

The diversity antenna **300** is very convenient for application in the 5 to 6 GHz frequency band where low-cost and antenna diversity are desired. Its multiple antenna element configuration is well suited to the form factor limits imposed by the dimensions of small cards, such as a PCMCIA. It can physically reside on a portion of such a card, and it can use a combination of printed copper (microstrip) techniques and lumped-element devices to implement the actual antenna elements. Thus, multiple antenna elements are provided in a small form-factor that deliver good diversity performance at low cost, which is particularly suited for use in wireless local area networks (WLAN) operating in the 5 GHz frequency bands.

U.S. patent application Ser. No. 09/693,465, filed Oct. 19, 2000, entitled DIVERSITY ANTENNA STRUCTURE FOR WIRELESS COMMUNICATIONS, by inventor James A. Crawford, is hereby fully incorporated into the present application by reference.

While the invention herein disclosed has been described by means of specific embodiments and applications thereof, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope of the invention set forth in the claims.

What is claimed is:

1. An antenna structure, comprising:

a card configured for insertion into a slot of a device; at least two antenna elements attached to the card at a first end thereof, wherein the antenna elements are located and configured to provide at least one antenna gain pattern that provides at least some coverage on one side of the card and at least one antenna gain pattern that provides at least some coverage on another side of the card so that at least some coverage is provided on both sides of the card; and

active circuitry attached to the card and coupled to the at least two antenna elements;

wherein at least two of the at least two antenna elements are sufficiently spaced apart so as to achieve spatial diversity.

2. An antenna structure in accordance with claim 1, wherein the at least two antenna elements are spaced apart by a distance equal to or greater than 0.5λ for a predetermined frequency of operation.

3. An antenna structure in accordance with claim 2, wherein the predetermined frequency of operation falls within 5 to 6 gigahertz (GHz).

4. An antenna structure in accordance with claim 1, wherein a first of the at least two antenna elements comprises a polarization that is orthogonal to a polarization of a second of the at least two antenna elements so as to achieve polarization diversity.

5. An antenna structure in accordance with claim 4, wherein the first antenna element comprises an active edge that is orthogonal to an active edge of the second antenna element.

6. An antenna structure in accordance with claim 4, wherein the first antenna element comprises a patch antenna and the second antenna element comprises a monopole antenna.

7. An antenna structure in accordance with claim 4, wherein the active circuitry comprises;

a first power amplifier coupled to the first antenna element; and

a second power amplifier coupled to the second antenna element.

8. An antenna structure in accordance with claim 1, wherein the card comprises connectors located at a second end thereof configured for engagement with an interface slot.

9. An antenna structure in accordance with claim 1, wherein at least one antenna element is located on a first surface of the card and at least one antenna element is located on a second surface of the card.

10. An antenna structure in accordance with claim 1, wherein one or more of the at least two antenna elements comprises a patch antenna.

11. An antenna structure in accordance with claim 1, wherein one or more of the at least two antenna elements comprises a monopole antenna.

12. An antenna structure in accordance with claim 1, wherein one or more of the at least two antenna elements comprises a vertically polarized antenna.

13. An antenna structure in accordance with claim 1, wherein one or more of the at least two antenna elements comprises a horizontally polarized antenna.

14. An antenna structure in accordance with claim 1, wherein the at least two antenna elements comprise four antenna elements.

15. An antenna structure in accordance with claim 14, wherein three of the antenna elements are located on a first surface of the card and one of the antenna elements is located on a second surface of the card.

16. An antenna structure in accordance with claim 14, wherein all four of the antenna elements comprise patch antennas.

17. An antenna structure in accordance with claim 14, wherein two of the antenna elements comprise patch antennas and two of the antenna elements comprise monopole antennas.

18. An antenna structure in accordance with claim 1, wherein the at least two antenna elements comprise six antenna elements.

19. An antenna structure in accordance with claim 18, wherein three of the antenna elements are located on a first surface of the card and three of the antenna elements is located on a second surface of the card.

20. An antenna structure in accordance with claim 18, wherein two of the antenna elements comprise patch antennas and four of the antenna elements comprise monopole antennas.

21. An antenna structure, comprising:

a card configured for insertion into a slot of a device; at least two antenna elements attached to the card at a first end thereof, wherein the antenna elements are located and configured to provide at least one antenna gain pattern that provides at least some coverage on one side of the card and at least one antenna gain pattern that provides at least some coverage on another side of the card so that at least some coverage is provided on both sides of the card; and

active circuitry attached to the card and coupled to the at least two antenna elements;

wherein a first of the at least two antenna elements comprises a polarization that is orthogonal to a polarization of a second of the at least two antenna elements so as to achieve polarization diversity.

22. An antenna structure in accordance with claim 21, wherein the first antenna element comprises an active edge that is orthogonal to an active edge of the second antenna element.

23. An antenna structure in accordance with claim 21, wherein the first antenna element comprises a patch antenna and the second antenna element comprises a monopole antenna.

24. An antenna structure in accordance with claim 21, wherein the active circuitry comprises;