CLAIMS

1. An antenna, comprising:

a plurality of waveguide antenna elements arranged in a first array configured to operate with a first polarization;

a plurality of waveguide output ports arranged in a second array configured to operate with a second polarization, wherein the second polarization is different from the first polarization; and

a polarization-modification layer with channels defined therein, and

a rotation component coupled to the polarization-modification layer,

wherein the polarization-modification layer is disposed between the waveguide antenna elements and the waveguide output ports,

wherein the channels are oriented at a first angle with respect to the waveguide antenna elements and at a second angle with respect to the waveguide output ports,

wherein the channels are configured to receive input electromagnetic waves having the first polarization and transmit output electromagnetic waves having a first intermediate polarization, and

wherein the waveguide output ports are configured to receive input electromagnetic waves and radiate electromagnetic waves having the second polarization, and wherein the rotation component is configured to adjust a position of the polarization-modification layer relative to the waveguide antenna elements and the waveguide output ports.

2. The antenna of claim 1, wherein the waveguide antenna elements and the waveguide output ports are substantially rectangular in shape.

3. The antenna of claim 1, wherein the waveguide antenna elements and the waveguide output ports are substantially circular in shape.

4. The antenna of claim 1, wherein the channels are shaped as rounded rectangles.

5. The antenna of claim 1, wherein the first polarization is orthogonal to the second

polarization.

6. The antenna of claim 1, wherein the first angle is between 44 and 46 degrees and wherein the second angle is between 44 and 46 degrees.

7. The antenna of claim 1, wherein a thickness of the polarization-modification layer is between a half and a whole wavelength of the input electromagnetic waves having the first polarization.

8. The antenna of claim 1, wherein the channels are filled with a dielectric material.

9. The antenna of claim 1, further comprising a secondary polarization-modification layer with secondary channels defined therein,

wherein the secondary polarization-modification layer is disposed between the polarization-modification layer and the waveguide output ports,

wherein the secondary channels are oriented at a third angle with respect to the waveguide antenna elements and at a fourth angle with respect to the waveguide output ports,

wherein the secondary channels are configured to receive input electromagnetic waves having the first intermediate polarization and transmit output electromagnetic waves having a second intermediate polarization, and

wherein the first intermediate polarization is different from the second intermediate polarization.

10. The antenna of claim 9, wherein a bandwidth of usable frequencies associated with the radar antenna lies within the 77GHz band.

11. The antenna of claim 9, wherein the first angle is between 25 and 35 degrees, wherein the second angle is between 50 and 70 degrees, wherein the third angle is between 50 and 70 degrees, and wherein the fourth angle is between 25 and 35 degrees.

12. A radar system, comprising:

a transmitter, comprising:

a plurality of first waveguide antenna elements arranged in a first array configured to operate with a first polarization;

a first polarization-modification layer with first channels defined therein, and

a first rotation component coupled to the first polarization-modification layer,

wherein the first polarization-modification layer is disposed adjacent to the first waveguide antenna elements,

wherein the first channels are oriented at a first angle with respect to the first waveguide antenna elements,

wherein the first channels are configured to receive input electromagnetic waves having the first polarization and transmit output electromagnetic waves having a second polarization; and

wherein the first rotation component is configured to adjust a position of the first polarization-modification layer relative to the first waveguide antenna elements; and

a receiver, comprising:

a plurality of second waveguide antenna elements arranged in a second array configured to operate with the first polarization;

a second polarization-modification layer with second channels defined therein,

wherein the second polarization-modification layer is disposed adjacent to the second waveguide antenna elements,

wherein the second channels are oriented at the first angle with respect to the second waveguide antenna elements, and

wherein the second channels are configured to receive input electromagnetic waves having the second polarization and transmit output electromagnetic waves having the first polarization to the second waveguide antenna elements.

13. The radar system of claim 12,

wherein the transmitter further comprises:

a third polarization-modification layer with third channels defined therein,

wherein the third polarization-modification layer is disposed adjacent to the first

polarization-modification layer,

wherein the third channels are oriented at a second angle with respect to the first channels, and

wherein the third channels are configured to receive input electromagnetic waves having the second polarization and transmit output electromagnetic waves having a third polarization; and

wherein the receiver further comprises:

a fourth polarization-modification layer with fourth channels defined therein,

wherein the fourth polarization-modification layer is disposed adjacent to the second polarization-modification layer,

wherein the fourth channels are oriented at the second angle with respect to the second channels, and

wherein the fourth channels are configured to receive input electromagnetic waves having the third polarization and transmit output electromagnetic waves having the second polarization to the second channels.

14. The radar system of claim 13, wherein the first angle is between 20 and 25 degrees, and wherein the second angle is between 20 and 25 degrees.

15. The radar system of claim 12, wherein the radar system further comprises:

a vehicle, wherein the transmitter of the radar system is coupled to a portion of the vehicle.

16. The radar system of claim 12, wherein the first channels and the second channels are shaped as rounded rectangles.

17. The radar system of claim 12, wherein the first angle is between 44 and 46 degrees.

18. The radar system of claim 12, wherein a thickness of the first polarization-modification layer is less than a wavelength of the input electromagnetic waves having the first polarization.

19. The radar system of claim 12, wherein the first channels and the second channels are filled with a dielectric material.

20. A method, comprising:

emitting electromagnetic waves having a first polarization from a plurality of waveguide antenna elements arranged in a first array;

receiving, by channels defined within a polarization-modification layer that is disposed between the waveguide antenna elements and a plurality of waveguide output ports arranged in a second array, the electromagnetic waves having the first polarization, wherein the channels are oriented at a first angle with respect to the waveguide antenna elements;

transmitting, by the channels defined within the polarization-modification layer, electromagnetic waves having an intermediate polarization;

receiving, by the waveguide output ports, electromagnetic waves having the intermediate polarization, wherein the waveguide output ports are oriented at a second angle with respect to the channels; and

radiating, by the waveguide output ports, electromagnetic waves having a second polarization, wherein the second polarization is different from the first polarization, wherein the second polarization is different from the intermediate polarization, and wherein the first polarization is different from the intermediate polarization; and

adjusting, by a rotation component coupled to the polarization-modification layer, a position of the polarization-modification layer relative to the waveguide antenna elements and the plurality of waveguide output ports.