CLAIMS

1. A casing segment that comprises:

a conductive tubular body; and

at least one transmission crossover arrangement, each transmission crossover arrangement having an adapter in communication with a coil antenna that encircles an exterior of the tubular body, wherein each transmission crossover arrangement further comprises an energy storage device.

2. The casing segment of claim 1, wherein the adapter comprises an inductive coil arranged along an interior of the tubular body.

3. The casing segment of claim 1, wherein the adapter comprises an inductive coil arranged along an exterior of the tubular body, wherein the tubular body includes one or more nonconductive windows permitting passage of electromagnetic energy to the inductive coil.

4. The casing segment of claim 1, wherein the adapter comprises an inductive coil arranged along an exterior recess of the tubular body, wherein the tubular body includes one or more nonconductive windows permitting passage of electromagnetic energy to the inductive coil.

5. The casing segment of claim 1, wherein the adapter comprises inner wall electrodes coated with a passivation layer.

6. The casing segment of claim 1, wherein the adapter comprises inner wall electrodes positioned in one or more channels along an inner wall of the conductive tubular body.

7. The casing segment of claim 1, wherein the adapter comprises a galvanic coupling interface.

8. The casing segment of claim 1, wherein the adapter comprises a capacitive coupling interface.

9. The casing segment of any one of the preceding claims, wherein each transmission crossover arrangement further comprises a control unit, each control unit having circuitry to direct EM transmissions or handle EM measurements acquired by a respective coil antenna.

10. The casing segment of claim 9, wherein each control unit handles EM measurements acquired by a respective coil antenna in accordance with an addressing or modulation scheme that uniquely identifies signals associated with different transmission crossover arrangements.

11. The casing segment of any one of the preceding claims, wherein the at least one transmission crossover arrangement comprises a plurality of nonparallel external coils and a control unit that selectively operates the plurality of nonparallel external coils to provide multi-component transmission or reception.

12. The casing segment of any one of the preceding claims, wherein at least one coil antenna corresponding to the at least one transmission crossover arrangement is tilted.

13. The casing segment of any one of the preceding claims, further comprising at least one sensor along an interior of the tubular body, wherein the at least one sensor is in communication with the at least one transmission crossover arrangement.

14. The casing segment of any one of the preceding claims, further comprising at least one sensor along an exterior of the tubular body, wherein the at least one sensor is in communication with the at least one transmission crossover arrangement.

15. The casing segment according to any one of claims 1 to 4, wherein each adapter is inductively coupled to a conductive path coil mounted to an inner tubular string deployed in a borehole.

16. The casing segment according to any one of claims 1 to 4, wherein each adapter is inductively coupled to a conductive path coil that is part of a wireline service tool deployed in a borehole.

17. The casing segment according to any one of claims 5 to 8, wherein each adapter galvanically or capacitively couples to a conductive path included with an inner tubular string deployed in a borehole.

18. The casing segment according to any one of claims 5 to 8, wherein each adapter galvanically or capacitively couples to a conductive path included with a wireline service tool deployed in a borehole.

19. The casing segment according to any one of claims 1 to 18, wherein the casing segment is deployed in a borehole as part of a casing string, and wherein the at least one transmission crossover arrangement is used to perform interwell tomography operations.

20. The casing segment according to any one of claims 1 to 18, wherein the casing segment is deployed in a borehole as part of a casing string, and wherein the at least one transmission crossover arrangement is used to perform ranging operations to guide drilling of a new well.

21. The casing segment according to any one of claims 1 to 18, wherein the casing segment is deployed in a borehole as part of a casing string, and wherein the at least one transmission crossover arrangement is used to transmit control signals to an inflow control device deployed in another borehole.

22. The casing segment according to any one of claims 1 to 18, wherein the casing segment is deployed in a borehole as part of a casing string, and wherein the at least one transmission crossover arrangement is used to receive sensor measurements from an inflow control device deployed in another borehole.