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LaurTec

EMC Testing

Measuring against a standard

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Abstract

Depending on which market you are developing your system for, you may be affected by one or more regulation and standard. For EMC conducted and radiation tests, the most known standards are the CISPR series released by the CISPR IEC technical committee, and the equivalent EN550xx. Formally, in Europe it should be rephrased the other way around. Indeed the official standards are the EN series and the CISPR are recognized to be equivalent. Said that, those standards are nice and clean, thus you just need to follow it and check if you comply or not with them. Ok, they are neither nice nor clean, but the majority of points do not leave for ambiguities.

EMC standards

If you read those standards, they are quite annoying, since they specify details that you do not typically care about. For an engineer a horse can be approximated with a sphere. Thus if the standard is telling an engineer that a board must be positioned 5cm from the ground, he is typically approximating it to the fact that the board must not touch the ground. Worst, at the end he will say that he complies with the standard with a small error that enabled him to measure the setup faster. Approximations to make models being optimized for a certain application, is a good practice and it reflects what an engineering problem is all about. Nevertheless if a standard requires you to take a measure for 10 seconds and the model you claim to be "optimized" requires 5 seconds, you are not measuring against the standard. It is as easy as that. Doing some early measures, known as pre-compliance tests (or do what you want to test), may justify the usage of your model to determine potential problems faster, but you should not claim that you comply with the standard until you use it.

This leads to a key point and question, what is a measure?

A measure is a comparison between two things, whatever they are. One has an unknown size while the second is your reference. Goal of the measure is to determine how many times the reference is within your object under measure.

The key point for the measure is the reference, indeed the measure to be really meaningful must be repeatable. If you cannot repeat a measure, typically there is no real reason for measuring.

Now it comes to the standard, it will define your reference, so that you and others can use it to make measurements of different objects (systems) and be able to compare those as you would do with apple and apple.

This sounds so easy, that many do not comply with that.

Once a standard defines a certain setup for making a measure, the goal is to make that measure repeatable. EMC standards such as the CISPR xx and EN 550xx do have limits out of which you can claim to be conforming or not with the standard.
To be able to use those limits, it is a must that your setup respects the requirements for

which the limits have been taken. Not doing that, it means that the measures you are taking cannot and must not be claimed to be conforming a certain standard. Moreover it also means that the results cannot be even compared with the limits shown in the standard. For this reason there are test labs that take seriously to be compliant against regulations and standards. They also make sure to take the most out of the customer wallet. Thus, customers try to do pre-compliance tests on their own to make sure that they will not be far from the standard limits. Afterward they rely on the final test taken by a serious test house.

Today being "compliant" from an EMC radiation perspective makes your product more trendy. Thus in many IC data sheets you will often find radiation test diagrams to show that the IC "complies" with a CISPR standard. Many magazines will show plots from their customer products and they will make the topic very interesting.

Those kinds of plots, since do not relate to a real system, they are not really relevant for the CE marking that would be required for your product. Indeed the radiation tests must be done at system level. Nevertheless they could be a guide and can make you feel comfortable that you are selecting for instance a good DC-DC converter rather than a DC-DC converter with an AM radio transmitter as a hidden feature.

Things that are there for making you comfortable may actually challenge you afterward. After all, once you will select a product it is your responsibility to make your system working and compliant. Thus an article advertising a product with a radiation plot has the goal to make you conformable and let you select it. Afterward it is your problem to make it work from an EMC perspective…
Good plots, beside writing in good characters the standard, they should specify that the measures have been taken from a third party or at least highlight with a picture the test setup and compliance with the standard.

Plots that claim that a product is compliant just by showing a single screen shot from the spectrum analyzer, are highly not compliant. CISPR standards are severe and strict, in the sweep timing and amplitude corrections you need to take. Compensating cables, gain, antenna factors, or LISN, cannot typically be taken with a single instrument shot but rather need data rework, typically done by specialized software or dedicated scripts.

Conclusions

Endorse the standard as it is and not as you would like it to be. Check the differences between your setup and the standard and evaluate the errors. Any time you are making your setup, even if you have a rough estimation of the error do not claim that you are compliant with a standard. Probably if you repeat the same measure after your vacation you will find other results. Nevertheless for your estimation and quality check your setup might be good enough to point possible system challenges. These are always worth to be detected as soon as possible.

Bibliography

[1] www.LaurTec.it: official site where you can download the "EMC Testing" series.

History

Date	Version	Author	Revision	Description
25. July 2020	1.1	Mauro Laurenti	Mauro Laurenti	Minor reformatting and typos corrections.
10. May. 2020	1.0	Mauro Laurenti	Mauro Laurenti	Original version.