All Inductors Are Not Created Equally

Preface: There are many situations where very accurate inductors may not be optimized for the specific circuit they are being used in. One can assume that inductors of a specific value will all be within a predictable tolerance 100% of the time. This is what accuracy is all about. In this sense they hit the component target 100% of the time yet they fail to hit the specific design target all. How can you hit the component target so consistently and yet miss the design target altogether? The quick answer is that the component target puts the desired resonance at the wrong frequency to hit the design target. There are several factors that may cause this kind of result.

Let's assume that a specific design puts the inductor at an EIA Value of 3.3 nHy, yet when the inductor is mounted in the circuit the resulting resonate frequency isn't where it was designed to be. One may ask "why did we miss the design target?". We verified that the inductor is indeed within the specified tolerance at 3.3 nHy but the resonate frequency is still off. What happened? The component target puts the resonance at the wrong frequency for the design.

What causes these misses of the design target? There may be influences of the way it is mounted in the substrate, distributed capacity at the location is not right for the desired precision resonance, or a packaging shield is affecting the resonance.

Many times, designers will then "adjust" inductors in circuit to achieve the desired resonance. The resulting "adjusted" or "Tuned" indictors would all miss all or part of the component target completely but would precisely hit the design target every time. If one assumes that only standard EIA value inductors are obtainable then each circuit will have to be "tuned" or "adjusted" to meet the desired resonate frequency. It the example cited above the "adjusted" inductor ends up being 3.45 nHy which is not a standard EIA value.

There is an analogy to this kind of situation in shooting sport. Accuracy is hitting the target 10 out of 10 times, just like the component target. Precision is when you may miss the target but your group of 10 shots is smaller than the 10 hits on the target. In this case the shooter that missed the target hit a smaller target every time. This is representative of the design target. It is outside of the component target but is precise to meet the design goal.

In many cases the inductors that hit the design target have a tighter tolerance on inductance than standard components and they end up as non-standard EIA values. This means that the design target is smaller than the component target.

It would make more sense to obtain precise inductors that will hit the desired design target every time. This would eliminate the costly and time consuming in-circuit "tuning". To obtain this objective, a range of different value inductors is fabricated around the inductor value

determined in the circuit design and offered to the designer. The one that results in the desired resonate frequency is identified by the designer and then they are all fabricated like the selected one within a tolerance that insures the design target is hit every time.

Written by: Timothy H Eyerman – Emicon Corporation – 900 Loma Verde Suite A – El Paso, TX 79936 – TEL (915) 590 0795 www.emiconcorp.com