Best Practices for Installation of the airFiber AF5/AF5U

Ideal Mounting Location: High in Elevation with Clear Line of Sight

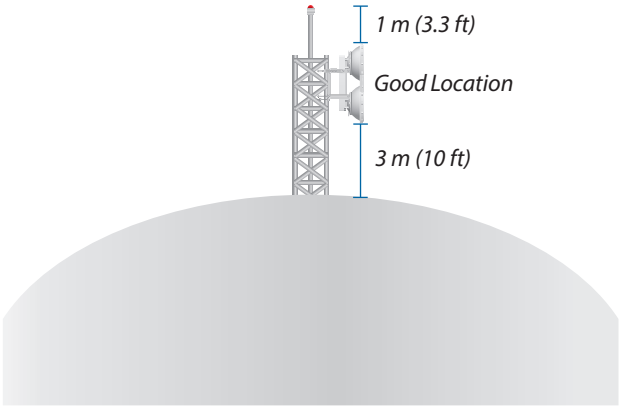
Custom Frequency and Transmit Power Configuration to Fit Your Application

Throughout Optimization with Maximum Frequency Reuse and Link Symmetry

Selection of Installation Site

The airFiber® AF5/AF5U, referred to as the AF5 in this Design Guide, features unique functionality that requires you to be cognizant of the installation environment.

For best performance, you must install the AF5 as high up as possible, with a line of sight free from obstructions. This is especially true in FDD (Frequency Division Duplexing) mode, as there is a requirement to maximize channel/spectrum reuse. Any objects in front of or near the front of the AF5 can have a significant impact on overall performance. The AF5 should be installed 1 m (3.3 ft) below the highest point of the structure to reduce the risk of a lightning strike. When the AF5 must be installed above a metallic surface like a corrugated flat roof or water tower, then you should ensure that the AF5 is located more than 3 m (10 feet) above the metal/reflective surface.

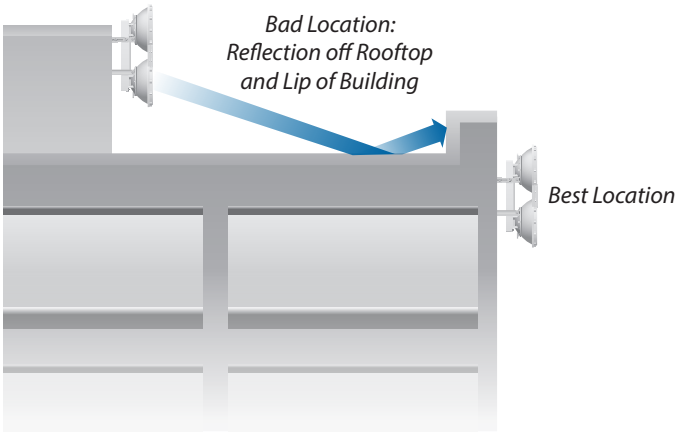


Close-up of Installation on Top of Water Tower

What is generally true for cellular installations is true for the AF5. You should mount the AF5 where it can see no reflections in the near field, so we recommend the following types of mounting sites:

- Perimeter mounting on a water tower/structure (best)
- Mounting near the edge of the top of a structure
- Mounting on an elevated mast or tower

Radios that are mounted anywhere near the surface of a roof or the top of a water tower can be significantly affected by reflections. FDD is more susceptible to the elements of a deployment environment than TDD (Time Division Duplexing) is.



Close-up of Installation on Rooftop of Building

Good and bad examples of deployments are depicted in this section, "**Typical Deployment Scenarios**" on page 2.

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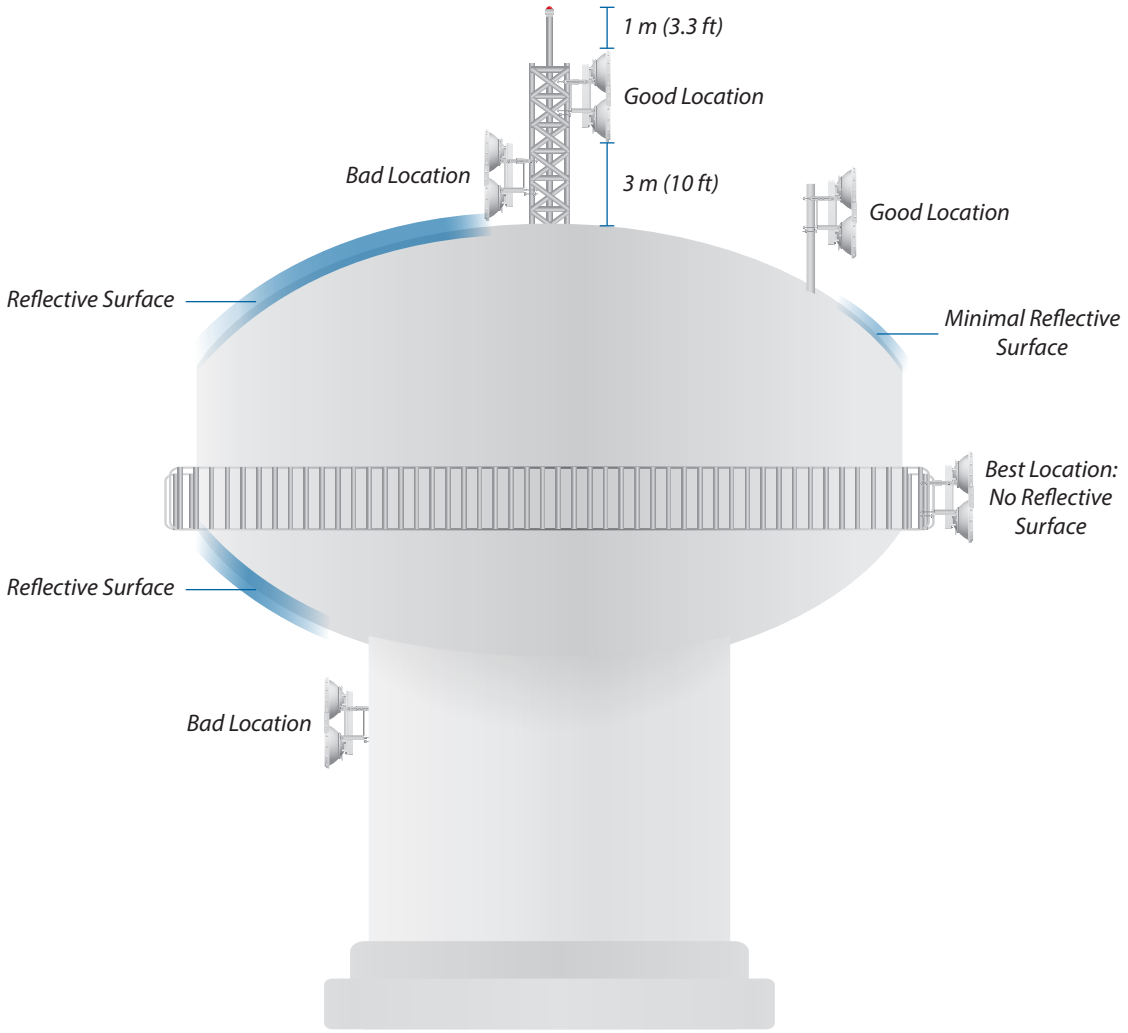
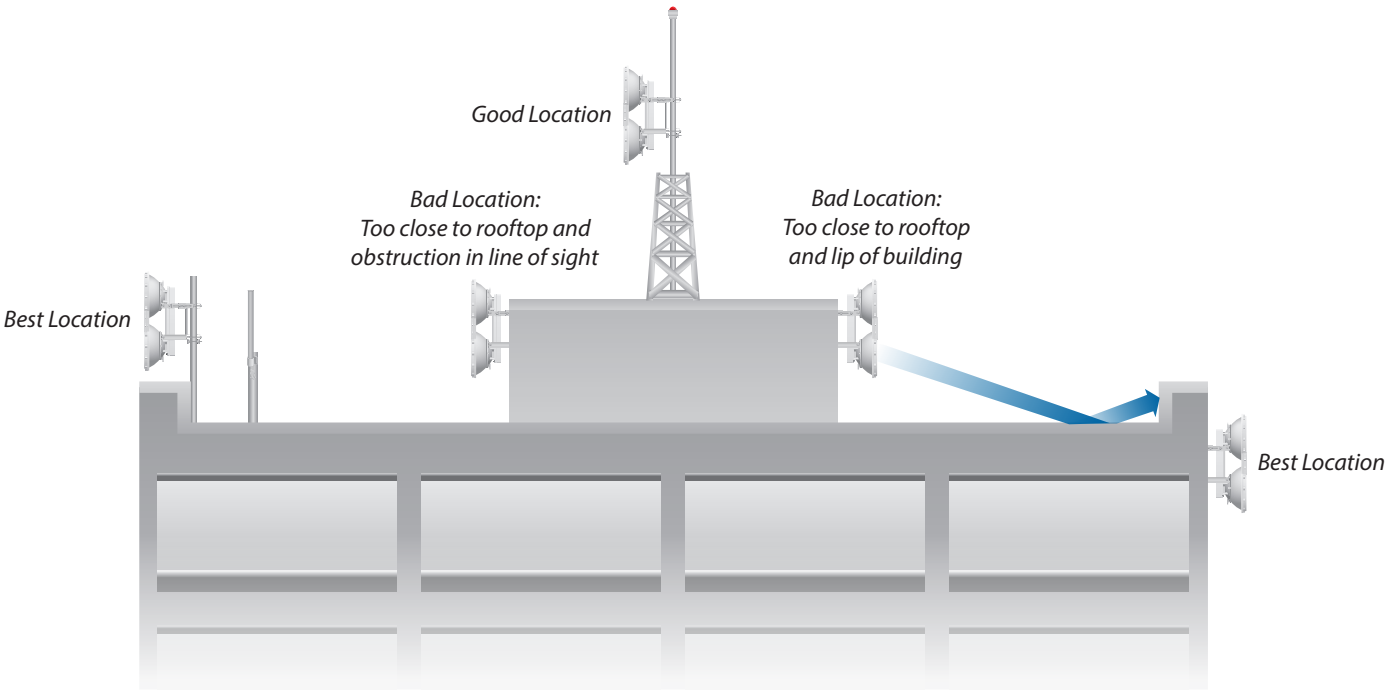
Typical Deployment Scenarios



Deployment on Water Tower



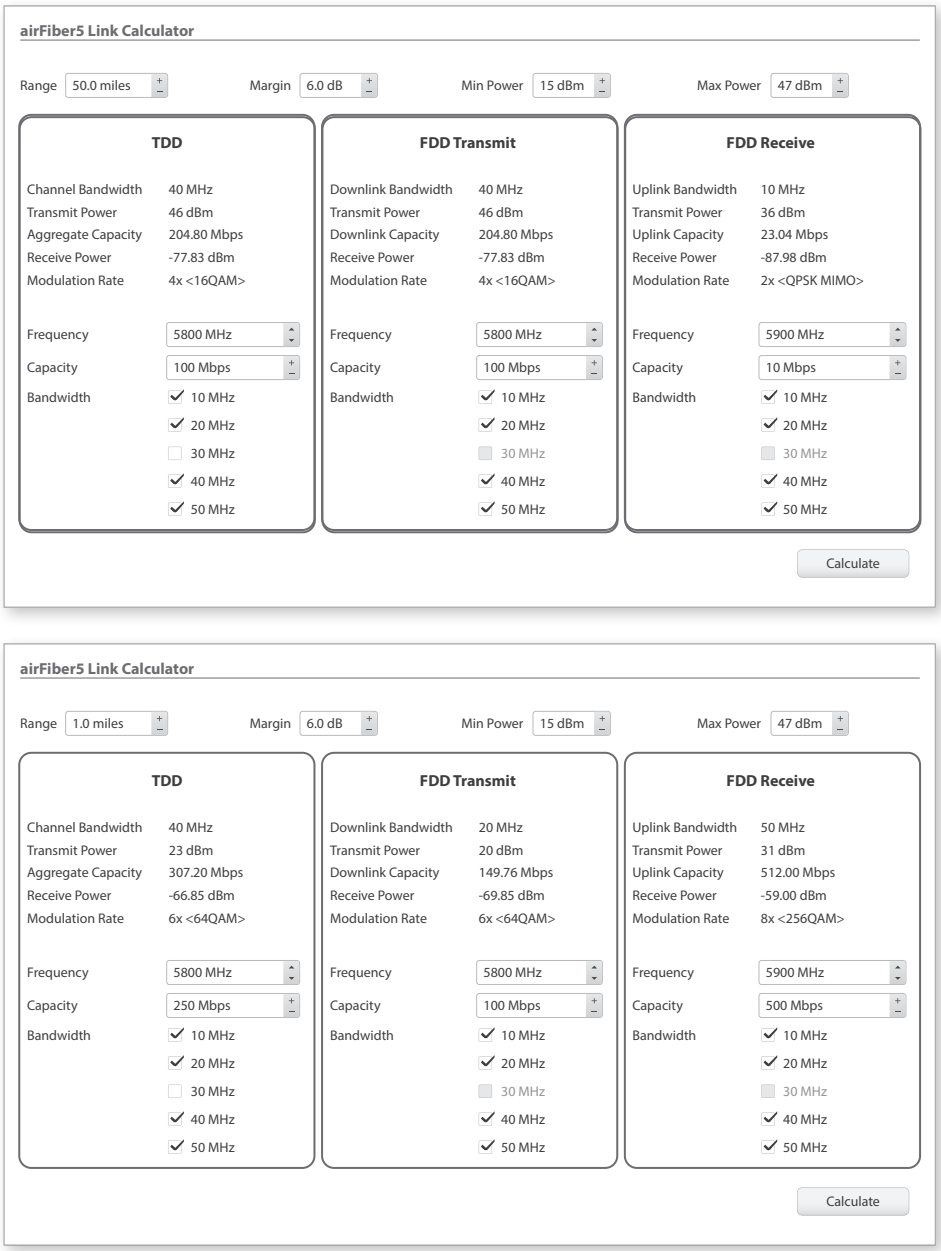
Deployment on Rooftop of Building

Frequency Configuration

FDD will be most useful in situations that have plenty of spectrum available and will show the greatest benefit on shorter-range links. For optimal performance, you should plan out channel pairs that have maximum frequency separation. Since the AF5 uses sophisticated data processing algorithms and a special antenna structure to eliminate the need for a pre-configured duplexing filter, you should space the 2 duplex channels at either end of the spectrum near the band edges for maximum-range applications.

Generally speaking, you can configure shorter-range links for less channel separation between uplink and downlink. You should also use the narrowest channel bandwidth that supports the intended link capacity. This conserves valuable frequency resources and also maximizes link budgets.

Ubiquiti Networks™ is currently developing a configuration tool, the airFiber5 Link Calculator*, that will guide you on how to best minimize bandwidth and power/interference based on the specific requirements of your installation.



Examples of airFiber5 Link Calculator (available soon)

* The airFiber5 Link Calculator will be available as a new tool in an upcoming firmware update. Check **community.ubnt.com/airfiber** for firmware announcements.

Transmit Power Configuration

The AF5 allows for a very high degree of flexibility in configuring transmit power, supported constellations, channel bandwidths, and duplexing modes. Because of the number of configuration options, refer to this guideline as you customize your AF5 configuration:

Depending on the country or region, the AF5 may be configured to support maximum transmit power as high as +50 dBm EIRP. Power levels in excess of approximately +43 dBm will start to affect the maximum supported constellation.

TX Power (dBm EIRP)	Supported Constellation
43	256QAM
45	64QAM
47	16QAM
50	QPSK

For example, if you have a relatively short-range link and you need to support a maximum constellation of 256QAM, then configure the AF5 for less than +43 dBm EIRP.

To minimize interference, you should use the lowest practical power setting that supports the intended target constellation for a given distance. Looking at the sensitivity values for the given channel bandwidth, you should target a receive signal value approximately 3 to 6 dB higher than the sensitivity threshold.

	10 MHz	20 MHz	40 MHz	50 MHz
8x	-70 dBm	-67 dBm	-65 dBm	-64 dBm
6x	-77 dBm	-74 dBm	-72 dBm	-71 dBm
4x	-84 dBm	-81 dBm	-79 dBm	-78 dBm
2x	-90 dBm	-87 dBm	-85 dBm	-84 dBm
1x	-93 dBm	-90 dBm	-88 dBm	-87 dBm
Ultimate	-95 dBm	-93 dBm	-92 dBm	-91 dBm

To obtain the greatest range performance, you may want to explore power settings above +43 dBm since the longest-range links will be limited to the lower-order constellations. The best possible range will be achieved with a combination of maximum power level, narrowest channel bandwidth, lowest-order constellation, and TDD.

Power Balance Optimization for FDD

In the default state, the AF5 has this configuration:

- TX power: +40 dBm
- Channel bandwidth: 10 MHz
- Duplexing mode: TDD

To optimize throughput with maximum frequency reuse:

1. Aim the AF5 using the factory default settings and TDD.
2. Allow the AF5 to automatically rate-adapt.
3. Configure the AF5 for FDD operation.
4. Check the modulation rate and capacity indicators for asymmetry.
5. You may notice significant asymmetry. If you do, then this could be due to a poorly aimed AF5 or an AF5 that is operating in some sort of reflective Fresnel environment. Ensure that the AF5 is correctly aimed and free of any potential reflections before proceeding to the next procedure.

To optimize both ends of the link for the best symmetry:

1. Test for a local desense condition (possibly due to a reflection or other disturbance). Begin with the AF5 that is receiving the lowest RX capacity reading, and decrease the TX power on *that* AF5 by 1 dB.
   a. Check if there is any increase in the RX capacity at the AF5.
   b. Watch for decreases in the TX capacity of the AF5.
2. Perform step 1 iteratively to find out if there is any RX capacity sensitivity to the local TX power level.
3. If this condition persists, try the following:
   a. Run the lowest transmit power that still allows for the best balance of performance on both ends of the link.
   b. Increase the FDD frequency separation and repeat the optimization process. (In general you should run the lowest power possible to meet the data rate requirements for the link.)

This link symmetry procedure should be repeated on the opposite end of the link to test for desense on the other side.

If desense is not an issue, then try this method to mitigate the asymmetry: Slightly increase the transmit power on the opposite end of the link. (Note: This should be tried only after you rule out local desense first.)

For the best possible FDD performance, use as much frequency separation as possible to minimize external coupling of energy.

Online Resources

Support: support.ubnt.com
Community: community.ubnt.com/airfiber
Downloads: downloads.ubnt.com/airfiber

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