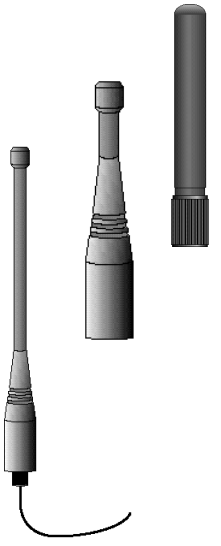
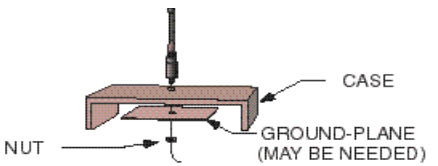
USING LINX 1/4-WAVE WHIP ANTENNAS



The antenna is a significant and often overlooked component that can have a substantial impact on the performance and integrity of an RF link. When correctly utilized in keeping with the following instructions, Linx quarter-wave antennas provide exceptional performance in a compact and rugged physical package.

CONNECTION CONSIDERATIONS

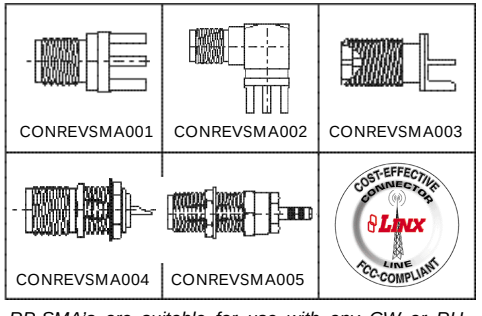
PW-Style antennas are coax-fed whips designed for permanent product mounting. The threaded bushing is normally inserted through a hole in a user's case and then anchored using a 1/4"-28tpi nut. If required, a piece of metal may also be anchored by the nut to serve as a ground-plane as described below. In some applications a user may prefer to use a Pem®-style fastener which can be preinstalled in the case.



Mounting of PW-Style Whip

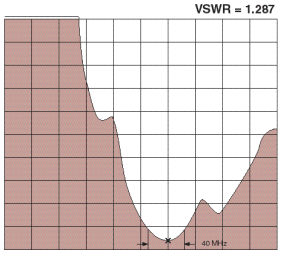
CW and **RH** antennas have an integral reverse polarity SMA connector (RP-SMA). This style of connector is utilized to comply with FCC certification requirements which call for a unique connector not widely available to the general public. RP-SMA connectors are not widely advertised in order to insure continued compliancy but they are available in a variety of styles from many sources including Amphenol, Zeus, and EF Johnson. As connectors from these companies tend to be quite expensive you may wish to consider those offered by Linx and pictured below. Linx RP-SMA's provide equal or superior quality and are significantly lower in cost.

Linx RP-SMA Connector Family

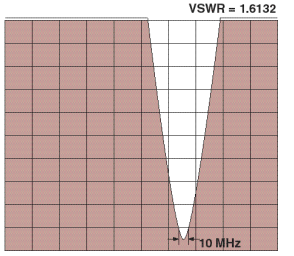


RP-SMA's are suitable for use with any CW or RH series antenna and meet FCC Part 15 or comparable certification requirements.

Typical VSWR Graphs



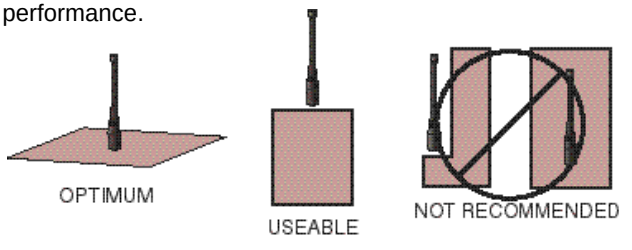
PW/CW Series



RH Series

GROUND-PLANE REQUIREMENT

Since a 1/4-wave antenna is not inherently self-resonant it must radiate against a ground-plane in order to operate effectively. The ground-plane acts as a counterpoise that forms the other quarter-wave element, in essence forming an effective half-wave dipole.The ground-plane can be a metal case or ground-fill areas on a circuit board. All Linx antennas are characterized using a 4.5" X 4.5" ground-plane centered and oriented at a 90° angle as shown below. Such an orientation is often not practical due to size and configuration constraints. In these instances a designer must make the best use of the area available to create as much ground-plane in proximity to the base of the antenna as possible. In instances where the antenna is remotely located or the antenna is not in close proximity to a circuit board plane or grounded metal case, a small metal plate may be fabricated to maximize antenna performance.

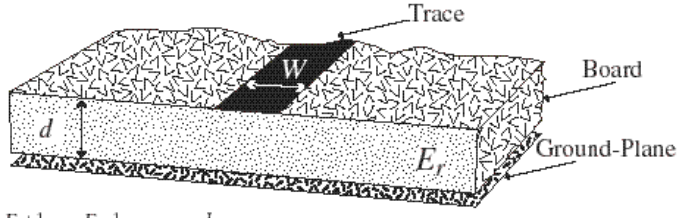


EFFICIENCY CONSIDERATIONS

At first it might appear that equal effort should be devoted to optimizing the performance of both the transmitter and receiver antennas. Yet this is not always true. In many modular and discrete designs the transmitter's output power is purposefully set higher than the legal limit.This allows a designer to utilize an inefficient antenna to achieve size, cost, or cosmetic objectives and still radiate the maximum allowed output power. With a high-performance whip it is often necessary to attenuate the output so concerns over efficiency at the transmitter are not as great as at the receiver. Once a transmitter is radiating full legal power the receiver and its antenna are the determining factor in range performance. If you are striving to achieve maximum range, careful attention to the receiver's antenna is critical.

ANTENNA FEED-LINE

The connection between an RF module and the antenna can be a significant source of loss or detuning. As the frequency of operation increases, overall antenna length is reduced.Thus, even a short antenna feed-line can have a significant effect on the operational bandwidth of the antenna.In general, if a trace length in excess of .200 is required to reach the antenna connector, a coax or a microstrip PCB transmission line should be used to prevent loss and minimize antenna detuning.



$$E_e = \frac{E_r+1}{2} + \frac{E_r-1}{2} \cdot \frac{1}{\sqrt{1+12d/W}}$$

$$Z_0 = \begin{cases} \frac{60}{\sqrt{E_e}} \cdot ln\left(\frac{8d}{W} + \frac{W}{4d}\right) & \text{For } \frac{W}{d} \le 1 \\ \frac{120\pi}{\sqrt{E_e} \cdot \left(\frac{W}{d} + 1.393 + 0.667 \cdot ln\left(\frac{W}{d} + 1.444\right)\right)} & \text{For } \frac{W}{d} \ge 1 \end{cases}$$

Dielectric Constant	Width/Height (W/d)	Effective Dielectric Constant	Characteristic Impedance
4.8	1.8	3.59	50.0
4	2	3.07	51.0
2.55	3	2.12	48.0

Microstrip formulas (E_r = Dielectric constant of PCB material)

LEGAL ISSUES

In many countries including the United States there are considerable restrictions placed on antennas used with unlicensed products. Most notable are connection requirements which generally call for an antenna to be either permanently attached or to utilize a unique and proprietary connector. This is intended to prevent the end-user from changing the performance characteristics of the products from those present when it was originally manufactured. All Linx whip styles comply with these requirements.

It should also be recognized that the efficiency and gain characteristics of the antenna may have an effect on product legality. It may become necessary to attenuate the transmitter's output with a pad to insure legal operation

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