Case History

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Coverage problem using a chip antenna in a proprietary IoT device.

Why should this case interest you?

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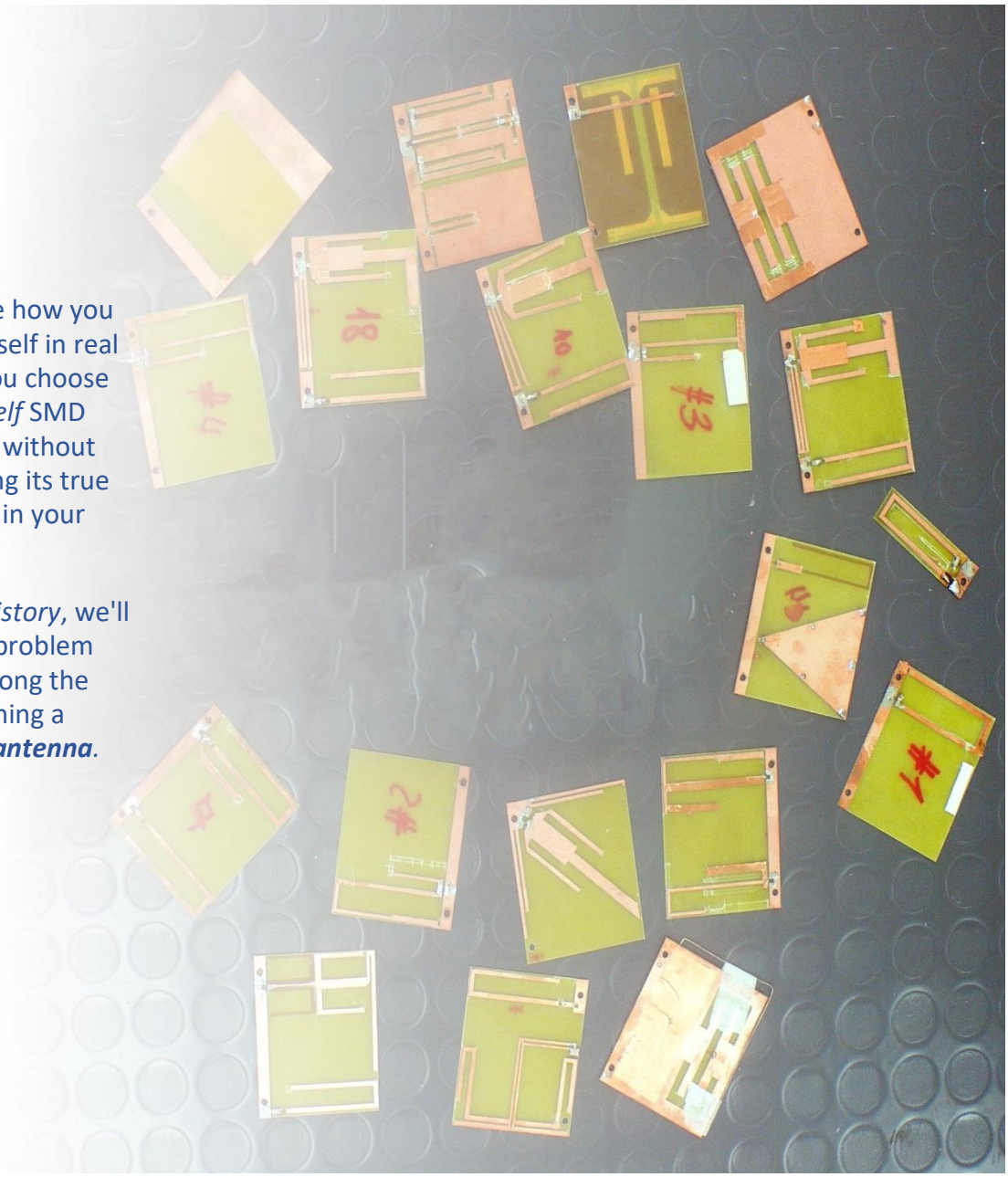


Let's see how you can find yourself in real difficulty if you choose an *off-the-shelf* SMD chip antenna without firstly checking its true performance in your own device.

In this *case history*, we'll see how the problem was solved along the way by designing a ***tailor-made antenna***.

ElettroMagnetic Services SRL

1. The customer's request.

The phone call received from the Customer, owner of a company that designs and manufactures devices for *IoT* applications, clearly showed how upset he was about the situation:

"Good morning. I can't waste my time on this and I won't mince my words, we're in trouble. We have to present our system to a Customer and, from the field tests carried out, we only noticed at the end of the design stage of our apparatus that the antenna does not work as it should. We need someone to solve the problem."

2. The technical reasons for the request.

For the antenna, has been reserved a small space at the top of the PCB that also houses the other electronics. The performance values indicated on the antenna data-sheet fitted their needs perfectly.
However, a serious problem came to light during the field trials. The system, which supposedly covered a distance of 700 metres, barely reached 100 metres.
Everything except the antenna, which did not offer the performance values indicated in the manufacturer's data-sheet, worked as it should.

3. Analysis and identification of the cause of the problem.

The analysis of the prototype we received clearly showed the cause of the problem: the miniaturised antenna had been assembled without taking into consideration the Application Notes provided by the manufacturer for that type of chip antenna.

Furthermore, a control of the *evaluation board* on which the characterisation parameters provided by the chip antenna manufacturer were carried out clearly showed that the space available did not allow the radiating element to operate as it should.

If these necessarily strict precautions are not taken into consideration, performance is poor.

In addition to all this, the use of a high thickness plastic container, necessary for outdoor installation of the product, caused further disturbance of the electrical characteristics of the antenna.

4. Constraints and possible modifications to the apparatus.

To find a solution, first of all we had to understand what the constraints to be respected were and where the modifications needed to solve the problem had to be made.

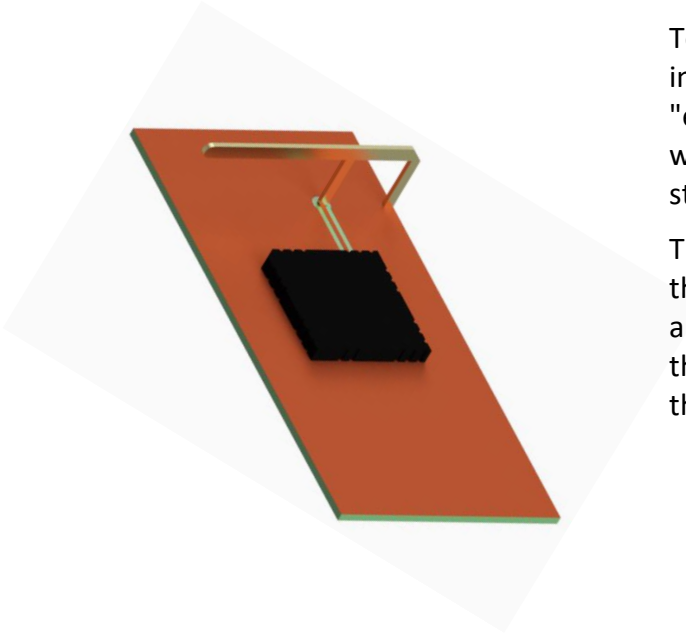
4.1. The constraints.

- Naturally, the dimensions of the apparatus could not be changed. In fact, as in almost all cases, the miniaturised antenna had been chosen precisely because of the limited space available. So, the space dedicated to the antenna had to remain the same.
- The design of the equipment was already at an advanced stage and any change entailed an unforeseen cost for the Customer.

4.2. Possible changes.

- The only possible modification that could be made was to change arrangement of some of the electronic components and some tracks on the PCB, without revolutionising the entire apparatus.

5. Proposed solution to the problem.



To solve the problem, we proposed designing an integrated antenna that took into account the "environment" in which it had to be inserted as a whole, i.e. all the components, electronic and structural, of the Customer's apparatus.

The Customer had to review some small details of the project that has already been defined; mainly the arrangement of some electronic components and the battery. This was essential in order to guarantee the required performance.

6. The results.

During the tests carried out at their end customer's premises at the end of the new design, the integrated antenna guaranteed a range of just over one kilometre, greater than the 700 metres initially estimated.

7. Concluding remarks.

Despite satisfaction with the result obtained, the Customer was annoyed at the waste of time and resources caused by having chosen the miniaturised antenna without carrying out a prior control of its performance.

If they had found out in advance that the antenna would not meet their needs, it would have been possible to obtain a better result, in a shorter time and at a lower cost by designing the antenna during the development of the apparatus in which it was incorporated, optimising the spaces and position of the various components.

To conclude, here are four useful tips if you are planning to use miniaturised *off-the-shelf* antennas in future applications:

- check that the space for the chip antenna is adequate (Manufacturer's *Evaluation Board*);
- follow the instructions provided in the chip antenna manufacturer's *Application Notes*;
- check the antenna's performance when you still have the chance to choose an alternative;
- do not compromise overly on the performance values of your system; by that, I mean always factor in room for manoeuvre that you can make use of if something does not go according to plan.

If, for your objectives and specific needs, you think it would be useful to evaluate the creation of a tailor-made integrated antenna, contact us at ***bollini@elettromagneticservices.com*** we will be happy to study the most suitable solution for you.

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