



nLight® AIR Design Guide



Please read this document prior to designing nLight AIR systems for either retrofit or new construction.

Designs that do not adhere to these guidelines may have performance problems once installed and configured. Following the information in this guide will significantly increase the likelihood of a trouble-free startup.



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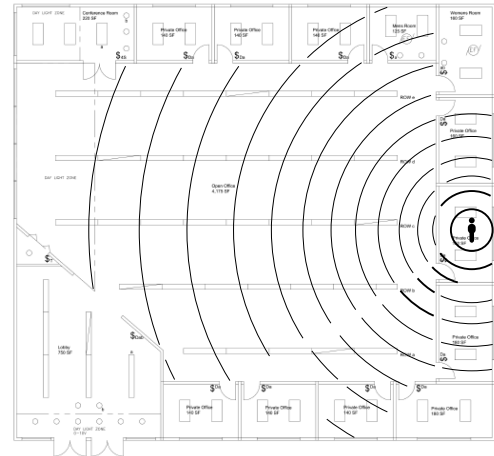
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1-1 Wireless Communication Principles

nLight AIR equipment communicates in the 900MHz band (904 - 926 MHz). This frequency band allows for longer communication distances in both open air and through obstructions.

However, each additional obstruction reduces the signal strength and overall communication distance.

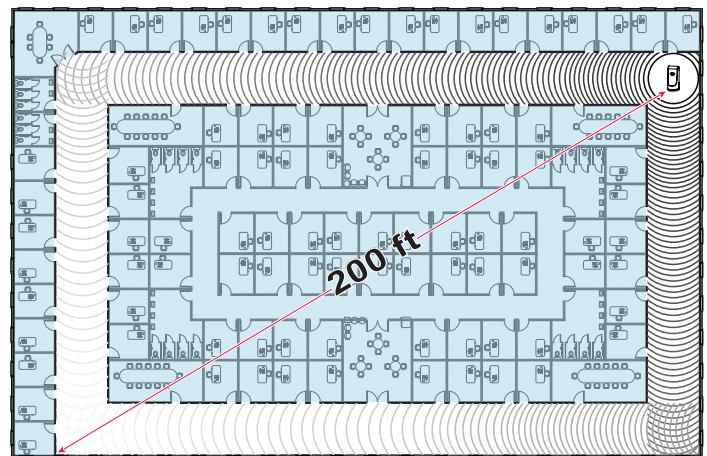
Consider the example to the right. If you're trying to communicate with all others in space by yelling, your voice will better propagate through the space in some ways better than others. If you're standing in a private office on the right-hand side, your voice may only travel through a few walls before it is no longer strong enough to be heard. However, it may be able to travel out into the open office space and be heard in areas across the floor – keeping in mind that sound can reflect and enter spaces not in direct line of sight. These same principles are true with radio frequency (hereafter referred to as "RF.") All materials have some finite impact on the signal strength.



Designs should include line of sight communication as a goal, followed by reflected signal, and lastly by penetration through obstacles. This approach ensures the most reliable communication between devices.

Each additional obstruction will reduce the signal strength.

In the graphic to the right, you can see how distance and reflection change the signal strength in an environment. Compared to the signal strength of reflections, nLight AIR's RF signal strength over 200' line of sight would be much stronger. nLight AIR can accomplish 1,000' line of sight.



1-2 nLight AIR Design Limitations

STAND-ALONE SYSTEMS

When designing a stand-alone nLight AIR system, one must design to the following practices:

- No more than 128 devices per Group
- Design stand-alone spaces as Groups. A Group is a collection of devices that occupy the same room or space and share the same behaviors.

NETWORKED SYSTEMS

When designing a networked nLight AIR system, one must design to the following practices:

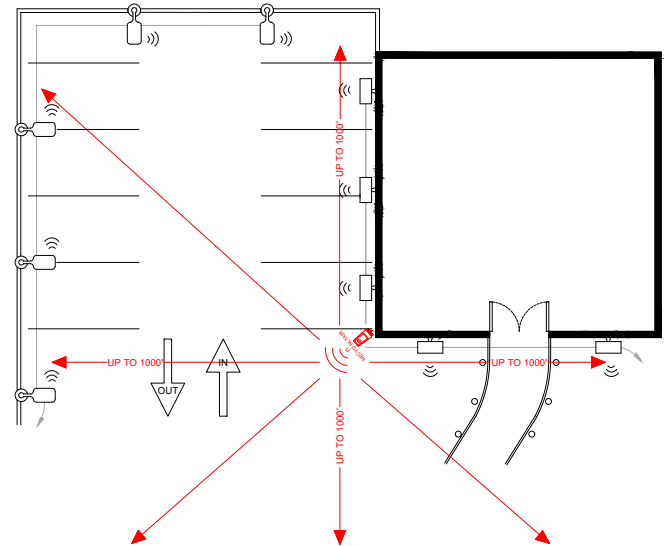
- No more than 255 nLight® ECLYPSE™ devices per Site
- No more than 750 devices per nLight ECLYPSE
- No more than 20,000 devices per Site
- No more than 128 devices per Group
- One Site per instance of SensorView
- For maximum distance between networked devices, see Section 2.

2-1 Range Considerations: Outdoor Applications

Typical Parking Lot or Building Exterior

Use 1,000' radius (line of sight communication only) for budgetary purposes when all obstructions cannot be confirmed and avoided or when signal strength has not been tested.

- The nLight AIR Adapter (NECYD NLTAIR G2, hereafter referred to as "Adapter") should be mounted outside on a wall or edge of a roof. Mounting on the corner of walls allows for the widest field of view and maximum coverage outdoors – 270° field of view.
 - For site applications, it is desirable to get the clearest path and best unobstructed view from the Adapter to the fixtures being controlled.
 - RF strength will weaken when penetrating exterior walls due to their typical constitution, so mounting an Adapter on an exterior wall – not at a corner – may limit its range to 180° of view.
 - Tall fences or thick foliage can reduce signal strength.
- A higher mounting height is typically better for avoiding obstructions and increasing range. Lightning protection systems per UL96 may be necessary depending on the Adapter mounting height.
- For protection from the elements, it is best to mount the Adapter under an overhang or canopy while still retaining a clear field of view from underneath the structure.
- When mounted outdoors, the Adapter must be mounted on an IP66 rated, plastic enclosure with the gasket compressing against the surface.
- In areas where regular snow accumulations are expected, it is recommended to mount the Adapter on the bottom of a box to avoid snow buildup around the Adapter.



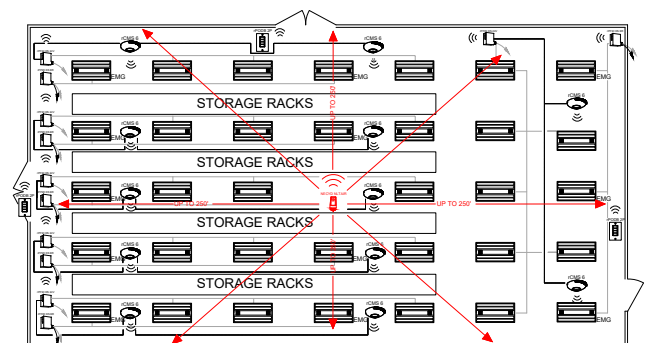
Typical Parking Lot

2-2 Range Considerations: Indoor Applications

Typical Industrial / Warehouse Applications

Use 250' radius for budgetary purposes when all obstructions cannot be confirmed and avoided, when machinery and rack realignment is expected, or when signal strength has not been tested.

- Best range typical of 600' radius in open environment without obstructions
- Typical construction is defined as large areas of open space with minimum obstructions between the Adapter and nLight AIR receiver.
- nLight AIR is not ideal for this environment when racks, equipment, or other obstructions consistently block the field of view between the Adapter and receiving devices. E.g., fixtures are mounted lower than racks. More than one Adapter is recommended for redundancy if such a situation is expected.
- The Adapter should be mounted at the same height as other devices in the space (such as wireless sensors) to aid in avoiding obstructions.
- A minimum of one Adapter should be used per floor where applicable.



Typical Warehouse

Use 150' radius for budgetary purposes when all obstructions cannot be confirmed and avoided or signal strength has not been tested.

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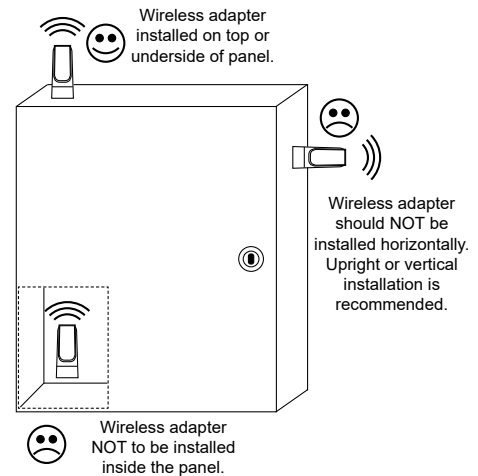
A top-down diagram of a 2D environment, likely a hallway or room. A small red robot is positioned in the center. Red arrows radiate from the robot, representing its field of view or sensor beams. The environment contains several black circular obstacles. Labels include 'UP TO 150°' for the vertical beam, 'UP TO 150°' for the horizontal beam, and 'UP TO 150°' for the diagonal beams. Arrows at the bottom indicate 'OUT' and 'IN' directions.

Use 100' radius for budgetary purposes when all obstructions cannot be confirmed and avoided or when signal strength has not been tested.

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- Typical Medical Center**

3-1 Adapter Mounting Notes

- Mounting the Adapter in large, straight, and open spaces maximizes range. For maximum signal strength, avoid mounting with one or more blind bends between the Adapter and the end device or fixture.
- The Adapter should be mounted vertically in the center of the chosen space, clear of any obstructions (metal or concrete obstructions are especially important to avoid).
- The cable for the Adapter is not plenum rated, so it should be routed through conduit when ran through a plenum.
- Do not allow the Adapter to hang from its cord for a permanent installation.
- The Adapter has a 16' cable. If a longer cable is required, use only those recommended by Acuity Brands. When using extender cables, 120V is required on the Adapter side of the extension. Please see the FAQ for recommendations on extenders when greater than 16' is needed.
- Never mount the Adapter in an electrical closet.
- Be very mindful of metal – especially large metal equipment, electrical panels, and metal objects hidden within the drywall. These will significantly reduce range in their direction.
- Signal coverage may have gaps when created without a site visit. Using budgetary ranges in Visual™ Controls (an Acuity Brands design tool) and inside of this guide will help to mitigate risk of insufficient coverage.
- Try to avoid high angles of incidences with obstructions. RF is more capable of penetrating an obstruction when approaching it straight on.



4-1 General Operation and Power Requirements

nLight AIR is a distributed-intelligence lighting control system. The nLight AIR parts and pieces intercommunicate with other group members to make decisions based on control inputs. Factors like ambient light conditions, occupancy status, switch presses, and controller commands dictate the light levels in each area. If some or all the nLight AIR devices are not energized, they cannot share control inputs or receive commands to change light levels.

nLight AIR is a system that must be permanently energized.

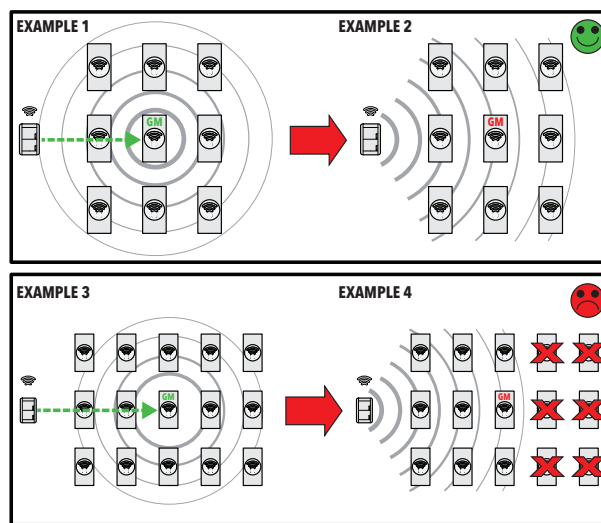
In retrofit applications, be sure to remove line-voltage switches, line-voltage occupancy sensors, automated contactor systems, and other equipment that may interrupt power to the nLight AIR equipment.

4-2 System Architecture: Stand-Alone Systems

Stand-Alone systems will always have a device assigned as a Group Monitor. The broadcasting device will communicate to the Group Monitor first, which will then broadcast to the rest of the devices. The Group Monitor is typically the center-most fixture or line voltage device in the group, selected by the CLAIRITY™ Pro mobile application grid placement and will not be a battery powered device. Should the Group Monitor fail, devices will communicate to all of the devices in RF range.

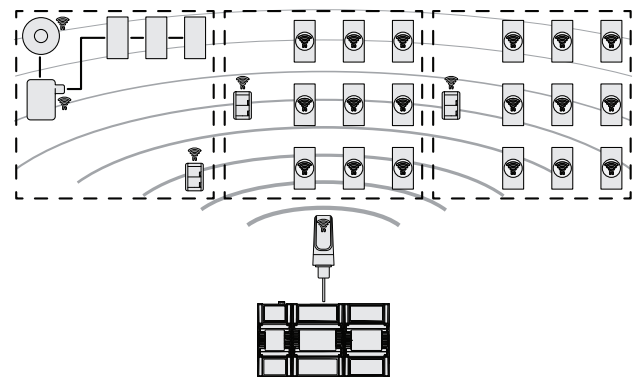
Consider the examples below. In example 1, the user presses a wall switch, which communicates to the Group Monitor, which then broadcasts the command to the entire group. In example 2, the Group Monitor does not respond to forward the command, but the devices, still being in the RF range of the broadcasting device, still function as expected. This is considered recommended design practice.

In example 3, again, the user presses a wall switch, which communicates to the Group Monitor, which then broadcasts the command to the entire group. In example 4, however, the Group Monitor has failed, and since a number of the devices are outside the RF range of the broadcast device, they no longer function as expected. Therefore, best design practices would have all the devices in the group within the RF range of the broadcasting device, and it is not recommended for very large groups to depend on the range of the Group Monitor. Losing the Group Monitor as a point of redundancy will not cause issues for properly designed systems, but it does make communication between devices less reliable.



4-3 System Architecture: Networked Systems

Consider the example to the right. There are three groups that have been networked to the same nLight ECLYPSE and Adapter. When messages need to be sent out to the devices, the Adapter communicates directly to the devices. It does not route messages to the Group Monitor. Therefore, all devices need to be within RF range of the Adapter.



5-1 Frequently Asked Questions

- **What is the IP rating of the Adapter?**
 - o The Adapter is IP66 rated.
- **What is the temperature rating of the Adapter and nLight ECLYPSE?**
 - o The nLight ECLYPSE is rated 0 to 50°C and should be installed in an environmentally controlled area. The Adapter is rated -40 to 65°C and can be installed outdoors.
- **Should the Adapter be mounted outside an electrical or IDF room?**
 - o The Adapter should be placed with the fewest obstructions between it and the devices it is controlling. Placing the Adapter outside an electrical or IDF room – such as in a hallway – is required and will allow the Adapter to communicate farther through the space.
- **Should the Adapter be mounted to a wall? From the ceiling?**
 - o The Adapter can be mounted to a wall or from the ceiling. These options are covered in the installation instructions. Generally, mounting the Adapter in the center of a room is best.
- **How do I extend the Adapter from the nLight ECLYPSE?**
 - o The Adapter includes a 16 foot cable, but extension cables are available that can extend the Adapter an additional 150 feet. An extender can be ordered using Acuity Brands CI Code *2624LG.
- **Can signals go through walls?**
 - o RF can penetrate many different types of obstructions. However, some wall materials reduce the signal strength more than others. Dry wall is penetrated more easily. Metal, reinforced concrete, and materials generally used on the exterior of a building (such as brick) are difficult to penetrate. As identified in the design section, relying on line of sight communication, then reflections, and lastly penetration will reduce the chance of insufficient signal strength.
- **Do you support repeaters?**
 - o Not at this time. If you need additional range, you should consider relocating the Adapter, adding an extender, or adding an additional Adapter and corresponding nLight ECLYPSE.
- **Can I use more than one Adapter per nLight ECLYPSE?**
 - o Each nLight ECLYPSE can support only one Adapter at this time.
- **Does RF go through glass?**
 - o Yes, however glass with re-enforcing wire or low-E coating/film will reduce the RF more than regular glass.
- **Can signals reflect to avoid a large obstruction?**
 - o Yes, however, each material has different characteristics for signal absorption and reflection. Some materials may reflect more RF than others.
- **Should I use the Adapter to communicate to devices on separate floors?**
 - o One Adapter should be used per floor. RF will not reliably penetrate the heavier-than-average construction required between floors.
- **Can indoor and outdoor be in the same group? Or on one nLight ECLYPSE?**
 - o It is recommended to use a separate nLight ECLYPSE and Adapter for the exterior and interior. Penetrating an exterior wall of a building is difficult and significantly reduces RF range, so for a reliable connection and more range, separate nLight ECLYPSE controllers and Adapters are needed.
- **What are some examples of significant obstructions?**
 - o Metal - metal equipment, metal-sided buildings, chain-link fence, wire mesh re-enforcement beneath stucco, re-enforcing wire in windows in doors, large electrical panels, and metal HVAC ducts.
 - o Mirrors – Large mirrors are significant obstructions as they reflect RF.
 - o Exterior walls – brick, cinder block, and concrete.
 - o Stairwells – typical construction of a stairwell.
 - o Electrical rooms, IT rooms, and Mechanical rooms – made of various constructions that generally impede RF.
- **What is the part number for an Adapter?**
 - o The Acuity Brands part number is NECYD NLTAIR G2. It is most often paired with the MVOLT version of the nLight ECLYPSE with an enclosure--NECY MVOLT ENC.
- **How do I determine in the field if my Adapter placement is ideal?**
 - o By using the CLAIRITY™ Pro application, signal strength between the Adapter and receiving devices can be measured.