

Installation Guide for 3M™ PIM Reduction Kit 1000

Product Description

3M™ PIM Reduction Kit 1000 is comprised of four parts: 1) 3M™ External PIM Absorber 1000, 2) 3M™ Butyl Mastic Tape 2212, and 3) Scotch® Super 33+ Vinyl Electrical Tape and 4) a “Do Not Remove” label. This combination of materials is an effective, robust solution to Passive Intermodulation (PIM) issues in wireless network infrastructure.

3M™ External PIM Absorber 1000 is a composite material consisting of a carrier resin, magnetic fillers and an acrylic pressure sensitive adhesive (PSA). This magnetic material is designed to help reduce radio frequency (RF) electrical currents associated with Passive Intermodulation (PIM) in wireless communications infrastructure. When 3M absorber 1000 is applied adjacent to a PIM source, currents flowing to and from the PIM source can be significantly reduced, thereby increasing the Signal-to-Noise Ratio (SNR) of the radio access network.

3M™ Butyl Mastic Tape 2212 is a high tack, self-fusing butyl rubber mastic ideal for making water and humidity resistant seals.

Scotch® Super 33+ Tape is a premium grade all-weather vinyl insulating tape that has excellent resistance to UV rays, abrasion, moisture, alkalis, solvents, and acids, and inhibits corrosion in varying weather conditions (including UV exposure).

The “Do Not Remove” Label is designed to inform technicians that the layers of tape shouldn’t be removed during maintenance tasks.



3M™ External PIM
Absorber 1000



3M™ Butyl Mastic
Tape 2212



Scotch®
Super 33+™
Vinyl
Electrical
Tape



“Do Not Remove” Label

Installation and Application Guide for 3M™ PIM Reduction Kit 1000

Site Hygiene

As good site hygiene is essential to achieving a low-PIM environment, we recommend that prior to employing 3M External PIM Absorber 1000 the user should first remove any likely sources of PIM such as decommissioned antennas, unnecessary brackets, hose clamps, or hardware of any sort that might cause PIM. When two equal sources of PIM are present and only one is effectively removed, that can result in at most a 3 dB reduction in PIM. When there are multiple such sources of PIM then the removal of one, even if effective, will not be significant. Only after good site hygiene is established can the residual sources of PIM be effectively addressed with 3M™ External PIM Absorber 1000.

Absorber Installation Procedure

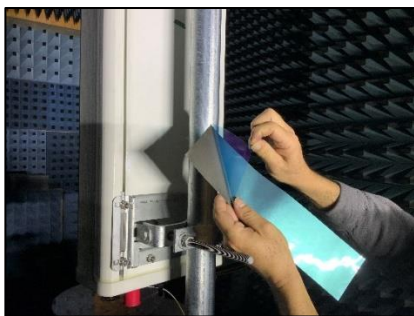


Ensure surface is clean, dry and free of debris or anything that may prohibit intimate contact between the absorber, tapes and surface.

1. 3M™ External PIM Absorber 1000

- a. Identify location(s) for 3M absorber to be applied using the Application Guide below
- b. Remove liner and cover layer (if present) from 3M absorber material and tack one end to surface of structural element (e.g. antenna mast)
- c. Begin wrapping 3M absorber around structural element, applying significant hand pressure.
- d. Overlap any extra material onto starting end of 3M absorber. Verify that 3M absorber is fully adhered at point of overlap. If 3M absorber material length is not sufficient to complete wrap, orient resulting gap away from any suspected sources of radiation that may be causing the PIM currents.
- e. Apply hand pressure over entirety of 3M absorber to ensure that all material is fully adhered

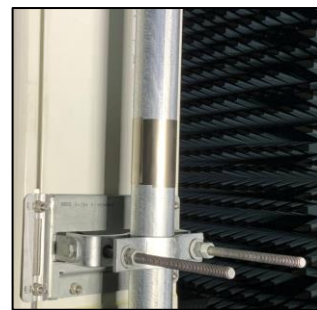
NOTE: 3M absorber may be temporarily applied in trial locations to assess the effectiveness in different positions. It will typically be possible to remove the 3M absorber and re-use it in different trial locations multiple times before permanently installing it in its final location. If many placements are anticipated, the 3M absorber can be temporarily secured without removing the liner, using masking tape as shown in the application guide.



Remove liner



Wrap absorber



Overlap extra material

Installation and Application Guide for 3M™ PIM Reduction Kit 1000

2. 3M™ Butyl Mastic Tape 2212

- a. Significant stretching is not recommended or required.
- b. Beginning 1" (25mm) beyond the edge of the 3M™ External PIM Absorber 1000, make half-lapped layers extending 1" (25mm) past the opposite end of the absorber.
- c. Compress by hand to minimize any lumps or ridges.



Apply 3M™ Butyl Mastic Tape 2122 1" beyond absorber



Wrap 3M tape 2122 with minimal stretch



Compress by hand

3. Scotch® Super 33+ Vinyl Electrical Tape

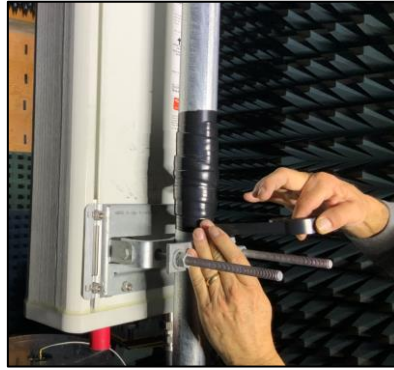
- a. Begin wrapping so that the last layer of Super 33+ tape on a vertical application will be applied from bottom up to create a shingle effect for water run-off.
- b. Sufficient tension should be used to produce a uniform wind. Appropriate tension will reduce the tape width to approximately 5/8 of original width.
- c. Beginning 1" (25mm) beyond the layer of 3M butyl mastic tape applied in the previous step, wrap the entire section of 3M butyl mastic tape with three layers of half-lapped Super 33+ tape, extending 1" (25mm) beyond the layer of 3M butyl mastic tape. At the end of each layer, simply reverse direction to begin the next layer; it is not necessary to cut the tape until the end of the final layer.

Installation and Application Guide for 3M™ PIM Reduction Kit 1000

d. The final wrap (i.e. several inches) should be made without tension to prevent flagging.



Apply Scotch® Super 33+ tape 1” beyond 3M tape 2212



Wrap Scotch® Super 33+ tape under tension 3 times



Minimize tension near end to prevent flagging



Completed installation

4. “Do Not Remove” Label

- Significant stretching is not recommended or required.
- Begin wrapping a “Do Not Remove” label around the previously installed tapes, applying significant hand pressure.
- Install additional labels as desired. Compress by hand to minimize any trapped air.



Installation and Application Guide for 3M™ PIM Reduction Kit 1000

Application Guide for 3M™ External PIM Absorber 1000

Introduction

3M™ External PIM Absorber 1000 is an effective means of helping reduce PIM in wireless network infrastructure when that PIM is generated by currents flowing in structural elements adjacent to base station antennas. Whether the location is a rooftop site, self-supporting tower or event venue, 3M absorber 1000 can help reduce PIM if applied in the appropriate manner. Proper installation and careful selection of location are important factors to help ensure maximum performance. This guide will provide recommendations on how to best utilize the 3M™ External PIM Absorber 1000, based on testing by 3M Corporate Laboratories.

Several key parameters determine the efficacy of the 3M™ External PIM Absorber 1000, as noted below:

- Location
- Distance from PIM Source
- Portion of Structure Wrapped
- Number of Absorber Layers
- Absorber Width

These parameters will be described in further detail in the following sections.

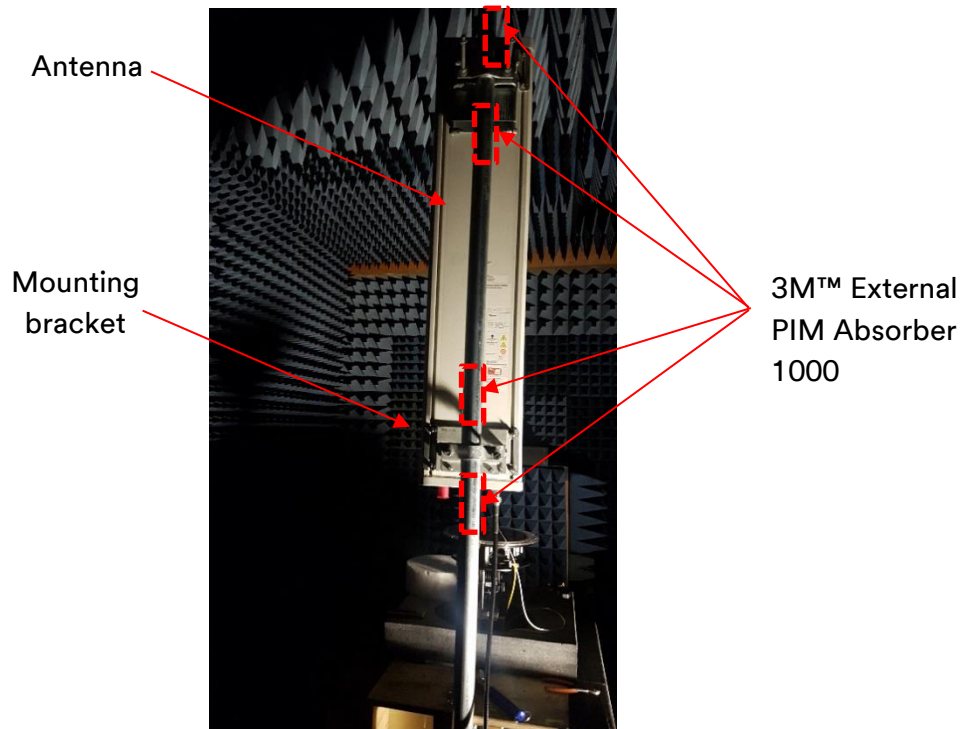
Key parameters

1. Location

The location of the 3M™ External PIM Absorber 1000 is one of the most critical parameters to obtain maximum PIM reduction. Since the intention is to reduce currents flowing in structural elements, the most benefit can be realized by placing 3M absorbers where the current density is greatest. These locations may not be immediately obvious, however based on testing experience and electromagnetic theory, some general guidance can be provided here.

In the diagram below, a base station antenna is depicted in a rooftop installation. There are likely several antennas and many PIM sources. For the purposes of this guide, it is supposed that the antenna mounting brackets are acting as PIM sources.

Installation and Application Guide for 3M™ PIM Reduction Kit 1000



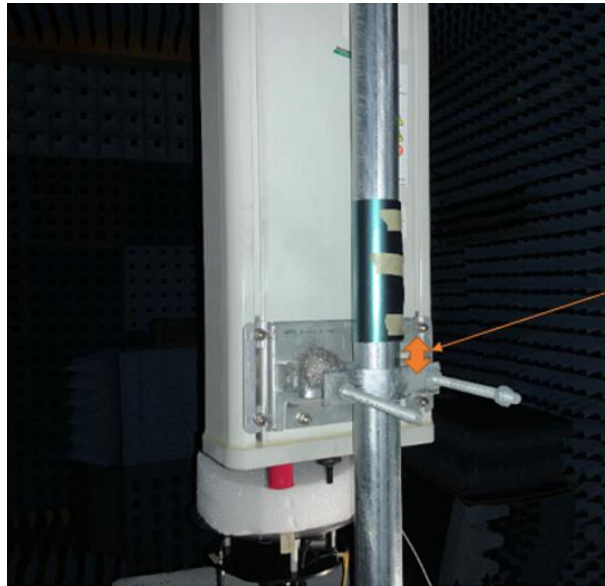
To attenuate currents flowing to and from the PIM sources, it is recommended that a 3M absorber be placed on each side of the PIM source and results monitored. In the simplified diagram above, the 3M absorber positioned above the lower bracket is subject to the greatest current density and will likely provide the most PIM reduction. The 3M absorber above the upper bracket is positioned where current density is the least due to the close proximity to the end of the mast; it will typically provide a lesser benefit. For cases where multiple antennas are mounted on the same mast or the PIM source is within the 3dB beamwidth of an adjacent antenna, the situation becomes more complex and further analysis or placement trials for the 3M absorber may be required. (The 3M absorber adhesive is designed for easy removal and re-use to facilitate such trials).

3M™ External PIM Absorber 1000 is not designed to be effective when placed over or cover a PIM source. Doing so will impede access to the mounting bracket or other hardware and it is not recommended.

2. Distance between 3M™ External PIM Absorber 1000 and PIM source

Continuing from the previous example, the next parameter to consider is the distance between the antenna PIM source (e.g. a bracket) and the 3M absorber. Although the current strength will vary over the length of an antenna mast or other conductive structures, the precise positioning of the 3M absorber relative to the PIM source is usually not critical. The 3M absorber can typically be moved several inches away from the PIM source with negligible impact on performance. A minimum of 2 inches should be reserved for weatherproofing tapes.

Installation and Application Guide for 3M™ PIM Reduction Kit 1000

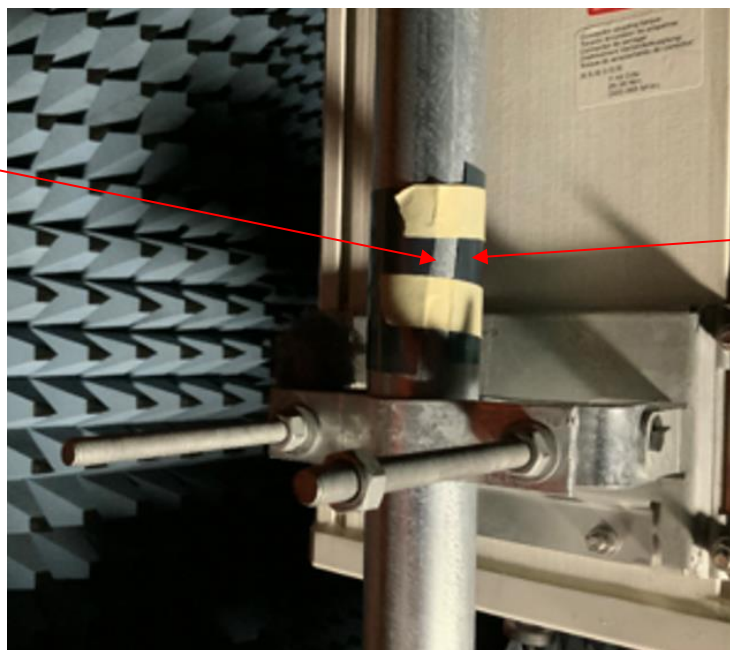


Gap not critical,
allow space for
weatherproofing

3. Portion of Structure Wrapped

It may not always be possible to wrap the 3M™ External PIM Absorber 1000 completely around the antenna mast or other structure. Even in this case it is possible to achieve significant PIM mitigation. When the 3M absorber cannot be wrapped completely around the current-carrying structure, it is best to orient the resulting gap away from suspected sources of radiation that may be causing the PIM currents. If oriented in such a manner, even a significant gap in the 3M absorber will often only minimally affect the reduction in PIM. However, if there are multiple sources of radiation present, it may not be possible to orient the gap in such a way. In this situation it may be best to apply additional PIM absorber, overlapping with the initially applied piece, to minimize PIM.

Orient gap away
from suspected
PIM source



3M™ External
PIM Absorber
1000

Installation and Application Guide for 3M™ PIM Reduction Kit 1000

4. Number of 3M Absorber Layers

3M™ External PIM Absorber 1000 has been designed so that only a single layer of absorber is required. For smaller diameter objects, it may be convenient to allow the 3M absorber to overlap significantly in multiple layers. While this is unlikely to improve PIM performance significantly, it will have no adverse effects.

5. 3M Absorber Width

As described in the previous section, careful consideration was given to maximizing performance and efficiency. Testing indicates that increasing 3M absorber width above the nominal 3 inches (i.e. applying adjacent absorbers) is not likely to provide a significant additional PIM reduction. It is not recommended however to use less than the nominal 3" width, unless forced to do so by geometrical constraints. 3M testing shows significant loss of efficacy for widths less than 2".

Summary

Using this guide, 3M™ External PIM Absorber 1000 can be used to significantly reduce PIM in wireless network infrastructure. By considering the location of the 3M absorber and other key parameters, performance can be maximized.

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