CLAIMS

What is claimed is:

1. A device comprising:

a transmitter coupled to transmit signals to one or more signal-carrying media having waveguide properties and supporting a plurality of waveguide modes, the transmitter having a plurality of antennas that shapes and concurrently transmits a first signal into a transmission media based on a training method that transmits a plurality of signals through the plurality of antennas, the training method providing a plurality of channel response measurements across a plurality of frequencies, amplitudes and phases of the concurrently transmitted signals; and

at least one coupler coupled between the transmitter and the signal-carrying media, the at least one coupler couples the signals to the signal-carrying media via at least one waveguide mode within the plurality of waveguide modes; and

wherein the signal-carrying media comprises at least one wire, each wire comprising a conductor covered with a dielectric insulator and the first signal propagates at least partially around the at least one wire.

2. The device of claim 1 further comprising a calibration unit coupled within the transmitter, the calibration unit transmits a plurality of test signals onto the signal-carrying media to select a first configuration of the plurality of antennas that results in a preferred shape of the first signal.

3. The device of claim 2 wherein the calibration unit adjusts settings across a vector precoder within the transmitter, the adjustable settings cause a shape of the plurality of test signals to change based on vector weights generated within the vector precoder and applied to at least one antenna within the plurality of antennas.

4. The device of claim 2 wherein the preferred shape is selected based at least in part on feedback from a remote receiver, the feedback identifying a detectability characteristic of at least one of the test signals.

5. The device of claim 4 wherein the detectability characteristic is a signal-to-noise measurement of the at least one of the test signals.

6. The device of claim 3 wherein the vector precoder reduces an interference caused by another transmitter or coupled from a different transmission mode which is not intended to be received by a corresponding receiver.

7. The device of claim 3 wherein the vector precoder is a type selected from a group consisting of: linear, zero-forcing, minimum mean squared error (MMSE), non-linear, generalized decision feedback equalizer (GDFE).

8. The device of claim 1 further comprising a symbol encoder coupled within the transmitter, the symbol encoder encodes data on the first signal prior to transmission onto the signal-carrying media.

9. The device of claim 8 further comprising a modulator coupled within the transmitter, the modulator converts the encoded first signal to a passband signal.

10. The device of claim 9 wherein the modulator comprises a passband modulator that converts the encoded first signal in desired wavelengths ranging from .1mm to 10mm.

11. The device of claim 1 wherein the conductor comprises at least one metal selected from a group consisting of: copper, aluminum, steel and stainless steel.

12. The device of claim 1 wherein the dielectric insulator comprises a non-conductive material selected from a group consisting of: paper, pulp, plastic, polyethylene and PVC.

13. The device of claim 1 wherein at least one conductive shield covers the at least one wire.

14. The device of claim 13 wherein the conductive shield comprises a metal selected from a group consisting of: copper, aluminum, steel and stainless steel.

15. The device of claim 1 wherein the at least one coupler comprises a polarizer coupled to the transmitter, the polarizer converts a polarization of the first signal received from the transmitter to a first polarization related to a coupling of at least one waveguide mode within the plurality of waveguide modes.

16. The device of claim 1 wherein the at least one coupler comprises a signal focusing lens that focuses the first signal received from the transmitter to a first location on the transmission media, the first location being related to a coupling efficiency for at least one waveguide mode within the plurality of waveguide modes.

17. The device of claim 1 wherein the coupler couples the first signal received from the transmitter to a plurality of wires including at least a pair of wires that couple to a single receiver.

18. The device of claim 1 wherein the plurality of waveguide modes comprises at least one mode selected from a group consisting of: transverse magnetic, plasmon traverse electro-magnetic, transmission-line, total internal reflection, and transverse electric modes.

19. The device of claim 1 wherein one or more of the waveguide modes further couples to air and propagates as a radio signal to a receiver.

20. The device of claim 1 wherein the first signal propagates at least partially in air around the at least one wire.

21. A device for receiving signals comprising:

a receiver coupled to receive signals from one or more signal-carrying media having waveguide properties and supporting a plurality of waveguide modes, the receiver having a plurality of antennas that concurrently receives a first signal from a transmission media based on a training method that transmits test signals through the plurality of antennas, the training method providing a plurality of channel response measurements across a plurality of frequencies, amplitudes and phases of the concurrently transmitted signals; and

at least one coupler coupled between the receiver and the signal-carrying media, the at least one coupler couples the signals from the signal-carrying media via at least one waveguide mode within the plurality of waveguide modes; and

wherein the signal-carrying media comprises at least one wire, each wire comprising a conductor covered with a dielectric insulator, the first signal being communicated around the at least one wire.

22. The device of claim 21 further comprising:

a sensor coupled within the receiver, the sensor converts an electromagnetic wave on a first waveguide mode to an electrical signal;

a vector post-canceller coupled to receive the electrical signal, the vector post-canceller reduces interference on the first electrical signal;

a demodulator coupled to receive the electrical signal, the demodulator coverts the electrical signal from a passband electrical signal to a baseband electrical signal; and

a symbol decoder coupled to receive a set of received symbols, the symbol decoder decodes data from the set of received symbols.