## CLAIMS

What is claimed is:

1. A guided drilling method that comprises:

drilling a first borehole and casing the first borehole with a casing tubular having at least one transmission crossover arrangement, each transmission crossover arrangement having an adapter in communication with a coil antenna that encircles the casing tubular;

deploying, inside the casing tubular, a conductive path that extends from a surface interface to the at least one transmission crossover arrangement;

drilling a second borehole with a drill string having a bottomhole assembly;

collecting a first set of electromagnetic (EM) field measurements based on a first EM field acquired using the bottomhole assembly and generated by the at least one transmission crossover arrangement and a second set of EM field measurements based on a second EM field acquired using the at least one transmission crossover arrangement and generated by the bottomhole assembly;

inverting at least the first set of EM field measurements and the second set of EM field measurements; obtaining at least one of distance and direction information between the bottomhole assembly and at least one of the transmission crossover arrangements based on the inversion of the first set of EM field measurements and the second set of EM field measurements; and

steering the drill string based at least in part on the at least one of the obtained distance and direction information.

2. The method of claim 1, further comprising: determining a position of the bottomhole assembly relative to the first borehole based at least in part on the obtained distance or direction information; and displaying a visual representation of the position.

3. The method of claim 1, wherein each transmission crossover arrangement further comprises a control unit, each control unit having circuitry to handle EM transmissions by a respective coil antenna and having an energy storage device that receives power from the surface interface via the conductive path and a respective adapter.

4. The method of claim 1, wherein each transmission crossover arrangement further comprises a control unit, each control unit having circuitry to handle EM measurements acquired by a respective coil antenna, a data storage unit to store the EM measurements, and an energy storage device to power

the data storage unit, wherein the energy storage device receives power from the surface interface via the conductive path and a respective adapter.

5. The method of claim 1, wherein the casing tubular has multiple, axially-spaced transmission crossover arrangements.

6. The method of claim 1, wherein the at least one transmission crossover arrangement includes a plurality of coil antennas with different orientations.

7. The method of claim 1, wherein deploying the conductive path comprises attaching a cable to an inner tubular and lowering the inner tubular into the casing tubular.

8. The method of claim 1, wherein each adapter couples to the conductive path via inductive coupling.

9. The method of claim 1, wherein each adapter couples to the conductive path via galvanic or capacitive coupling.

10. The method of claim 1, wherein a frequency of the first EM field emitted by the at least one transmission crossover arrangement is different from a frequency of the second EM field emitted by the bottomhole assembly.

11. The method of claim 1, wherein the at least one transmission crossover arrangement is positioned at a first location along the casing tubular and a different transmission crossover arrangement is positioned at a second location along the casing tubular, and wherein obtaining the distance and direction information comprises acquiring, by the bottomhole assembly, the EM field measurements generated by the different transmission crossover arrangement.

12. A guided drilling system that comprises:

a downhole casing tubular deployed in a first borehole and having at least one transmission crossover arrangement, each transmission crossover arrangement having an adapter in communication with a first set of one or more coil antennas that encircles an exterior of the casing tubular;

a conductive path, deployed inside the casing tubular, that extends from a surface interface to the at least one transmission crossover arrangement;

a drill string with a bottomhole assembly deployed in a second borehole and having a second set of at least one coil antennas; and

a processing unit that determines distance or direction information from a first set of EM field measurements obtained using the second set of at least one coil antennas of the bottomhole assembly and generated by the first set of at least one or more coil antennas of the at least one transmission crossover arrangement and a second set of EM field measurements obtained using the first set of at least one or more coil antennas of the at least one transmission crossover arrangement and generated by the second set of at least one coil antennas of the bottomhole assembly;

wherein the processing unit determines distance or direction information from electromagnetic (EM) field measurements based on an inversion of the first set of EM field measurements and the second set of EM field measurements; and wherein the drill string is steered based at least in part on the determined distance or direction information.

13. The system of claim 12, further comprising a monitor, wherein the processing unit determines a position of the bottomhole assembly relative to the first borehole based at least in part on the determined distance or direction information, and wherein the position is displayed on the monitor.

14. The system of claim 12, wherein each transmission crossover arrangement further comprises a control unit, each control unit having circuitry to handle EM transmissions by a respective coil antenna and having an energy storage device that receives power from the surface interface via the conductive path and a respective adapter.

15. The system of claim 12, wherein each transmission crossover arrangement further comprises a control unit, each control unit having circuitry to handle EM measurements acquired by a respective coil antenna, a data storage unit to store the EM measurements, and an energy storage device to power the data storage unit, wherein the energy storage device receives power from the surface interface via the conductive path and a respective adapter.

16. The system of claim 12, wherein the casing tubular has multiple, axially-spaced transmission crossover arrangements.

17. The system of claim 12, wherein the at least one transmission crossover arrangement includes a plurality of coil antennas with different orientations.

18. The system of claim 12, wherein the conductive path comprises a cable attached to an inner tubular and lowered into the casing tubular.

19. The system of claim 12, wherein each adapter couples to the conductive path via inductive coupling.

20. The system of claim 12, wherein each adapter couples to the conductive path via galvanic or capacitive coupling.

21. The system of claim 12, wherein a frequency of the first EM field emitted by the at least one transmission crossover arrangement is different from a frequency of the second EM field emitted by the bottomhole assembly.

22. The system of claim 12, wherein the at least one transmission crossover arrangement is positioned at a first location along the casing tubular and a different transmission crossover arrangement is positioned at a second location along the casing tubular, and wherein the processing unit determines distance or direction information from electromagnetic (EM) field measurements from a third EM field, by the bottomhole assembly, emitted by the different transmission crossover arrangement.