric for each of the other antenna elements;

(d) finding the minimum difference value;

(e) determining (1) if a dwell value is greater than a multiple of the minimum difference value and (2) if the signal quality metric computed for the currently selected antenna element is less than a threshold value; and

(f) if either or both of (1) or (2) in step (e) is true, then switching from the currently selected element to one of the other antenna elements for supplying the radio signal to a receiver and repeating steps (b) through (e).

2. The method of claim 1, further comprising:

producing a switch control signal computed in software in the receiver baseband processor, generating a hardware signal output to an external hardware switch; and

connecting one or more of the antenna elements to an input of a receiver in response to the switch control signal.

3. The method of claim 1, wherein the threshold value is about 0.5.

4. The method of claim 1, wherein the dwell value is adjusted based on the signal quality metric for the currently selected antenna element.

5. The method of claim 1, wherein the dwell value is adaptively increased as a function of the signal quality metric.

6. An apparatus comprising:

a plurality of antenna elements configured to receive a radio signal;

a switch configured to connect one or more of the antenna elements to an input of a receiver; and

a processor configured to (a) compute a signal quality metric for the signal received on each of the antenna elements, (b) determine a difference value between the signal

quality metric for a currently selected antenna element and the signal quality metric for each of the other antenna elements, (c) find the minimum difference value, (d) determine (1) if a dwell value is greater than a multiple of the minimum difference value and (2) if the signal quality metric computed for the currently selected antenna element is less than a threshold value, and (e) if either or both of (1) or (2) in step (e) is true, then control the switch to switch from the currently selected element to one of the other antenna elements to supply the radio signal to the receiver and repeat (a) through (d).

7. The apparatus of claim 6, wherein the processor computes a switch control signal in software and generates a hardware signal output to control the switch.

8. The apparatus of claim 6, wherein the threshold value is about 0.5.

9. The apparatus of claim 6, wherein the dwell value is adjusted based on the signal quality metric for the currently selected antenna element.

10. The apparatus of claim 6, wherein the dwell value is adaptively increased as a function of the signal quality metric.

11. A method comprising:

receiving a radio signal on a plurality of antenna elements, wherein the radio signal includes a digitally modulated component;

computing a digital signal quality metric for the signal received on each of the antenna elements;

using the digital signal quality metric for an antenna element currently supplying the radio signal to a receiver to determine if diversity switching is desired; and

producing a synthesized FM intermediate frequency proxy control signal that causes a diversity switch control to implement a desired switching of the antenna elements.

12. The method of claim 11, wherein the synthesized FM intermediate frequency proxy control signal comprises:

an unmodulated FM intermediate frequency carrier signal when no switching is desired; or

a noise-like FM intermediate frequency signal when switching is desired.

13. The method of claim 11, wherein the synthesized FM intermediate frequency proxy control signal is produced in software in a baseband processor of a receiver.

14. The method of claim 11, wherein the radio signal comprises:

a hybrid signal including an analog FM component and the digitally modulated component, and the digital signal quality metric is based on the signal quality of the digitally modulated component of the hybrid signal.