

## An EMI estimation method by simple evaluation of radiated emission

◇ Simple and low-cost EMI estimation by using spectrum/signal analyzer(338E/438E/538E/558E)

### \* Application \*

Precompliance EMI test system MR2300 using spectrum/signal analyzer (338E/438E/538E/558E) and anechoic box has superior cost performance. This paper presents further low-cost EMI estimation method.

### \* Solution \*

#### ■ Condition

EMI from EUT might be estimated by evaluating radiated emissions in a normal laboratory, if the following conditions are met.

Condition	description
Strict EMI measurement accuracy is not required.	It is worth to try this method, if the main objective is to measure EMI frequencies, or relative EMI level among some types of EUT.
Environmental noise in the laboratory is sufficiently smaller than EMI limit level.	The difference between the measured EMI and environmental noise is equivalent to EMI from EUT.
Even if the environmental noise at the specific frequency is relatively large, EMI from EUT at the same frequency is negligible.	Environmental noise that can be distinguished from the EMI may not be a big problem.

#### ■ Calculation method to estimate EMI from EUT

The EMI at every frequency can be calculated by the following expression.

$$\text{Estimated EMI [dBuV/m]} = 20 \log \left( 10^{\frac{M}{20}} - 10^{\frac{N}{20}} \right)$$

M: Measured emission noise from EUT [dBuV/m]

N: Environmental noise without EUT [dBuV/m]

The EMI can be measured by spectrum/signal analyzer (338E/438E/538E/558E) with a function to calibrate properties of cable and antenna used. It is important to subtract N from M in linear [uV/m], not in [dBuV/m]. Measurement distance, and the height of EUT and the antenna should be the same to those of formal EMI test site. If not taking into account the effect of the floor surface reflection, a certain configuration freedom may be provided. For example, in case of 2.5 m in measurement distance, above estimated EMI can be corrected by adding a coefficient  $20 \log(2.5[m]/3[m]) = -1.6[\text{dB}]$ . However, when measurement distance is too short, there is a possibility that measurement error increases in the impact of near field of the antenna and EUT.

#### ■ Discussion

This EMI estimation approach is with an emphasis on convenience more than the measurement accuracy. The approach has been proposed as one of the solutions to a very strong demand to need to understand EMI characteristics easily at low cost.

If more accurate discussion is needed, issues to be considered (ex. phase in subtraction operation, and influence of reflected wave from ceiling, wall, and floor) are not less. But why don't you try to find a space in your laboratory suitable for simple EMI test with the handheld spectrum/signal analyzer? It is not necessarily exactly consistent with the results at the regular test site, but you may find the place and the condition that it is operational as long as it is a relative evaluation in an acceptable error range.

### \* System configuration \*

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| <u>Example</u> | <ol style="list-style-type: none"> <li>1. Signal analyzer [MSA538E]</li> <li>2. Low noise amplifier [MAP302]</li> <li>3. Measurement antenna</li> <li>4. Jigs to mount antenna and EUT</li> <li>5. Others(PC, I/F modules, cables, etc)</li> </ol> |
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