Course 140 - Speech Intelligibility for Public Address Systems

Sound Pressure Level (SPL) Measurements

SPL Measurements: Video 1

1. Sound Pressure from Sound Power

A transducer converts electrical power to acoustical power. The acoustical power produces atmospheric pressure waves that are perceived as sound if they fall within the bandwidth of the human auditory system. The hearing mechanism converts the pressure deviations into electrical signals that are fed to the brain for further processing. A microphone converts the pressure deviations into a voltage that can be fed to the input of an audio component, usually a mixer.

Most sound measurements are of sound pressure, not sound power. A sound power measurement must quantify all of the sound energy emitted from a source. There are two methods:

1. Confine the radiated energy to a specially designed enclosed space and measure it.
2. Make a grid of pressure measurements around a source and integrate them to assess the radiated power.

Sound power measurements are important in some areas of acoustics, but they are not normally needed in sound system work. Instead, we are interested in the sound pressure level at a point in space such as at a listener position. A sufficient sampling of positions must be considered to assess the performance of a sound system. This lesson will examine the measurement of the sound pressure level at a point in space.

2. Sound Pressure Level

The decibel lesson showed that the pressure sensitivity range of the human auditory system extends from 20 micro pascals to about 200 Pa. Sound pressure can be thought of as an “acoustic voltage.” It is a force that acts upon the eardrum. This means the decibel relationships used for electrical voltage also apply here. As with electrical voltage, the deviation from a reference value is the quantity of interest.

Using the ambient, or resting atmospheric pressure as a reference, there is a minimum pressure deviation required to produce audible sound. Absolute acoustic levels use this minimum

deviation as the reference. Twenty micro pascals is “0 dBSPL.”
An alternative way to express this is L_P = 0 dB. The use of L with subscripts is common in room acoustics work and noise testing.

The “SPL” suffix is commonly used in sound reinforcement work. A sound with negative dBSPL is possible, but it is not audible. Some specialized chambers can achieve such low levels, and specialized microphones are required to measure them.

The range of human hearing extends from 0 dBSPL to about 140 dBSPL, a range of 140 dB. This is a pressure ratio of about 1/10,000,000. Now that you’ve seen the pascal values and the ratios, you can ignore them and just use the dB. It is not practical nor necessary to work directly in pascals.