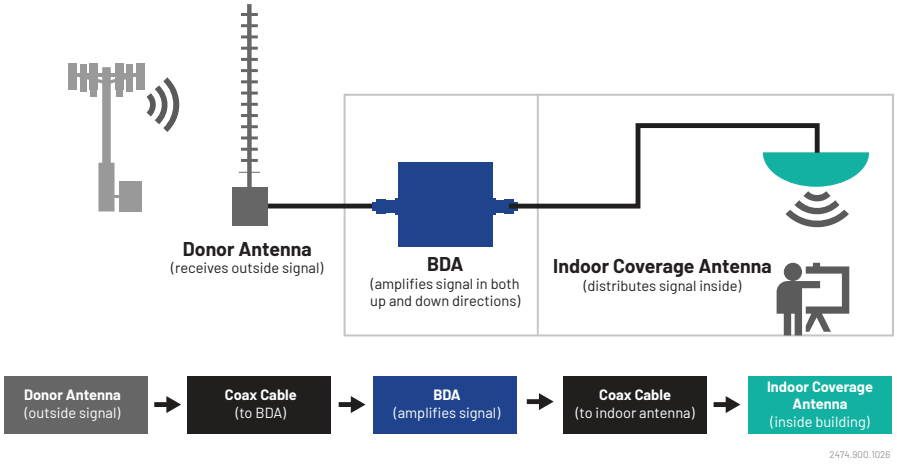
Antenna Isolation Testing with OneAdvisor 800

Quickly and easily identify radio link issues

Antenna isolation is a critical verification test for RF communication systems that involve multiple antennas located in relatively closer proximity. This is often the case for passive DAS (distributed antenna systems) that provide indoor coverage with in-building installations. Active DAS systems (based on fiber) can also be prone to the same problems.

Without proper isolation between close-by antennas, there can be issues like signal coupling, cross-talk effects, or intermodulation that ultimately reduce the intended performance of the communication system.

Antenna isolation testing is of particular importance for repeating systems using bidirectional amplifiers (BDA) that boost cellular signals inside a building to ensure adequate and reliable cellular coverage. A cellular repeater contains a BDA consisting of forward and reserve power amplifiers and duplexers filters.



Example of a coax-based, passive Distributed Antenna System (DAS) with its main components

A repeater system typically has two types of antennas. First, the donor antenna communicates to the donor base station and is typically a high-gain (narrow beam) antenna with a high front-to-back ratio to reduce coupling to the indoor coverage antennas that are the ones providing the in-building service to users.

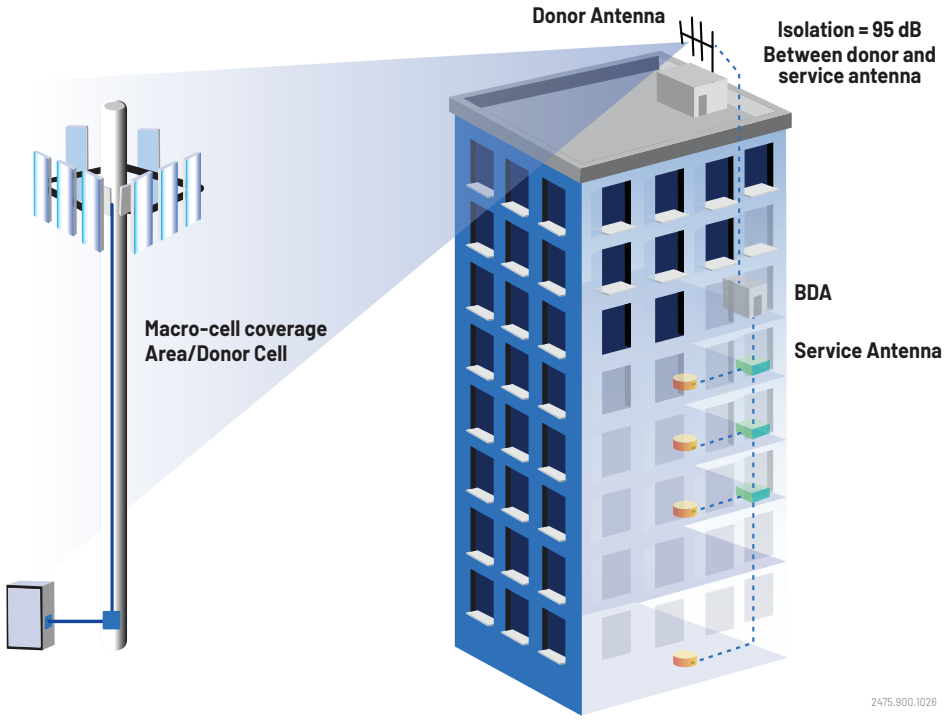
The most frequent problem with an in-building installation is inadequate isolation (path loss) between the roof antenna and those within the building. When isolation is insufficient, the system oscillates due to positive feedback and causes interference. Identifying and correcting these issues in a timely manner is critical for assuring proper cellular coverage and service.

Quickly and easily identifying radio link issues like interference or antenna isolation are a major challenge for the RF industry. Customers require tools that can quickly identify sources of a problem so that correct actions are taken in a cost-effective way.

Example

For several months, a service provider has been experiencing problems at one of their in-building networks. Initially, it was thought that the repeater at the site was causing interference, so the repeater was replaced. Yet after the repeater replacement, the performance issue persisted. VIAVI Solution partnered with the service provider and ran an antenna isolation test. The industry standard for minimum antenna-to-antenna isolation is calculated as follows:

Antenna-to-antenna isolation = BDA gain + 15 dB



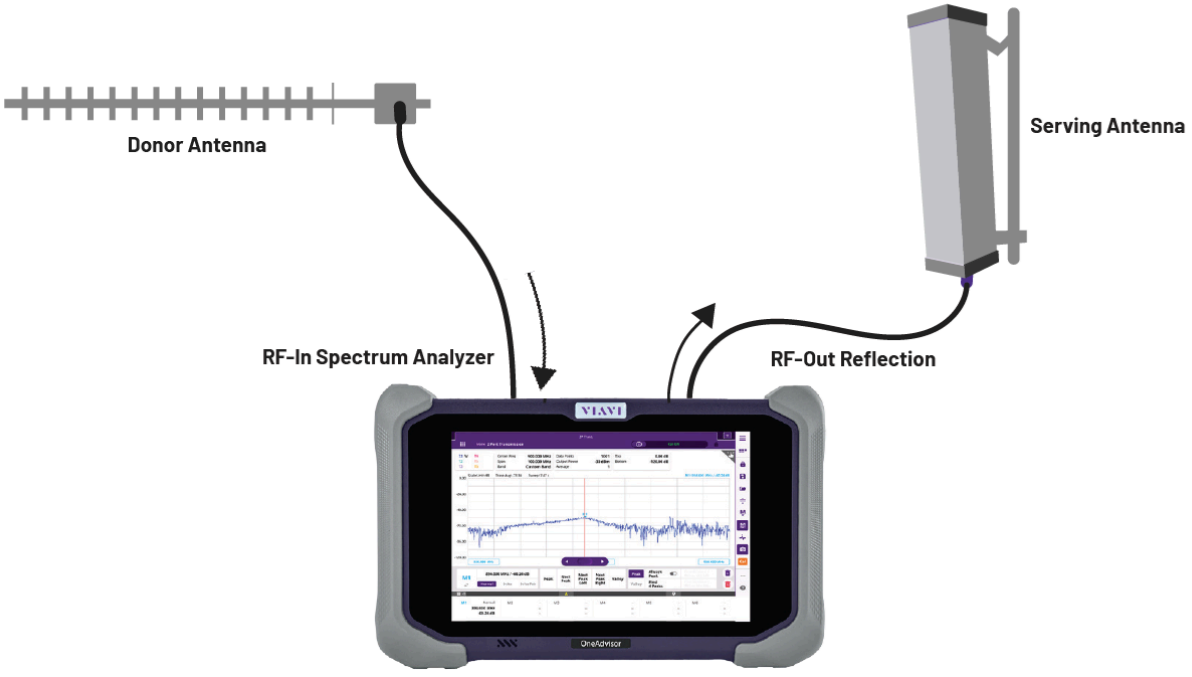
In this case, BDA gain was 80 dB, so an isolation of 95 dB was required.

Solution

The VIAVI OneAdvisor 800 Wireless with an independent CW signal generator and spectrum analyzer can operate as a 2-port insertion loss / tracking generator tool and is an ideal set up for testing antenna isolation. It simultaneously generates a sweeping CW signal and measures the RF power from the spectrum analyzer in tracking mode.

Technicians connected two antennas (donor and service) as shown in the figure. The VIAVI OneAdvisor 800 generated a CW signal at a defined signal level and sent it to the serving antenna. Connected via an input port to the donor antenna, the spectrum analyzer measured the received RF power. The delta between the generated signal level and the received (lower) power level represented the antenna isolation (path loss) observed.

Having identified the issue, the technicians tested different antenna locations for the serving antenna until the target isolation and expected RF coverage level was satisfied.



Antenna Isolation Remediation Techniques

Antenna isolation techniques are strategies designed to achieve higher isolation levels between antennas. These methods include:

- **Physical/spatial separation:** antennas are placed far enough apart to reduce coupling
- **Polarization diversity:** this technique uses antennas with alternative polarizations including directionality to minimize interaction between antenna patterns
- **Shielding:** effective shielding involves using barriers or materials to block unwanted electromagnetic interaction, often with the use of filters and/or duplexers

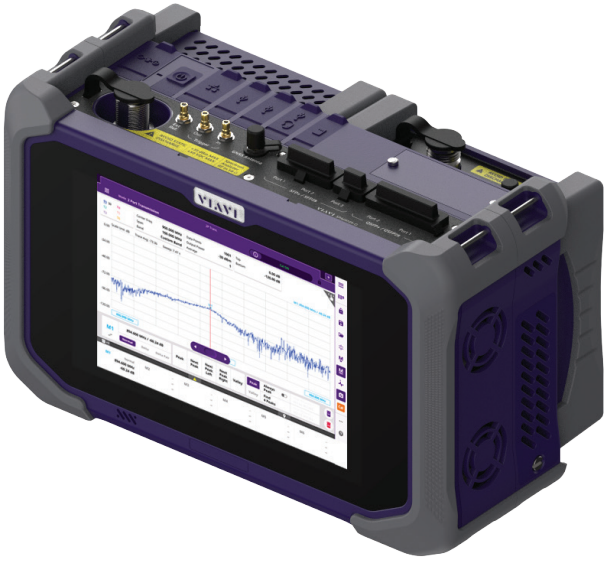
Effective implementation of these techniques is essential for minimizing interference and ensuring consistent performance in complex RF systems.

Summary

Antenna isolation test is the process of quantifying the extent of isolation between closer by antennas. This measurement reflects the loss of signal power between two antennas and is typically expressed in decibels (dB). An antenna isolation test evaluates the efficiency of antenna placement and design by measuring the isolation between the antennas.

Radio communication engineers use antenna isolation measurements to identify potential issues and to verify that the system meets defined performance levels. An antenna isolation test and measurement help identify potential issues and ensure antennas operate efficiently without negatively impacting transmission or reception.

The ability to identify, confirm, and eliminate antenna isolation-related issues in a timely manner is an absolute must-have for service providers. The VIAVI OneAdvisor 800 spectrum analyzer with signal-generation capabilities is a perfect tool for this application.



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