



PIM Happens

Just Not On Our Watch

FREQUENTLY ASKED QUESTIONS



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1. **What is PIM (Passive Intermodulation)?**

PIM is the result of two or more wireless signals mixing together to create additional, undesired frequencies that cause interference or degrade transmission of desired signals in wireless networks.

2. **What causes PIM?**

PIM may occur in passive non-linear radio frequency (RF) circuits with two or more common components. The two fundamental causes are current rectification at the conductor joints, and/or varying magnetic permeability due to ferromagnetic material in or near the RF path. Common contributors to PIM at a cell site include:

- Poor connector attachment
- Improperly torqued connectors
- Scratches/oxidation/contamination on conducting surfaces
- Poor quality of components or components that lack durability
- Plating quality or improper plating thickness
- Low quality or damaged cable assemblies, adapters, or connectors
- Ferromagnetic materials in or near the RF path

3. **How does PIM affect network performance?**

PIM levels that approach those of thermal noise or other interference can desensitize the receiver, causing performance to deteriorate. The result is signal blockage or loss of reception. The degree of the desensitization varies depending on the power of the generated harmonics.

4. **How do I know I have a PIM problem?**

The only way to verify the presence of PIM is through reliable on-site testing; Andrew Solutions Site Services regularly tests customer sites prior to commissioning. This is done using approved PIM testing equipment and technicians certified in field PIM testing. In the absence of pretesting, dropped calls or reduced cell capacity can be symptomatic of PIM.

5. **How should PIM testing be conducted?**

Andrew Solutions recommends PIM performance testing be conducted with equipment that uses swept frequency operation and 2x20 watt carriers. Frequency dependent components, such as antennas, must be tested in the frequency band of operation. Frequency independent components may be tested in a frequency band that is suitable to characterize component PIM performance. For additional details and insight on proper PIM testing, refer to Andrew's "PIM Support" section on www.commscope.com.

6. **How do I isolate and test specific components in the RF path during field testing?**

If the RF path tests out of specification, begin by taking the antenna off line, then remove components from the RF path individually while testing the remaining assembly into a load. Using the process of elimination allows you to identify the components out of specification. To test the antenna, either rotate it off path or remove it from the structure for ground testing.

7. **What is Andrew Solutions recommended system level PIM specification?**

Recommended PIM levels are largely dependent on the specifications of the system being tested. We suggest using Andrew's online PIM and VSWR System Calculator. It enables you to input the basic characteristics of your system then provides an estimate of the acceptable PIM levels for the RF path being tested. You can access this tool in the "PIM Support" section on www.commscope.com.

8. **How does Andrew Solutions limit the impact of downtime while field testing for PIM?**

Additionally, by working with you to test frequencies within your operating band and reducing transmit power when possible, we can mitigate some of the inconveniences associated with field testing for PIM.

9. **How does Andrew Solutions minimize the impact on other carriers' availability during system testing?**

Andrew Solutions works to minimize unwanted RF radiation during testing. For instance, we test antennas at ground level and test transmission lines as well as other components into a load. We prefer to conduct testing during the evening maintenance window and will work with customers to test frequencies within their operating band if possible.

10. **What documentation does Andrew Solutions provide as part of a standard PIM test?**

The Summitek PIM testing equipment we use automatically generates a comprehensive report saved as a PDF file. The report includes site specific information that includes sector and line description, TX frequencies and their power output levels, 3rd order mode frequency readings, a pass/fail threshold value, time and date stamps, and operator information.

11. **Does Andrew Solutions perform site testing?**

Andrew Site Services can be contracted to perform PIM testing. The cost for PIM testing varies based on location, the number of lines being tested, and the overall scope of work. Please contact Andrew's Technical Support Team at 1-800-255-1479 for assistance with your requirements.

12. **How do I check the PIM specification on the individual Andrew Solutions RF components I've purchased?**

The product specifications for our passive products list the PIM specification for each individual product. To access the specifications, go to www.commscope.com and click the eCatalog tab. Enter the name or part number of the component. All PIM testing on Andrew's RF components is conducted utilizing 2x20 watt carriers and in the swept frequency mode.

13. **Is there a PIM calculator?**

Yes. Andrew Solutions has developed a sophisticated PIM and VSWR System Calculator that enables operators to input the various components from their RF paths, along with the component PIM specification, model number, and length of cable used. The PIM and VSWR System Calculator then generates both a typical PIM value (in which the vectors combine randomly), and a worst-case value (in which the vectors all combine in-phase.) For a more detailed explanation of how the PIM and VSWR System Calculator works, or to use the calculator, go to the "PIM Support" section located on www.commscope.com.

14. **Are there any performance guarantees that address PIM levels across my system?**

The short answer is, no. Because your RF path is made up of components from multiple vendors, there's no way for one vendor to ensure system-wide PIM performance. We do, however, guarantee that all Andrew SureFlex™ Premium Cable Assemblies and base station antennas are tested for 3rd order distortion using swept frequency analysis. Andrew is currently developing and packaging complete RF path solutions that will provide guaranteed PIM performance across the system.

15. **Are all Andrew Solutions products individually PIM qualified and factory tested?**

Many products are 100% tested for PIM. For specific information on your product please go to www.commscope.com and utilize the eCatalog section to obtain PIM specification. For specific questions we encourage you to contact Andrew's Intermod Squad at 1-800-255-1479.

16. **Does Andrew Solutions have supporting data for those products that are factory tested?**

Yes, Andrew offers support data for PIM tested products. For example, all SureFlex™ Premium Cable Assemblies are tested in our factories for PIM and VSWR. A unique serial number on each assembly is linked to the test data. The results are stored in a central database that can be accessed on www.commscope.com.

17. **What PIM testing equipment do you recommend?**

We typically utilize Summitek PIM testing equipment. PIM should always be done with 2x20 watt carriers and preferably with PIM equipment that can support swept frequency mode testing.

18. **Does Andrew provide PIM training?**

Yes, the Andrew Institute has developed a new PIM Fundamentals training curriculum designed to help installers, field technicians and RF engineers prevent, diagnose, and resolve PIM related issues. Training is conducted using Andrew base station antennas, cables, and other connectivity solutions, plus portable analyzers developed by Summitek Instruments.

19. **How long does it take to test a system?**

The time required to adequately test for PIM depends upon the number of antennas and transmission lines in the site or sector, as well as the scope of work. To test a system and provide the necessary reports may be done in as little as several hours or may take as long as a few days.

Note: While PIM testing can often be done in less than a day, isolating the cause of PIM and correcting it may take several days, underscoring the importance of pretesting and prevention.

20. **Is there a preventative maintenance schedule for PIM?**

When upgrades or changes are made to the RF path, PIM levels should be checked. Additionally technicians should receive regular installation and connectorization training, such as that offered by the Andrew Institute, which teaches PIM prevention techniques.

21. **How often does Andrew Solutions recommend checking for PIM?**

Since the RF path must be off line during PIM testing, Andrew suggests testing yearly or when the site or sector performance suggests a problem.

22. **Where can I find additional information and resources on PIM and PIM testing?**

We recommend starting your research at the "PIM Support" section on www.commscope.com. Here, you'll find a range of educational materials that goes beyond the web. At the Andrew Institute, our internationally recognized training facility, we've developed a new PIM Fundamentals curriculum that helps your installers and field technicians minimize PIM during installation.

We've also created the Andrew Intermod Squad, a team of PIM experts. Their job is to assist you with your PIM-related questions or concerns. You can access their expertise either by phone, 24/7 toll-free 1-800-255-1479, or by email at intermod squad@andrew.com.

The industry is rapidly evolving, new components are hitting the market, your RF path is becoming more and more cluttered.

PIM happens...just not on our watch.



www.commscope.com/andrew

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