Design Aspects of a RS-105 Facility Using a Conical Transmission Line

D. V. Giri
Dept. of ECE, Univ of New Mexico
Albuquerque, NM, USA and Pro-Tech,
11-C Orchard Ct, Alamo, CA 94507-1541,
USA Giri@DVGiri.com

Tae Heon Jang
EMC Technology Center , Korea Testing Laboratory,
516 Haean-ro, Sa-dong, Sangnok-gu, Ansan-si,
Gyeonggi-do, South Korea 326-901
jhjang@ktl.re.kr

***Abstract*— This paper describes the design, fabrication and preliminary measurements of a facility in Seoul, South Korea to meet the Radiated Susceptibility Standard RS 105. This facility is under development. This facility will be used for susceptibility testing of electronic equipment.**

Key Words - Transient pulse, RS-101, EMP, susceptibility testing

I. Introduction

This facility has been called KEMPS and the goal is to produce the RS-105 compliant e-field environment and the facility is schematically shown in Figure 1.

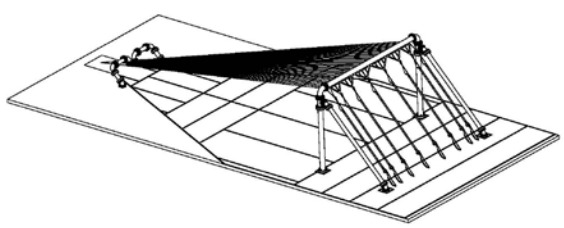

Figure 1. Schematic diagram

The pulser exciting the facility is manufactured by EMC Montena of Switzerland and the model number is EMP 230K-2-23 which is designed to work into a load of 100 Ohms.
The facility is designed for a TEM impedance of 100 Ohms with the overall dimensions of: length l = 18.5 m, maximum height b = 3.71 m and the full width of the top plate 2a = 5.98 m . This makes (l/b) = 4.98 and (b/a) = 1.240 resulting in ~ 100 Ohms to match the pulse generator. The top plate is formed by stretching stainless steel wires. Two catenaries' supports are required, to support and maintain the tension in the wires. Stainless steel wires have been routinely used to prevent corrosion problems and they have adequate electrical conductivity. The sag will be held to less than 5% of the span. The ground plane design accounts for the test object loading factor and are made of galvanized steel mesh of varying sizes except in the pulser region, where it is designed to be a solid plate. A portion of the ground plane is formed by solid plates for test object movement.

II. Spherical TEM Mode Calculations

A spherical TEM mode propagates in the conical transmission line and the excitation pulse has frequency components ranging from DC to about 200 MHz. The low frequencies in the pulse are well terminated by the distributed termination at the end of the line and the high frequencies do not see the termination and get radiated out. Some of the intermediate frequencies can leak to the sides of the facility. The spherical TEM mode is depicted in Figure 2. The radial components of the electric and magnetic fields are zero. The principal components are E_θ and H_ϕ. The spherical TEM mode propagation is shown in Figure 2.

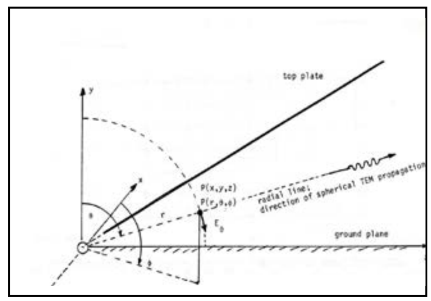

Figure 2. Propagation of spherical TEM mode

III Predicted E-field Levels

The predicted fields in a normalized format are shown in Figure 3 as constant-field contours.

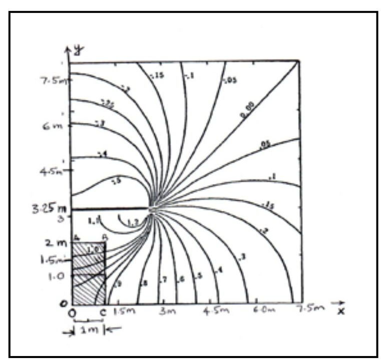

Figure 3. Constant normalized e-field contours in the central plane of the working volume (2m x2mx2m)

The normalized e-field at the center of the working volume is 0.96. The corresponding absolute value for a 230 kV input pulse will be [230kV/3.71m] x 0.96 = 59.5 kV/m. It is noted that since the pulser output is nearly a double exponential, the analysis and results presented here are applicable at any instant of time t during the pulser waveform, in a relative sense. In other words, at every t during the pulser waveform, TEM waveform is propagating. In the frequency domain, the results presented are valid from dc up to a frequency where a non-TEM mode comes in with appreciable amplitude. Details of analyses and preliminary measurements will be presented.