

Why only one PIM standard in PIM Master™ accessory kits?

Introduction

In the past, two PIM standards were shipped with Anritsu's PIM Master accessory kits. One was designed to produce PIM at approximately -80 dBm in the 1800-1900 MHz range and the other was designed to produce the same level of PIM in the 800 - 900 MHz range. This was done as a convenience to customers so that they would only have to remember one value (-80dBm) when verifying performance of their 850 MHz, 900 MHz or 1900 MHz PIM Masters.

Today, Anritsu produces PIM test instruments serving the 700 MHz, 800 MHz, 850 MHz, 900 MHz, 1800 MHz, 1900 MHz, 2100 MHz and 2600 MHz frequency bands. It is no longer economically feasible to develop a unique PIM standard for each frequency band simply for convenience. Rather, Anritsu now provides one PIM standard in each accessory kit with an instruction card describing the expected performance across the full range of test frequencies.

Discussion

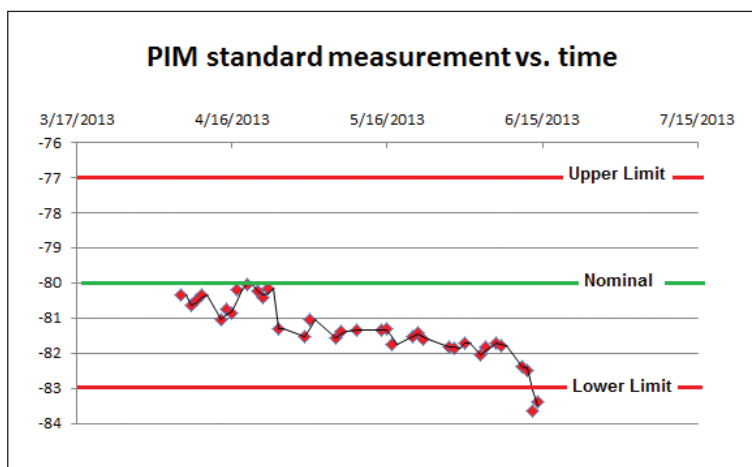
Only one PIM standard is required to correctly calibrate the MW82119A/B family of PIM test instruments. The magnitude of the PIM standard is not used during the calibration process. The fact that our PIM standards happen to measure -80 dBm at a particular frequency is interesting, but not relevant during calibration.

The PIM standard is only used during the first step of the calibration process to establish the "zero distance" location for Distance-to-PIM (DTP) measurements. Install the PIM standard on the instrument connector during calibration and the instrument connector will be the 0 meter mark for subsequent DTP measurements. During this step, you could use a -70 dBm, -80 dBm, -90 dBm or even -100 dBm PIM source. The magnitude of the PIM source is not used in any way during this calibration step. It only needs to be consistent (not changing in magnitude during the calibration process) and needs to generate a dominant PIM signal (stronger than the internal PIM of the instrument).



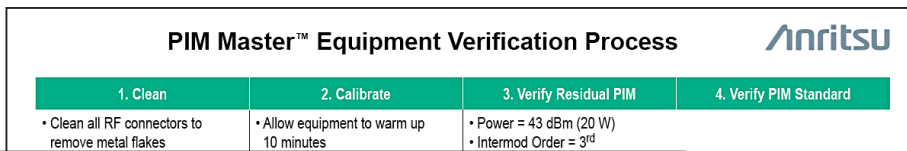
After calibration is completed you need to verify that the equipment is working properly. A simple way to accomplish this is to measure something that produces a known magnitude of PIM and verify that the instrument reports the expected value within some tolerance. It is not necessary to use a -80 dBm PIM standard for this step. The magnitude of the PIM standard could be anything as long as you know what it should be and can verify that the instrument reports the expected value within +/- 3 dB. Measuring a PIM standard verifies the output power and receiver operation in one simple step. If the test power is off by 1 dB, the PIM standard measurement will be off by almost 3 dB. If something is wrong with the receiver, the PIM standard measurement will be incorrect, indicating that a problem exists.

A good practice is to maintain an equipment log showing the results of your PIM standard measurement over time. The PIM standard that Anritsu provides in the accessory kit can vary more than 1 dB from the nominal advertised value due to normal manufacturing variation. Monitoring the PIM level that is measured on a particular PIM standard over time provides an early indication when something is changing with your unit. Below is data from an actual customer who was able to observe an equipment issue develop over time and take corrective action before taking invalid site measurements.



Note: Using a different low PIM termination in combination with a given PIM standard can also result in 1 dB variation. While not necessary, a more accurate indication of performance vs. time will be achieved using the same PIM standard + low PIM termination combination for each daily equipment verification.

So, to reiterate, only one PIM standard is required to calibrate the MW82119A/B PIM Master or to verify that the instrument is operating correctly. Since the expected PIM value from a PIM standard changes vs. frequency, Anritsu provides the Equipment Verification Process (11410-00726) shown below with each accessory kit. The guide describes the verification process on one side and provides the expected PIM value vs. frequency the current as well as previous PIM standards offered by Anritsu on the other. Providing data for all standards enables customers to use whichever standard they own during the equipment verification process.



| PIM Master™ Equipment Verification Process | | | | | | | | | | | | | Anritsu | | | |
|--|----------------------------|--|--------------------|---|--------------------|---|--------------------|------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--|--|
| | | 1. Clean | | 2. Calibrate | | 3. Verify Residual PIM | | 4. Verify PIM Standard | | | | | | | | |
| | | • Clean all RF connectors to remove metal flakes | | • Allow equipment to warm up 10 minutes | | • Power = 43 dBm (20 W) • Intermod Order = 3 rd | | | | | | | | | | |
| | | PIM Master™ Equipment Verification Process | | | | | | | | | | | Anritsu | | | |
| PIM Standard values (See other side) | | PIM Master Option | 700L | 701L / 702L | 700U | 701U / 702U | 850 | 800 | 900 / 902 | 180 | 192, 193 / 194 | 190, 193 / 194 | 210 | 260 | | |
| | | F1 | 734 MHz | 768 MHz | 734 MHz | 768 MHz | 869 MHz | 791 MHz | 935 MHz | 1805 MHz | 1930 MHz | 1930 MHz | 2110 MHz | 2620 MHz | | |
| | | F2 | 757 MHz | 803 MHz | 757 MHz | 803 MHz | 894 MHz | 821 MHz | 960 MHz | 1880 MHz | 2130 MHz | 1990 MHz | 2170 MHz | 2690 MHz | | |
| Part Number | Description | IM3 Frequency | 711 MHz | 733 MHz | 780 MHz | 838 MHz | 844 MHz | 851 MHz | 910 MHz | 1730 MHz | 1730 MHz | 1870 MHz | 2050 MHz | 2550 MHz | | |
| 1091-403-R | PIM STD, -80dBm @ 910 MHz | Typical IM3 @ 2x 20W | -81 dBm / -124 dBc | -81 dBm / -124 dBc | -80 dBm / -123 dBc | -80 dBm / -123 dBc | -80 dBm / -123 dBc | -80 dBm / -123 dBc | -80 dBm / -123 dBc | -74 dBm / -117 dBc | -74 dBm / -117 dBc | -72 dBm / -115 dBc | -72 dBm / -115 dBc | NA | | |
| 1091-446-R | PIM STD, -80dBm @ 1730 MHz | Typical IM3 @ 2x 20W | -87 dBm / -130 dBc | -88 dBm / -131 dBc | -90 dBm / -133 dBc | -89 dBm / -132 dBc | -85 dBm / -128 dBc | -90 dBm / -133 dBc | -85 dBm / -128 dBc | -80 dBm / -123 dBc | -80 dBm / -123 dBc | -78 dBm / -121 dBc | -77 dBm / -120 dBc | -73 dBm / -116 dBc | | |
| 1091-390-R | PIM STD, -80dBm @ 1775 MHz | Typical IM3 @ 2x 20W | -87 dBm / -130 dBc | -87 dBm / -130 dBc | -86 dBm / -129 dBc | -86 dBm / -129 dBc | -86 dBm / -129 dBc | -86 dBm / -129 dBc | -86 dBm / -129 dBc | -80 dBm / -123 dBc | -80 dBm / -123 dBc | -78 dBm / -121 dBc | -78 dBm / -121 dBc | -75 dBm / -118 dBc | | |

Note: Typical values shown. PIM standards can vary ±3 dB due to manufacturing variation. Record the starting value of your PIM standard and use that value for test equipment verification.

Attach PIM standard and Low PIM termination

Note: Okay to use 910 MHz, 1730 MHz, or 1775 MHz PIM standard for this step

Perform PIM vs. Time test

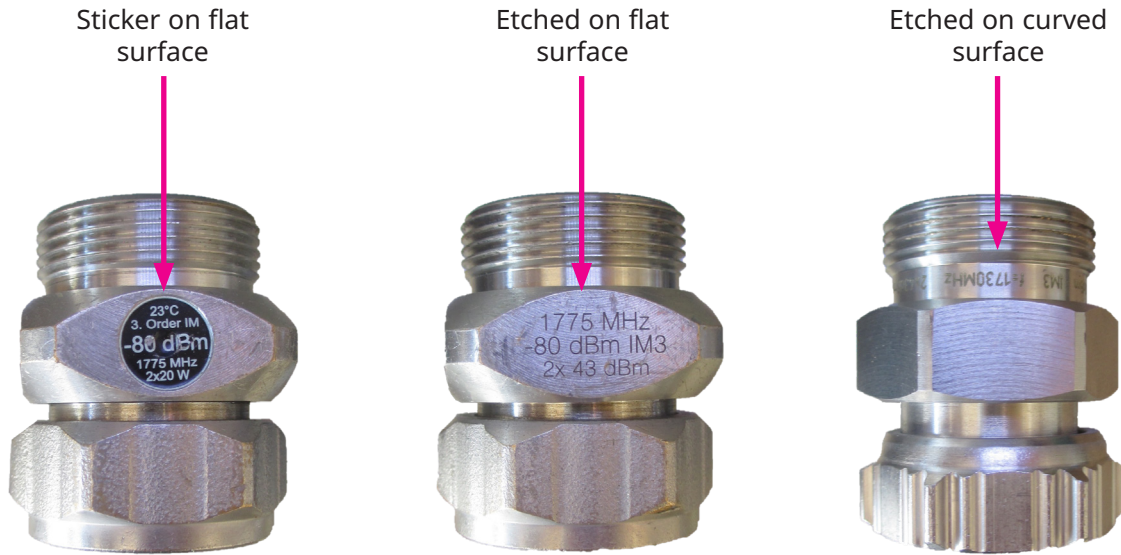
Verify Peak PIM value is within ± 3 dB of expected value (see other side)

Save this result to include with report

2015-09

PIM Standard Identification

Each PIM standard is marked by the manufacturer with its expected PIM value at a particular frequency. Depending on the manufacturer, this marking may be located on one of the flat faces or on the cylindrical body of the PIM standard. Anritsu's part number is not marked on the PIM standard. The Anritsu part number is however included on the 11410-00726 verification card to facilitate ordering a replacement if a customer's PIM standard is lost or damaged.



Summary

Only one PIM standard is required to calibrate the Distance-to-PIM (DTP) feature, and to verify that the PIM Master is operating properly. For this reason, Anritsu only supplies one PIM standard with its 2000-1745-R and 2000-1746-R PIM Master accessory kits.



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