

How to do accurate measurement in high frequency when using LCR meter

I received one customer's question. When he used his LCR-6300 to measure the leak inductance of high frequency transformer (the value is around 200nH at 300kHz). In Rs-Ls mode, when measuring the inductance, the measurement value varies too much (from 35nH to 270nH), and each time different values are shown. But for large values of inductance, the relative error is not large.

The customer did the open/short calibration just shown on from the figure 1. After the calibration is finished, the device is not still well calibrated and it shows +/- 30nH or more while still its probes are short circuit. The variation is a lot of error to his measurements. Customer's setting is shown in figure 2.

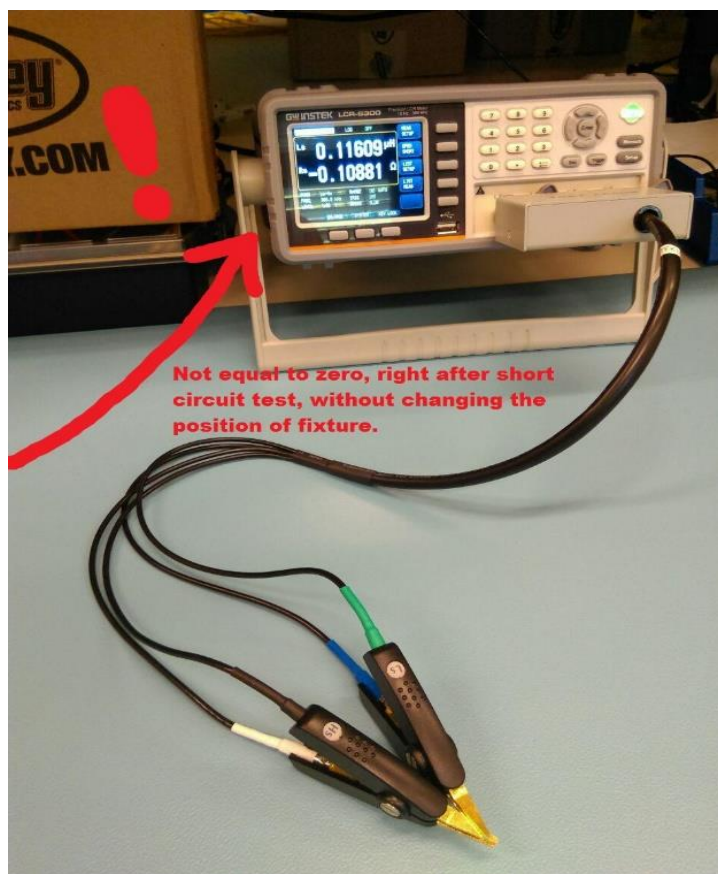


Figure 1 Customer's set up for open/short calibration



Figure 2 Customer's measurement setting

However, according to the datasheet, the LCR-6000 series can measure up to 0.00001uF and the LCR-06B test fixture's measurement range from DC to 1MHz, these should have no problem with the measurement value. So, what may cause the error? After analysis, there are two factors influence the measurement results of this customer:

- (1) When measuring in high frequency, the loop inductance (figure 3) will play a quite significant role in high frequency measurement.

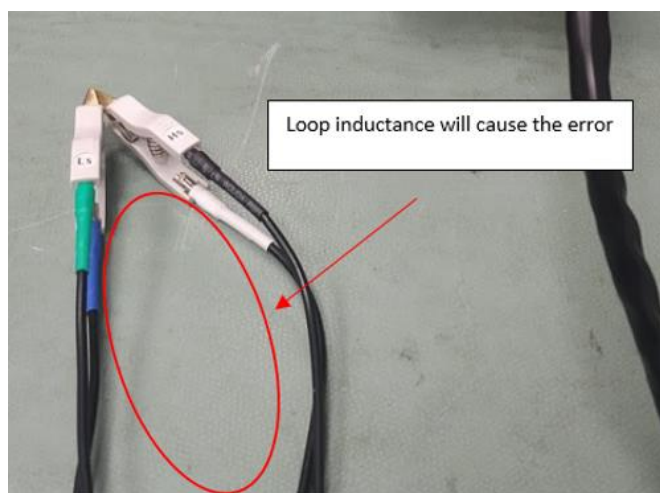


Figure 3 Loop inductance

So, I suggested our customer when doing short/open calibration, to **minimize the measurement loop**. Use a wire to short circuit just like figure 4 shows.



Figure 4 Use a short wire to do the short-circuit calibration

This is the results that got from LCR-6300 when short circuit like figure 4. You can see it is much better now.



Figure 5 Test result

- (2) I also checked the customer's setting, customer using [4] AUTO mode. which refer to user-manual of figure7. The range [4] is for measurement 3KΩ.



Figure 6 Customer's measurement setting

Range	Impedance	Effective measurement range
8	10Ω	0 - 10Ω
7	30Ω	10Ω-100Ω
6	100Ω	100Ω-316Ω
5	300Ω	316Ω-1kΩ
4	1kΩ	1kΩ-3.16kΩ
3	3kΩ	3.16kΩ-10kΩ
2	10kΩ	10kΩ-31.6kΩ
1	30kΩ	31.6kΩ-100kΩ (∞)
0	100kΩ	100kΩ-∞ (This range is available only when the test frequency < 20kHz.)

Figure 7 Capture from user-manual

For the accuracy measurement from 0-10Ω, I suggest customer to **switch to range [8]** as Figure 8.



Figure 8 Revised setting

After did these changes(reduce the loop and change the meaurement range), customer told me that the measurement results now are good and he could do accurate meaurement of leakage inductance of the high frequency transformer.

Some additional infomation: This customer's applicataion is only to 300kHz, if you want to measre L,C,R up to 10MHz, GW-instek offer LCR-8000G series which can measure up to 10MHz. We also provide SMD/Chip test fixture LCR-15 for more accurate measurement in high frequency.



LCR-15



Should you have any further questions, please contact: service@gw-instek.eu