CLAIMS

What is claimed is:

1. An antenna assembly, comprising:

a tool mandrel having a longitudinal axis;

a coil including a plurality of windings wrapped about the tool mandrel and tilted to form a winding angle with respect to the longitudinal axis; and

a soft magnetic band having an edge radially interposing between the coil and the tool mandrel and extending about a circumference of the tool mandrel, the edge being tilted to form a band angle with respect to the longitudinal axis and orthogonal to the winding angle about the entire circumference of the tool mandrel, wherein the soft magnetic band includes a plurality of inserts, and wherein a gap is defined between each laterally adjacent insert and the gap extends parallel to the longitudinal axis.

2. The antenna assembly of claim 1, wherein the tool mandrel defines a saddle and the coil and the soft magnetic band are positioned in the saddle.

3. The antenna assembly of claim 1, wherein the soft magnetic band comprises a material selected from the group consisting of a ferrite, mu-metal, permalloy, metallic glass, and any combination thereof.

4. The antenna assembly of claim 1, wherein each insert comprises:

a length that aligns axially with the longitudinal axis; and

a width, wherein each insert exhibits an arcuate shape across the width to conform to a curvature of the tool mandrel.

5. The antenna assembly of claim 4, wherein each insert comprises a rectangular or parallelogram-shaped member.

6. The antenna assembly of claim 1, wherein at least a portion of the coil extends axially past the soft magnetic band where the soft magnetic band fails to radially interpose between the coil and the tool mandrel.

7. The antenna assembly of claim 6, wherein one or more of the plurality of inserts is removed from the soft magnetic band at opposing circumferential locations about the tool mandrel where the portion of the coil extends axially past the soft magnetic band.

8. A method, comprising:

introducing a wellbore logging tool into a wellbore, the wellbore logging tool including an antenna assembly that includes:

a tool mandrel having a longitudinal axis;

a coil including a plurality of windings wrapped about the tool mandrel and tilted to form a winding angle with respect to the longitudinal axis; and

a soft magnetic band having an edge radially interposing between the coil and the tool mandrel and extending about a circumference of the tool mandrel, the edge being tilted to form a band angle with respect to the longitudinal axis and orthogonal to the winding angle about the entire circumference of the tool mandrel, wherein the soft magnetic band includes a plurality of inserts, and wherein a gap is defined between each laterally adjacent insert and the gap extends parallel to the tool axis; and

obtaining measurements of a surrounding subterranean formation with the wellbore logging tool.

9. The method of claim 8, wherein the tool mandrel is operatively coupled to a drill string and introducing the wellbore logging tool into the wellbore further comprises:

extending the wellbore logging tool into the wellbore on the drill string; and

drilling a portion of the wellbore with a drill bit secured to a distal end of the drill string.

10. The method of claim 8, wherein introducing the wellbore logging tool into the wellbore further comprises extending the wellbore logging tool into the wellbore on wireline as part of a wireline instrument sonde.

11. A method of assembling an antenna assembly, comprising:

positioning a soft magnetic band, having an edge, about a circumference of a tool mandrel having a longitudinal axis, wherein the edge extends about the tool mandrel and is tilted to form a band angle with respect to the longitudinal axis, the soft magnetic band including a plurality of inserts, and wherein a gap is defined between each laterally adjacent insert and the gap extends parallel to the longitudinal axis;

wrapping a plurality of coil windings about the tool mandrel, the coil windings being tilted to form a winding angle with respect to the longitudinal axis and orthogonal to the band angle about the entire circumference of the tool mandrel, such that the soft magnetic band radially interposes at least a portion of the coil windings; and

tuning the soft magnetic band to optimize a magnetic dipole moment of the antenna assembly.

12. The method of claim 11, wherein tuning the soft magnetic band comprises altering the band angle with respect to the winding angle.

13. The method of claim 11, wherein tuning the soft magnetic band comprises altering a number of the plurality of inserts.

14. The method of claim 11, wherein each insert comprises a length that aligns axially with the longitudinal axis and a width, and wherein tuning the soft magnetic band comprises varying at least one of the length and the width of one or more of the plurality of inserts.

15. The method of claim 11, wherein tuning the soft magnetic band comprises varying a size of the gap separating laterally adjacent inserts.

16. The method of claim 11, wherein tuning the soft magnetic band comprises varying a shape of one or more of the plurality of inserts.

17. The method of claim 16, wherein varying the shape comprises at least one of rounding, chamfering, and smoothing an edge or a corner of the one or more of the plurality of inserts.

18. The method of claim 11, wherein tuning the soft magnetic band comprises altering a geometry of the tool mandrel adjacent the plurality of coil windings and thereby reducing eddy current effects on the winding angle.