CLAIMS

What is claimed is:

1. A nuclear magnetic resonance (NMR) logging method that comprises:

establishing a static magnetic field ~~(B0)~~ with a tool positioned along a borehole through a formation;

concurrently driving a plurality of antenna cells to produce a radio frequency field ~~(B1)~~ in said formation;

measuring an individual response from each antenna cell as NMR relaxation occurs in the formation; and

determining at least one characteristic relaxation time of the formation based at least in part on said individual response.

2. The method of claim 1, wherein said concurrently driving includes driving an antenna in each antenna cell with current having a substantially identical amplitude and phase.

3. The method of claim 1, wherein each antenna cell includes multiple coils configured to produce substantially orthogonal radio frequency fields.

4. The method of claim 3, wherein said concurrently driving includes concurrently producing said orthogonal radio frequency fields with a phase shift between the fields.

5. The method of claim 3, wherein different ones of said multiple coils are driven independently to produce only one of said orthogonal radio frequency fields at a time.

6. The method of claim 1, wherein said determining includes combining individual responses from multiple antenna cells to increase signal to noise ratio.

7. The method of claim 1, further comprising associating said individual responses with positions of the antenna cells when the individual responses were measured.

8. The method of claim 7, wherein said determining includes combining only individual responses associated with a given position.

9. The method of claim 8, further comprising excluding individual responses from antenna cells that due to tool motion are not measuring optimally polarized or saturated portions of the formation.

10. The method of claim 1, wherein said at least one antenna cell includes multiple coils from which orthogonal field measurements can be made.

11. The method of claim 10, wherein said determining includes combining individual responses from said multiple coils.

12. A nuclear magnetic resonance (NMR) logging tool that comprises:

an arrangement of one or more magnets that generates a static magnetic field ~~(B0)~~ in a formation penetrated by a borehole containing said tool;

plurality of antenna cells attached to the tool body, each cell having at least one coil antenna; and

circuitry that drives the plurality of antenna cells ~~in concert~~concurrently to produce a radio frequency field ~~(B1)~~ in said formation,

wherein the circuitry further measures an individual response from each antenna cell as NMR relaxation occurs in the formation.

13. The tool of claim 12, wherein said circuitry drives the plurality of antenna cells in series or parallel to inject currents having a substantially identical amplitude and phase in each antenna.

14. The tool of claim 12, wherein said circuitry combines individual responses from multiple antenna cells to obtain a combined response having an increased signal-to-noise ratio.

15. The tool of claim 12, wherein each of the plurality of antenna cells includes a transmit coil that is also used to measure said individual responses.

16. The tool of claim 12, further comprising a motion sensing unit that tracks a position of the tool.

17. The tool of claim 12, wherein the circuitry associates said individual responses with borehole positions of the antenna cells from which the individual responses were measured.

18. The tool of claim 17, wherein the circuitry combines individual responses associated with a given borehole position.

19. The tool of claim 18, wherein the circuitry excludes those individual responses suffering from degradation due to tool motion.

20. The tool of claim 12, wherein the circuitry tracks tool motion based at least in part on signal degradation in the individual responses.

21. The tool of claim 12, wherein each of the antenna cells in the plurality of antenna cells includes multiple coils from which orthogonal field measurements can be made.

22. The tool of claim 21, wherein the circuitry combines individual responses from said multiple coils.

23. The tool of claim 21, wherein the circuitry drives said multiple coils in a phased relationship to produce the radio frequency field ~~(B1)~~.

24. The tool of claim 12, wherein the tool is a wireline tool or a tubing-conveyed logging tool.

25. The tool of claim 12, wherein the tool is a logging-while-drilling tool.

26. The tool of claim 12, wherein each of the plurality of antenna cells includes a coil antenna that is used to transmit but not to receive.