Time Domain Measurements to detect Defects on OATS

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Abstract:

The quality check of Open Area Test Sites (OATS) is very important to achieve a good reproducibility of EMC compliance tests on different OATS [1]. To examine the influence of the ground plane geometry and size on the normalised site attenuation (NSA) a comparison of different open area test site geometries and sizes has been carried out [2]. The calculations and measurements in the frequency domain (CW) show, that the size and geometry of the ground plane significantly influences the field distribution above the plane. Thus the physical effects have been depicted.

This approach has the disadvantage, that it does not give any information about the position of the error on a real OATS, as it is not possible to carry out a field scan above the whole ground plane to determine the field strength distribution. To eliminate this problem further investigations have been performed with measurements in time domain, which give the desired error localisation. Contrary to the NSA measurement, which is the standardised method to check the characteristics of the OATS, it is possible now, to depict the physical effects of wave propagation and to localise errors.

Measurements

The fundamental idea is, that the previously detected effect of surface current maxima at the rim of the plane at special frequencies has to be stimulated with a pulse excitation also. This procedure has the advantage, that it is possible to detect and localize reflecting objects. With the elapsed time between the pulse excitation from source to the reflecting target and back to the source the length of path can be calculated.

Contrary to CW-measurement space information is given, which makes it possible to locate errors and to fix them.

The measurement equipment consists of a vector network analyser with time domain extension. The measurement is performed in frequency domain and then transformed to time domain with the inverse Fourier transform. It is possible to perform time gating.

To achieve good space localisation it is necessary to use an antenna with good directivity and a small radiation pattern. Therefore the TEM-Horn has been used, which has broadband characteristics with the necessary constant amplitude and linear phase. Contrary to [3] only one antenna is used and the reflection coefficient $\underline{S}_{11}$ is analysed (Fig. 1). The antenna has been calculated theoretically and numerically with the method of moments to obtain the electric characteristics.

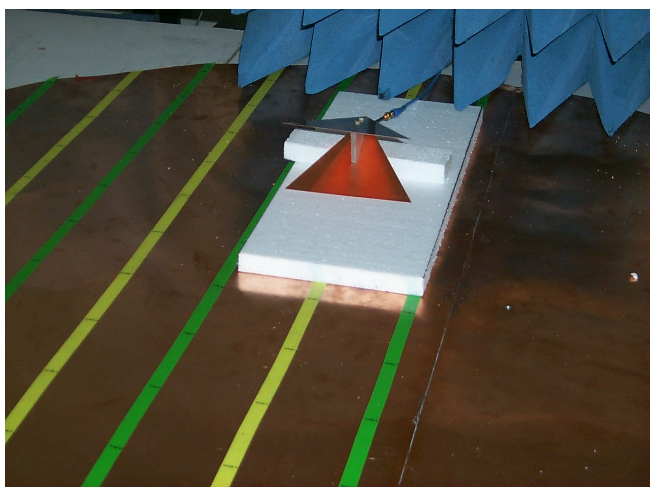

Fig. 1: TEM-Horn on scaled OATS

If a superposition of different errors occurs it is a simple method to disambiguate the measurement by moving a metal plate as a defined reflector over the plane. The place of the error is determined if the strong reflection of the metal plate matches with the smaller site defect reflection. Thus it is possible to perform an online correction with a control of the improvement by observing the reflection coefficient.

Conclusion

The measurement results on scaled OATS show, that the time domain measurements provide a powerful tool to detect errors of the ground plane or reflecting objects in the environment. Furthermore it is possible to check site characteristics during operation by comparing actual measurements with the measurements performed after site construction. This method should be used as an extension of the NSA measurement.

References

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