Measuring electromagnetic disturbance emissions at the workplace

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The ESA case contains all the equipment for the ESA workplace: GP21 baseplate, HFW21 RFtransformer, HFA21 RFcharge eliminator, shielding tent, near field probes and pre-amplifier

• •Electromagnetic disturbance emissions of an equipment under test (EUT) in the 80 to 150 MHz range in conjunction with the radiated emissions from radio stations can drive developers nearly crazy. Up to now, the solution has been to arrange an appointment in a laboratory's EMC screening cabin so that the set delivery date can be met. A new system is now available to developers that allows them to assess the disturbance emission of a module directly at their own workplace with no interim far field measurements. Every developer is more or less forced to deal with the disturbance emissions of his EUT. Either there is still a nagging doubt, even though the EUT has passed the standard measurements, or the ordeal of several modifications to the EUT with measurements in the far field that accompany the developments has taken its toll on his nerves and has emptied his purse. The reasons for this strain is the wish to always meet standards as precisely as possible. The gap between what is demanded and what is feasible in one's own laboratory is almost impossible to overcome.

Help is expensive and experience has shown that developers wait until the last possible minute before calling for assistance. The decisive weak spot when combating the disturbance emissions of the EUT is the lack of any possibility to measure the disturbance emission simultaneously at the workplace. The specialists at Langer EMV-Technik have a tip in such cases: keep calm and concentrate on what's feasible! The mentioned accuracy is often not even necessary for tests that accompany the development. Therefore a modified measuring method can be used that is characterised by a great reduction in time and costs. Engineers at Langer developed the idea for this measuring method from their knowledge about the disturbance emission mechanisms of a module.

Although a module or a circuit-board conductor alone will not emit any disturbance, it will generate RF fields and feed RF currents into the connected cables. This leads to a self-excitation of the overall metallic system, consisting of the flat modules and connected cables as well as those metal parts in the direct vicinity such as enclosure, screen plates, etc., via electric or magnetic cross-couplings (thus in the near field). The overall metallic system acts like an antenna and is excited by parts of the electronics. The exciting current can thus be taken as an approximate size of the EUT's disturbance emission. In the majority of cases, an emission measurement will be carried out under the normal measurement conditions with development EUT, e.g. in a free field with measuring antenna and measurement receiver. After all, modifications are only absolutely necessary if limits are exceeded. This provides measured values that serve as references for subsequent comparative measurements.

All RF currents of the EUT are measured at the developer's own workplace in a small-scale, defined measurement set-up with the RF instrument transformer. If the critical frequencies are within a range with an increased external disturbance, this is simply screened against this disturbance with a shielding tent construction and all conducted feeds attenuated in terms of RF. In the next step, the critical "RF sources" are sought on the EUT's printed circuit boards. Magnetic or electric field probes to scan ICs, conductor joints, plug connectors, etc. are suitable for this purpose. An exact analysis of the frequency shares and orientation of the near fields often provides information on their interaction with the exciting currents.

The front of the shield has to be opened to measure the near fields with sensors. The shielding effect is, of course, much lower in this case than in the closed state. The near fields of the EUT are, however, generally much stronger than those fields that are coupled in from the environment so that successful measurements are still possible. Once the "RF sources" have been located the characteristics of the EUT are changed on the spot on the printed circuit board by soldering on components or re-routing conductors. The results can be assessed for any reduction immediately by measuring the exciting currents using the RF instrument transformer. In more extensive tests you can alternate between measurements with an RF instrument transformer and near field probes. The developer can thereby change the module so that a minimum exciting current flows into the connected conductor.

This solution provides the developer with a method to evaluate the disturbance emission of a module directly at his workplace with no interim far field measurements. What's more, he can change between measurement and modification in a matter of seconds, thus saving both time and money. • •