Contact-less Antenna Test in Production

Using a VNA as a Grid Dipper: contact-less measurements

Although a very good design will help to achieve high yield on antenna performance, batch to batch tolerances in PCB and components can suddenly influence resonance frequencies of on-board antennae.
There is an easy way to determine the resonance frequency by wireless without having to probe electrically. Just as with the old grid-dippers

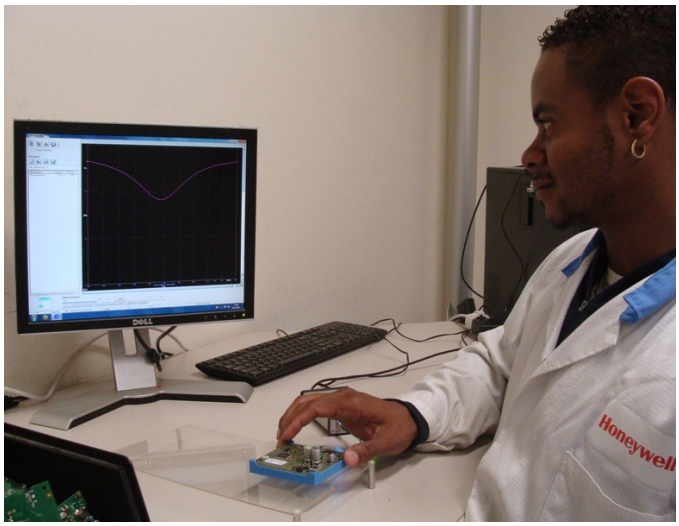
RF antennas and tolerances

RF antennas are components that are by nature very susceptible for their environment. That is what an antenna got to do after all!

But here is a draw back to this: the performance, esp. the resonance frequency, of an RF antenna is greatly influenced by batch to batch tolerances of the PCB material and components, like capacitors, inductors and ceramic antenna. PCB material turn out to be a recursive problem for many of our customers. Because putting very tight tolerances on the PCB-production process and materials is very expensive.

Most of the time all goes well, and then suddenly the yield in a new batch of products can be too low. Not very nice to encounter *after* you've assembled 10k+ boards!

Because if you've had known all this in advance, you've could have tackled the problem by just changing that one small tuning capacitor.



Contact-less measurement of resonance frequency of the on-board antenna at Honeywell

feed forward i.s.o. throwing away

In order to tackle this dilemma, MegiQ designed a very simple test set-up for Honeywell in their production process of wireless climate control products.

Although the design and production processes at Honeywell are very well controlled, they had to make the trade-off between paying for tight tolerances or having the chance to have more rejects in a batch every now and then.

The idea is to measure the resonance frequency of the on board antenna at a low sample size *prior* to make the big run.

In first instance that was done at assembled boards, but later on it appeared that in many occasions this could already be done on bare PCB boards.
Almost every on-board antenna needs some kind of matching and after determining the influence of one of the matching component(s) on resonance, it turns out to be very simple to predict the right value once you measure the actual resonance frequency of the antenna on the bare PCB before assembly of the boards.

Most of the time that would be the value that had been designed during R&D. Just a few times a year you'll have to change the value of just one reel of capacitors on the P&P machine.

Et voilà, high yield at low cost!

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contact less measurement

The idea came from using grid dipper. That is an instrument that can measure resonance frequencies of passive circuits. This is done by coupling the field generated by the instrument into the field of the passive circuit. Thus it is completely contact-less. As long as you do not couple too tight, you do not influence the system under test.

Grid dippers are outdated, read-out is difficult and they are not accurate enough for the purpose we are aiming at now.

But a VNA would be a very nice instrument if you would combine it with a fixture that would couple one port of the VNA with the antenna on the board under test.

That can be done by a non-resonant antenna. This is not one size fits all, but well, you will need a fixture per type of product anyway, because it is very unlikely tat all dimensions of the PCB of all your products are the same.

the test fixture

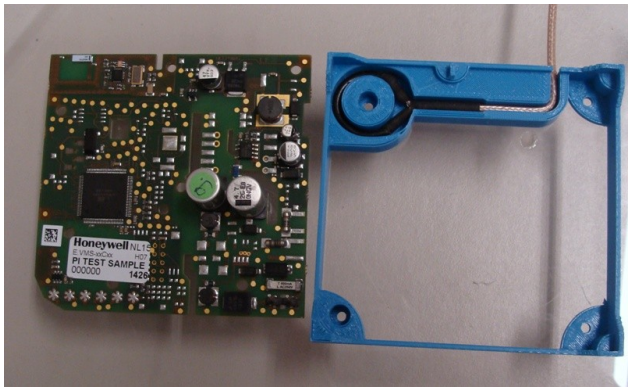
Until now MegiQ designed and produced several test fixtures with pick-up antenna for this purpose that allow reliable measurements on several types of antennas, Loops, monopoles, dipoles, PIFA on all kinds of bands.

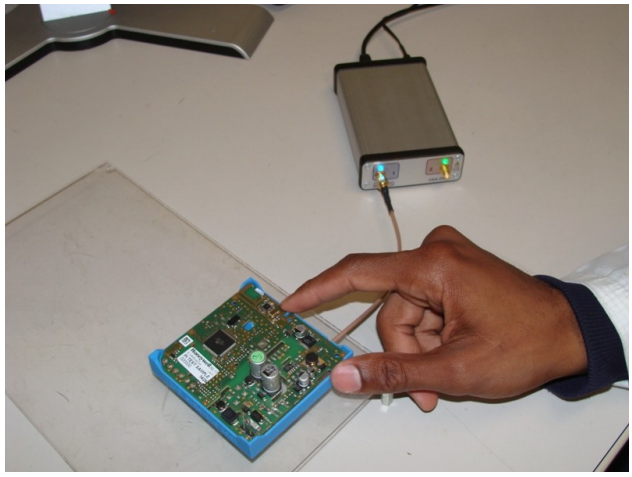
You can outsource this design to us. Of course we need your product to be able to design the fixture.

If you would like do design your own fixtures, take care of the following points:

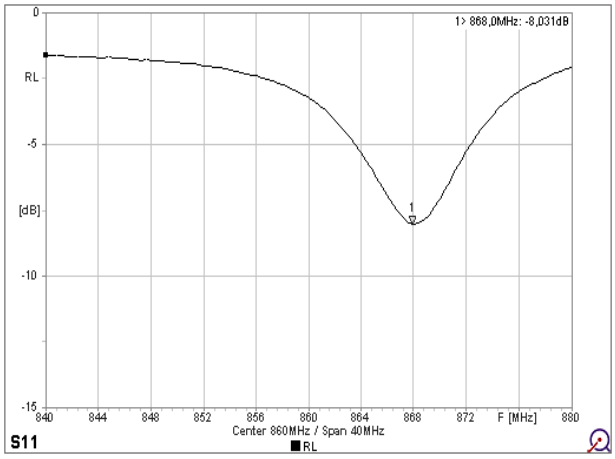
- the self resonance of the pick-up antenna should lay well away from the frequency of interest

- make the coupling mechanically stable, and do not couple too tight.





product and test fixture for contact-less measurement of resonance frequency



Screen for antenna at 868MHz

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- do not influence resonance by nearby objects, like the fixture itself.

- beware that the enclosure of the end product will also influence the resonance frequency, so take this into account.

software

When just checking a few samples every batch of new PCB's, you can just use the user interface software that comes with the MegiQ VNA. It is very handy in use, you can store the complete settings of the instrument inclusive calibration, and recall the right setting for every one of your products. The system remembers also markers, so readout is easy.

But if you want to collect data on many boards, you can completely automate the process, by using the API that comes with the VNA and writing your own application. If you want with Go/NoGo decision making and interfacing with the production line.
But well that programming is up to you!

questions?

In case you have any questions about contact-less testing of antennae, please do not hesitate to contact us.

Of course you are also welcome with other questions about vector network analysis, and antenna measurements.

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