



Another EMC resource
from EMC Standards

18 - Cost effective uses of close field probing


Updated for 2020 - Version 3.2

Helping you solve your EMC problems


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Module 18

Cost-effective uses for near-field probing, and RF current monitoring in every project stage, for emissions, immunity, and more!



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- A kit of parts for your own near-field probing / RF current monitoring facility**

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Change Record: v3.0 to v3.2

- Slide #137: Note added about the frame of the Cal Jig
- Slides 169-173 added: Example Kit of Parts
- Slide # 31: errors in semi-rigid diameters corrected:
was 1mm – now 2.2mm; was 2mm – now 3.6mm
- Title improved

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Near-Field Probing

Introduction to near-fields, and near-field probing (= close-field probing)

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Near-field probing: quick, low-cost, and very useful (1)

- **EMC Test Labs need good absolute amplitude accuracy, to compare measurements to absolute limits**
- **Near-field probing *can't easily* achieve absolute amplitude accuracy...**
 - **but *can easily* provide accurately repeatable amplitude measurements...**
 - **so *can easily* be used for relative measurements, e.g...**
 - ◆ is this seam, joint, cable, etc., noisier than others?
 - ◆ does this modification seem to have fixed the problem?
 - ***repeatability of near-field probing, is the main requirement for success!***

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Near-field probing: quick, low-cost, and very useful (2)

- **We can buy (or easily make our own) near-field probes, which are *very powerful indeed* even used with low-cost spectrum analyzers (SAs) (or oscilloscopes)...**
 - **e.g. I have often used a simple 15mm loop of plain wire with a \$1,000 portable SA to find the cause of EMC test failures that manufacturers had wasted many months repetitively respinning designs and retesting in EMC labs...**
 - ***before coffee break in the morning of my first visit***
 - ***including trying out and proving practical fixes!***

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Near-field probing: quick, low-cost, and very useful (3)

- **“Near-field probes/probing” covers many different probe types...**
 - and may use different names - e.g. ‘close-field probes’, ‘loop probes’, etc...
 - this short presentation covers most types, and how to use them
- **Once people learn how to use near-field probes repeatably, they *always* wonder how they ever managed without them!**

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Near-field probing: quick, low-cost, and very useful (4)

- **Radiated emissions / immunity tests generally measure in the ‘far field’...**
 - with the entire equipment and its cables ‘in full view’ of the antennas...
 - which creates an aggregated/averaged overall result that can only give us a rough idea of what might be causing any emissions / immunity problems,
 - based on the combinations of turntable angles and antenna polarisations at which the worst cases were measured

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Near-field probing: quick, low-cost, and very useful (5)

- **But near-field probes are only usually sensitive within a few tens of millimetres (i.e. an inch or two)...**
 - so they can quickly locate the actual causes of the problem emissions

 - **Note: strictly speaking, we usually probe the ‘Radiating Near-Field region’ (see slide 13) but for brevity we call it the ‘Near-Field’**

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Near-field probing: quick, low-cost, and very useful (6)

- **There is generally no *direct* comparison between near-field probe test results and the results of ‘proper’ EMC laboratory tests...**
 - (but see ‘Current Monitor probes’ later)*
 - but – with experience – we may be able to predict full-compliance test results quite well...

 - *especially* when comparing the results of a product that has been modified, upgraded, etc., with its fully-tested original ‘Golden Product’...

 - ◆ see Parts 1 and 2 in the “DIY EMC Testing” series at: www.emcstandards.co.uk/diy-emc-testing-series-2001 for a description of how to create and use ‘Golden Products’

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Near-field probing: quick, low-cost, and very useful (7)

- ***We might only ever need to visit an EMC Test Lab for a final validation (if we need one at all)...***
 - ◆ using 'full-compliance' EMC tests is the most costly / slowest way of proving a design's EMC, although it is very good business for the Test Labs!

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Near-field probing: quick, low-cost, and very useful (8)

- **If used with a low-cost SA (or oscilloscope: *not covered here*) it can quickly identify radiated/conducted emissions problems ...**
 - and quickly reveal weak points for immunity and susceptibility...
 - when used with transient and/or radio-frequency (RF) generators
 - and save a lot of time / money – while reducing risks – ***for every stage in a product's lifecycle (see later)***

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How does near-field probing work? (1)

- **All far-field emissions begin as very complex 3-dimensional 'radiating near-fields'...**
 - by probing the radiating near-fields we see the sources of all of the far-field emissions...
 - with good precision of location, which is not possible at all in the far-field...
 - *see the next slide...*

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How does near-field probing work? (2)

Equipment Under Test (EUT) and its cables

The Far-Field region
where most standard radiated emissions tests are made

The Near-Field region
(mostly the actual electrical signals, data and powers themselves)

The Radiating Near-Field region
responsible for all Far-Field emissions
(so: this is where we place our probes)

Example of a Far-Field measuring antenna

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