Testing circuit in the lab

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February 15, 2019

Background

Recently I have been working on a piece of circuit that gives you a bandpass filter, with a sharper roll-off at the lower side. The circuit also needs to have very low noises. I designed it, tested it and sent it for manufacture. It is not obvious that a working design will lead to a successful test, because testing the board in the lab can be nasty, with a lot of unexpected problems coming up. Here is a list of things that wasted me a lot of time wondering. I want to remember them so that next time I can save some time and directly get stuck on something new.

Power

We use a DC power supply. It turns out that power supplies are not stable. Sometimes, it creates some oscillations, depending on what kind of load you put there.
Therefore, the best idea is that you need a power regulator chip, which gives you a stable voltage, no matter what it is connected to. Besides, if the frequency of oscillation is low, we can also use some bypass capacitors - a small capacitor connecting from power to ground.

Power cable

We had three wires going from the DC power supply and the board: +15V, -15V and GND, and we used three wires to connect them. This causes oscillations in the power voltage as well - there are inductance between the wires and there are capacitance on the board. Therefore, they create a RLC resonance circuit.
The solution is to twist them together so that the inductance between them becomes small.

Use the right BNC cables

There are different BNC cables. You want to use the high impedance ones expecially you are working on a piece of precision circuit. Also, there are ones that can only be used on oscilloscopes. Do not use them on other places (it gives you unwanted noises).

Soldering

It is very important to do soldering well - bad soldering can cause unwanted capacitance and resistance. For example, if you want to solder a SMD resistor onto its pad, you want to

1. Put a minimum amount of solder onto one pad.
2. Melt the solder, and then put the resistor in place (so that it stays there).
3. Put sufficient solder on both pads.

If it is done well, you should see a shiny inclined surface between the component and the pad, not a ball or other shape.
Another important detail about this is that when you try to put solder anywhere, you should heat up the joint first and then put the solder in place, instead of melt the solder first and try to put the solder to the place. Solder goes to hot places - if the joint is cold, there is no way to force it to go there.

Operational Amplifier - flipped pin

This is simple - a feedback loop of an op amp should always go to the negative input. God knows what you will get if you make it go to the positive. However, we have been stuck there for a long time when I flipped the positive and negative inputs for the output op amp in an operational amplifier.