

Reduced Passive Intermodulation (PIM)

Features:

- Designed to Reduce PIM Distortion
- Optimized Copper/Laminate Interface

Benefits:

- Greatly reduces the production of new, unwanted signal frequency components
- Improved Receiver Performance
- Measured PIM values < -155 dBc

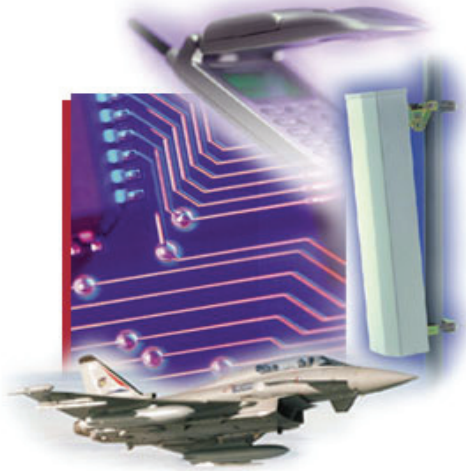
Typical Applications:

- A single site with two or more base station transceivers
- High Transmitter signals levels
- High Receiver sensitivity
- Transmitters and receivers sharing a common antenna

Arlon's reduced Passive Intermodulation (PIM) laminates are a series of woven fiberglass reinforced Teflon (PTFE) composite materials designed for use as printed circuit laminates. They have been engineered to reduce the contribution of the base laminate to Passive Intermodulation loss and distortion in finished microwave constructions, for example, antennas and filters.

This reduction is the result of optimizing the interface between the copper and laminate, specifically controlling copper surface morphology and treatment, as well as the laminate construction and processing. The result is a series of materials that demonstrate reductions in PIM of up to 20dB in both microstrip testing and finished antennas vs. standard laminates. Typical values achieved with Arlon reduced PIM laminates are -155dB or better, when tested as described below.

PIM Performance Test: The following test was conducted to determine the performance of Arlon's reduced PIM laminates: Microstrip test vehicles (12 inch 50 ohm line) and finished antennas were tested using a Summitek Passive Intermodulation Distortion Analyzer. The power level used was two tones with each carrier at 20 watts (+43dBm). The 3rd Order Intermodulation Product was measured in dBc (dB below the carrier peak). The testing was performed at 1.90 Ghz. Please note that many factors in both microstrip and antenna testing have a significant impact on PIM results, particularly the print and etch quality of the pcb as well as all elements of the workmanship in the assembly of the microstrip test vehicle or finished antenna. This testing sought to hold these variables constant to isolate the effect of the laminate on intermodulation values.



Typical Properties: PIM Laminates

| Property | Test Method | Condition | AD PIM 250 | AD PIM 300 | AD PIM 320 | AD PIM 350 | DiClad 880-PIM |
|---|--------------------|--------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Dielectric Constant | IPC TM-650 2.5.5.5 | C23/50 | 2.5 | 3.0 | 3.2 | 3.5 | 2.17, |
| Dissipation Factor | IPC TM-650 2.5.5.5 | C23/50 | 0.0018 | 0.003 | 0.003 | 0.003 | 0.0009 |
| Thermal Coefficient of Er (ppm/°C) | IPC TM-650 2.5.5.5 | -10°C to + 140°C | -110 | -110 | -110 | -110 | -160 |
| Peel Strength 1/2 ounce lbs per inch | IPC TM-650 2.4.8 | n/a | 15 | 15 | 15 | 15 | 12 |
| Peel Strength 1 ounce lbs per inch | IPC TM-650 2.4.8 | n/a | 17 | 17 | 17 | 17 | 12 |
| Volume Resistivity (MΩ-cm) | IPC TM-650 | C96/35/90 | 1.2 x 10 ⁹ | 1.2 x 10 ⁹ | 1.2 x 10 ⁹ | 1.2 x 10 ⁹ | 1.4 x 10 ⁹ |
| Surface Resistivity (MΩ) | IPC TM-650 | C96/35/90 | 4.5 x 10 ⁷ | 4.5 x 10 ⁷ | 4.5 x 10 ⁷ | 4.5 x 10 ⁷ | 2.9 x 10 ⁶ |
| Arc Resistance | ASTM D-495 | D48/50 | >180 | >180 | >180 | >180 | >180 |
| Tensile Modulus (kpsi) | ASTM D-638 | A, 23°C | 706, 517 | 706, 517 | 706, 517 | 706, 517 | 267, 202 |
| Tensile Strength (kpsi) | ASTM D-882 | A, 23°C | 20.9, 17.3 | 20.9, 17.3 | 20.9, 17.3 | 20.9, 17.3 | 8.1, 7.5 |
| Compressive Modulus | ASTM D-695 | A, 23°C | 365 | 365 | 365 | 365 | 237 |
| Flexural Modulus (kpsi) | ASTM D-790 | A, 23°C | 540 | 540 | 540 | 540 | 357 |
| Dielectric Strength (kV) | ASTM D-149 | D48/50 | >45 | >45 | >45 | >45 | >45 |
| Density (g/cm ³) | IPC TM-650 2.6.2.2 | E1/105 + D24/23 | 2.40 | 2.40 | 2.40 | 2.40 | 2.23 |
| Coefficient of Thermal Expansion (ppm/°C) X Axis Y Axis Z Axis | | 0°C to 100°C | 12 15 95 | 12 15 95 | 12 15 95 | 12 15 95 | 25 34 252 |
| Thermal Conductivity | ASTM E-1225 | 100°C | 0.235 | 0.235 | 0.235 | 0.235 | 0.261 |
| Flammability | UL 94 | C48/23/50, E24/125 | 94V-0 | 94V-0 | 94V-0 | 94V-0 | 94V-0 |
| Water Absorption (%) | IPC TM-650 2.6.2.2 | IPC TM-650 2.6.2.2 | 0.07 | 0.07 | 0.07 | 0.07 | 0.02 |

Material Availability:

Arlon's reduced PIM laminates are currently available as follows:

| PRODUCT | Dk (@ 10 GHz) | Df (@ 10 GHz) | Thickness |
|----------------|---------------|---------------|---------------|
| DiClad 880-PIM | 2.17, 2.20 | 0.0009 | 0.031"/0.062" |
| AD250-PIM | 2.5 | 0.0018 | 0.031"/0.062" |
| AD300-PIM | 3.0 | 0.003 | 0.031"/0.062" |
| AD320-PIM | 3.2 | 0.003 | 0.062" |
| AD350-PIM | 3.5 | 0.003 | 0.030 |

Results listed above are typical properties; they are not to be used as specification limits. The above information creates no expressed or implied warranties. The properties of Arlon laminates may vary, depending on the design and application.



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