2-loop Antenna Measurement Method for the Emission Noise Test of Automotive Component

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Abstract **– CISPR25 test is used to characterize EMC performance of automotive component. To avoid miss detection of unwanted emission in this test, it is necessary to scan the measurement antenna along the wire. In this paper, we propose a no scanning method using two loop antennas placed near DUT and wire terminal. Simulation and measurement show that the proposed method picks up unwanted signal with the errors less than 5 dB.**

Index Terms **— electromagnetic compatibility (EMC), electromagnetic emission, measurement method, CISPR25**

1. Introduction

Recent years, number of electronic devices within vehicles is increasing for improvement of performance by electronic control. Under such environment, electrical devices are densely packed and vehicles should be tested to find the possibility of malfunction by the interference of emission noise. CISPR25 component-level test [1] is global standard to evaluate for radiation noise in electromagnetic compatibility (EMC) test of automotive. Under the test, radiated emissions may be missed due to the null position of electric field distributions at measurement probe and the scanning measurement is required [2]. It can measure exactly by avoiding the small field position but takes more time for measurement than CISPR25 test.

We propose 2-loop antenna measurement method to remove scanning function in emissions test. It consists of two loop antennas placed near device under test (DUT) and wire termination, respectively. This paper shows simulated and measured performance of proposed method.

2. Scanning measurement method

The setup of CISPR25 test is shown in Fig. 1. It consists of test system (DUT, harness, line impedance stabilization network (LISN), battery, and metal table) and receiving antennas (bi-conical antenna in 30-300 MHz and log-periodic antenna in 300-1000 MHz) placed within an anechoic chamber whose floor is gland plane. In the simulation, DUT model is the shield box included a comb generator as noise source and LISN is 50 Ohm terminator.

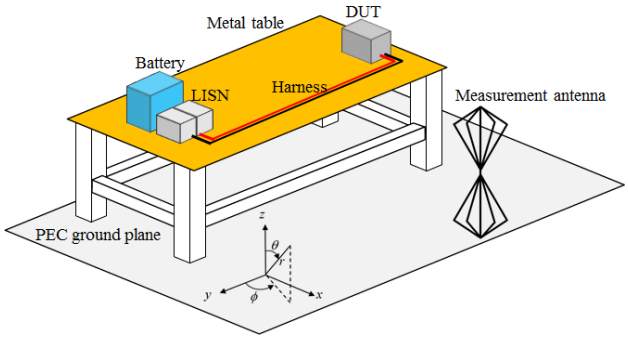

Fig. 1 CISPR25 test setup

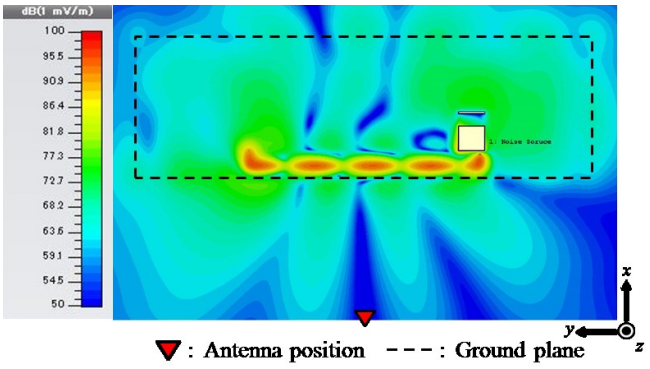

Fig. 2 Electric field in 400 MHz

The test evaluates at only single point whose distance from the harness is 1 m with a height of 1m above the ground plane. Under the test, radiated emissions may be missed when the null of electric field causes at the measurement position as shown in Fig. 2.

Scanning measurement method solves the problem [2]. It measures the maximum value of electric field from 7 points with moving the antenna along the harness at intervals of 250 mm between DUT and wire termination to avoid the weak point of field. The measurement result is shown in Fig. 3. The method provides precise to obtain radiated emissions with long time for measurement as compared with CISPR25 test.

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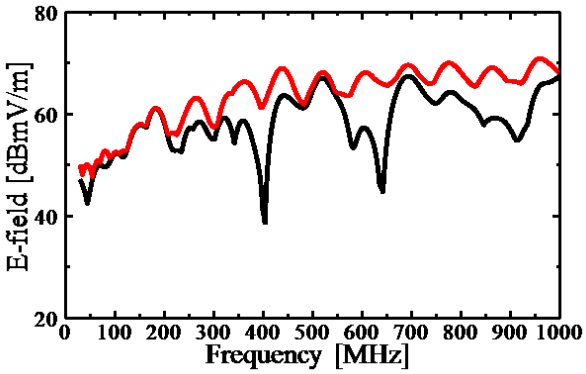

Fig. 3 Effectiveness of Scanning measurement method

3. 2-loops measurement method

We propose the 2-loop antenna measurement method. The setup of the method is shown in Fig. 4. It consists of test system and two loop antennas installed near DUT and wire termination, respectively. The loop antenna is shorted to metallic table at one end and connected to 50 Ohm feed port at the other end. The size of both antennas is 150 mm × 150 mm. Proposed method obtains receiving voltage near DUT and wire termination and picks up the sum of two probes as the measurement value. The result of proposed and scanning method is shown in Fig. 5. The voltage curve of proposed method is gradually increased, whereas scanning one shown as black line is flat for frequency. This difference is caused by the antenna characteristic in each method. This difference is compensated by adjusting measurement using antenna factor (AF) as shown by blue line in Fig. 5.

Proposed method derives radiated emissions from measured value by adjusting the difference of each method and multiplying AF to convert into electric field value. Fig. 6 shows the deviation of each method in emission test for actual automotive component. The method is possible to evaluate within about 5 dB except for 30 MHz and 200 MHz and achieve miniaturization and simplification compared with scanning method.

4. Conclusion

This paper presented 2-loops measurement method to remove scanning operation. The results show that the proposed method provides measured data within about 5 dB except for 30 MHz and 200 MHz compared with scanning method. We demonstrated the effectiveness of proposed method as the method of the radiated emissions test of automotive component.

References

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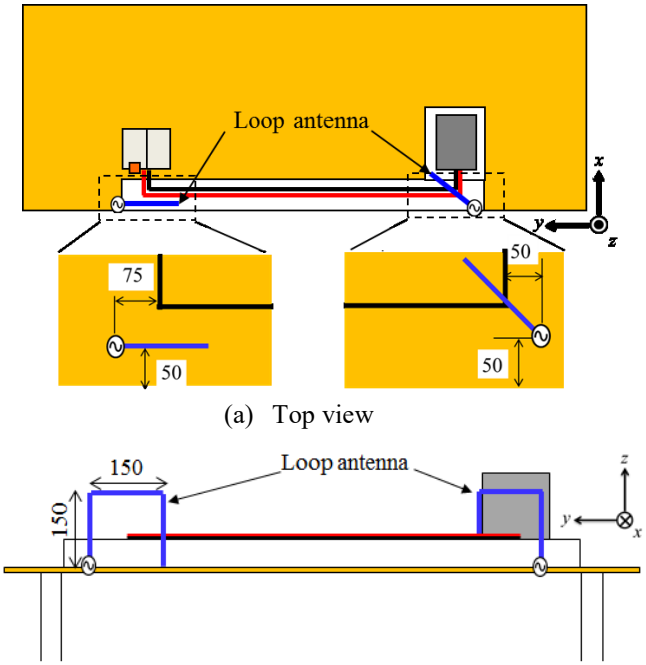

(a) Top view

(b) Front view

Fig. 4 Setup of 2-loop antenna measurement method

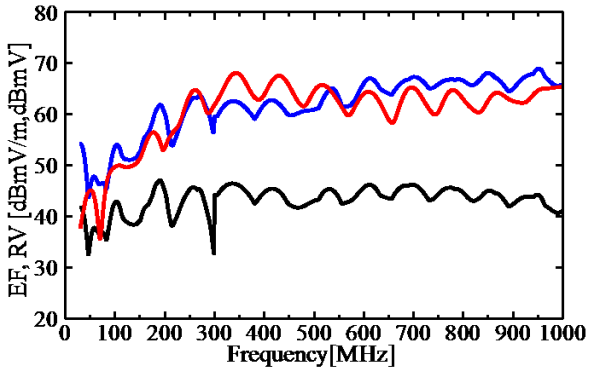

Fig. 5 Compared scanning measurement method with 2-loops measurement method

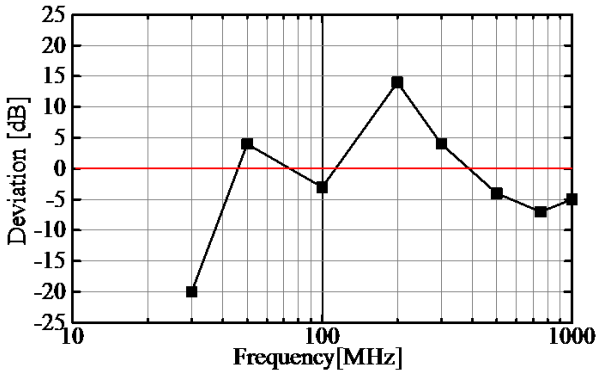

Fig. 6 Deviation between scanning method and 2-loop antenna method for actual component