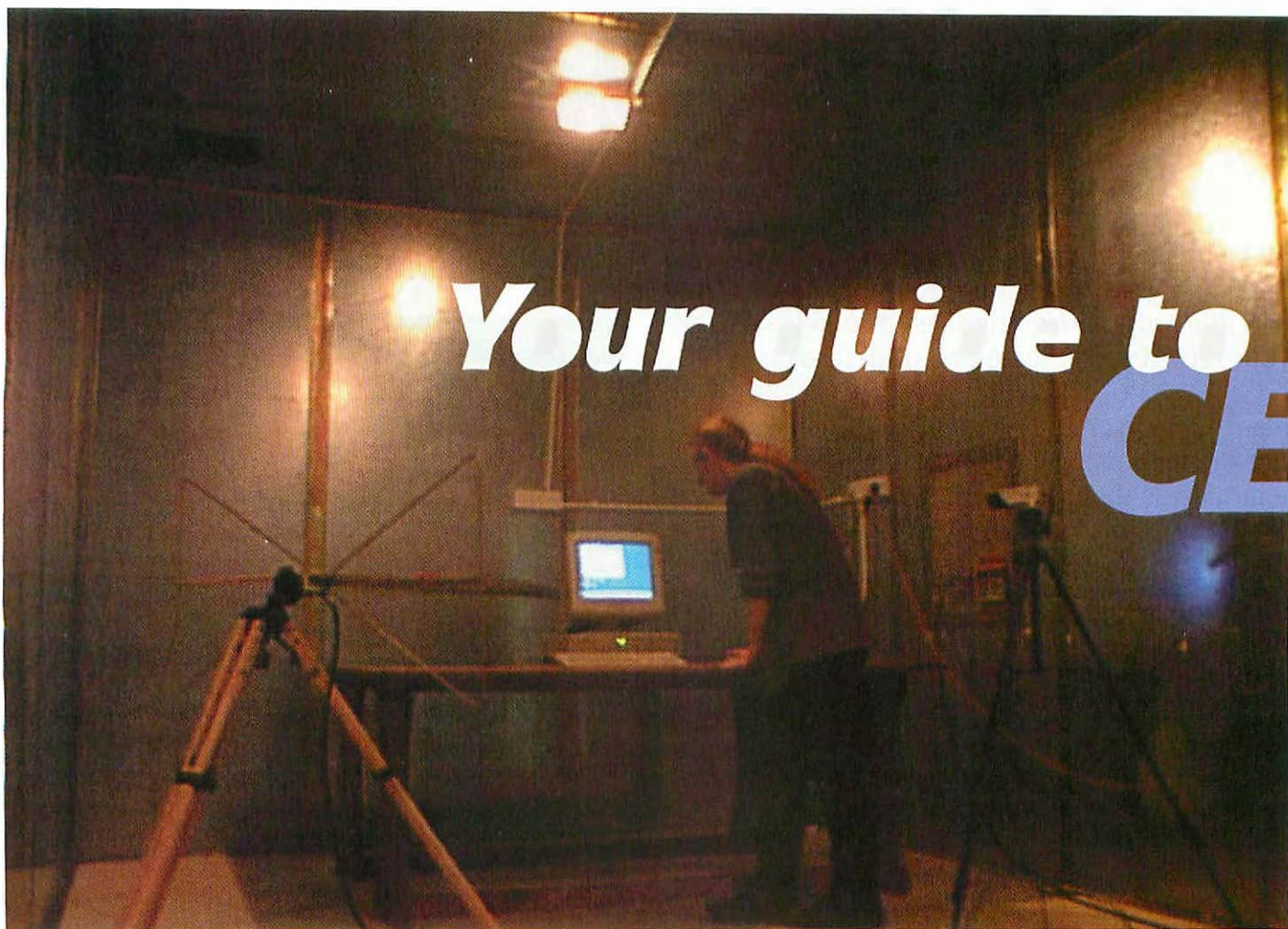


# *Your guide to* **CE**



# MARKING

by Gareth Bradley





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IN **PART 2** OF CE MARKING, GARETH BRADLEY LOOKS AT THE DIFFERENCES AND EFFECTS CREATED BY PRE-COMPLIANCE OR COMPLIANCE.

**T**he question that needs to be asked is: If compliance testing can prove your product and place the CE marking on your product, why pre-compliance testing?

## The answer is simple.

Pre-compliance testing can be done during the development stage of the project. It is a quick look at your products EMC performance during the prototype stage. This is to get an idea of how well the product will perform in a full compliance test. Although the pre-compliance test does not adhere so strictly to the standards it should be done in a meaningful way. The idea behind it is to bring down the level of uncertainty. It is no good testing in such a way that the level of uncertainty is so high that any measurements obtained are so out that they give no real indication that the product will pass a full compliance test. In extreme cases the measurements taken might lead you into believing that the product will pass when in reality it will fail.

If pre-compliance testing is not done and the product is sent for compliance testing, when the product goes into production, there is no guarantee that the product will pass or fail. If it passes then you are lucky, if on the other hand the product fails it can cause huge problems depending on the product and the nature of the failure. What can be done to solve the problem? There are a few things that can be done, but these will unavoidably add cost to your product and delay the time involved in getting your product to market.

Things like adding shielding, conductive paint and filters, all these can all contribute towards reduction of your EMC problem but used as a cure rather than a preventative measure, they can add to your product cost, time to market and it can become a nightmare for production. In drastic situations

it may be necessary to take the product back to the drawing board and start the design over again. This will most certainly add extra unwanted time and expense. It is far better to incorporate these into the design stage and have them accounted for in the initial costing should your product need them.

Pre-compliance can help solve this problem, it can find EMC problems early on in the prototype stage where the problems are easier, cheaper and quicker to fix. Pre-compliance testing is quicker and cheaper to have done. Some companies even set up their own pre-compliance facility because pre-compliance test equipment does not have to be as accurate as full compliance and therefore a lot cheaper which brings it into the said companies budget. Also pre-compliance can provide useful test data which can help you pinpoint potential problems of where the product would fail in full compliance testing. This data can be used for reference for any future projects and help predict the EMC characteristics of your design. As the tests involved in pre-compliance are not as strict as full compliance the time taken to test is a lot shorter. For instance for emissions for full compliance, testing would require all four sides testing for maximum emissions (6 sides if the product can be hand held and has no orientation for use) whereas in pre-compliance an educated decision can be made as to which side will give maximum emissions and test the product just on that one side, once again saving time and money and a big disappointment when the company realises that the product in question which is now all ready for production and shipping out to the market place fails the test. This product can not go out until the EMC problems are addressed and sent back for further full compliance testing, therefore it makes sense to use pre-compliance.

More and more companies are going over to in-house pre-compliance, the cost is more affordable for some companies. Some of the issues to be considered when thinking about an in-house pre-compliance test facility are

does the amount of testing that you will be doing warrant it compared to shipping out to a outside test house for your testing to be done. How long would the equipment take to pay for itself compared to the amount you will save from doing the testing in-house. Also each pre-compliance will be different, your new in-house pre-compliance test facility might vary in test results when compared to a known test house. It is a good idea to try and get your results as close to a known good test house as possible thus bringing your degree of uncertainty down. One way of doing this is to send a product for testing at a recognised test house and then doing tests in your own pre-compliance facility and seeing just how close the results are.

The equipment needed for pre-compliance will vary depending on what it is you want to test. The physical size of your product will define what set up to use. If your product is fairly small then there are set-ups available where to do RF immunity testing normally requires a large screened room, others would only require a small screened cell. There are companies that deal with pre-compliance equipment. They have different solutions depending on your products. It is a good idea to shop around to find the most suitable place for your particular product.

## Useful links

[www.taolaceinstruments.com](http://www.taolaceinstruments.com)

Advice on:

Self test and certifying.

Pre-compliance

Product Design

Product testing

[www.ml-electronics.co.uk/emctest.htm](http://www.ml-electronics.co.uk/emctest.htm)

Pre-compliance testing

[www.compliance-club.com](http://www.compliance-club.com)

EMC compliance journal

Useful information.

Guide to EMC directive and standards.



# Your guide to CE MARKING

## PART 3 GETTING YOUR PRODUCT TO PASS.

by Gareth Bradley

**Y**ou've got a new product and you want it to pass, preferably first time. What can you do? Firstly it is a lot easier quicker and cheaper to ensure that EMC is thought about during the design stage of the product.

PCB layout design is important, a PCB that has had no consideration to EMC can contribute to EMC problems.

Increasing the width of power supply tracks on the PCB can help reduce the common impedance values which will help reduce EMC problems.

Minimising the loop area formed by the power tracks and the ground tracks will also help. This is done by keeping supply and return tracks close together. This will reduce pick up from external magnetic fields and reduce radiation from the board itself. See fig 1 for example of good layout and bad layout.

If your product is multi layered then use of separate power supply planes and ground planes can significantly reduce the common

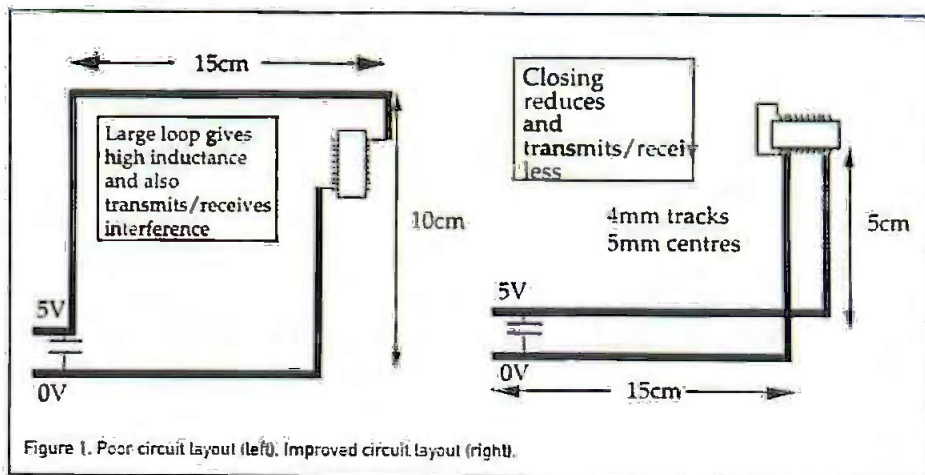


Figure 1. Poor circuit layout (left). Improved circuit layout (right).

of a separate distribution bus for power supplies will allow the routing of other signals to be simplified.

Also having return paths for signal tracks and also minimising the loop area that can be

used.

For particularly sensitive circuits which are used on the same PCB as power logic or power circuits such as signal conditioning circuits and a-d converters. The common of ground connections for each supply should be connected together at one point (if needed at all). If the common or ground connections are made at more than one point then this can cause problems. It can cause return current to flow along the small signal common track and create common impedance coupling which is not wanted. See fig 3 for examples.

The most common and basic way of helping towards reducing the EMC problems is the use of decoupling capacitors across Vcc and ground.

Capacitive coupling can be a big problem as far as EMC performance goes.

If you have any two conductors in proximity this will cause a capacitive coupling effect. This does not just apply to any PCB tracks in proximity but also applies to any components with metal cases that are nearby the source (heatsinks and mounting hardware etc). Any change applied to the potential of the source conductor or PCB track will cause current flow in the victim conductor which will result in a change in the potential of the victim conductor. Reduction of capacitive coupling can be achieved in several ways.

1. You can increase the distance between the source and the victim. This will reduce the actual coupling capacitance.

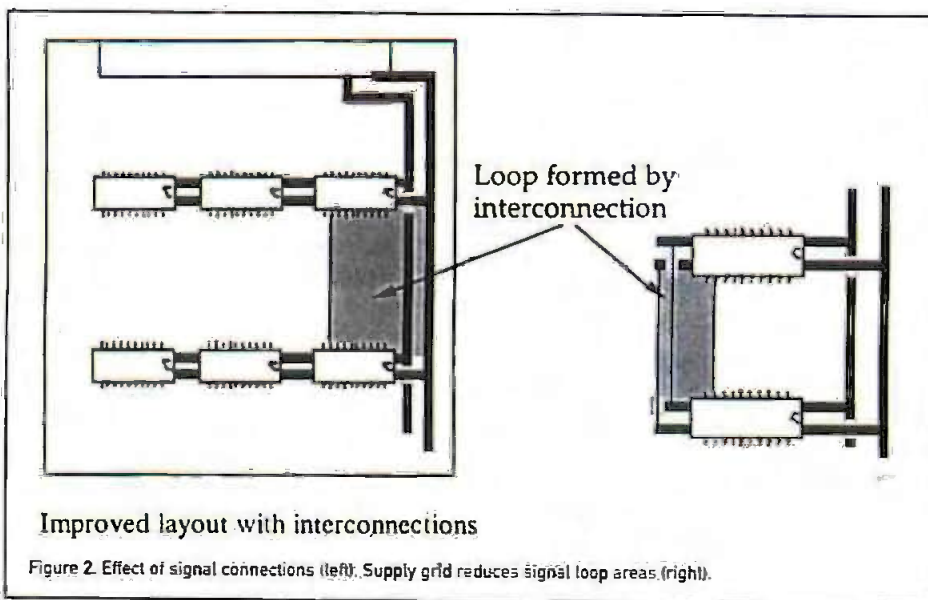
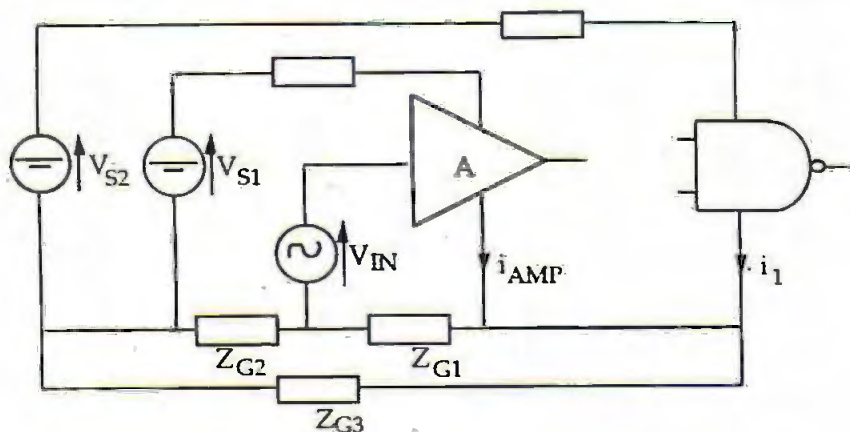


Figure 2. Effect of signal connections (left). Supply grid reduces signal loop areas (right).

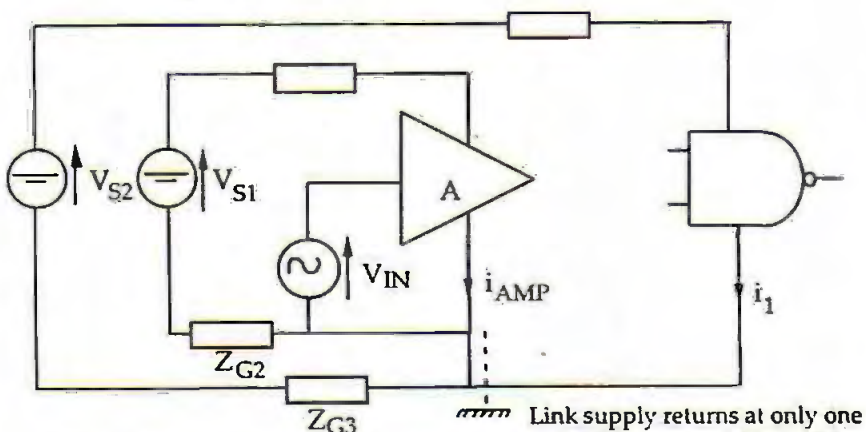
impedance values. If your PCB is only single side or double sided then the use of power planes and even a single ground plane may be impossible. In these cases the use of low impedance buses to reduce supply line impedance. These are available from various suppliers. They consist of two metal strips separated by a thin insulating layer with PCB pins for mounting and power take off. These provide a low impedance supply and the use

formed by these signal tracks will help reduce EMC problems. See Figure 2 for examples.

The use of slower devices in the logic family can also help. The speed of the rise and fall times of devices contribute to the overall EMC performance of the product. The slower the rise and fall time of the devices the less they will contribute to the EMC performance. The functionality of the product may limit the choice on which logic family is



The wrong way to do it



This is how it should be done

Link supply returns at only one point (if necessary). Preferably at system ground point

Figure 3. Use of separate power supplies to minimise coupling between circuits.

2. Use of a ground plane.
3. The use of an earthed screen between the source and the victim to prevent the electric field produced by the source from reaching the victim. The screen must be made of conductive material and must also be properly earthed.
4. Use of guard conductors to reduce the coupling effect.

When designing the PCB careful layout of the components on the PCB is a good measure against capacitive coupling. Do not run sensitive analogue circuits next to high power or switching circuits.

Inductive coupling is when a magnetic field exists around circuit carrying current, any change in the current flow produces a proportional change in the magnetic field and this change can induce currents in other nearby circuits. The most common source are ones that large are rapidly changing currents

are present. Switching regulators, high speed logic circuits with fast rise and fall times, power switching circuits, and power amplifiers are all examples.

This inductive coupling on PCB is usually due to long parallel tracks or running them in closely

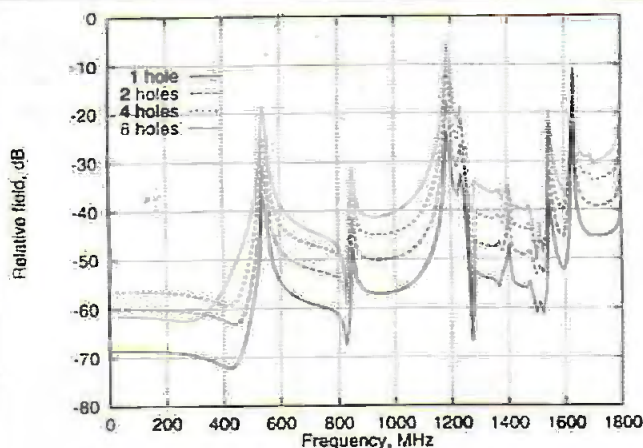


Figure 4. Effects of increasing number of holes.

coupled loops. This can be avoided with the following techniques.

1. Increasing the distance between the tracks to reduce mutual inductance.
2. The use of an earthed screen between the circuits.
3. Using a ground plane near the cause of the coupling. Eddy currents induced in the plane cancel out some of the magnetic field.

Any tracks that run near power tracks that cross the power track at right angles are not effected by this it is only parallel runs that are effected.

Overall emissions from the product can be reduced and even nullified by the use of metal cases.

A completely closed box will offer good protection against emissions. For every hole that is placed in the case this will reduce the effectiveness of the shielding. The shielding effectiveness will vary depending on the size and amount of the holes. See fig 4 for examples. It is better to have separate holes than combine any of the holes. The amount of fastenings and type of fastening can make a difference, the more secure they are the better the protection. Where any cables leave and enter the case, the position of these cables in relation of the Case can also make a difference to the overall EMC performance. See Figure 5.

There are companies that specialise in providing solutions to minimise EMC emissions. These products include caskets to go on any lid or any part of the case that detaches. There is also paints available to coat the inside of the case. These paints can offer quite good protection.

### Useful links

1. [www.spraytech.co.uk](http://www.spraytech.co.uk)
2. [www.appliccoat.com](http://www.appliccoat.com)
3. [www.lairdtech.com](http://www.lairdtech.com)

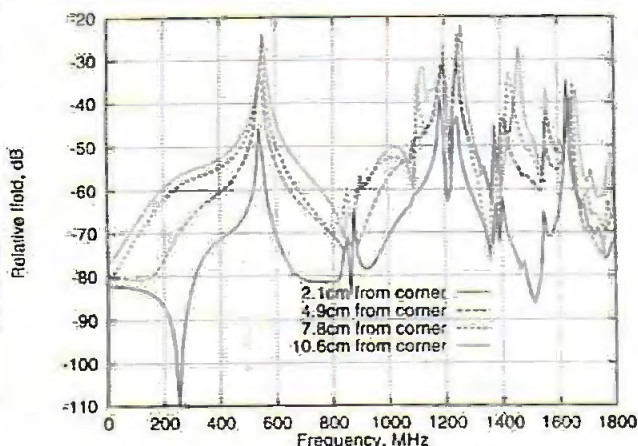


Figure 5. Comparison of varying entry point for cable penetration.