Calibrating the LABPRO and LABBOX Constellation Simulators from Navigation Laboratories

1. Overview

The Navigation Laboratories Constellation Simulators are based upon a proprietary Digital Base Band Signal Generation engine (NLSGE-L/M). This engine has been calibrated at the factory for absolute L_1 L_2 L_5 power level. Our all-digital design eliminates the need for inter-channel calibration because our channel signals are combined digitally before conversion. However, we do have two programmable attenuators that operate on the combined analog portion of the signal. These components are analog and do experience overall level variation. This document describes the procedure to be used to calibrate these two simulation elements. If you prefer not to perform this calibration, you may return your unit to Navigation Laboratories and we will be happy to re-calibrate and certify your equipment as part of your warranty service.

1.1 Required Equipment

- Spectrum analyzer capable of processing Continuous Wave (CW) output levels in the range of –60 to – 90 dBm.
- The Simulator powered on for at least 10 minutes. This allows the OCX in the simulator to reach a steady state temperature.
- The **Calibration** program element accessible trough the TAPESTRY SHELL program.

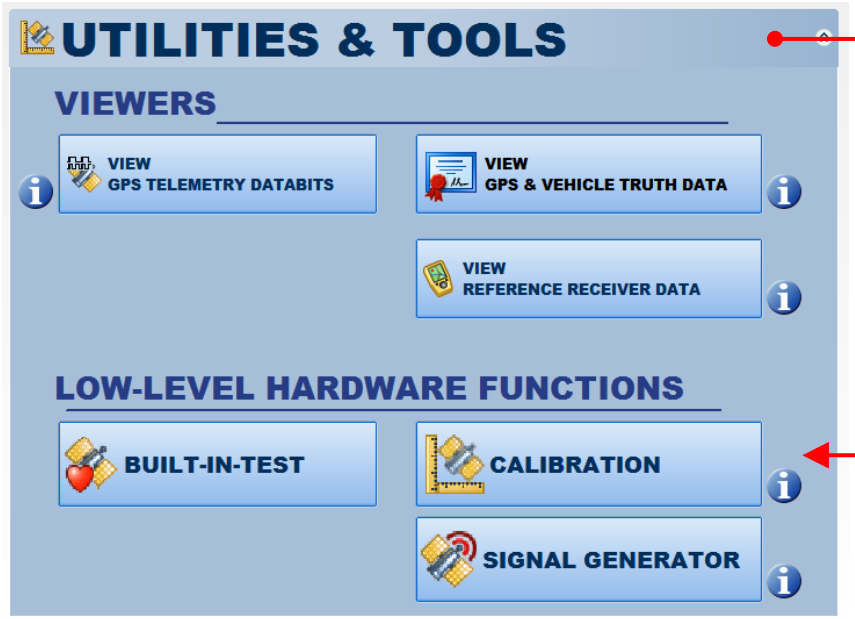
1.2 Recommended Calibration Interval

As a precaution, we recommend that you examine and update the power levels on the simulator once per year. We provide a ***Calibration*** application within TAPESTRY for this purpose. Within the ***Calibration*** application you can perform the following functions:

- Generate a CW signal at approximately –60 dBm.
- Control the modulation of Code and Data on L_1 L_2 L_5.
- Generate a single channel GPS signal with user controlled Z-count, ephemeris, and programmable Doppler.

2. The Calibration Application

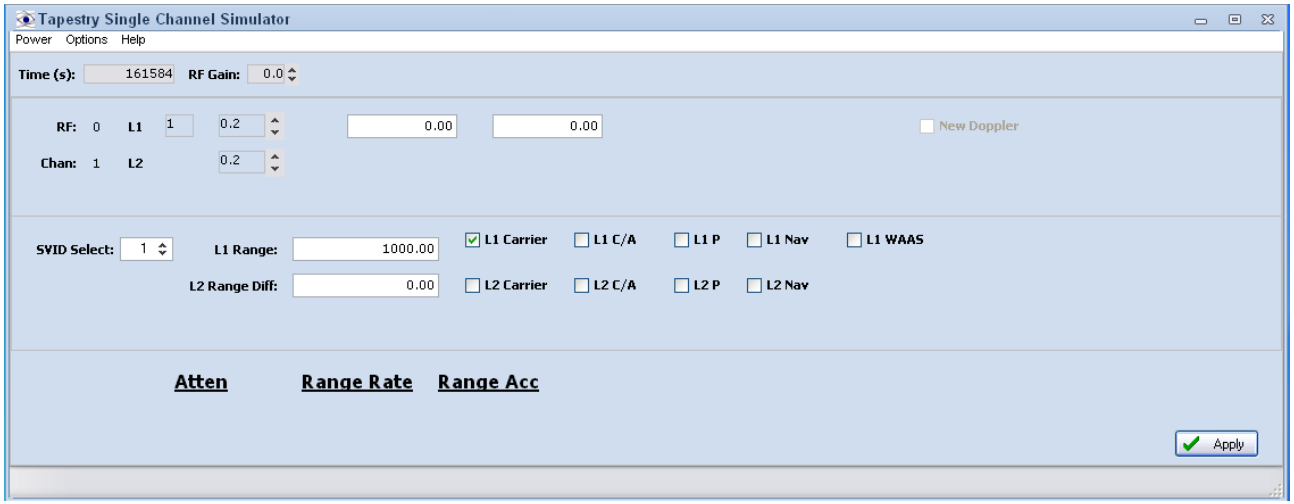
To Calibrate your simulator, access the Calibration Application from TAPESTRY (SHELL)



SELECT

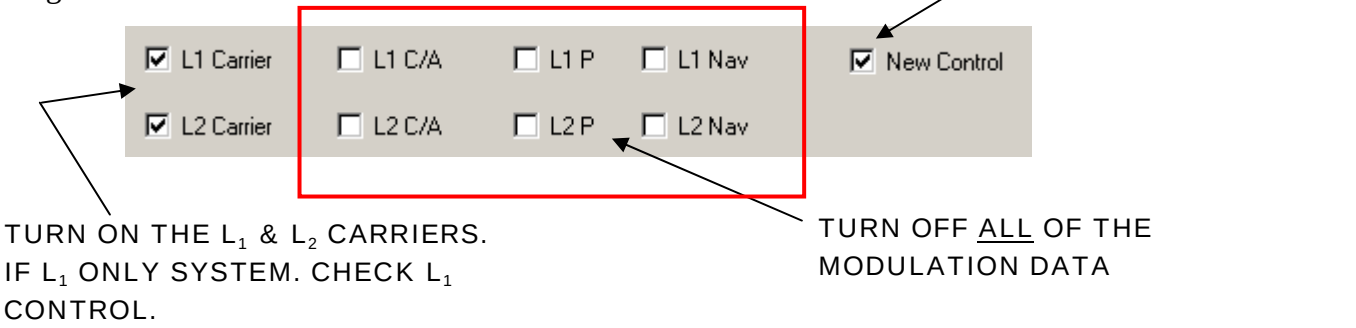
2.1 Step by Step Procedure for Calibrating the Simulator

2.1.1 Measuring the Power Levels



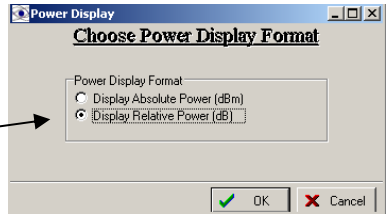
To setup the Calibration controls properly perform the following actions:

1. In the **Range Rate** edit box enter the value 0.0
2. In the **Range Acc** edit box enter the value 0.0
3. In the **SVID Select** control select the value 1
4. For the **L1 Range** edit box enter the value 1000.0
5. In the **L2 Range Diff** edit box enter the value 0.0
6. Make the following selections for the checkbox controls



7. Select the *Power* pull down menu item and select Power format Display. The following form will be presented – select Display Relative Power (dB) as shown.

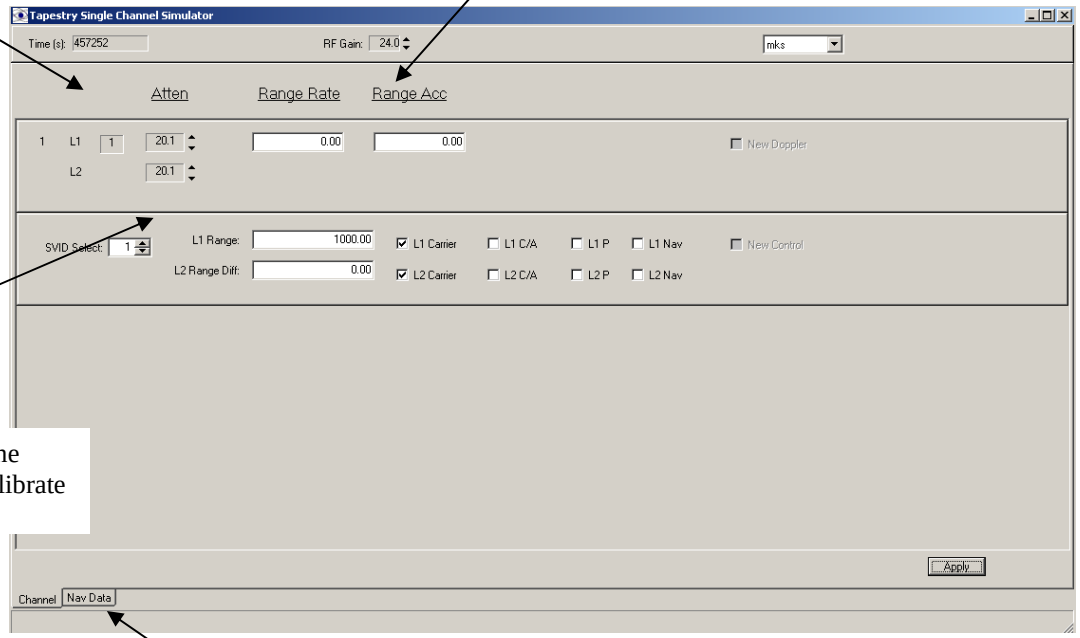
Select this check box. Power will be displayed from 0-36 db on the main form



8. Once the simulator starts, the SVID will be displayed along with the nominal attenuation present in the power calibration table. The screen will look something like this:

Time will update here. If not updating press the **APPLY** button

Set the **RF ATTENUATION** to 0.



Use the counters to set the attenuation = 0. Then calibrate each setting separately.

Ignore this tab – there is no useful data contained when calibration is being performed.

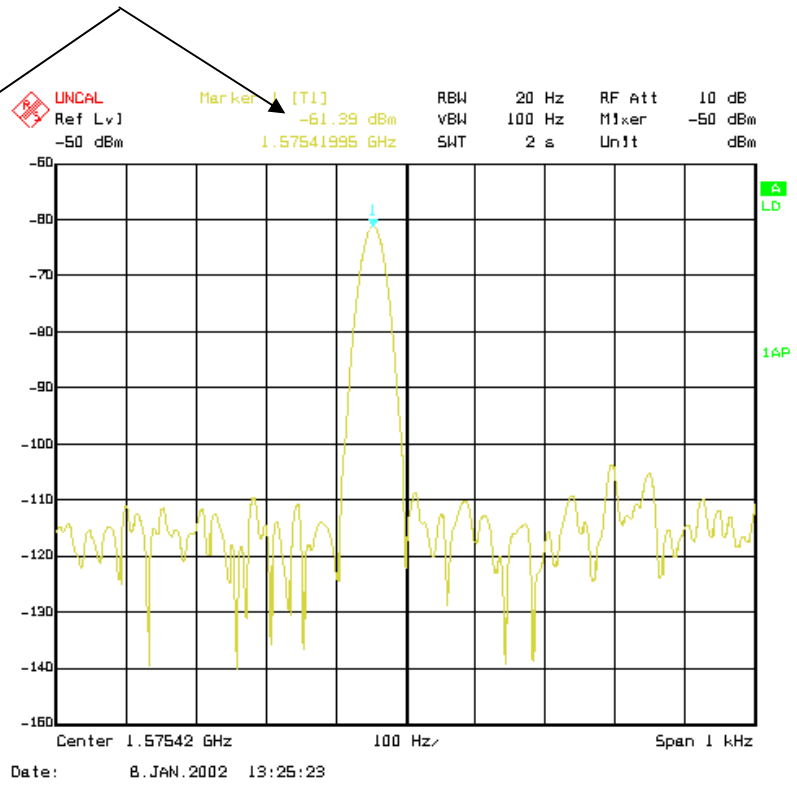
Now, you need to connect a spectrum analyzer to the N-type RF output port on the front of your simulator. Before connecting to the N connector, make sure that NO fixed attenuator pads are attached to the connector.

9. Calibrate the L_1 channel by setting your spectrum analyzer as follows:

   - Center Frequency: 1575.42 MHz
   - Frequency span: 2 MHz
   - Resolution Bandwidth: 1 MHz
   - Reference Level: - 60 dBm

10. You should see a signal similar to that shown below.

This is the output power with zero (0) attenuation.



Note the power level – this is the nominal output power at zero attenuation and an RF Gain = 29. This value should be in the range –50 to – 65 dBm.

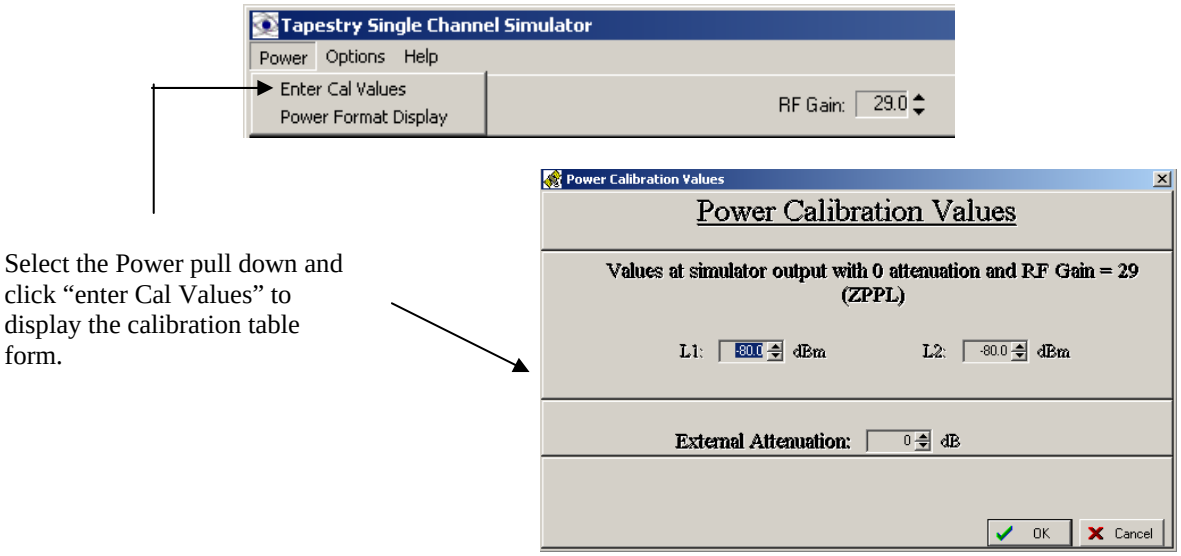
Record the power value measured above as the Zero Point Power Level (ZPPL). This is the L_1 ZPPL value and must be input into the calibration table described subsequently.

11. Repeat the above procedures for the L2 channel (if present in your simulator) by setting your spectrum analyzer as follows (recording the L_2 ZPPL for entry into the calibration table):

    - Center Frequency: 1227.6 MHz
    - Frequency span: 2 MHz
    - Resolution Bandwidth: 50 kHz - 1 MHz
    - Sweep average 20
    - Reference Level: - 30 dBm

2.1.2 Updating the Calibration Table

The values you have just recorded need to be incorporated into the simulator database.
The ***Calibration*** application can perform this function for you. From the *Power* pull down menu item select "Enter Cal Values" and the following menu will be displayed



Select the Power pull down and click "enter Cal Values" to display the calibration table form.

Note the L1 spin control. Use it to enter the ZPPL value you have just measured. If applicable, enter the L2 value into the appropriate control. Click OK and the calibration table for your simulator will be updated automatically.

***Note: At this point, you should <u>not</u> have any external attenuation applied to your simulator. However, when running your simulator in constellation mode, typically a 30dB pad is used. Eventually – after calibration – you should enter the pad value into this table. Once the pad value and the ZPPL calibration value have been entered, the simulator will display absolute power in dBm on the main screen. To view absolute power use the Power pull down and select "Display Absolute Power (dBm)" rather than relative power.**

Once you have pressed OK the calibration process is complete. All scenario's previously built will be updated when they are executed and you do not need to rebuild them. All new scenarios will incorporate the new calibration values when constructed.