



**A straightforward comparison between metal
and non-metallic enclosures is necessary
before selecting one for protecting
wireless controls**

- More than 18 years of expertise in manufacturing, as a plant manager and manufacturing engineering manager. Obtained Masters of Business Administration Indiana Wesleyan University B.S. Mechanical Engineering Technology Lake Superior State University.
- Currently the Engineering Manager at Stahlin Non-Metallic Enclosures in Belding, MI.



- Research indicates that use of wireless applications will increase exponentially over the next 5 years, as a result of their association with lower costs and increased reliability.



- Optimizing a wireless product line requires that designers have a thorough understanding of wireless basics and the ability to readily identify products that are open and adhere to set standards.



- Wireless transmission is useful in cases where interconnecting wires are inconvenient, hazardous, or impossible.
- With wireless data transmission, such as radio, the proportion of energy received becomes critical if it is too low for the signal to be distinguished from the background noise.
- If a signal is shielded, the signal - to- noise ratio (SNR) diminishes and the signal level drops below the 20dbm threshold. As a result data transmission errors occur. The consequences to a laptop user would be slow browsing or the inability to browse at all.

- Radio receivers receive all signals on the frequency at which the receiver is set- in the case of Wi-Fi: 2.4Ghz. For data transmission to occur, the Wi-Fi signal must be at least 20dbm greater than the signal level of the noise or spurious transmissions.



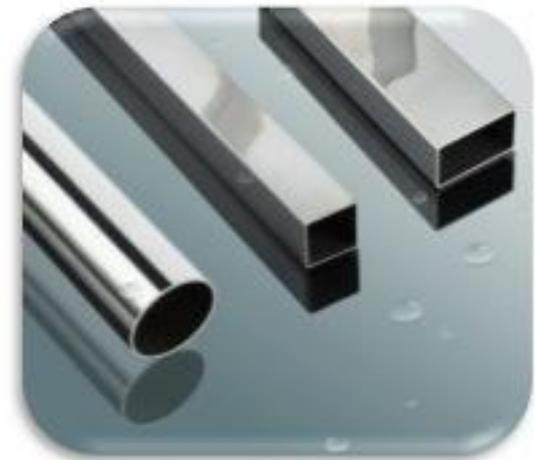


Material Selection For Wireless: Proper specification for the application.



- Designers with the opportunity to select their material should make sure to investigate and determine that it's appropriate for the intended environment.
- Every application has its unique demands. In fact, many of the capabilities are considered to be inherent in certain material choices.
- An errant or over-estimated material choice, however, can have many repercussions in the life cycle of a product. It makes good sense to select a product that is sufficient across the board.

- **Stainless steel**
 - Pros
 - Corrosion resistance
 - Impact resistance
 - Natural shielding of RFI/EMI
 - Cons
 - More expensive than LC steel or Aluminum
- **Low Carbon Steel**
 - Pros
 - Cheapest of the metals
 - Natural shielding of RFI/EMI
 - Cons
 - Requires a coating to prevent rust
 - If the coating wears off, susceptible to rust
- **Aluminum**
 - Pros
 - Rust resistant
 - Lighter than steel
 - Cons
 - Lower impact resistance than steel



- **Polycarbonate**
 - **Pros**
 - Exceptional impact resistance
 - Appearance
 - Allows RFI/EMI transmissions
 - **Cons**
 - More expensive than lower grades
- **PVC**
 - **Pros**
 - Cheaper than PC
 - Allows RFI/EMI transmissions
 - **Cons**
 - Lower impact resistance
 - Limited temperature range



- **Polymer-fiberglass composites**
 - **Pros**
 - Corrosion resistance
 - Weight to strength ratio
 - Allows RFI/EMI transmissions through material
 - **Cons**
 - Blooming



Enclosure Choices: Metallic vs. Non-metallic



- **Metallic Enclosures: External Antennas Necessary For Optimum Use**
- Premium metals such as stainless steel can be used where long life, corrosion resistance and weatherability are critical, usually in the area of control protection.
- However, their higher cost and excessive weight are characteristics many OEM's are unwilling to pass along to their customers.

- Designers must also keep in mind, what frames the most critical issue in regards to wireless application enclosure selection, the fact that metal enclosures block RF signals. To address this issue users sometimes will install an internal cable assembly, linking the wireless module to a bulkhead connector.
- This is intended to bridge the gap, allowing an external antenna such as the Delta 1 series, to screw directly onto the bulkhead connector. In practice, a metallic enclosure with this configuration of an external antenna generally performs better than one featuring an internal antenna.

Stainless Enclosures for Wireless Antenna Necessary



- For most applications, the choice of a metallic enclosure for Wi-Fi components has proven to be an ineffective one - unless there is an external antenna.
- External antennas have many downsides including their vulnerability to: environmental elements corrosion, ferrous oxide deterioration, natural ambient interference such as that from the environmental forces.
- This is why many designers are making the switch to non-metallic materials because they allow for free transmission of electronic signals.

Non-Metallic enclosures enable electronic signals to transmit freely



- Ultimately, the choice of enclosure material is dependent on the concentration of various corrosives present in the application environment and other physical properties necessary to meet design specifications.

Material Chemical Resistance: When selecting an enclosure for a wireless application use recommended enclosure materials for the corrosives found in the environment



TABLE 1. BROAD CATEGORIES OF ENCLOSURE MATERIAL CHEMICAL RESISTANCE

CONTINUUM OF USE	GENERAL CATEGORY OF CHEMICALS		
	Acids	Alkalines	Solvents
↓ Recommended	Stainless Steel	Fiberglass Stainless Steel	Fiberglass Stainless Steel Aluminum Powder Coated Steel
↓ Acceptable	PC PVC Powder Coated Steel	PC Galvanized Steel Powder Coated Steel	Galvanized Steel
↓ Limited or Unacceptable	Aluminum Galvanized Steel	PVC Aluminum	PC PVC

Fiberglass useful features for wireless applications include:



- Does not block wireless signal
- Simple to drill cutouts for audio/ video connections
- Properly protects controls in harsh environments
- Non-conductive
- Extreme cold and heat applications

Similar to fiberglass polycarbonate's useful features for wireless applications include:



- Does not block wireless signal
- Simple to drill cutouts for audio/video connections
- Properly protects controls in harsh environments
- Non-conductive
- Attractive finish/appearance

Successful Uses of Fiberglass (Composite Materials) For Wireless Controls: AMCi, Enviro Tech Instruments, RACO, Metis Secure Systems



- AMCi is a company that provides innovative remote monitoring, alarm, and control solutions using advanced low-cost satellite along with other forms of communications equipment that serve energy, water, environmental and security markets.
- They've ascertained that fiberglass NEMA 4X enclosures are specifically fabricated and rated for resistance to the harshest corrosive agents.
- Additionally, in their comparisons of materials, they determined that metal enclosures and radio frequency signals specific to wireless controls were not adequately compatible. Those two factors resulted in the selection of fiberglass composite enclosures for use in AMCi's housing and protection wireless controls.

AMCi: Selects fiberglass



- Enviro Tech Instruments chose fiberglass for their AutoLAB 4 product line. AutoLAB 4, in a cost effective manner, provides high-frequency nutrient data for its customers, with minimal operator overhead, due to its ability to offer wireless transmits. Their data telemetry, via low-cost radio or cellular modems, provides customers with complete real-time visibility of field conditions for monitoring and early warning.

AutoLAB systems installed in a nursery in central Florida where they are exposed to continuous UV Rays, humidity and heavy rainfall and in a remote location required a wireless application for optimum use.



Fiberglass allows transmission of data without incident



- Because AutoLAB's applications always requires placement in environments characterized by extreme conditions - the critical controls and instrumentation must be properly protected to ensure high level functioning and to maintain optimum reliability in the transfer of critical data from field-to-customer.
- To safeguard these essential instruments, AutoLAB relied on a non-metallic enclosure and were able to transmit data without incident.

RACO Cellularm System fiberglass enclosure allows for ease of data transfer.



RACO housing incorporates a cellular phone transceiver, antenna, and one of their many versions of alarm auto dialers



- RACO Cellularm System represents the next generation of fixed cellular equipment designed to provide voice and data communications over the cellular telephone network. Designed for temporary or permanent field use, their system needs to be rugged and housed in a heavy duty, weather-resistant enclosure.
- RACO also needed the housing to incorporate a cellular phone transceiver, antenna, and one of their many versions of alarm auto dialers packaged in a single, integrated unit while still allowing for ease of data transfer. The fiberglass enclosure they selected, met all of their needs.

MS-6100 Emergency Help Station controls protected by a non-metallic enclosure



Again fiberglass allowed the transmission of wireless signals.



- Metis Secure Solutions recently developed the MS-6100 Emergency Help Station. The Emergency Help Station is designed to be on constant response to a Request for Help from persons in need. With the simple press of a button, people are connected to police dispatch in seconds. Before Metis began to explore their enclosure options, they felt that fiberglass would be a prime choice of materials.
- Why? First, fiberglass allowed the transmission of wireless signals. Typically an exposed a metal enclosure would require an external antenna to ensure signals could be sent and received. Next, the company's systems are placed in extreme an urban environment, which means they anticipated damage to antennas was likely and would compromise the functionality of the device. In turn, the lowered functionality would pose a safety risk and create an ongoing maintenance and service issue. Their solution? A custom, yellow, molded non-metallic enclosure.

Successful Uses of Polycarbonate For Wireless Controls: Ease of use for temporary wireless internet connections.



Wireless controls can be housed in fiberglass and polycarbonate

- In order to remain competitive, many of today's music and sporting events offer it's attendees the option of free wireless internet. Due to its lightweight, ability to withstand environment elements such as heat, cold, wind, rain and dust, and cost-competitive polycarbonate enclosures are often chose for housing the wireless controls.
- Key factors among all of the companies for their product needs were wireless compatibility, rugged durability and resistant to harsh environments – everything non-metallic enclosures are perfect for.

Thoughts? Is it just an enclosures?



Results: Many making the switch to non-metallic



- After reviewing the many available options, an increasing number of companies requiring protection for wireless control systems chose non-metallic enclosures. The reasons why include:
- Metal is not as accommodating as non-metallic materials in terms of enabling electronic signals to transmit with the speed their information systems require.
- Control systems are often placed in extreme and remote environments. Users did not want to risk exposing an external antenna, which makes remote solutions more vulnerable to failure.

Results: Non-metallics are durable



- Non-metallic enclosures, such as polycarbonate and fiberglass, ultimately provide proven durability - essential for protecting applications.
- Non-metallic enclosures do not present the problem of rust or corrosion in harsh elements.
- Non-metallic enclosures are suitable for preventing unauthorized access with dual latching/lockable lids.

Results: Non-Metallic more resilient to impact



- Non-metallic enclosures are also more resilient to impact - they “give” rather than dent.



- One major negative consequence to metal enclosures can be the compromise of the gasketed seal. This seal is extremely important because it prevents moisture, dust and other environmental factors from damaging internal controls.

Results: Non-metallic a good option for wireless applications



- Companies such as AMCi, Enviro Tech Instruments, RACO Cellularm Systems, Metis Secure Solutions and others have had hands-on experience with the detrimental factors present in using metallic enclosures.
- They all concluded that for protecting wireless controls, while still ensuring maximum transmission qualities, non-metallic enclosures are the most reliable choice for housing Wi-Fi-related applications.

For more information:



- www.amc-wireless.com
- <http://www.envirotechinstruments.com/>
- <http://www.racoman.com/index.html>
- <http://www.metissecure.com/solution/?id=outdooralerting>
- www.stahlin.com