

A basic method of calculation in dB for wireless applications

◇How to create level diagram of a wireless application using anechoic box

Application

In recent years, even circuit design and digital design engineers should learn radio technologies with the increase of wireless applications. Some of those engineers may not be good at analyzing in dB. This paper presents a way how to create level diagram of a wireless application using anechoic box.

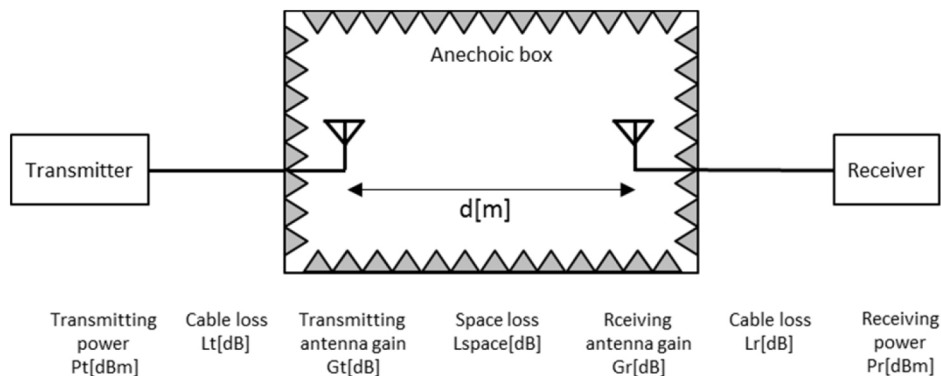
Solution

■A basic of calculation in dB

1[mW]: $10 \times \log(1) = 0[\text{dBm}]$, 10[mW]: $10 \times \log(10) = 10[\text{dBm}]$, 20[mW]: $10 \times \log(20) = 13[\text{dBm}]$,
100[mW]: $10 \times \log(100) = 20[\text{dBm}]$

■Calculation in dB for creating level diagrams of wireless applications

A test system with an anechoic box to evaluate communication properties in wireless applications is shown in below figure.



$$P_t - L_t + G_t - L_{\text{space}} + G_r - L_r = P_r$$

$$\text{Space loss: } L_{\text{space}} = 20 \log\left(\frac{4\pi d[\text{m}]}{\lambda[\text{m}]}\right), \text{ Wave length } \lambda = \frac{0.3}{f[\text{GHz}]}$$

As shown above, the transmission power and the received power is related in a simple algebraic sum. Accordingly, and when inserting a power amplifier between the transmitter and the transmitting antenna, or inserting a low noise amplifier between the receiving antenna and the receiver, level diagram can be created by simply adding their amplification degree [dB] in the above equation.

System configuration

- Example
1. Signal analyzer [MSA538/558]
 2. Anechoic box
 3. Antenna
 4. Jigs to mount antenna and EUT
 5. Others(PC, I/F modules, cables, etc)