**APPENDIX: UNCERTAINTY ANALYSIS**

Here, we derive the uncertainty for the measured inductance where

, (A1)

where is the real part of the complex permeability, is the vacuum permeability, *A*e is the effective cross-sectional area of core, *N*12 is the number of primary winding turns, and *L*e is the effective length of the core. For a given variable the combined uncertainty uc2(*y*) in *y* is given by36

(A2)

For these measurements, we assume that all the variables are uncorrelated, so that the second term in Equation A2 vanishes. The sensitivity coefficients, , are determined from the partial derivatives of Equation A1.

(A3)

(A4)

(A5)

The combined uncertainty uc(*L*) in the measured inductance, *L*, is given by the following:

, positive error bars (A6)

, negative error bars (A7)

For these calculations, the nominal values of 2.0x106 m2 for *A*e and 1.3x103 for *L*e were used and the uncertainties uc(*A*e), uc(*L*e), were estimated to be 7.2x10-7 m2 and 5.0x10-4 m, respectively. The modeled uncertainty for , uc (), ranged from 64 at 100 Hz to 328 at 1MHz.