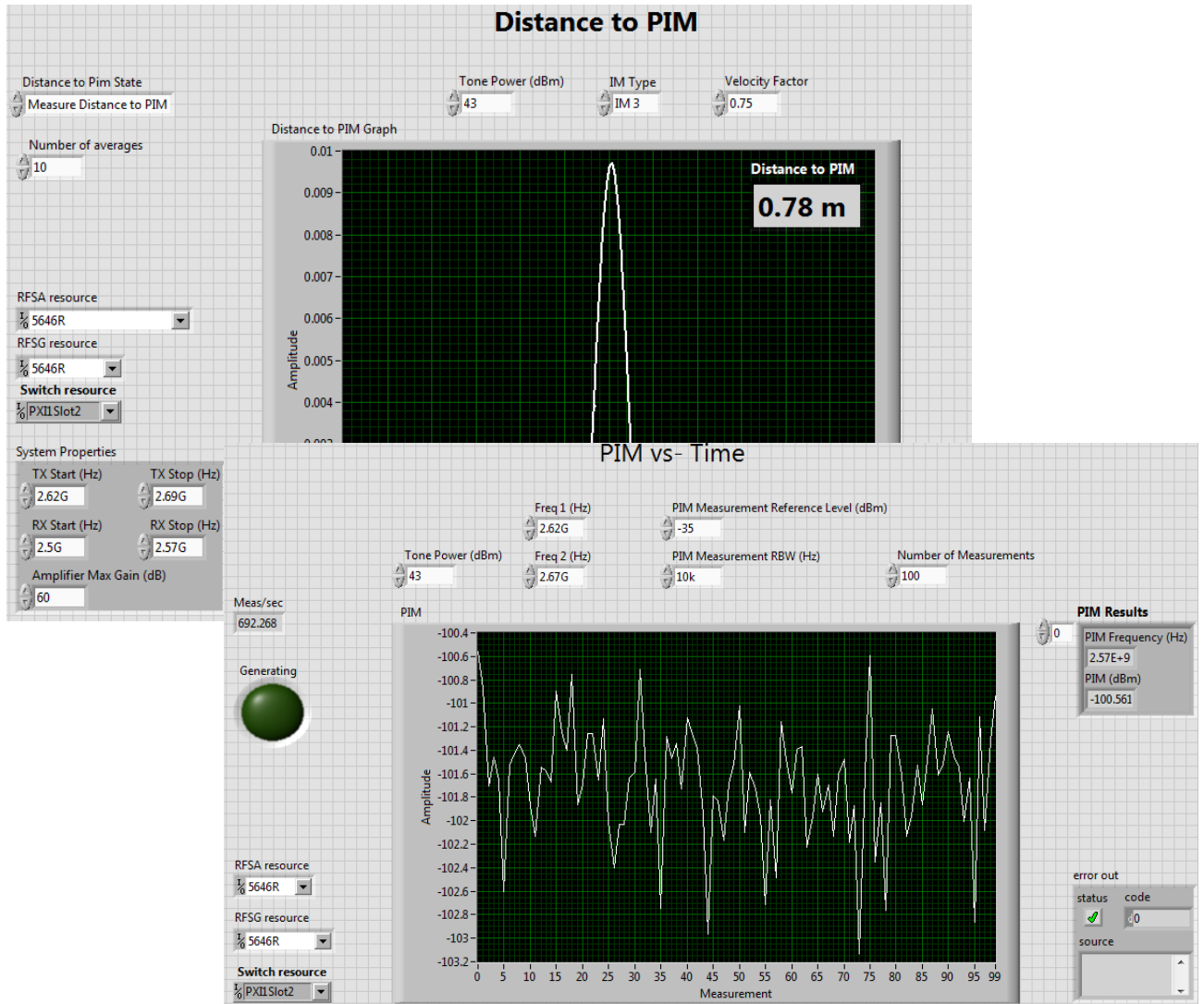


# GTT PIM TOOLKIT

## USER GUIDE



Gefle Testtechnik™

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# 1 Introduction

GTT PIM Toolkit enables measurements of Passive InterModulation (PIM) of filter and antenna products.

It features a high performance PIM measurement in a very cost effective setup.

- Measurement as low as -150dBm using 2x43dBm input signals
- PIM over time with 100+ measurements per second for PIM @-130 dBm
- Distance to PIM capability
- PIM over frequency
- Support for system calibration

The system is built on the Labview 2014 platform.

## 2 System Requirements

See <http://testteknik.se/content/product> for a list of SW and HW requirements for the product.

## 3 Installation

Start LabVIEW and VIPM with administrator rights and start the installation of the “GTT PIM toolkit” using VIPM 2014 or newer.

The installed APIs are by default located at:

... \National Instruments\ [LabVIEWInstallDir] \vi.lib \GefleTestteknik \FilterAntenna \...

**Note:** The system supports Windows 7, 64 bit. For other Windows versions please contact [sales@testteknik.se](mailto:sales@testteknik.se) for latest status.

### 3.1 To activate/deactivate a license

The distributed executables and the GTT LabVIEW libraries (\*.lvlib) are licensed and have an evaluation period of 30 days and must then be activated for continued use. The license is locked to the computer that is used during installation.

We recommend using GTT licensing toolkit for activation of licenses. The built in activation tool in Labview may also be used. Be aware that licenses activated in Labview versions older than 2014 cannot be transferred at a later date, should it be needed.

To transfer a license it must first be deactivated on the system where it is currently active before activation on the new system. When restoring the computer from a backup image deactivation must be performed before deleting the old system.

A product can be manually activated (i.e. offline) by sending an email to [sales@testteknik.se](mailto:sales@testteknik.se) in the following format. NOTE that manually activated licenses cannot be deactivated or transferred:

Company Name:  
User Name:  
Executable User Code 1:  
Executable User Code 2:  
LabVIEW Library User Code 1:  
LabVIEW Library User Code 2:

For further information refer to the preferred tool for activation.

## 4 HW Setup

Hardware is not part of this product. The setups presented below are typical setups and shall be seen as examples of use. For complete solutions including hardware please contact [sales@testteknik.se](mailto:sales@testteknik.se) for further information.

For measurement systems where only PIM is to be measured the hardware setup is in principal the same for Antenna and filter systems.

For setups where for instance S-parameters are to be measured in the same system please contact GTT ([sales@testteknik.se](mailto:sales@testteknik.se)) for further information.

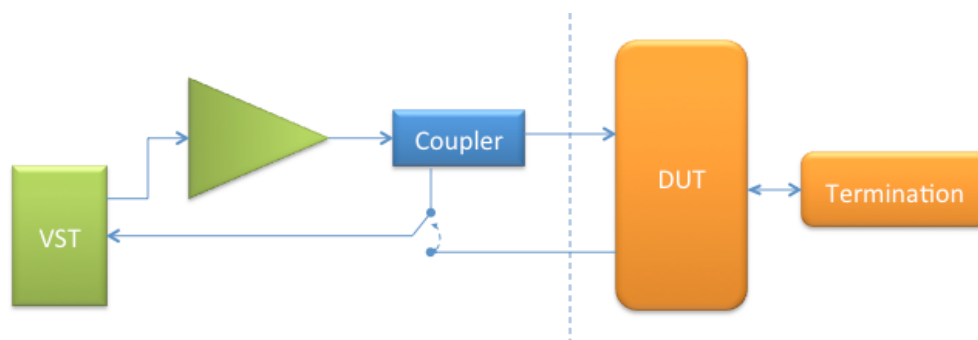


Figure 1 Typical HW setup for filter measurements

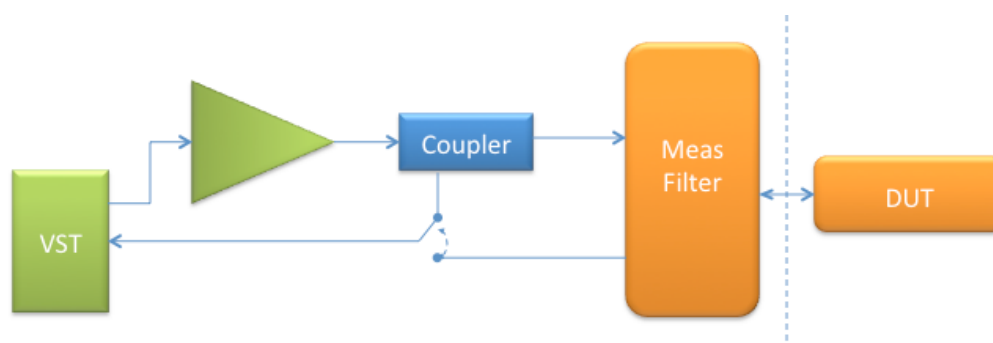


Figure 2 Typical HW setup for antenna measurements

The sample code supplied with the product is made for the above setup. For specific settings and ports refer to chapter 5 Example

## 5 Example

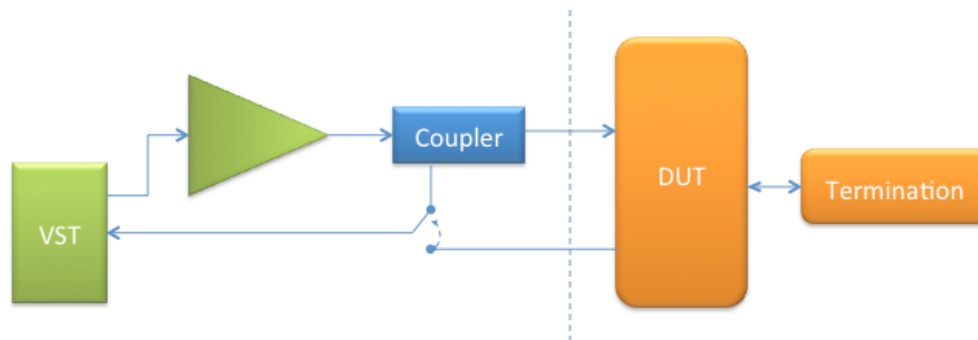
This chapter shows example of how the code can be used.

The examples are only showing the lower IM component but the software can handle any filter configuration.

For demo purposes different PIM loads has been used when producing the screen shots below.

Residual and actual performance depends on the hardware used. For more information please contact [sales@testteknik.se](mailto:sales@testteknik.se).

### 5.1 General HW setup and prerequisites



The example test HW setup consists of the following:

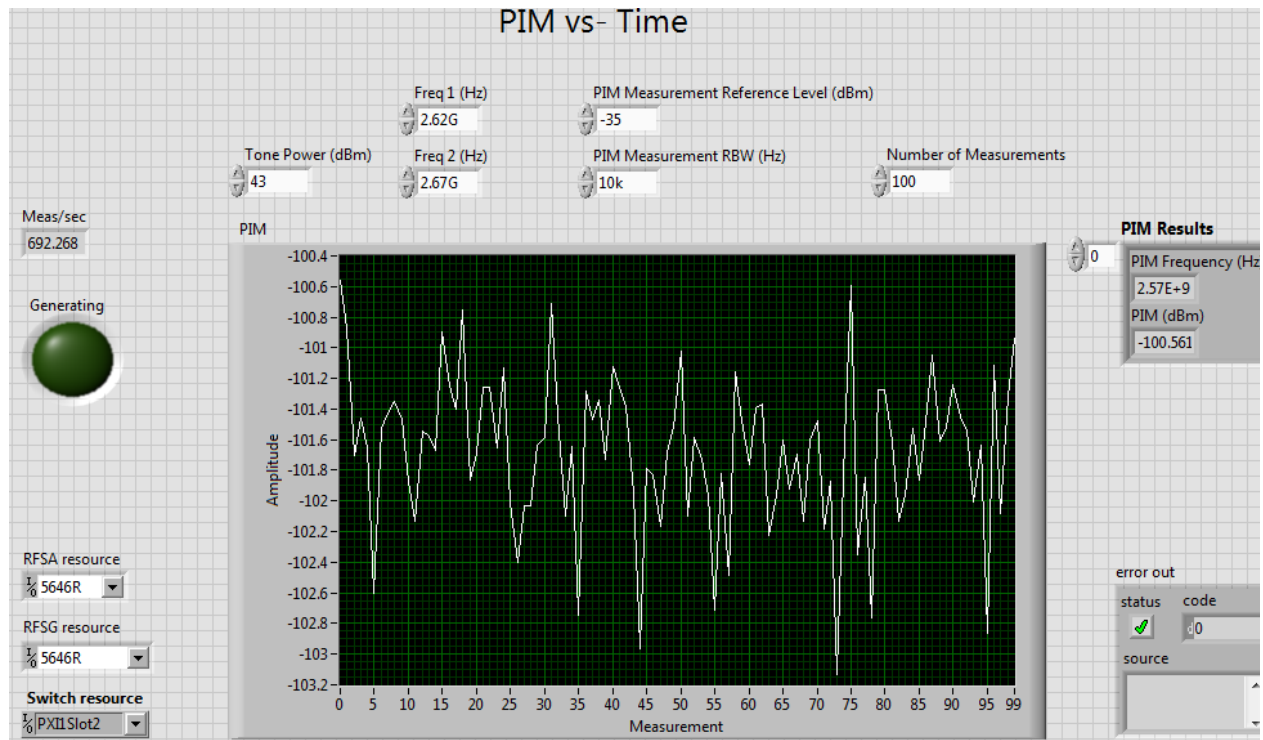
- VST: NI PXIe-5646R
- PA: > 50 dB gain, > 50 dBm output
- Coupler: Coupling factor > 55 dB. The coupling factor needs to be 5-10 dB higher than the amplifier gain
- Solid state RF switch: NI PXIe-2543
  - Switch Port usage:
    - CH1a: Receiver port (RX) on DUT.
    - COMa: RFSA Input
    - CH2a: Coupler forward port
- Termination: Low PIM, > 150 W
- Low PIM RF cable: Between the DUTs antenna (common) port and the termination.
- PIM load (not shown): Used for calibrating a zero distance in the Distance to PIM measurement.

- In the examples a low PIM duplex filter for band 7 has been used as the DUT. This duplexer is also the frequency limiting factor for the hw setup.
  - TX band 2620-2690 MHz
  - RX band 2500-2570 MHz

In all examples below the Tone Power input box is the power (in dBm) per tone.

The visible controls on the front panels are a subset of all available API calls possible to perform.

## 5.2 PIM over Time



Performs an IM measurement on a fixed IM frequency settable by the user. “Freq1 (Hz)” and “Freq2 (Hz)” are the two IM generating tones. Both tones are fixed in frequency.

The measurement performance is determined by “PIM Measurement Reference Level (dBm)” and “PIM Measurement RBW (Hz)”.

The “PIM Measurement Reference Level (dBm)” is a direct adjustment of the RFSA Reference Level.

The “PIM Result” box is scrollable and shows all performed measurements over time in the present session.

### 5.3 Distance to PIM

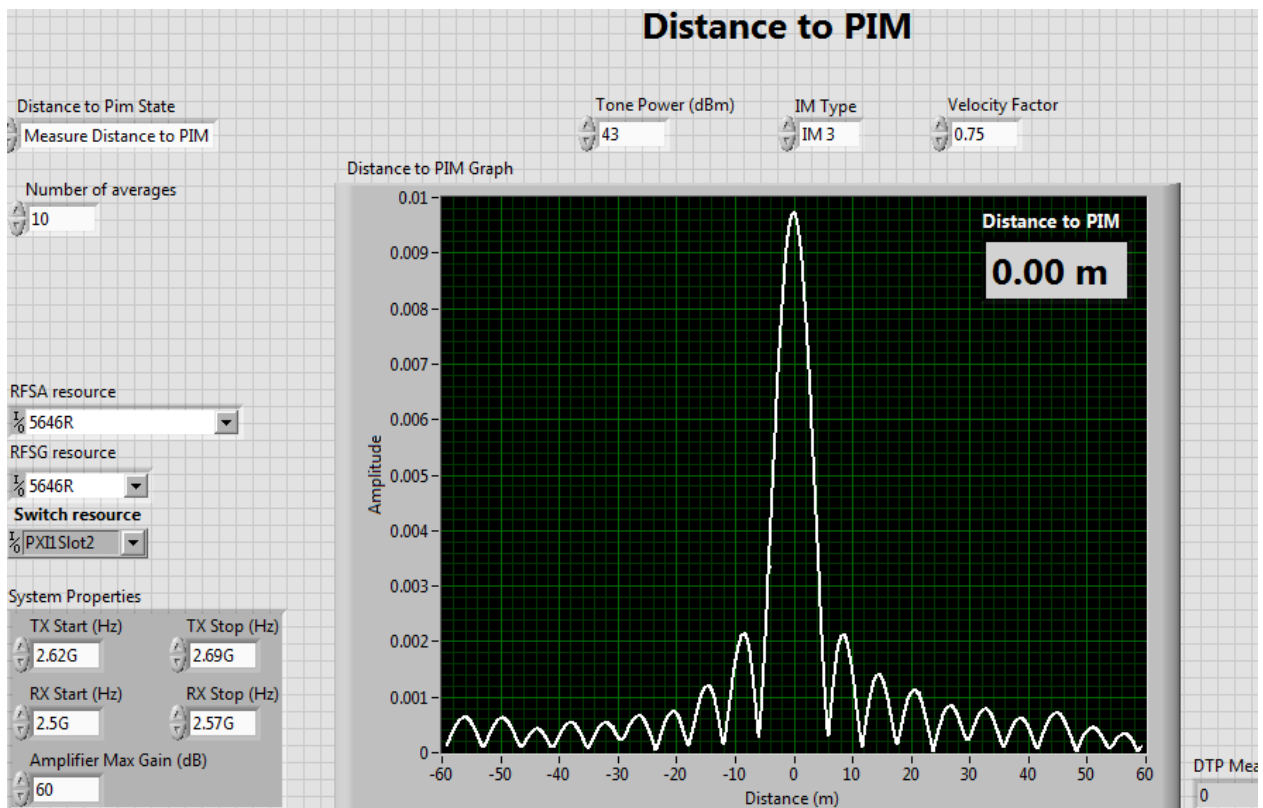
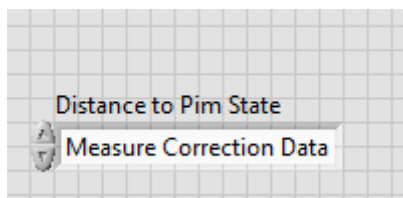
This measurement will use the duplexer and the low PIM RF cable, connected to the antenna (common) port, as a part of the test system. The end of the low PIM RF cable will become the test port.

The Distance to PIM measurement is divided in two states; a correction measurement state and a measuring state. The state is chosen in the “Distance to PIM State” box. The correction measurement must be performed once before a real measurement of a test object can be performed.

#### 5.3.1 Measure Correction Data for Distance to PIM

To set up the correction measurement, choose “Measure correction Data” in the “Distance to PIM State” box.

The velocity factor for RF components between the test port and the test object must be entered. 0.7-0.75 is a normal figure for most high grade RF components.



This picture shows the result after the correction data measurement has been performed.



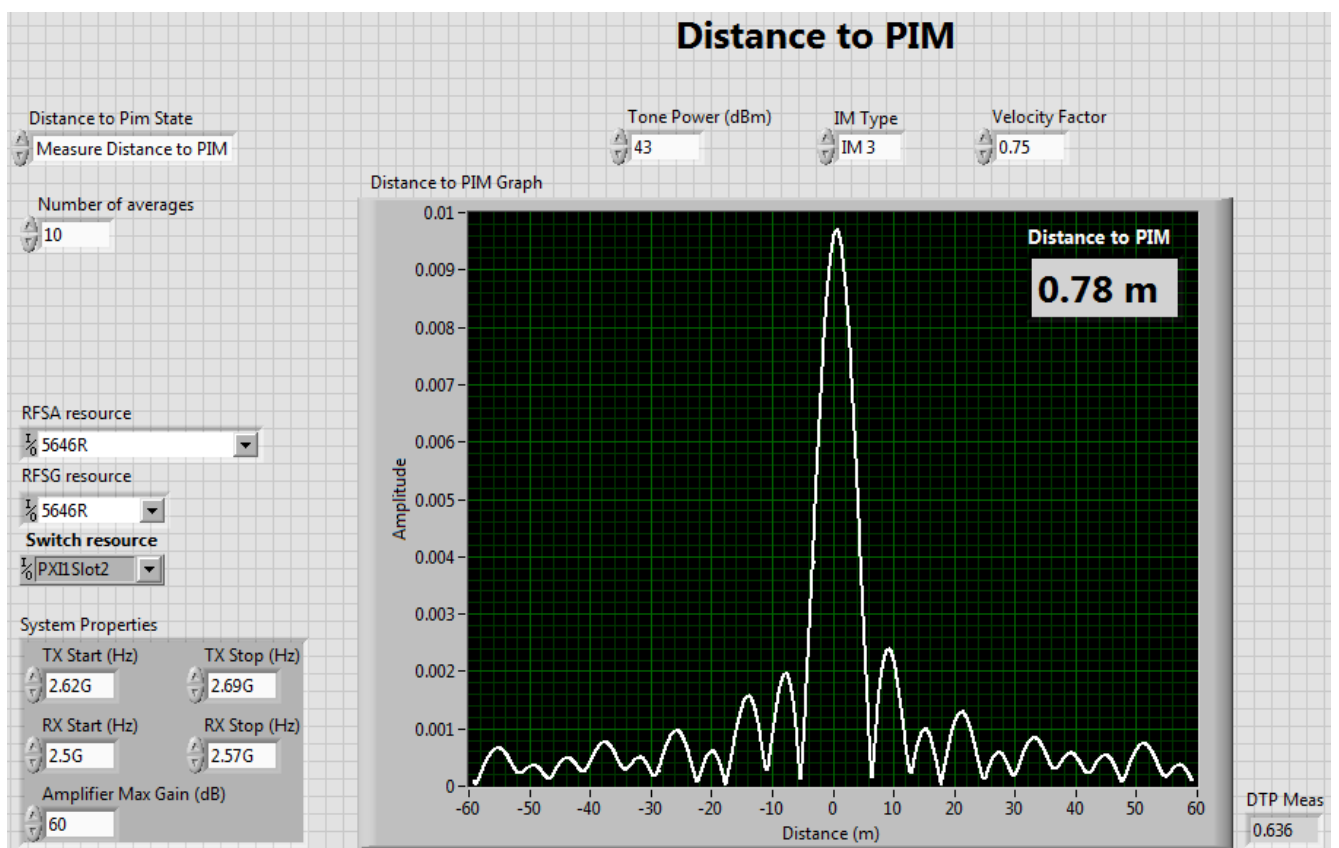
To measure the correction, a PIM load is used. The load will generate a PIM reflection and is in this case inserted between the low PIM RF cable and the PIM termination to create a zero distance reference point.

The zero distance reference point will be at the end of the low PIM RF cable connected to the duplexer's antenna (common) port.

The "System Properties" defines the parameters for the chosen duplexer that is being used in terms of frequency coverage. The "Amplifier Max Gain" is set according to used power amplifier in the HW setup.

### 5.3.2 Perform a Distance to PIM Measurement

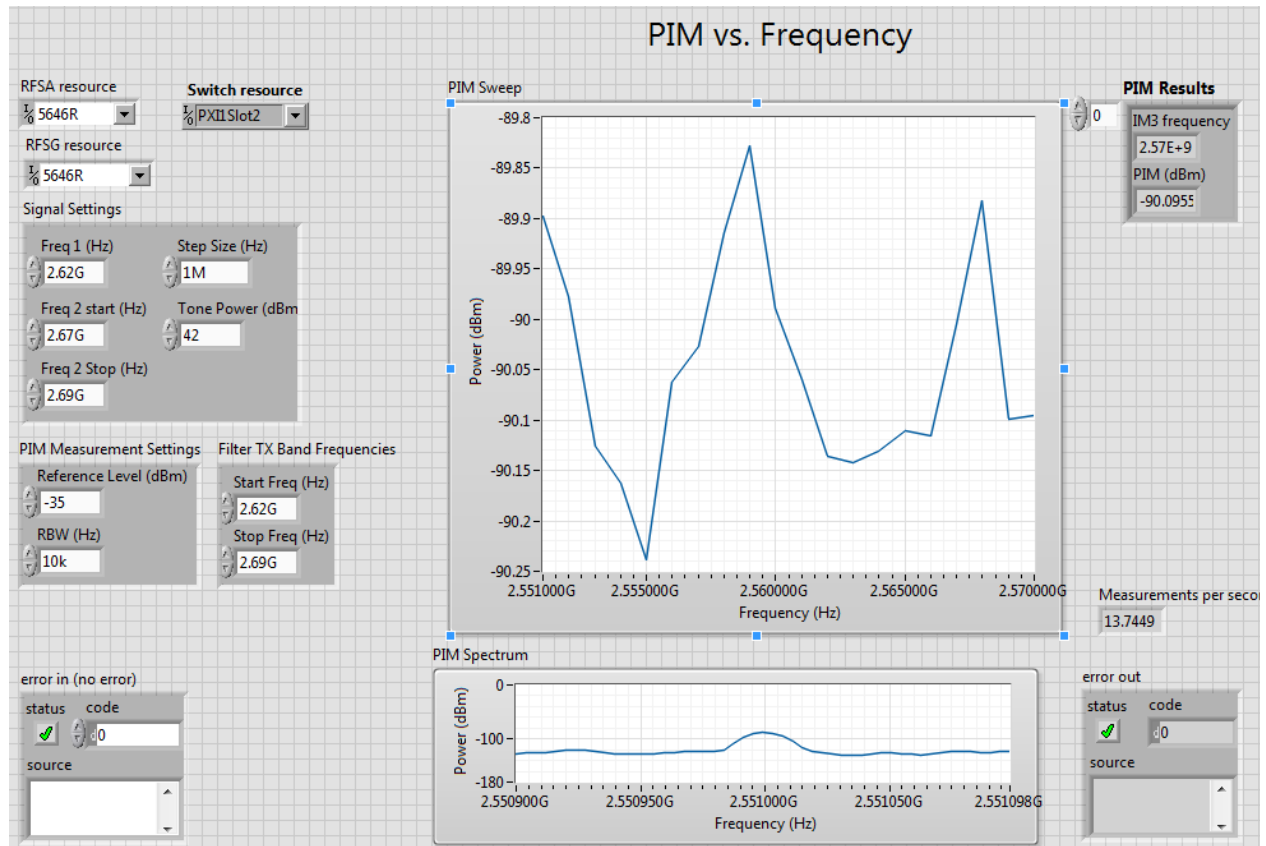
To set up the Distance to PIM measurement, choose "Measure Distance to PIM" in the "Distance to PIM State" box.



The DUT in this case is a normal non PIM specified high power RF terminator, connected via a 75cm RF cable to the test port.

The "Distance to PIM" result in the graph is an average of the results based on the number of measurements stated in "Number of Averages". The DTP Meas output box shows the last measurement of that series.

## 5.4 PIM over Frequency



In this test the 2<sup>nd</sup> IM generating tone is moved in frequency within the TX band whilst the 1<sup>st</sup> IM tone remains fixed.

The number of frequency points and frequency span is determined by “Freq 2 Start (Hz)”, “Freq 2 Stop (Hz)” and “Step Size (Hz)”.

The measurement performance is determined by “PIM Measurement Reference Level (dBm)” and “PIM Measurement RBW (Hz)”.

The “PIM Measurement Reference Level (dBm)” is a direct adjustment of the RFSA Reference Level.

The “PIM Sweep” graph shows the finalized IM measurement over frequency and the “PIM Spectrum” graph shows the actual frequency being measured.

The “PIM Result” box is scrollable and shows all performed IM measurements over frequency in the present session.

## 6 User Interface (API)

Refer to the context help in the LabView block diagrams for details.