CLAIMS

What is claimed:

1. A magnetic resonance imaging system comprising:

a housing comprising:

a front surface,

a permanent magnet for providing a static magnetic field,

a radio frequency transmit coil, and

a single-sided gradient coil set,

wherein the radio frequency transmit coil and the single-sided gradient coil set are positioned proximate to the front surface;

an electromagnet;

a radio frequency receive coil; and

a power source, wherein the power source is configured to flow current through at least one of the radio frequency transmit coil, the single-sided gradient coil set, or the electromagnet to generate an electromagnetic field in a region of interest, wherein the region of interest resides outside the front surface.

2. The system of claim 1, wherein the radio frequency transmit coil and the single-sided gradient coil set are located on the front surface.

3. The system of claim 1, wherein the front surface is a concave surface.

4. The system of claim 1, wherein the permanent magnet has an aperture through center of the permanent magnet.

5. The system of claim 1, wherein the static magnetic field of the permanent magnet ranges from 1 mT to 1 T.

6. The system of claim 1, wherein the radio frequency transmit coil comprises a first ring and a second ring that are connected via one or more capacitors and/or one or more rungs.

7. The system of claim 1, wherein the radio frequency transmit coil is non-planar and oriented to partially surround the region of interest.

8. The system of claim 1, wherein the single-sided gradient coil set is non-planar and oriented to partially surround the region of interest, and wherein the single-sided gradient coil set is configured to project a magnetic field gradient to the region of interest.

9. The system of claim 1, wherein the single-sided gradient coil set comprises one or more first spiral coils at a first position and one or more second spiral coils at a second position, the first position and the second position being located opposite each other about a center region of the single-sided gradient coil set.

10. The system of claim 1, wherein the single-sided gradient coil set has a rise time less than 10 μs.

11. The system of claim 1, wherein the electromagnet is configured to alter the static magnetic field of the permanent magnet within the region of interest.

12. The system of claim 1, wherein the electromagnet has a magnetic field strength from 10 mT to 1 T.

13. The system of claim 1, wherein the radio frequency receive coil is a flexible coil configured to be affixed to an anatomical portion of a patient for imaging within the region of interest.

14. The system of claim 1, wherein the radio frequency receive coil is in one of a single-loop coil configuration, figure-8 coil configuration, or butterfly coil configuration, wherein the coil is smaller than the region of interest.

15. The system of claim 1, wherein the radio frequency transmit coil and the single-sided gradient coil set are concentric about the region of interest.

16. The system of claim 1, wherein the magnetic resonance imaging system is a single-sided magnetic resonance imaging system that comprises a bore having an opening positioned about a center region of the front surface.

17. A magnetic resonance imaging system comprising:

a housing comprising:

a concave front surface,

a permanent magnet for providing a static magnetic field,

a radio frequency transmit coil, and

at least one gradient coil set,

wherein the radio frequency transmit coil and the at least one gradient coil set are positioned proximate to the concave front surface, wherein the radio frequency transmit coil and the at least one gradient coil set are configured to generate an electromagnetic field in a region of interest, wherein the region of interest resides outside the concave front surface; and

a radio frequency receive coil for detecting signal in the region of interest.

18. The system of claim 17, wherein the radio frequency transmit coil and the at least one gradient coil set are located on the concave front surface.

19. The system of claim 17, wherein the static magnetic field of the permanent magnet ranges from 1 mT to 1 T.

20. The system of claim 17, wherein the static magnetic field of the permanent magnet ranges from 10 mT to 195 mT.