EMC Test Cell S-LINE

Compact EMC test cell of high field homogeneity and wide frequency range

In S-LINE, Rohde & Schwarz offers a favourably priced test cell for measuring susceptibility to electromagnetic fields in the frequency range 150 kHz to 1 GHz in the development phase. The test cell, which comes in two sizes, is an attractively priced alternative to compact anechoic chambers. By generating the field using a symmetrical line, S-LINE offers a larger test volume than conventional cells.

With the expiry of the transitional period for the electromagnetic compatibility law at the beginning of this year, all manufacturers of electrical and electronic products in Europe are now required to supply EMC conformity declarations for their products and label them with the CE mark. Small and medium-sized businesses in particular have to decide which of the required measurements they can perform on their own with due consideration of their facilities and budget. Test setups and systems conforming to standards call for relatively high investment. Particularly interesting, therefore, are solutions that offer low-cost EMC measurements in preliminary testing, ie precertification, prior to acceptance testing. Such measurements can further provide proof of the effectiveness of EMC measures already at the development stage, so standard-conforming measurements performed by external test houses can be reduced to a minimum.

EMC measurements are divided into electromagnetic interference (EMI) and electromagnetic immunity or susceptibility (EMS) measurements. For EMI measurements, test receivers or spectrum analyzers are required. Many users have already invested in instrumentation of this type. Rohde & Schwarz offers the budget-priced Test Receiver ESPC [1], for example, which was presented in the spring of 1995 at the EMC show in Zurich.

For susceptibility measurements, signal generators and power amplifiers are needed and, like in EMI measurements, coupling networks or antennas in addition. Unlike EMI measurements, electromagnetic susceptibility measurements must be carried out in shielded enclosures. Standards stipulate a shielded (anechoic) chamber as test environment, which must be partially fitted with absorbers to achieve the required uniform field strength (referred to as uniform area). Since the construction and furnishing of anechoic chambers involve a lot of technology and expense, cheaper alternatives have already appeared on the market. Examples of this are TEM cells or GTEM (GHz Transverse Electromagnetic) Cells, compact anechoic chambers and precompliance test cells [2].

S-LINE, developed by Rohde & Schwarz, is a new type of EMC test cell (FIG 1) offering the user decisive benefits:

- substantially lower costs compared with anechoic chambers,

S-LINE, developed by Rohde & Schwarz, is a new type of EMC test cell (FIG 1) offering the user decisive benefits:

- substantially lower costs compared with anechoic chambers,

For susceptibility measurements, signal generators and power amplifiers are needed and, like in EMI measurements, coupling networks or antennas in addition. Unlike EMI measurements, electromagnetic susceptibility measurements must be carried out in shielded enclosures. Standards stipulate a shielded (anechoic) chamber as test environment, which must be partially fitted with absorbers to achieve the required uniform field strength (referred to as uniform area). Since the construction and furnishing of anechoic chambers involve a lot of technology and expense, cheaper alternatives have already appeared on the market. Examples of this are TEM cells or GTEM (GHz Transverse Electromagnetic) Cells, compact anechoic chambers and precompliance test cells [2].

S-LINE, developed by Rohde & Schwarz, is a new type of EMC test cell (FIG 1) offering the user decisive benefits:

- substantially lower costs compared with anechoic chambers,
• uniform field strength throughout test volume,
• highly compact size allowing easy installation in existing rooms,
• correlation with standard-conforming test methods.

**Mechanical design**

S-LINE comes in two sizes. The larger model with dimensions of 1.5 m x 1 m x 1 m offers a test volume comparable to that of compact anechoic chambers. This small size makes S-LINE suitable for use in any development lab. Compared with conventional precompliance cells, S-LINE has clear advantages with respect to radio-frequency characteristics. The enclosure prevents the emission of electromagnetic energy into the surroundings. It is fitted with an RF-shielded door which provides easy access to the inside. The EUT is taken up by a level worktop in the cell. Since the EUT functions must be monitored during measurements in S-LINE, a shielded window is fitted in the door and the cell can be illuminated inside for visual monitoring. For electrical monitoring, standard filtered feed-throughs are provided and, in addition, screwed-on access panels allowing the cell to be configured as required.

**Operation**

Conventional test cells can be regarded as widened unsymmetrical coaxial lines with the EUT exposed to the EM field between the inner and the outer conductor. By contrast, S-LINE consists of symmetrical, two-wire TEM lines provided in the electrically shielded enclosure (FIG 2). The lines are fed with an RF signal at one end and terminated with their characteristic impedance at the other. In this case too, the EM field generated between the lines is used for determining the electromagnetic susceptibility of the EUT. However, due to the symmetrical arrangement, a much greater test volume is obtained than with conventional cells of the same size.

A theoretical assessment of the field distribution in a transverse plane of S-LINE can be made using a simple charge distribution model. The enclosure surfaces form the mirror lines in the transverse plane. The potential field and consequently all other field parameters are obtained by superimposing the potentials of all charges. In the case of TEM transmission, this assessment can be applied to the E-field components. FIG 3 illustrates the area of the ±3-dB and ±6-dB limits of the relative field strength determined in the way described over the complete transverse plane of S-LINE. This is the plane in which the uniform area is to be proven in accordance with IEC 1000-4-3. S-LINE fulfills the standard requirements over an area of 50 cm x 50 cm. Practical measurements confirm the calculations and show that the requirement for a uniform area is fulfilled even in a volume of 50 cm x 50 cm x 50 cm almost in the entire frequency range.

**EMC systems and setups with S-LINE**

S-LINE can be used to complement existing measuring equipment. Rohde & Schwarz also offers complete EMC test setups incorporating S-LINE. For example, an EMC test system for the frequency range 150 kHz to 1 GHz can be implemented with Signal Generator SMY, Power Meter NRVD,
a power amplifier and S-LINE. System Software EMS-K1 [3] allows fully automatic tests to be performed.

Dr. Klaus-Dieter Göpel

REFERENCES


Condensed data of EMC Test Cell S-LINE

- Frequency range: 150 kHz to 1 GHz
- Input power: max. 100 W CW
- Input impedance: 50 Ω
- VSWR of empty cell: <2.5; typ. <1.5
- Size of uniform area:
  - Large model: approx. 50 cm x 50 cm
  - Small model: approx. 35 cm x 35 cm
- Field strength:
  - Large model: 10 V/m at 20 W input power (large model, calculated in center of S-LINE)
- Dimensions (L x W x H):
  - Large model: 1.5 m x 1 m x 1 m
  - Small model: 1.0 m x 0.7 m x 0.7 m
- EUT monitoring:
  - Visually through shielded window, electrically via access panel with integrated filters,
  - AC: 220 V/4 A,
  - DC: 12 V/2 A, 5 V/4 A

Reader service card 151/02

Rohde & Schwarz now on Internet

Since the beginning of March, Rohde & Schwarz has been using its own Web site, ie a server for World Wide Web. The network address is:

http://www.rsd.de

The offer comprises four categories of information, mostly in English:

- "What's new" offers the latest news such as the press releases of the past months in German and English.
- "About Rohde & Schwarz" comprises general information about the company, history, technical milestones and international marketing addresses.

- The third category “Products” is the key offer and is arranged according to activity fields and applications. Written and display information about products can be called up.

- “Events” presents the complete Rohde & Schwarz training program in German and English and a list of known participation in shows for a whole year in advance.

Online information thrives on news. For this reason our pages are continually revised so that they are always right up-to-date.

We recommend use of the Netscape Navigator as an access program (Browser). This program ensures troublefree display of data.

In short