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## RF Antenna Selection Guide

### Overview:

The purpose of this tech-note is to provide guidance in the selection of an RF antenna to best fit the intended application. Listen offers a variety of antenna options to meet as wide a range of applications as possible. ListenRF operates in either the 72 MHz or 216 MHz bands in North America.

Note: For information on frequency selection in North America, see our tech-note: [72 MHz vs 216 MHz Considerations](#)

### Venue Selection:

Below are the common types of venues where ListenRF systems are used. Choose which type of space best fits your venue to assist with proper antenna selection.

- **Small Spaces:** Venues with a small coverage area that generally fit under 100 people and the transmitter is located within the same room as the receivers. Examples of these spaces: classrooms, houses of worship, residences, conference rooms, courtrooms, etc. ([see page 2](#)).
- **Medium to Large Spaces:** Venues with a medium to large coverage area and the transmitter typically is in a rack room that requires a remote mounted antenna to cover the space. Examples of these spaces include: theatres, houses of worship, ballrooms, indoor stadiums, exhibit halls, etc. ([see page 3](#)).
- **Outdoor Spaces:** Venues with a large coverage area and the antenna must be mounted outdoors in the intended coverage area. Examples of these spaces include: sports stadiums, zoos/parks, city streets, amphitheatres, fairs, etc. ([see page 4](#)).

### Antenna Specifications and Other Considerations:

For range specifications, pros vs cons, and other considerations in antenna selection assistance, please [see pages 5-7](#).

### Small Spaces:

These rooms require minimal coverage that is typically handled by an entry level antenna. The transmitter is locally installed within or adjacent to the room and running a coaxial cable to the antenna is not necessary. The transmitter may also be setup as a portable system that is moved from room-to-room when needed. Here are examples of these types of spaces and an overview of how the RF system is implemented:

- **Classrooms:** The transmitter is installed within the room and connects to a microphone used by the teacher and/or source audio from a laptop/projector. There are likely other classrooms adjacent to one another and also have an RF system installed, limiting the transmitter’s range may be needed to avoid interference.\*
- **Houses of Worship:** The transmitter may be located at the pulpit or with other audio equipment for the space but is still within the same room as the parishioners or in an adjacent sound booth. Audio from the lectern mic and/or choir is input to the transmitter. Signal will cover the sanctuary and may cover adjacent spaces.
- **Residential:** The transmitter is located near the audio source, typically from a TV or home theater system. The signal may be strong enough to cover the entire house.
- **Conference Rooms:** The transmitter is installed within the room and is connected to an output from a conference system. Limiting the transmitter’s range should be done so signal is not received outside of the room.\*
- **Courtrooms:** The transmitter is located within the courtroom and connects to the microphone(s) within the room. There may be other courtrooms that are adjacent to one another and will also have a system installed and/or the audio is confidential. Limiting the range may be needed to avoid interference and/or to limit the range of transmission.\*

\*For more info on limiting transmitter range, see our [Stationary RF Transmitter Range Limiting](#) tech-note (72 MHz only).

This table shows the recommended antennas for these types of spaces:

Frequency Band	Antenna Model			
72 MHz	LA-101	LA-106	LA-123	LA-125
216 MHz	LA-102	LA-124	LA-126	

[See pages 5-7](#) for antenna specs and other considerations to assist in antenna selection.

**Medium to Large Spaces:**

These rooms have a larger coverage area and the transmitter is generally located in a rack room away from the space that requires coverage. It is necessary to run coaxial cable from the transmitter to the antenna so it can be mounted within the space and/or higher to provide adequate coverage; this is referred to as a “remote mounted” antenna. Here are examples of these spaces and an overview of how the RF system is implemented:

- **Theatres:** Even though these spaces vary in size, the transmitter is commonly located in a different room from the theatre, typically where the existing sound system may be located. The transmitter connects to a mixing console that also feeds the speakers within the theatre. A remote antenna is mounted within the theatre to provide coverage to the entire seating area.
- **Houses of Worship:** Larger houses of worship, such as megachurches, require more coverage and the transmitter is commonly located in a separate rack room than the sanctuary. Microphone and music audio is fed into the transmitter with the remote antenna mounted within the sanctuary to cover the seating area.
- **Ballrooms:** These are large multipurpose rooms where the transmitter is not located within the space due to the different room configurations. A separate room is used to house the audio equipment and the transmitter. The remote antenna is mounted within the ballroom; an inconspicuous antenna may be preferred for these spaces.
- **Indoor Stadiums:** Indoor arenas and gymnasiums can hold many people and requires an efficient antenna to provide coverage to the entire seating area. Play-by-play and the PA system audio are commonly fed into the transmitter. The remote antenna is mounted high up in the facility to provide coverage to entire the stadium. A flexible antenna may be preferred for these spaces as it is more resistant to being hit by objects.
- **Exhibit Halls:** Large spaces that are utilized for various events, audio from a microphone and/or PA system is fed into the transmitter. The remote antenna is mounted within the exhibit hall.

This table shows the recommended antennas for these types of spaces:

Frequency Band	Antenna Model		
72 MHz	LA-116		LA-122
216 MHz	LA-107	LA-117	LA-122

[See pages 5-7](#) for antenna specs and other considerations to assist in antenna selection.

### Outdoor Spaces:

These are commonly very large venues that can hold a large group of people. The transmitter is not designed for outdoor use, so it will be installed indoors, such as in a rack room. The remote antenna is then mounted outdoors within the coverage area. Some of these spaces use the RF system to send audio to remote locations using the LR-100 Stationary Receiver that is integrated with a speaker system. Here are examples of these spaces and an overview of how the RF system is implemented:

- **Sports Stadiums:** These stadiums hold a substantial amount of people and are commonly a bowl style seating arrangement that requires a broad range of coverage. The play-by-play and PA system audio is fed into the transmitter. The remote antenna is mounted above the bowl seating, typically on the gantry or canopy above.
- **Zoos/Parks:** Venues like these are large and use our RF system to play music and PA audio throughout the park. The transmitter is located in a central rack with the audio source and the remote antenna is mounted outside and elevated to provide line-of-sight coverage to each stationary receiver that is connected to a speaker.
- **City Streets:** Street applications use our RF system to play music or PA audio down a city street during events like a parade. The transmitter is located in a city building with the audio source and the remote antenna is mounted outside and elevated to provide line-of-sight coverage to each stationary receiver.
- **Amphitheatres:** These theatres, commonly used for concerts, have a large coverage area. Microphones and music audio are fed into the transmitter located in a rack or sound booth. The remote antenna is mounted outdoors, typically above the proscenium, to provide line-of-sight coverage to entire seating/standing area.
- **Fairs:** Similarly to zoos and parks, these outdoor events use our RF system to play music or PA audio throughout the fairgrounds. The transmitter is located in a rack with the audio source and the remote antenna is mounted outside and elevated to provide line-of-sight coverage to each stationary receiver.

This table shows the recommended antennas for these types of spaces:

Frequency Band	Antenna Model	
72 MHz	LA-116	
216 MHz	LA-107	LA-117

*Note: 216 MHz is recommended for outdoor applications over 72 MHz due to superior signal range and the LA-107 antenna being designed specifically for outdoor use.*

[See pages 5-7](#) for antenna specs and other considerations to assist in antenna selection.

## Antenna Specifications:

Below is a table indicating the maximum achievable range of each antenna Listen offers.

Antenna Model	Max Range	Antenna Model	Max Range
<b>72 MHz</b>		<b>216 MHz</b>	
LA-101	122m (400 ft.)	LA-124 & LA-126	198m (650 ft.)
LA-123 & LA-125	122m (400 ft.)	LA-102	229m (750 ft.)
LA-106	198m (650 ft.)	LA-107	914m (3000 ft.)
LA-116	244m (800 ft.)	LA-117	914m (3000 ft.)
LA-122	304m (1000 ft.)	LA-122	914m (3000 ft.)

*Note: Any obstructions and additional coaxial cable lengths used for remote mounting antennas will reduce the overall range.*

## Pros & Cons:

Below is a list of the antenna types Listen offers and the benefits and disadvantages of each.

### Helical Antennas (LA-101, LA-123, LA-125, LA-124, LA-126)

- Pros:
  - Ideal for small or portable applications
  - Direct connects to the transmitter or adapts to the LA-326 rack mount kit (see LA-125/LA-126)
  - Compact size
    - 8" (210mm) for 72 MHz
    - 4 ½" (114) for 216 MHz
- Cons:
  - Limited range
  - Not ideal for remote mounting



LA-123 Helical Pictured

### Telescopic Antennas (LA-106, LA-102)

- Pros:
  - Provides greater range than the helical type of antennas
  - Direct connects to the transmitter (10-32 screw thread)
- Cons:
  - Cannot be used in rack
  - Cannot be remote mounted
  - Not compact - must be fully extended for maximum range
    - 39" (990mm) for LA-106 (72 MHz)
    - 12 ¼" (311mm) for LA-102 (216 MHz)



LA-102 Telescopic Pictured

## Coaxial Dipole Antennas (LA-116, LA-117)

- **Pros:**
  - Provides excellent range
  - Inconspicuous
  - Easy to mount flush to walls or within drop ceilings
  - Shock resistant for rough environments
- **Cons:**
  - Not compact - must be fully extended vertically on both sides for maximum range
    - 78" (1981mm) for LA-116 (72 MHz)
    - 24 ½" (622mm) for LA-117 (216 MHz)
  - Preassembled with 25' of coax attached for remote mounting – must use coupler to run additional cable



*LA-116 Dipole Pictured*

## Antenna Kit (LA-122)

- **Pros:**
  - Can be configured as Telescoping Dipole, Telescoping Monopole, Flexible Dipole, Flexible Monopole
  - Provides excellent range when configured as dipole
  - Includes hardware for multiple mounting options
- **Cons:**
  - Conspicuous; bulkier and more components
  - Can be damaged in rough environments
  - Not compact - must be configured as a dipole and fully extended on both sides for maximum range
    - 78" (1981mm) for 72 MHz
    - 24 ½" (622mm) for 216 MHz



*LA-122 Dipole Configuration Pictured*

## Ground Plane Antenna (LA-107)

- **Pros:**
  - Provides excellent range
  - Rated for outdoor use
  - Includes 50' of RG-58 for remote mounting
  - Includes mounting hardware for mast mounting
- **Cons:**
  - Difficult to mount to walls or other flat surfaces; designed for mast/pole mounting



*LA-107 Ground Plane Pictured*

### Other Considerations:

This section goes over additional details to consider when selecting an antenna for an RF system.

- **Coaxial Cable for Remote Antennas** – Running excessive coaxial cable feeds from the transmitter to the antenna attenuates the RF signal power, resulting in reduced range from the antenna. Listen sells unterminated or preassembled RG-58 and RG-8 coaxial cables by the foot to meet individual needs. Please see the below table for the coaxial cable loss for each frequency:

Frequency Band	RG-58 Cable		RG-8 Cable	
	15m (50 ft.)	30m (100 ft.)	15m (50 ft.)	30m (100 ft.)
72 MHz	1.9 dB	3.9 dB	0.8 dB	1.6 dB
216 MHz	3.4 dB	6.8 dB	1.5 dB	3.0 dB

*Note: There may be variances in loss between different cable manufacturers. Impedance rating of 50 ohm is required. Every 6 dB of loss equates to approximately a 50% decrease in overall transmission range from the antenna.*

- **Listen Part Numbers for Coaxial Cable:**
  - Unterminated – [LA-112](#) (RG-58) / [LA-113](#) (RG-8)
  - Preassembled – [LA-391](#) (RG-58) / [LA-390](#) (RG-8)
- **Antenna Selection for LR-100 Stationary Receiver** – Each LR-100 receiver comes with a basic helical antenna. The LR-100-072 (72 MHz) comes with an LA-123 helical and the LR-100-216 (216 MHz) comes with an LA-124 helical. However, the antenna used on the LR-100 receiver should match the antenna selected for the LT-800 transmitter for optimal range.
- **Combining Transmitter Outputs to Single Antenna** – It is possible to combine multiple transmitter outputs to a single antenna for multi-channel applications, commonly referred to as “antenna combining.” Max achievable range is reduced with this approach. Please see our tech-note on [Stationary RF Antenna Combining](#) for additional information on achieving this.

For further assistance in antenna selection or other questions, please contact Listen’s support team via email at [support@listentech.com](mailto:support@listentech.com) or call 801.233.8992.