RF Calibration

For

Docking Stations

In

Stand-Alone Mode

AN #20131208-01

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Accel-RF Instruments Corporation specializes in the design, development, manufacture, and sales of accelerated life-test/burn-in test systems for RF and Microwave semiconductor devices. This white paper describes technical information related to the AARTS Hardware. For more information contact:

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1 Overview

Accel-RF Instruments Corporation (ARF) sells a docking station for use with their Smart Fixtures products. The docking station allows testing of devices in a stand-alone mode of operation. ARF also produces two software products that are useful for controlling the smart fixtures (LifeTest and USBControl programs). The LifeTest program may be used to monitor over time RF power levels and frequency using external instruments. At this time, DC power may only be controlled and monitored using its own line of power supplies.

This application note explains how to calibrate and utilize supported external RF power meters (Agilent E4417 and E4419 series) with the LifeTest software. This is useful for characterization purposes.

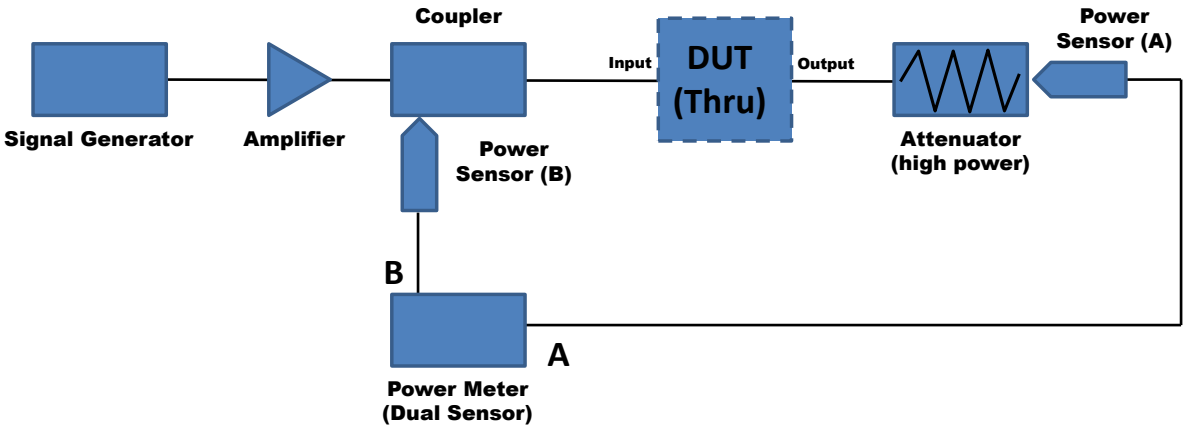
2 Stand-Alone RF Configuration

A typical block diagram of a stand-alone system is shown in Figure 2-1. The device under test (DUT) is installed in the Smart Fixture which is mounted in the docking station. The user supplied coupler on the input side is routed to the “B” head of a dual power meter. The “A” side is used as a reference and as the output monitor as shown. Note: separate “single” power meters may also be employed.

Please refer to the RF Calibration Techniques application note referenced below and the LifeTest software manual for additional information on RF calibration techniques for accounting for circuit losses. This app note primarily shows how to use an external source and RF Power meter in stand-alone operation.

App Note: AARTS_RF_Calibration_Techniques_RevB_AN20090405-01

Figure 2-1: Example Stand-Alone RF Setup

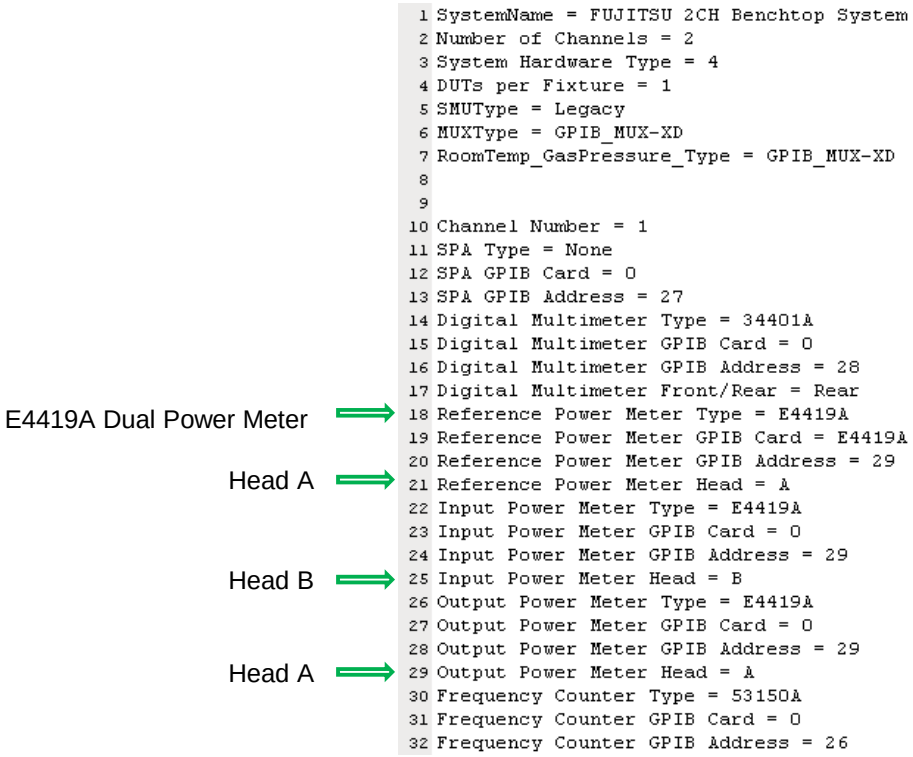


3 Configuring the SYSTEM Setup Files

The LifeTest software manages all system configuration through a few key files. The default location for these files is in the C:\LIFE\SYSTEM folder. For this application the key file of interest is named SYSTEM.CFG. A screen shot illustrating the lines that may need to be modified are shown in Figure 3-1. Note that each channel may employ its own unique meter for the purposes of calibration and measurement. In this case, only channel 1 is of interest.

The supported power meter types are the Agilent E4419A and E4417A. The default GPIB card and address information is as shown. The key difference from a standard AARTS system configuration is that the "output" power meter head uses the "A" head (in the standard system, both input and output utilize the "B" head). However, when there is no RFUP box available, use of the "A" head avoids the need for an external RF switch matrix.

Figure 3-1: C:\LIFE\SYSTEM\SYSTEM.CFG Changes



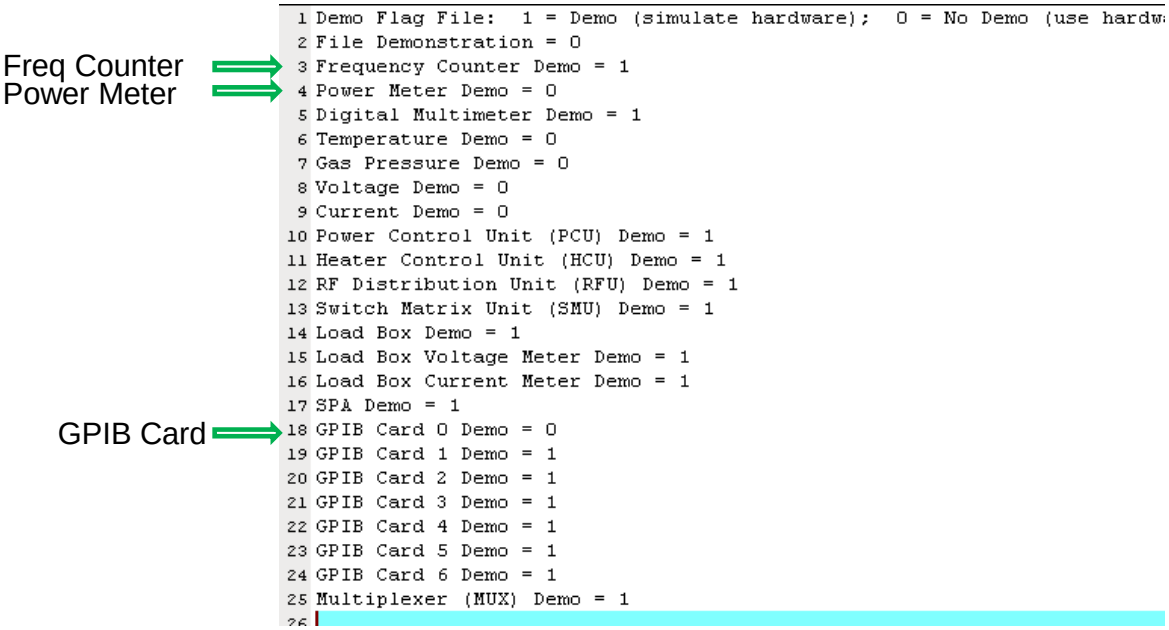

```
SystemName = FUJITSU 2CH Benchtop System
Number of Channels = 2
System Hardware Type = 4
DUTs per Fixture = 1
SMUType = Legacy
MUXType = GPIB_MUX-XD
RoomTemp_GasPressure_Type = GPIB_MUX-XD


Channel Number = 1
SPA Type = None
SPA GPIB Card = 0
SPA GPIB Address = 27
Digital Multimeter Type = 34401A
Digital Multimeter GPIB Card = 0
Digital Multimeter GPIB Address = 28
Digital Multimeter Front/Rear = Rear
Reference Power Meter Type = E4419A
Reference Power Meter GPIB Card = E4419A
Reference Power Meter GPIB Address = 29
Reference Power Meter Head = A
Input Power Meter Type = E4419A
Input Power Meter GPIB Card = 0
Input Power Meter GPIB Address = 29
Input Power Meter Head = B
Output Power Meter Type = E4419A
Output Power Meter GPIB Card = 0
Output Power Meter GPIB Address = 29
Output Power Meter Head = A
Frequency Counter Type = 53150A
Frequency Counter GPIB Card = 0
Frequency Counter GPIB Address = 26
```

One other change relates to the DEMO.TXT file (Figure 3-2), located in the main application installation folder. This file allows the user to signal the program to use, or simulate, certain instruments when running. A "1" causes the software into demo mode for that instrument, a "0" signals the software to use the actual instrument. In the example here, the National Instruments GPIB0 card, PCU box, and power meter are used. Everything else is ion demo mode.

The temperature is measured within the smart fixture Pulser card, and the voltage/current readings are measured within the PCUHCU box. If an external frequency counter is used, that line should be changed to "0" as well.

Figure 3-2: C:\LIFE\DEMO.TXT Changes



4 Configuring LifeTest for External RF Frequency Source

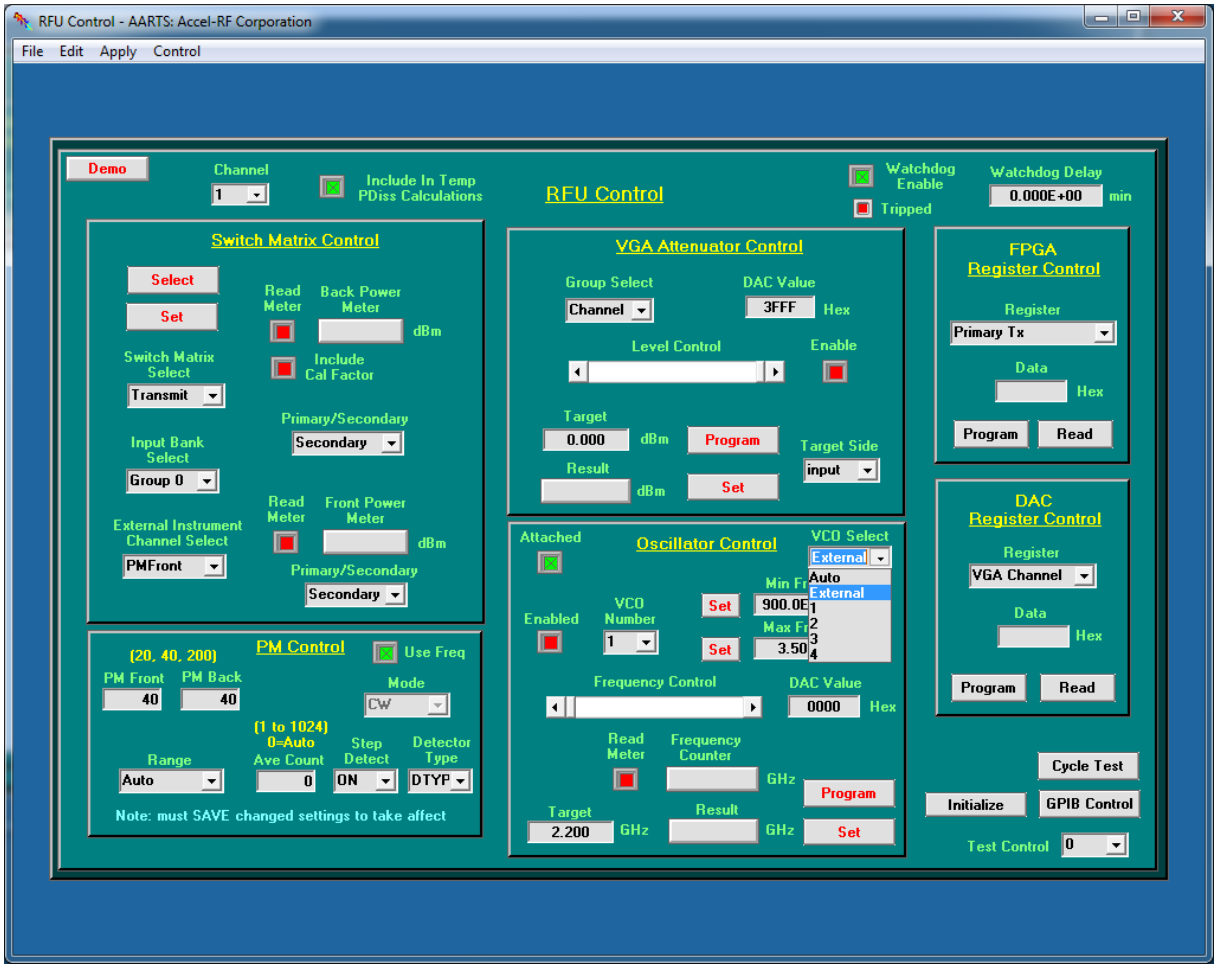
The LifeTest software allows use of an external frequency source. Follow these steps to configure the software to use the external source:

Step1: Launch the LifeTest Software. At the top level menu click on the [Control->RFU Control] menu item to launch the RFU Control Form [illustrated in Figure 4-1].

Step2: Select the channel of interest (Channel 1 works well for a single-channel system). In the "Oscillator Control" area select the pull-down box labeled "VCO Select" and click on "External". If the system has more than one channel, repeat for all channels.

Step 3: Click on [File->Save and Exit].

Figure 4-1: RFU Control Form (External Source)



5 RF Calibration

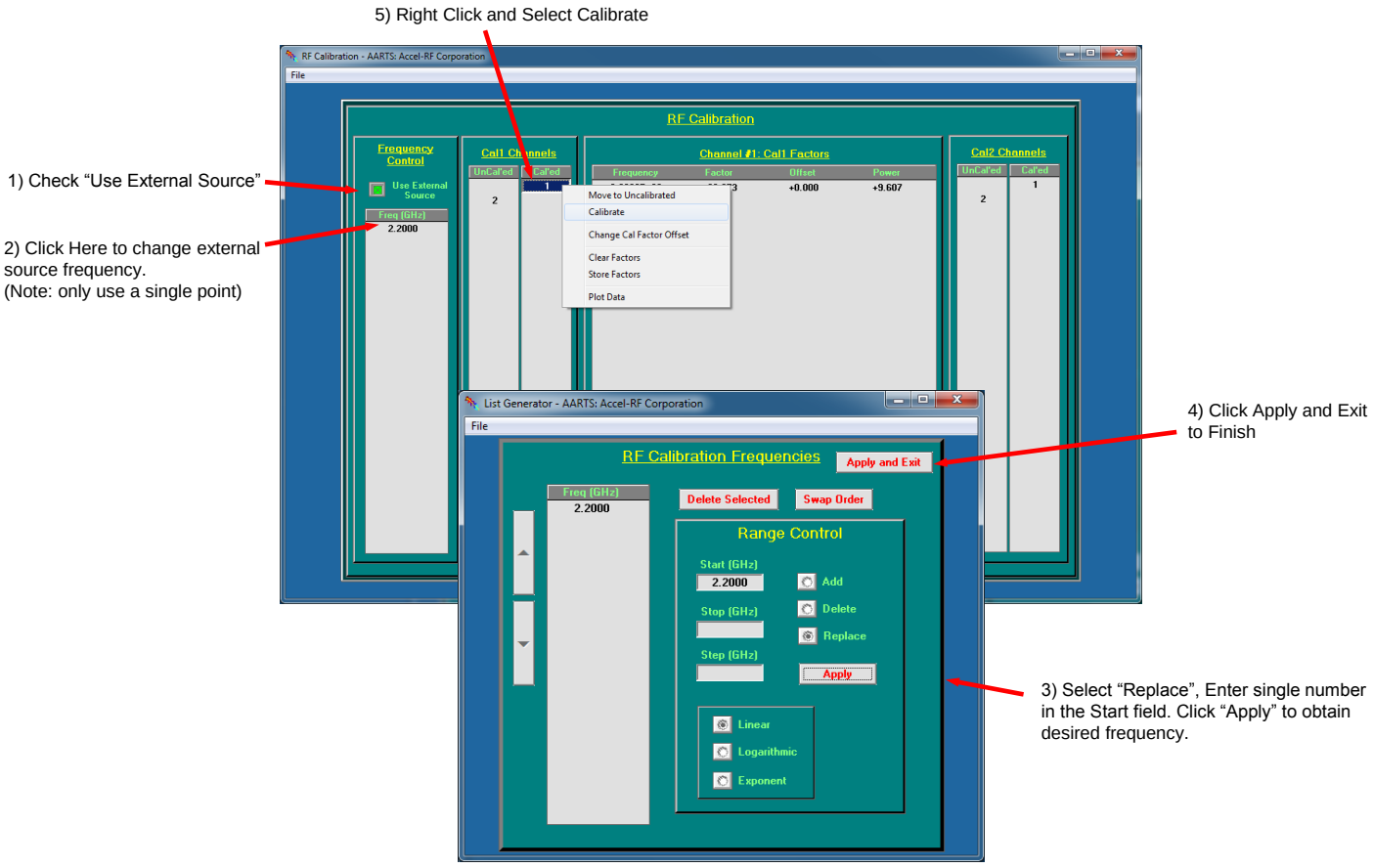
The next step is to perform the RF calibration setup as illustrated in Figure 5-1. Launch the RF Calibration Form from the top level menu by selecting the [Cal->RF Calibration] menu item.

Step1: Select the “Use External Frequency” checkbox option.

Steps 2-4: Enter the frequency of interest using the number list generator as indicated.

Step 5: Select the channel of interest (note: it may be in either the Uncal’ed or Cal’ed column – this is simply a useful aid in keeping track of which channels are calibrated in a system with many channels). Right click to pop up a menu selector to launch the Cal1 Form (input side calibration). This launches the Cal1 Form as shown in Figure 5-2.

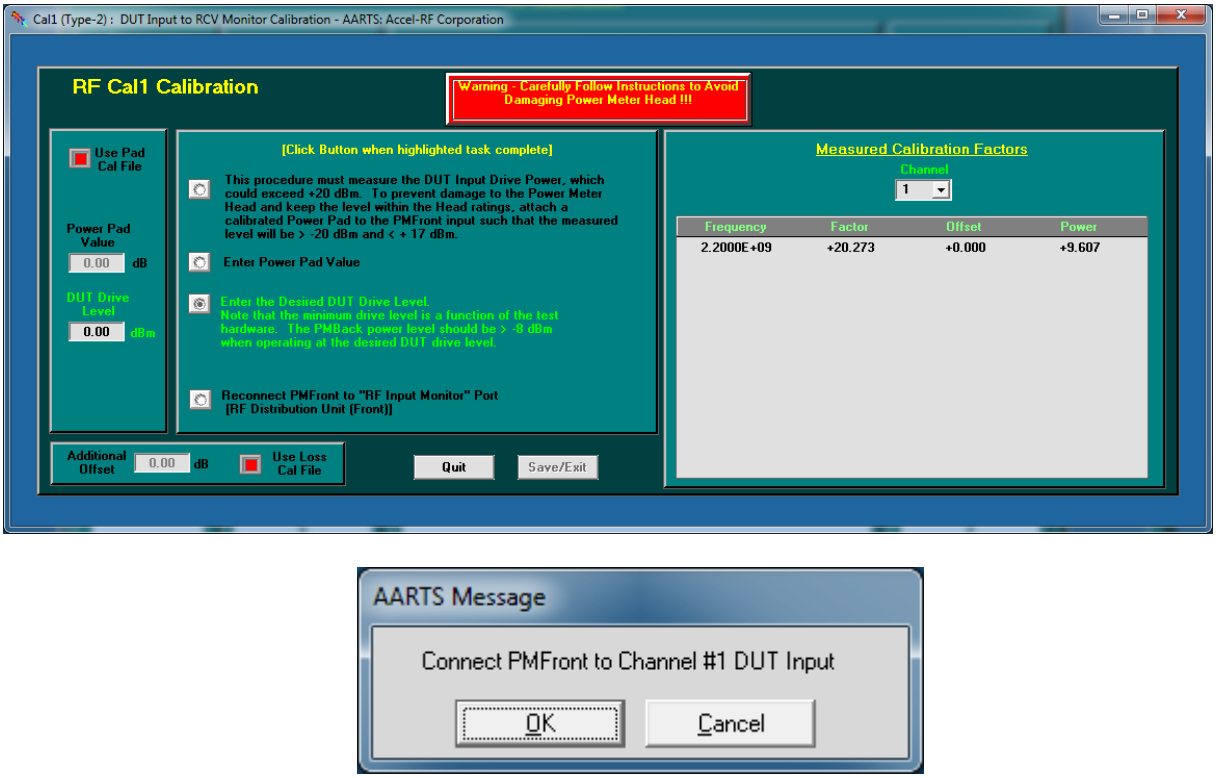
Figure 5-1: RF Calibration Process Setup

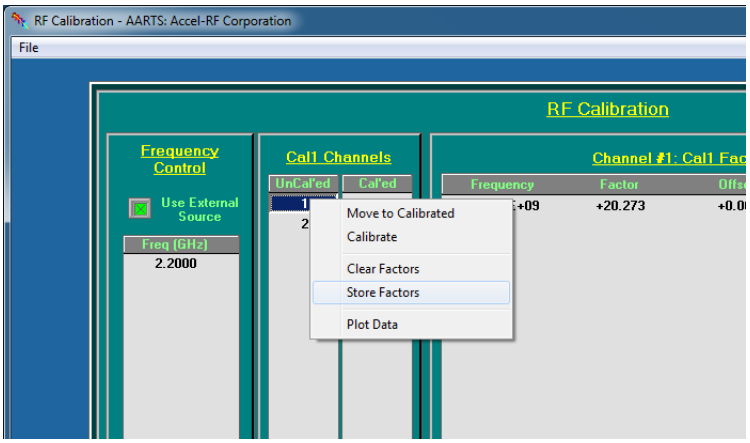


The “Cal1” process is needed for accurately determining the DUT RF input power. The screen shown in Figure 5-2 illustrates the process (see the LifeTest software manual and app note referenced earlier for more details on how to perform the calibration). The DUT Drive Level is irrelevant since the user is setting that externally – leave it at “0”. After clicking on the green radio button (shown below), a message box will appear. The “PMFront” is equivalent to the “PM Reference” head defined in Section 3. Connect it to the DUT input point and click OK. Once complete the values will populate the box as shown. Click through to Save/Exit to pass the values back to the RF Calibration Form.

At the RF Calibration Form, Right Click over the selected channel and select “Store Factors” to save the values (note: this is required to properly calibrate Cal2 – output side).

Figure 5-2: RF Cal1 Procedure



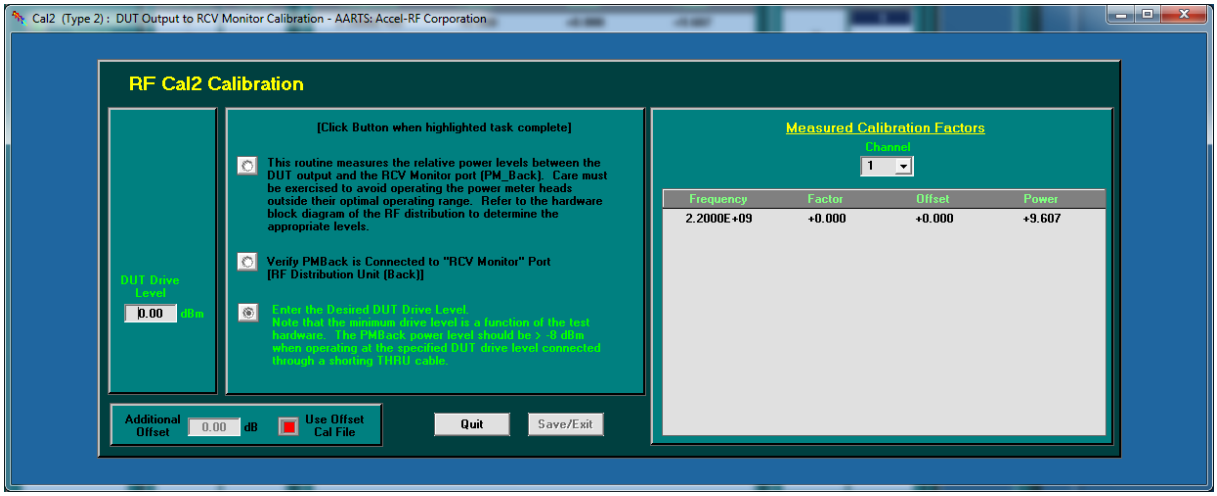


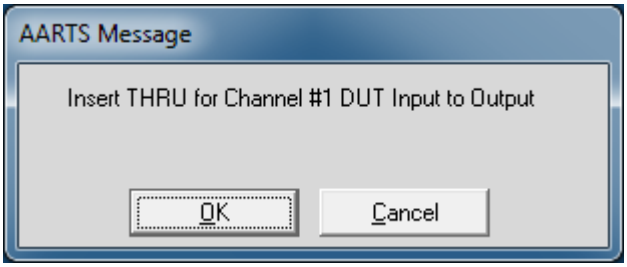
The “Cal2” process is needed for accurately determining the DUT RF output power. In the RF Calibration Form, select channel 1 and right click to launch the Cal2 Form. The screen shown in Figure 5-3 illustrates the process (see the LifeTest software manual and app note referenced earlier for more details on how to perform the calibration).

As with Cal1, take the default values and click through to the pop-up menu as shown below. Place a Thru in place of the DUT as described in the software manual and/or app note, and leave the power attenuator in place as shown in Figure 2-1. Note that the same power meter Head is used for both the Reference and the Output Meter. Hence, no additional action is required. Click through to Save/Exit to return to the RF Calibration Form.

At the RF Calibration Form, Right Click over the selected channel and select “Store Factors” to save the values. Use the techniques described RF Calibration Techniques to account for fixture circuit losses to the device interface. Save and Exit to return to the main top-level menu.

Figure 5-3: RF Cal2 Procedure





6 RF Measurements

The system is now ready for use. Launch the Edit Levels and check the gain with the Thru still installed in place of the DUT. Select the channel and check the "DC On" check box (note: since no DUT is installed the DC values are irrelevant at the moment) – this is required to cause the software to measure RF output power. Check the "RF On" check box and click the "Continuous Update" box the RF measured data area. The measured gain should be ~0-dB (as shown in Figure 6-1) if no fixture circuit losses have been calibrated out.

The system is now ready to configure channel and run monitored life test runs.

Figure 6-1: Measured Performance of Thru