![ARTA logo]

A R T A - A P P L I C A T I O N N O T E

No 2: RLC measurement with LIMP

LIMP can be used to measure the value of resistors, capacitors and inductors simply by calculating the resistive, inductive or capacitive parts of the measured impedance. For example, Figure 1. shows the impedance curve of an inductor with nominal value of 1.5mH.

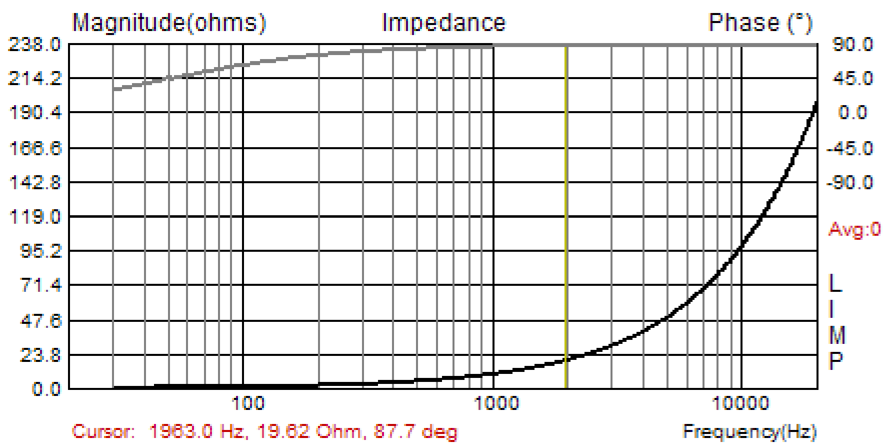

Figure 1 The impedance graph of a 1.5mH inductor

By clicking the menu command **Analysis->RLC Impedance value at the cursor position** we get the dialog box with report as shown on Figure 2. LIMP reports that the measured impedance has a resistive part of 0.776 ohms and imaginary part is inductive with value of 1.589mH. By the same process, LIMP can measure capacitors or resistors.

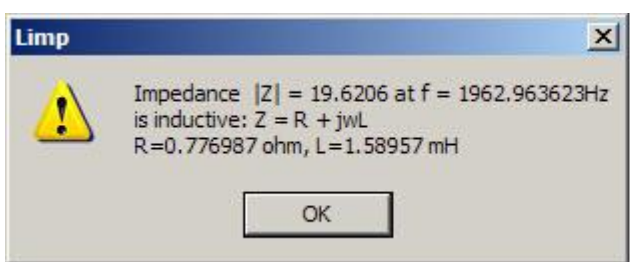

Figure 2. The computed impedance parameters of an air core inductor

The same way Limp measures the capacitance or even pure resistance.

Importance of calibration

When measuring impedance and capacitance it is very important to make a calibration before the measurement.

Why?

Even if there is a very small difference between soundcard channel sensitivities (i.e. 0.1 dB) LIMP can give a very inaccurate result, because an inductor's impedance has a phase close to +90º, and a capacitor's impedance has a phase close to -90º. In that case if there is a difference in the sensitivity of the measured generator voltage V1 and impedance voltage V2 (if sensitivity of V1 is larger than sensitivity of V2) estimated impedance gives phase values that are larger than 90º and in graph we have warped jump in the phase for 180º (see **Figure 3.**).

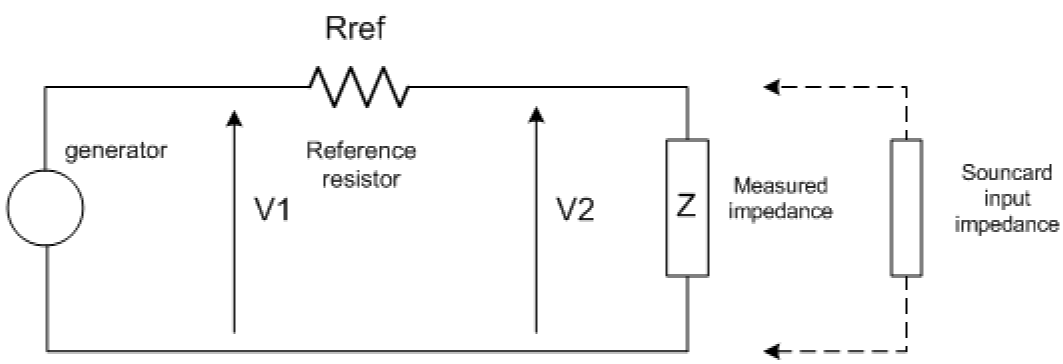

Figure 3 Basic elements of impedance measurement circuit

Figure 4. shows the result of measuring a capacitor without calibration. In half the range the phase is close to + 90º which suggests that we are dealing with an inductance. Figure 5. shows the capacitor impedance after calibration. We now see the correct values for phase for the frequency range of interest.

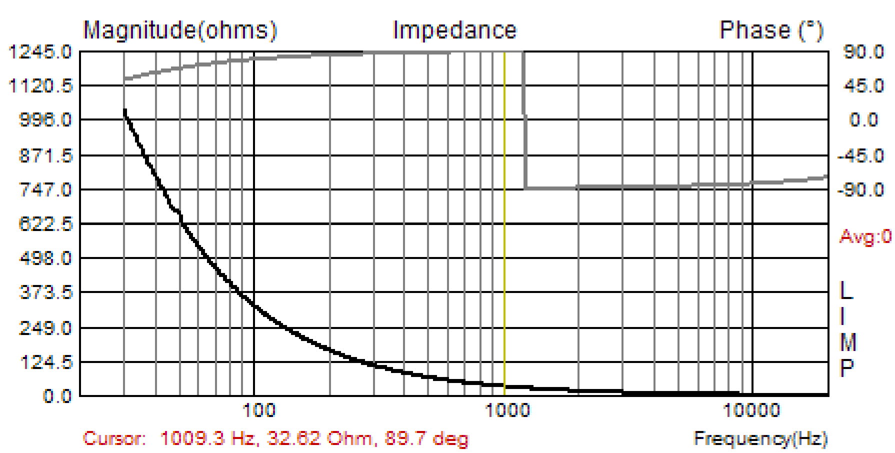

Figure 4. Incorrectly estimated impedance of a plastic capacitor 4.7 uF/250V measured without calibration.

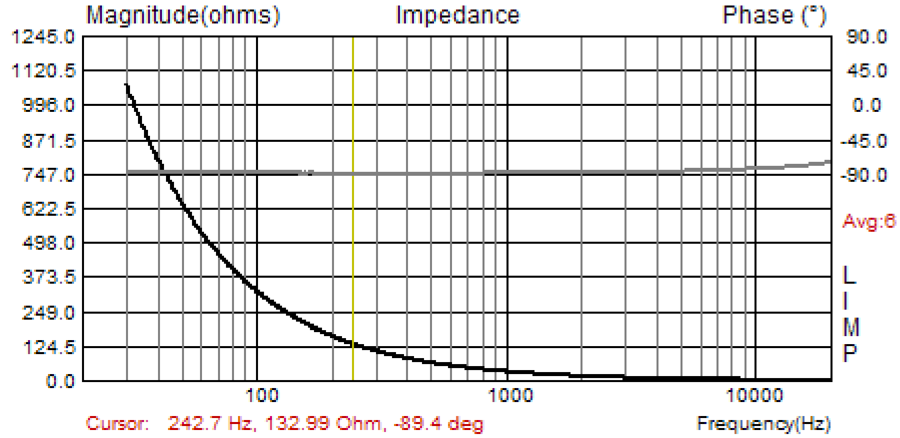

Figure 5 Correctly estimated impedance of a plastic capacitor 4.7 uF/250V measured after the calibration.

Not all LIMP users will have this problem. As explained before, the problem exists when probe for impedance voltage V2 has higher sensitivity than the sensitivity of the probe for generator voltage V1. To circumvent this condition we can change a probe's sensitivity or we can simply exchange the input channels and also change the reference channel in the LIMP measurement setup.

Note:

To get a good estimation of capacitance or inductance it is recommended to put the cursor on a frequency where the impedance magnitude is lower than 100 ohms. This will ensure measurement of impedance within 1% tolerance. Why? The answer lies in fact that the measured impedance is bypassed with the probe or soundcard input impedance which usually has value of 10k ohms.