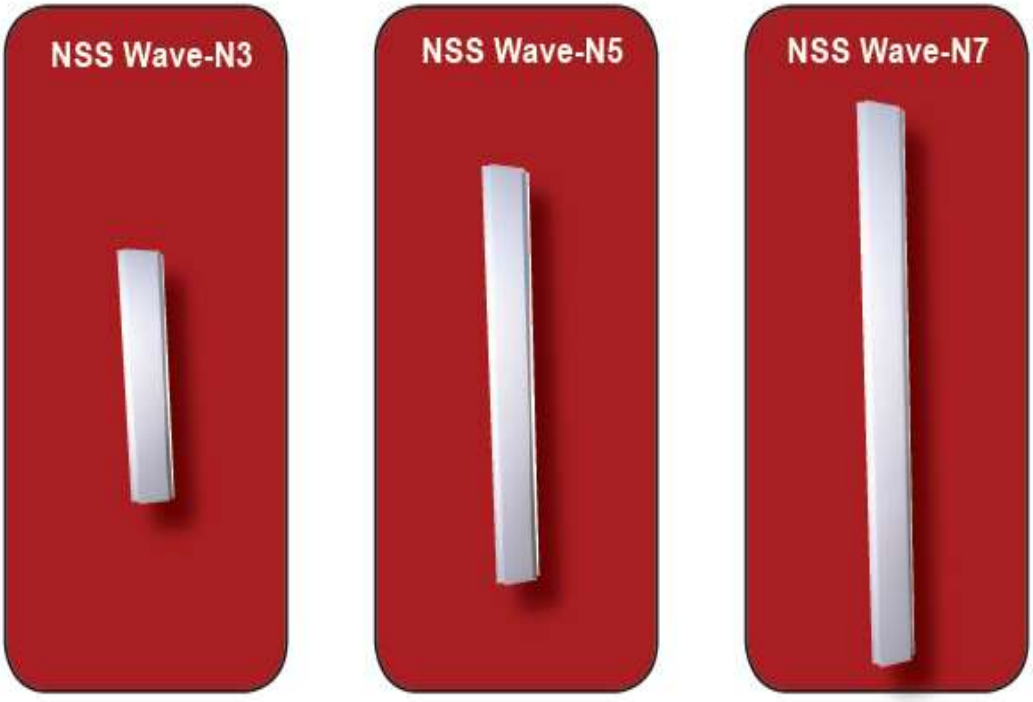
wave® Antenna and Portal User Guide



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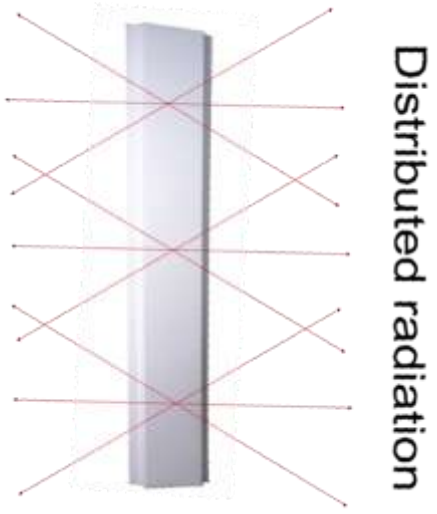
How the wave® Antenna Works:

- YouTube link to video:https://www.youtube.com/watch?v=AV84sLjJ_g0
- newave has developed a patented wave Antenna that is uniquely designed for superior RFID performance and provides a novel UHF zone-based coverage that brings a cost effective high performing item-level solution to the RFID marketplace.
- This one-of-a-kind wave Antenna coupled with our unique smart reader technology will significantly lower costs yet capture more data in a more accurate manor. This technology greatly reduces labor and equipment costs.
- The wave Antenna creates **five** beams in elevation that completely surround the antenna about its long axis. Because of this unique feature it can cover zones front and back of the antenna
- The wave Antenna embodies a radically new concept in RFID antenna design. Unlike a traditional multipurpose patch antenna that radiates a single beam in a given direction, the wave antenna is designed to uniformly illuminate a volume of space.



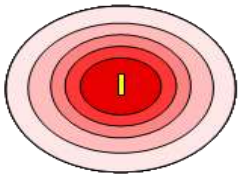
- Installing the antenna in pairs enables the antennas to complement each other and provide spatial, direction-of-arrival, and polarization diversities throughout the volume in order to eliminate fading, which is a major factor leading to poor RFID read performance.

- wave Antennas are uniquely designed to cover all three tag orientations within a user defined zone that can be varied from 2x2x2 to a 10x10x10.

How the wave® Antenna Works Continued:

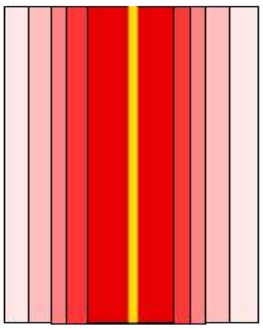
A 7' Antenna Depicted

Top View

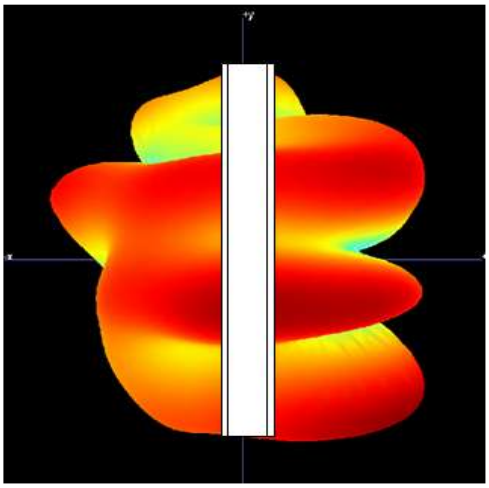


The coverage zone is about 12' diameter and 10' tall

Side View



3' Antenna Depicted



The Wave™ antenna has multiple beams and covers front and back sides

- Note that the antenna is a cylindrical radiator meaning that it radiates equally well around the whole length of the antenna. Thus, it covers a full 360 degrees around the axis of the antenna.

- Coverage is limited to the front half of the antenna when a ground plane is placed on the backside of the antenna. Thus, it covers about 180 degrees in front of the antenna.

- The wave Antenna creates the necessary beam and polarization diversities needed to handle the prevalent fading associated with RFID item-level applications.

How the wave® Antenna Differs from a Patch Antenna:

- Like a *florescent light*, the wave antenna illuminates in a cylindrical pattern for an optimal zone along the entire length of the antenna.

- The Patch Antenna, however, closely resembles a *flashlight* illuminating in a conical pattern well beyond an optimal RFID Zone. This causes tag reads outside the intended read zone and produces inconsistent tag reads in close proximity.

wave® Antenna Test Guidelines

Pre-Test Survey Questions

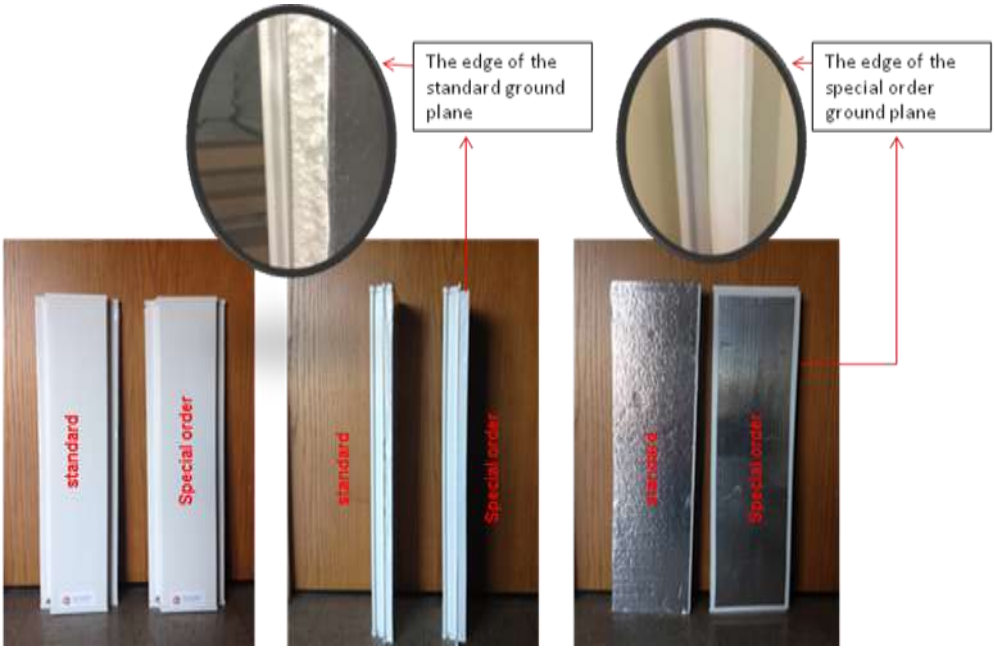
- Are you testing RFID tags with UHF 902-928MHz frequencies?
- What type of materials/assets will you be trying to read?
- In what type of environment do want to use these antennas?
- What is the maximum distance you want to be able to read tags?
- How much space is allotted for your antenna install?
- Describe where these will be installed, i.e. doorway, hallway, dock door, exit, on the ceiling, etc.
- What type of reading pattern are you trying to achieve, i.e. 360°, 180°, 90° or less?

Test Recommendations

- If you are used to working with patch antennas, you will find our wave antennas to be dramatically different in use and superior in performance if properly used.
- Tips on getting to know our product line. Our customers tell us these are important:
    - Antennas should be used in pairs to optimize coverage. If antennas are not used in pairs the blind spots or fading becomes unpredictable and tag reads could be missed.
    - Most users need a ground plane and foam backing to insure they have front forward RFID tracking. Our antennas will radiate 360 degrees. Thus, if you desire 180-degree coverage in front alone, you will not be obtaining optimal performance without the proper ground plane.
    - We have a variety of different applications. Our portals for example are best suited to use at a door or entrance way versus our antennas.
    - Our coverage is based on the antenna length. The three-foot antenna is meant to cover a smaller zone, say 5 feet tall. The five-foot antenna covers about 7 feet in height and the seven antenna covers about nine to ten feet in height. The range of coverage is dependent on the input power.
    - Unlike patch antennas, you can test our antennas out by reducing power at the reader which will limit the range and the possibility of having extraneous reads.
    - Our antennas connect to the reader with RP TNC cables. If you don't have this type of cable, you will need to order them separately.

Metal Back Plane Usage:

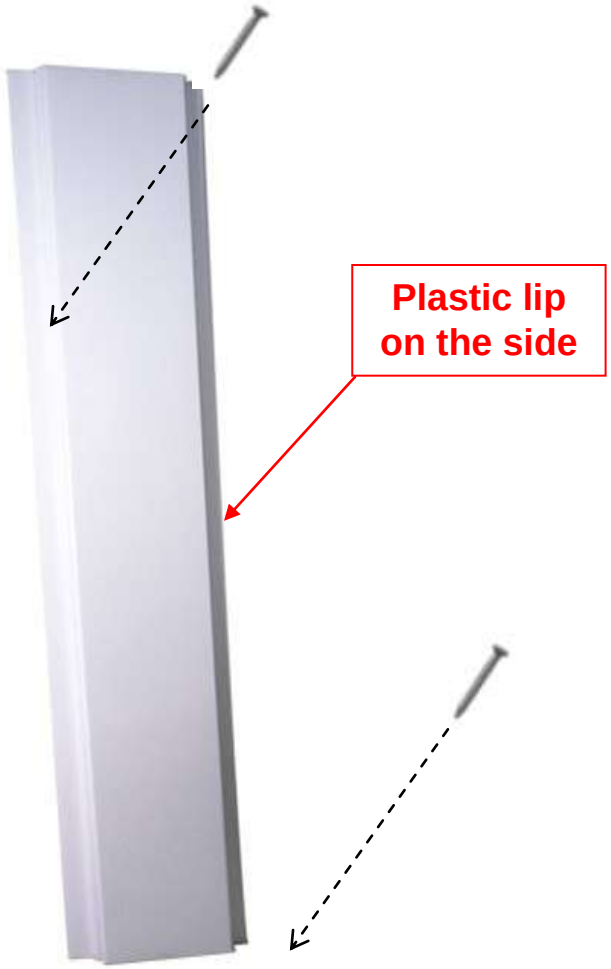
Emits RF Illumination more strongly towards the front of the antenna



- If the coverage zone is required to be just on the front side of the wave Antenna, one can add a metal ground plane (such as aluminum foil) to the back side of the antenna.
- The back-ground plane can be mounted directly behind the 7' antenna, **but** for the 3' and 5' antennas, the metal plane **must be** mounted using a ¾" spacer such as a ¾" foam piece.
- The antenna gain will increase based on the size of the ground plane. If the ground plane is roughly the same size as the antenna, the gain will increase by about 1.5dB. For example, the gain of the 3' antenna is about 3dBi, which will increase to 4.5dBi with a ¾" spacer and a backplane the same size as the antenna. If the back plane is significantly larger than the antenna, then the gain may increase by as much as 3dB.
- We currently have two options for ground planes. The first is the standard foam and foil ground plane referred to as the "Standard" in the above picture. The standard version is made using a ¾" foam backing covered in aluminum foil. Our other option is referred to as the "Special Order" ground plane and is available for an additional charge. The Special-order option is made out of a ¾" corrugated plastic covered in aluminum foil trimmed with a white vinyl tape on all edges. This option is used in areas that need improved aesthetics for very public areas such as an office atrium, medical facilities, or company offices.

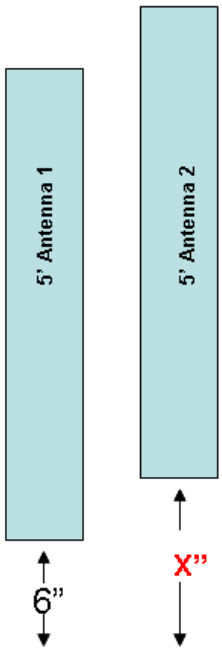
Mounting the wave® Antenna:

- The wave Antennas can be easily mounted using the lip on the sides of the plastic antenna enclosure. You can simply use a drilled hole or directly use a self-tapping screw. The antenna structure is very lightweight but stiff so only four screws are needed



How to Mount Antennas based on desired Read Range:

Mount Two 5' Antennas on Each Sidewall



X=Offset	Range
12"	6'
24"	8'
36"	10'

- **If antenna one is 6 inches from the floor and antenna 2 is 12 inches from the floor, the RF illumination range is about 6 feet. As the antenna offset becomes greater (see chart) the RF illumination range also increases.**

wave® Antenna Cabling:

- 50 Ohm cable assemblies are specially adapted for use with the wave antennas. The assembly comes with a RP TNC plug to maximize performance. Cables are available in 5, 10, 15, and 20-foot lengths. Cable accessories are compatible with our cables.

smartPortal™ Applications

newave plug&play Portal

Multi-Use Portal using wave embedded antenna radiators

wave radiator

Multi Use Portal

newave sensorSolutions, LLC 9011 Heritage Drive Plain City OH 43064 www.newaverfid.com

newave superior rfid accuracy

Multi Use Portal Application

Materials Supplied:

- (1) SLS smart PORTAL – A and B-Panel
- (2) Safety Yellow Angle Iron (purchased Separately)
- (12) 3/8” x 3” Concrete Anchor Screws
- (8) 1/2” x 4” Concrete Anchor Screws

Materials Needed:

- Tape Measure
- Concrete Impact Driver
- Concrete Rotary Hammer Drill
- 5/16” SDS Drill Bit (minimum 6” long)
- 7/16” SDS Drill Bit (minimum 6” long)
- 9/16” Impact Socket
- 3/4” Impact Socket

Steps:

1. Place the two angle-iron on opposite sides of the dock door centered at approximately 3-4 feet in from the wall and 4-8 inches outside of the dock door track. (The dimensions will vary based on the dock door environment).
2. Once the angle-iron have been placed, drill holes into the concrete using the 5/16” SDS Drill Bit.
3. Using the 9/16” Impact Socket, screw the 3/8” x 3” Concrete Anchor Screws into the holes, securing the angle iron.
4. Next, place the A-Panel on the right side of the dock and the B-Panel on the left side of the dock, butting the graphics-side of the panels up to the angle-iron. Center the panels on the angle-iron.
5. Again, using the 5/16” SDS Drill Bit, drill four holes per panel in the designated spots on the feet of the panels.
6. Secure the panels by screwing in the 3/8” x 3” Concrete Anchor Screws into the holes.
7. Next, place two bollards (sold separately) on either side of the dock approximately 4-6 inches out from the edge of the angle-iron and flush with the front face of the angle-iron.
8. Using the 7/16” SDS Drill Bit, drill holes into the concrete at the specified areas at the feet on the bollards.
9. Secure the bollards by screwing in the 1/2" x 4” Concrete Anchor Screws using the 3/4" Impact Socket.
10. Once all hardware is secured in the ground, open the top access panel on the B-Panel. Inside there will be two 25’ cables. Unscrew those cables from the bracket inside and feed the end that was just unscrewed, through the hole on the told of the panel and reattach to the bracket.

11. Next, unravel the 25’ cable and feed up-and-over the dock door. Attach the 90-degree end to Ports 3 and 4 on the Impinj R420 Reader. (Zip ties work best for attaching the cables over the dock door)
12. Replace the access panel on the B-Panel.
13. The smartPORTAL and its reader is **powered by ethernet, or POE**. The last step is to plug an ethernet cable into the POE drop at the dock door and into the Impinj R420 Reader.
14. Check to make sure the lights are flickering at each of the antenna ports and at the ethernet jack.
15. Configure the reader to the identified Static IP Address.
16. Replace the access panel on the A-Panel and your SLS smartPORTAL is ready to operate.

Troubleshooting:

- Antennas not reading any tags:
    - First, one should check to make sure that the reader is working properly and that the antenna port is activated.
    - Next try and replace the RP TNC cables to see if the problem is with the cable
    - If after the cable has been replaced the antenna still does not read any of the tags, then the antenna will need to be replaced.
- Periodic blind spots causing unread tags:
    - newave recommends that antennas be used in pairs (set of 4 total). If antennas are not used in pairs the blind spots or fading becomes unpredictable and therefore, tags may be missed.
- Cable connection issues to the reader:
    - Only RP TNC cables can be used to properly attach to the NSS reader
- Metal Back Plane issues:
    - If a back plane is used on the 5' or 3' antenna it must contain a ¾" foam spacer. One does not need the spacer for the 7' antenna.
- Designed to read UHF 902-928 MHz:
    - The United States operates in the 902-928 MHz frequency band as required by FCC regulations. Antennas used in Europe will not work in the US as they operate in a different UHF range.
- **For Technical support: North America**: (888) NSS-RFID (677-7343), Option #2