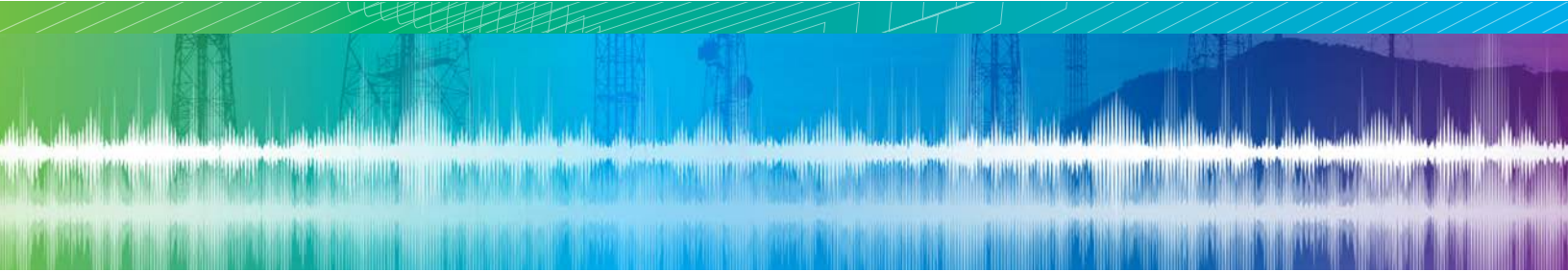# PIM AFFECTS PERFORMANCE—BUT IT CAN BE OVERCOME

ANDREW® expands their PIM-mitigating solutions for mobile networks

Passive intermodulation (PIM) has been a costly fact of life in RF networks since their invention. PIM reduces network performance in the uplink, requiring more transmit power to overcome the loss in capacity and coverage.

ANDREW's Mike Wolfe, CTO, tells us how PIM affects mobile networks and what ANDREW is doing to help mobile network operators (MNOs) overcome those effects.

Figure 1: Intra-band PIM scenario involving dual-band radio
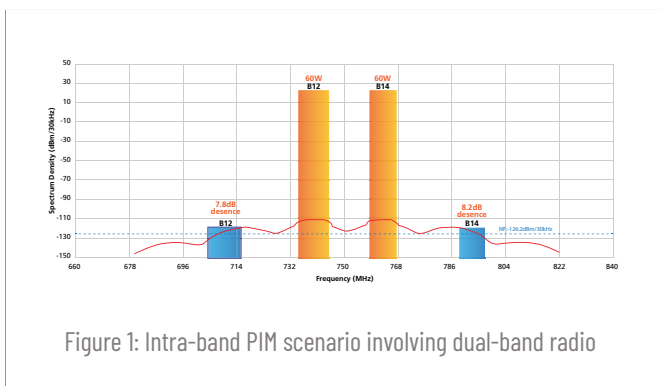
Q. WHY IS PIM A PROBLEM FOR MOBILE NETWORK OPERATORS?

A. All RF networks are inherently susceptible to internal and external PIM effects. This is a problem because, whatever its source, PIM interference decreases a site's coverage area and increases the data error rate, which reduces the effective traffic capacity of that site. It's also worth mentioning that the rollout of 5G networks, often co-sited with existing 4G networks, has created a situation where cross-band PIM is becoming a bigger challenge than ever.

Q. WHAT IS PASSIVE INTERMODULATION, OR PIM?

A. PIM is a kind of interference that degrades RF network performance, particularly on the uplink. It's commonly a result of an internal discontinuity in the RF path, such as a poorly-seated connector, damaged cable or area of moisture infiltration (this is called "intra-band PIM"). But it can also be created by nearby external sources, where different bands interfere with each other (cross-band PIM). We offer a deeper explanation in our recent eBook, Simplify and evolve your mobile network: A guide for optimizing your RF path.

Q. WHAT ELSE CAN MNOS DO TO MITIGATE THE EFFECTS OF PIM?

A. There are a lot of options and approaches, because there are so many possible sources of PIM in and around a modern macro cell site. Some of the most basic are using PIM-tested components in the RF path and using advanced network analysis and modeling tools to predict and mitigate internal and external PIM sources.

Q. HOW DOES PIM FIGURE INTO ANDREW'S DESIGN PROCESS?

A. PIM is a pervasive problem, but also a preventable problem, so ANDREW designs our RF solutions to mitigate (or, in some cases, completely eliminate) PIM in the RF path. We factory-test and validate PIM performance in our products to ensure mobile network operators get the performance they pay for. But in addition to these practices, designs and materials choices, we're advancing the technology with entirely new solution types designed to defeat PIM, preserve network performance, and reduce TCO for our mobile network operator partners.

Q. WHAT ARE THESE INNOVATIVE PIM MITIGATION TECHNOLOGIES?

We have been leading the charge against PIM for decades, but in the last couple of years, we have delivered some truly breakthrough solutions that reduce PIM—both internal and external—at virtually every point it can arise:

- The MOSAIC® antenna platform is designed to provide mobile network operators with a simple, interference-free way to add 5G active antenna systems to existing 4G sites—without compromising the performance of either technology by cross-band PIM that could otherwise result from having both antennas in such close proximity. It nests the active 5G antenna directly behind the passive 4G antenna, which is transparent to 5G bands. The result is multiple technologies operating seamlessly side by side, with one of the major causes of PIM virtually eliminated.

- PIM-Guard® accessories replace many of the metallic components associated with internal PIM with high-performance polymer equivalents. These accessories run the gamut from RRU mounts to standoff brackets and support clips. As an added bonus, they are also lighter and less expensive than the more PIM-prone components they replace. Our latest addition to the portfolio is BSA PIM-Guard solution, which provides exceptional PIM defense from external PIM sources located behind an antenna, while also reducing wind load up to 21%.

- SEED® highly efficient technology use an innovative, low-loss distribution feed network and advanced phase-shifter technology to boost the antenna's radiated power relative to its input power. Because these devices feature fewer solder points in their construction, they are less susceptible to a common source of internal PIM. Super-efficient SEED technology also helps operators achieve their own sustainability goals.

- **ANDREW's PIM calculators** have always provided an easy-to-use tool to analyze and predict real-world impacts of cross-band PIM. We have offered various types of calculators over the years, but our latest 3D PIM Calculator predicts interference from broadband modulated signals on multiple ports. Unlike traditional PIM analysis, which is restricted to narrow-band tones on a single port, it allows us to analyze real-world scenarios with multiband antennas and actual modulated signals on different or the same ports. The results are presented as the level of desense for a given RX band, i.e., how much the noise floor has increased due to passive intermodulation. This desense will reduce coverage and capacity of the system.

> ANDREW has made it our mission to help our MNO partners defeat PIM at every opportunity, helping them build more efficient and sustainable networks. PIM has always been a preventable problem; our job is to make it easier to prevent it.

Mike Wolfe
CTO
ANDREW

Mike is responsible for strategy, marketing, and technical support at ANDREW an Amphenol company. He has over 28 years of experience in wireless technology and focuses on making ANDREW a valuable partner to customers as they evolve their networks towards 5G technology and beyond.