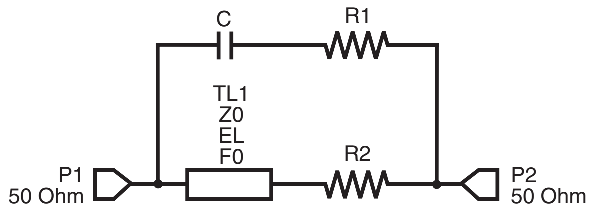
Transmission Line Model 350RAT, 394RAT

These transmission line models accurately simulate the frequency-dependent behavior of Coilcraft surface mount "Spring" air core inductors within the frequency limits shown in the accompanying table for each individual inductor. They are based on de-embedded measurements using a 2-port network analyzer.

The model schematic, shown below, combines an ideal transmission line model with lumped elements. Each model should be analyzed only as a whole at the input and output ports. Conclusions based on individual lumped element values may be erroneous. The individual element values R1, R2, C, Z0, EL, and F0 are listed in the table for each individual spring inductor.



Effects due to different circuit board traces, board materials, ground planes or interactions with other components are not included. They *will* have a significant effect when comparing the simulation to measurements of the individual inductors using other production verification instruments and fixtures.

Typically, the Self-Resonant Frequency (SRF) of the inductor model will be higher than a measurement of the component mounted on a circuit board. The parasitic reactive elements of a circuit board or fixture will effectively lower the circuit resonant frequency, especially for very small inductance values. Data sheet specifications are based on typical production measurements. These models are based on de-embedded 2-port measurements as described below, so the model results may be different from the data sheet specifications.

Lumped Element Modeling Method

The measurements were made over a brass ground plane with each component centered over an air gap, as illustrated in Figure 1. The gap width for each size component is given in Table 1. The test pads were 30 mil (50 Ohm) wide traces of tinned gold over 25 mil thick alumina, and were not included in the gap. The TRL* calibration plane is also illustrated in Figure 1.

Table 1. Test Gap

Size	Gap Width (inch / mm)
350	0.040 / 1,016
394	0.120 / 3,048

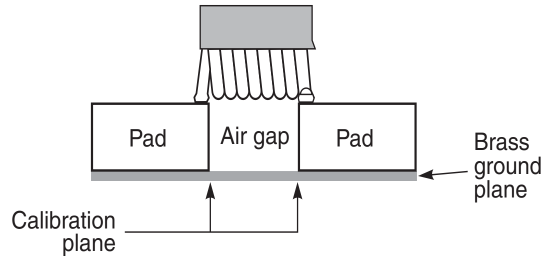


Figure 1. Test Setup

The lumped element values were determined by matching the simulation model to an average of the measurements. This method results in a model that represents as closely as possible the typical frequency-dependent behavior of the component within the specified frequency limits of the model. The lumped element models were used to generate our 2-port S-parameters and therefore give identical results with the same number of simulation frequency points. The S-parameters are available on our web site at **http://www.coilcraft-cps.com/models.aspx**.

Disclaimer

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Transmission Line Model for Coilcraft CPS 350RAT, 394RAT

Part number	Frequency limit of Model (MHz) Lower	Frequency limit of Model (MHz) Upper	R1 (Ω)	R2 (Ω)	C (pF)	TL1 Z0 (Ω)	TL1 EL (degrees)	TL1 F0 (MHz)
350RAT1N7	100	18000	0.079	0.0698	0.0660	104.8	30.47	5031
350RAT2N6	100	16000	0.000	0.0968	0.0720	130.5	37.80	5479
350RAT3N9	100	11000	0.650	0.1524	0.0899	153.1	42.80	4750
350RAT5N4	100	8000	4.606	0.2201	0.1276	158.3	51.19	4307
394RAT5N6	100	11000	10.71	0.2170	0.0589	162.9	57.83	4760
394RAT7N2	100	9500	1.026	0.2852	0.0830	160.5	68.22	4349
394RAT8N8	100	9000	2.568	0.3529	0.0526	196.8	70.07	4451
394RAT9N9	100	7500	3.278	0.3681	0.0758	189.3	84.30	4686
394RAT13N	100	6500	5.453	0.4695	0.0791	212.3	100.3	4956

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