# Line 6 Guide to XD-V70 Antenna Setup

Electrophonic Limited Edition - Rev C

## Introduction

This guide provides information helpful in ensuring maximum performance when using Line 6 XD-V70 wireless systems in most typical applications. Dropouts are not usually caused by defective hardware, but by improper use or installation. One of the biggest contributing causes of RF dropouts is improper antenna placement. Additionally, proper antenna placement and usage can improve performance in environments that have other RF signals competing with the microphone transmitters.

## Range

XD-V70 systems are rated at 300 feet under ideal conditions. This "Open Air Wireless Range" is also known as "Line of Sight", meaning the transmitter's antenna must have a clear path to the receiver's antenna and be reasonably free of reflections and interference. For best performance, "Line of Sight" should be maintained between the receiver's antennas and the transmitters. Radio waves travel in straight lines and do not go around corners. Barriers such as walls can significantly impede the path of radio waves depending on the thickness and the type of construction. The greatest amount of attenuation for an RF signal is when it encounters metal barriers. If you have aluminum siding or a metal roof, it is unlikely the RF signal will transmit through this barrier with much signal strength. When using wireless systems indoors you should expect to have a moderate reduction in range as compared to outdoors due to the barriers and reflective surfaces that typically exist indoors.

Another reduction of range can be experinced if the receiver's antennas for the XD-V systems are very close to other intentional radiators such as wireless IEM systems or Wi-Fi WAPs. Using the XD-V70 with remote paddle antennas and placing them away from the interfering radiators can be an effective way to mitigate this condition

Likewise, RF will not have much success transmitting through earth, so if the receiver is placed in the basement, and the earth or ground is obstructing the line of sight transmission, it will not likely receive the signal. Human bodies are also absorbers of RF energy and can affect maximum range, so remember to place your antennas accordingly.

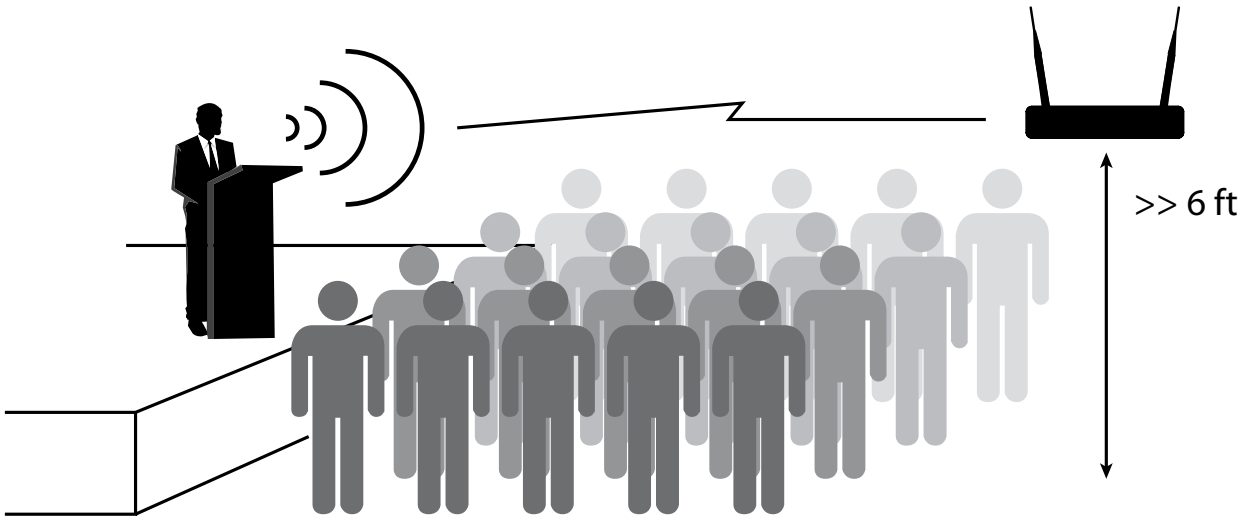
*Fig 1, Effect of body blocking forward transmission if beltpack is worn on back*

## Antenna Placement

It is important to always maintain the best possible line of sight when determining where to mount the antennas. Typically the receiver antennas should be located above head level or above any other obstructions. Avoid placing the receiver in the bottom of the rack unless remote antennas are employed. Typically, antennas should be at least 1m above the floor. Avoid placing the receiver in close proximity to RF generating equipment including computers, wireless access points and microwave ovens. It is also important to separate In-Ear Monitor and intercom transmitters from the radio receivers. Although these devices typically operate at different frequencies than the XD-V series, they can negatively impact reception when placed too close to the XD-V antennas

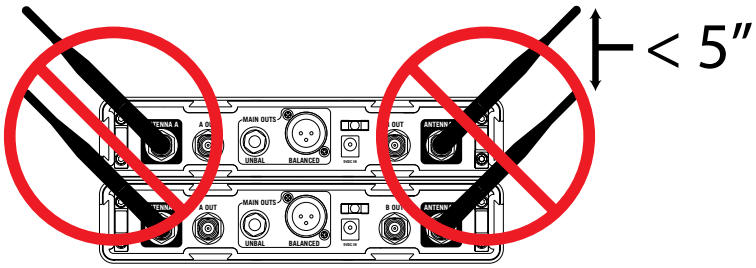
## Antenna Height

Raising your antennas above the heads of your audience and any other obstructions will make sure that your RF path is not passing through each and every body in your audience. You should avoid placing antennas closer than one meter from the floor if at all possible to help avoid RF reflections.



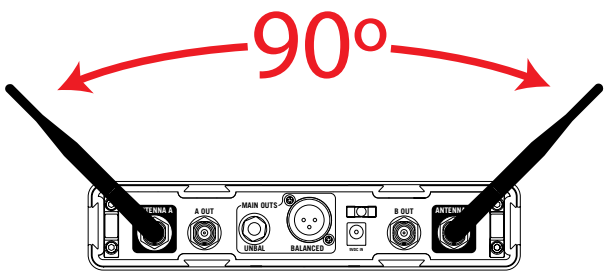
## Antenna Spacing

It is important to maintain adequate spacing of your antennas. Ideally, they should be at least one wavelength apart (aprox 5" for 2.4 GHz)



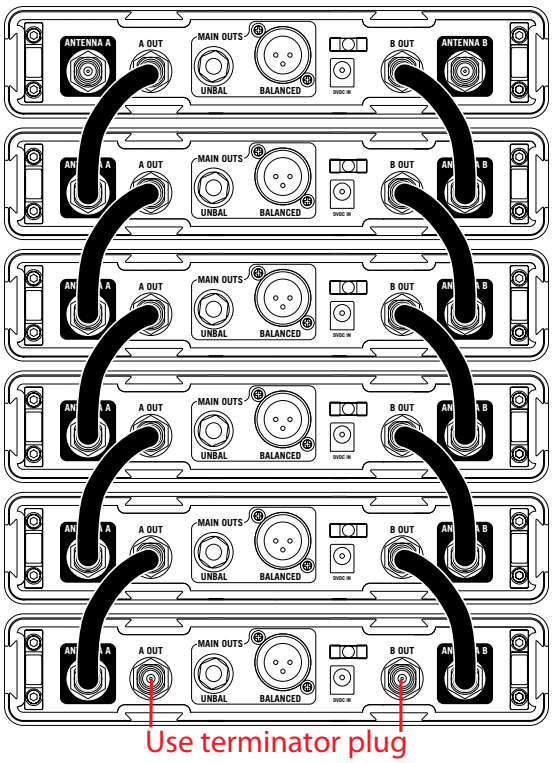

## Antenna Orientation

As best as possible, both receiving and transmitting antennas should be orientated in the same plane. This is often difficult to achieve in actual usage, given the performer's tendency to be moving around. In practice, it is usually wise to place the receiver antennas at a 45-degree angle. In this way there is a difference of 90 degrees between the pair and if the signal to one antenna becomes weak, the other antenna usually becomes proportionally stronger.



## Antenna Distribution

The spacing of multiple stacked or racked receiver antennas can degrade the performance of the wireless systems. Antenna Distribution should be employed if using more than three receivers. XD-V70's built-in antenna distribution systems makes this easy and at no extra cost.




When daisy-chaining the antennas, it is best to limit the maximum number of units per stack to six due to potential signal loss after a large number of connections. All systems must be powered on and the supplied terminator plugs must be installed in the last receiver in the chain. Always walk test the system to decide if performance is sufficient before using the system.

## Antenna Types

Both the supplied "rubber ducky" and the optional P360 paddle antennas are omni-directional antennas, which means they can pick up RF transmissions in a "donut" shape that is 360 degrees in the horizontal plane relative to the antenna position.

The optional P180 antenna is a directional "patch" type antenna, meaning that it is able to receive RF from the front side and reject unintended RF energy from the back side. This antenna should be used for long-range pickup or when pattern control is desired.

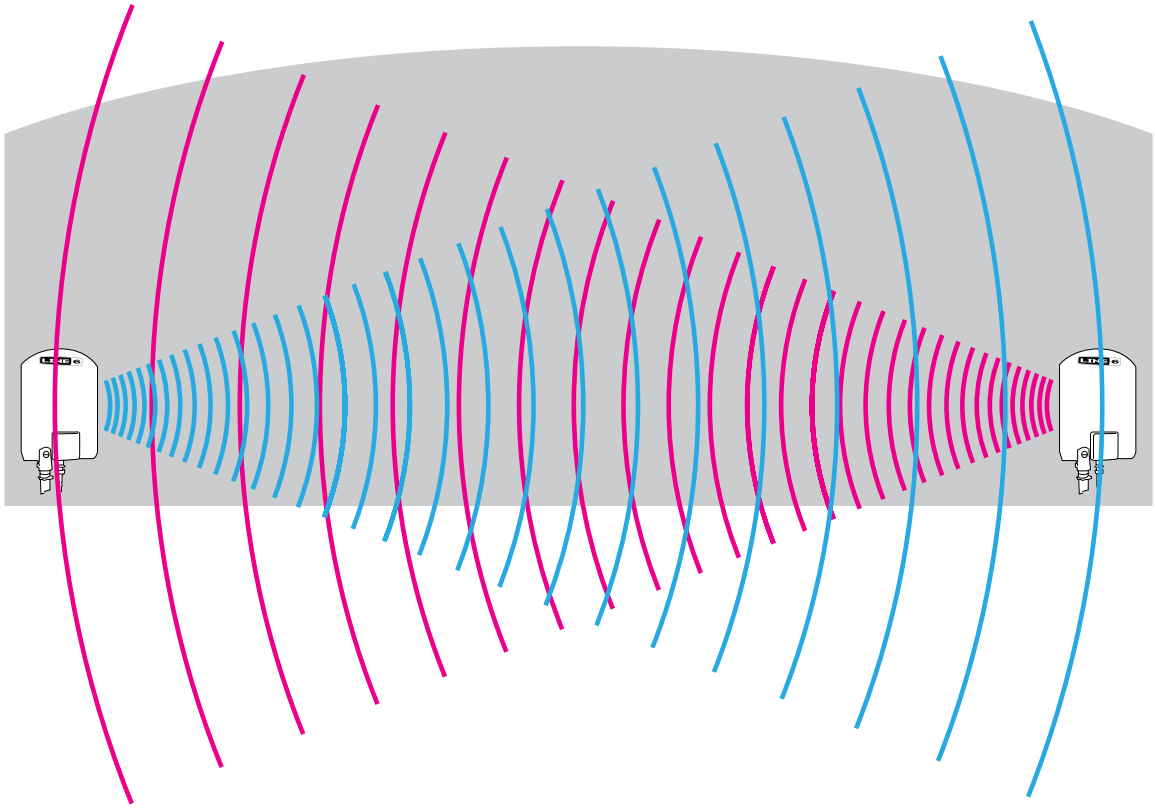
## Antenna Remoting

In an effort to maintain the best possible line of sight, it is sometimes necessary to mount the antennas remotely from the receiver chassis. By separating the antennas from each other, the likelihood of possible "near/far" issues is reduced. All Line 6 antennas are suitable for this purpose without the need of a ground plane.

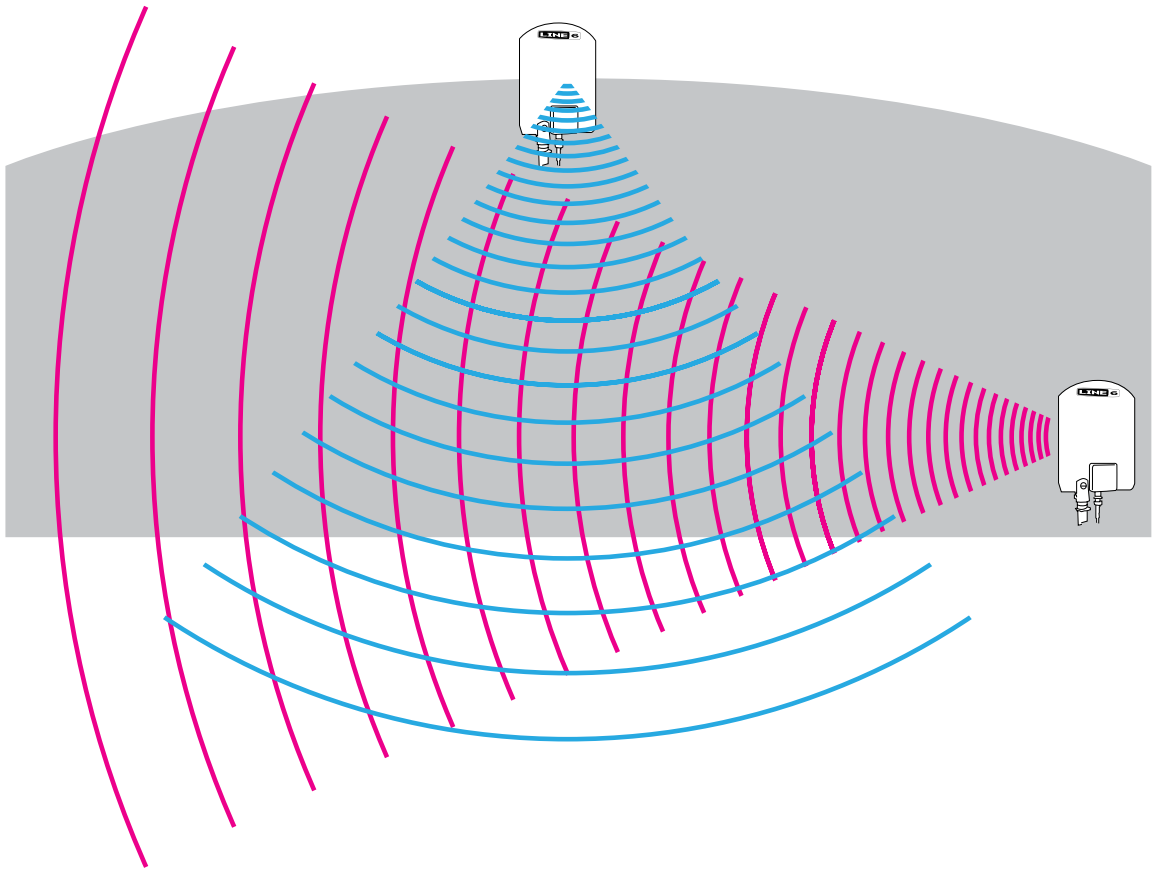
RF loss in coaxial cable should be considered when planning remote antennas. The use of low-loss cable such as LMR-195 or better is highly recommended in place of the more common RG-58 style cable. Cable lengths should be kept shorter than 15 feet (note LMR-195 has a loss of 18.6 dB per 100ft … so 15 feet yields a loss of 2.8 dB). It is not important that the cables to each antenna be of equal length (in fact it is not important that the two antennas match). The Line 6 paddle antennas are the best choice when the cable lengths need to exceed 15 feet. Both the P180 and P360 have built-in amplifiers to make up for cable losses and are switchable for +3dB, +12dB or +23dB of gain, which correspond to approximately 16', 65' and 124' make-up gains for LM-195 cable. Greater cable distances can also be achieved with low loss cable such as LMR-400 (6.8dB per 100 feet) or 9913 (7.7dB per 100 feet).

It is preferable to keep the distance from transmitter to receiver antenna relatively short, and extend the length of the audio cable rather than the other way around. However, when it is necessary to mount the antennas more than 100 feet from the transmitters (particularly when using multiple receivers with the antenna distribution system engaged) the paddle antennas are recommended.

# Possible Antenna Setups

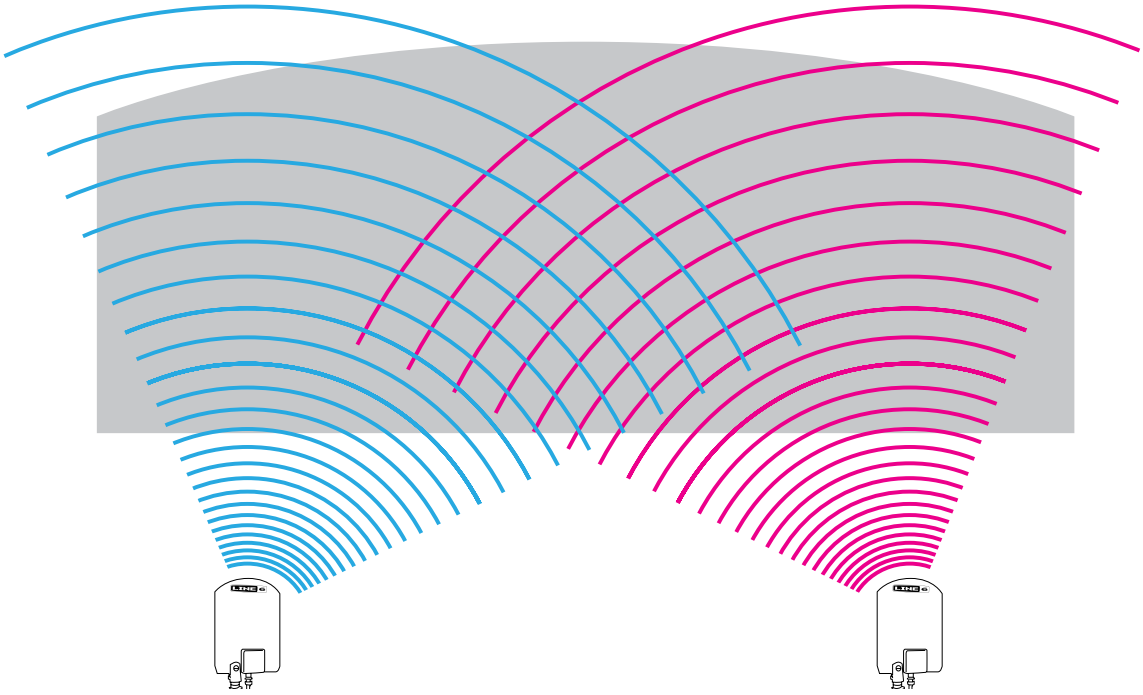


**Example 1**
This figure shows a typical stage (in blue) with a pair of P180 (directional antennas) placed in either wing. This will give a good wash of the stage as well as moderate pickup out into the audience (if necessary). Careful positioning of the antennas can keep more pickup from the stage and less from the audience area should that be desired.



**Example 2**

This antenna placement may be more helpful when using beltpack transmitters as they tend to be mounted on the performers' backs. By moving one antenna upstage you may have better line of sight. Depending on circumstances, one or both of these antennas could be either directional (P180) or omni (P360).



**Example 3**

Placement of the antennas may be more convenient when near the mixing position or when the performers will walk into the audience. This is usually best done with P180 directional antennas. Remember this placement will include any RF from the audience, so if you would like to avoid it move the paddles up to the apron of the stage. If necessary, the antennas can be placed much closer together than shown in the illustration. It is only necessary to keep them one wavelength (5") apart (but better if a few wavelengths apart).

The above illustrations are simply to offer general recommendations. In all cases it is recommended to walk your intended coverage area and check performance. Small adjustments can yield big improvements. Remember, antenna patterns should be selected with the thought of including or rejecting pickup of a selected area.