AnaPico CalToolv3

Full Calibration Guide (v1.1)

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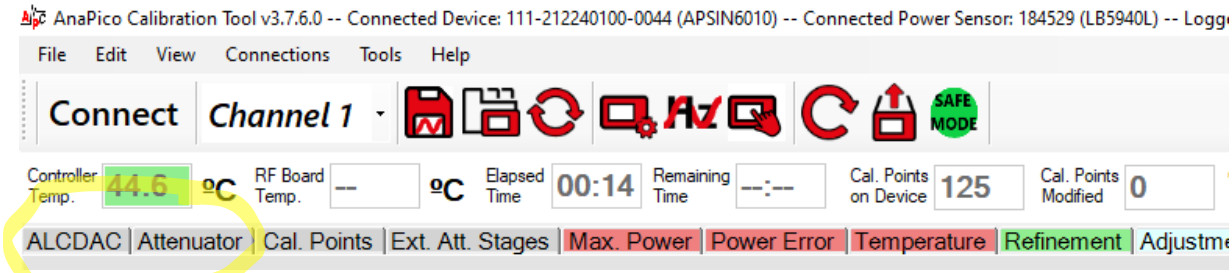
Pre-requisites

- A DUT is connected to the calibration PC via USB.
- A supported power sensor is connected to the channel to calibrate (on the DUT) and to the calibration PC via USB.
- The user has followed the 'First Start-Up & Instrument Connections' section within the User Guide. This means that connections have been established to the DUT and the connected power sensor (as appropriate).
- The device 'Controller Temperature' has stabilised i.e. has reached a constant state with minimal fluctuation i.e. the controller temperature indicator has turned green [see below]

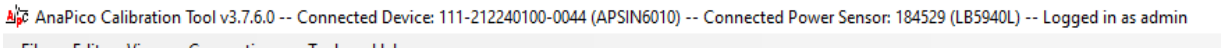


- When connecting to an AnaPico device, the *default* parameters for calibration are loaded automatically. Unless otherwise noted, these will be the parameters to use.

Full Calibration of a Device

When an initial factory calibration is required, the following is the internal procedure for calibrating a signal generator/synthesiser from scratch.

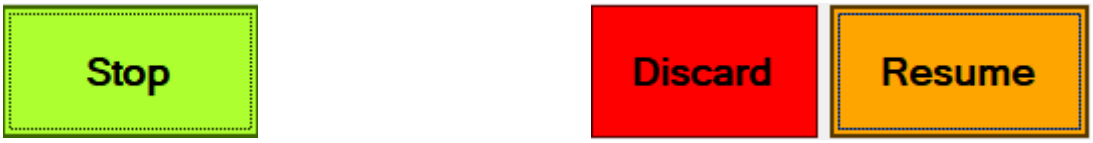
1. Verify that a DUT and power sensor are connected (displayed within the title bar).



2. Switch to the 'Calibration' tab and click the 'Start' button to begin the full calibration process.

   If a base calibration or settings file is not available for the DUT then this will be indicated within the log and the calibration will terminate. In this case the existence of a valid base file and a mapping to the DUT will have to be checked.

   A full calibration may be paused by clicking the 'Stop' button. Calibration data will not be lost. When clicking 'Stop' a 'Resume' button will appear in its place with a 'Discard button alongside. Resume will continue from the last calibrated frequency. Discard will delete all intermediate calibration data and allow a new calibration to be started from scratch.

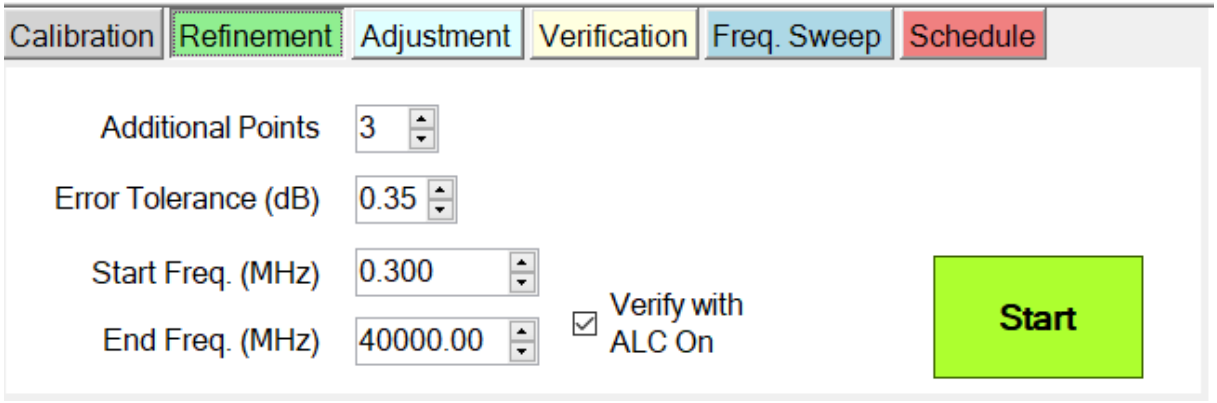


3. Switch to the refinement tab and ensure the tolerance is set to 0.35dB, Additional Points is set to '3' and the frequency range to calibrate matches the calibrated frequency range of the DUT model (the frequency range can be verified by clicking 'Open Device Settings' on the 'Calibration' tab).

Click ‘Start’ on the refinement tab to begin the refinement process. A success message in the log output will indicate when the refinement has completed.

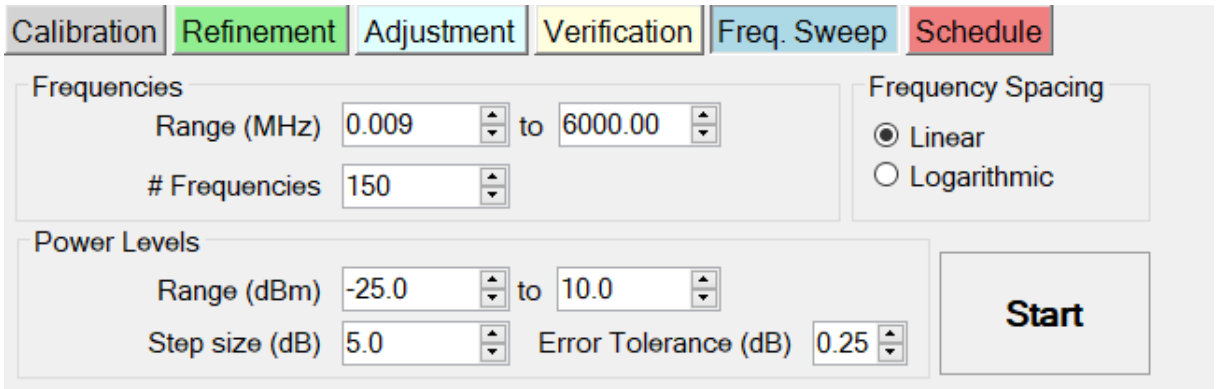
For some devices, two separate refinements will have to be run, one to ensure accuracy with ALC Off and one with ALC on. For these devices, first run the refinement with the ‘Verify with ALC On’ checked and when complete, run a second time with the option unchecked. The settings used should be identical for each run.

Currently the second refinement is required for APVSG devices only.



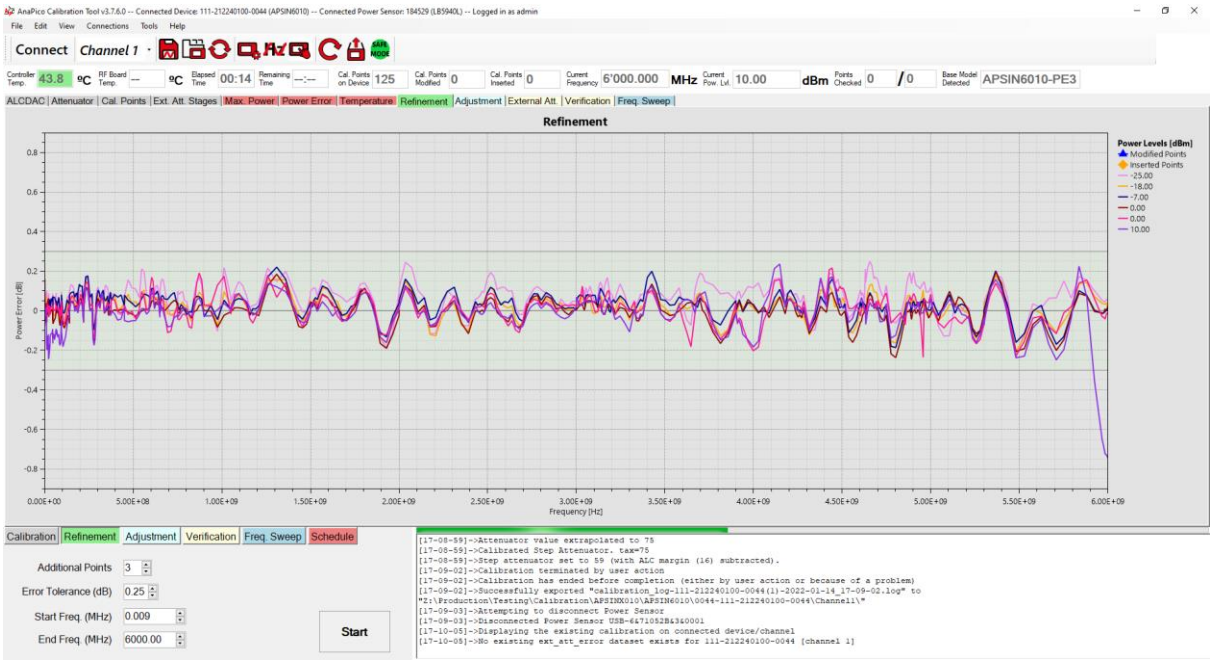
4. Switch to the ‘Freq. Sweep’ tab and ensure the tolerance is set to 0.35 and the frequency and power range to be tested match the frequency and power range calibrated for the connected model. Also check that number of frequencies to be tested is equivalent to 40MHz steps across the set frequency range. (The calibrated power range can be verified by reading back the list of calibrated power levels from the ‘ALCDAC’ or ‘Attenuator’ tabs).

   Click ‘Start’ on the Freq. Sweep tab to begin the frequency sweep. A success message in the log output will indicate when the sweep has completed.



5. Verify that all calibration tasks have completed successfully. For the refinement and frequency sweep, open the refinement and frequency sweep tabs and ensure all plotted points are within the displayed green tolerance band. A small number of very

slight outliers might be acceptable, but ensure the tolerance is within the specified accuracy within the datasheet for the device.



6.  Ensure that when opening the device results directory with this toolbar button, all calibration, refinement and frequency sweep files are present. There should be 2 CSV files, one beginning with ‘calibration-‘, one with ‘refinement-‘. Check the timestamps of these files are consistent with the calibration run.
Ensure there are PNG image files showing the plotted output from the refinement and frequency sweep tabs.
Ensure there are log files ‘calibration_log’, ‘refinement_log’ and ‘freq_sweep_log’ with appropriate timestamps.

   If any calibration files are missing then please follow the section below ‘Re-Export files to the Calibration Directory’.

7. Click the ‘Connect’ button on the toolbar and then click the ‘Disconnect’ button under both the Device and Power Sensor lists. Alternatively, click the ‘disconnect all’ button on the toolbar 

Scheduled Full Calibration of a Device

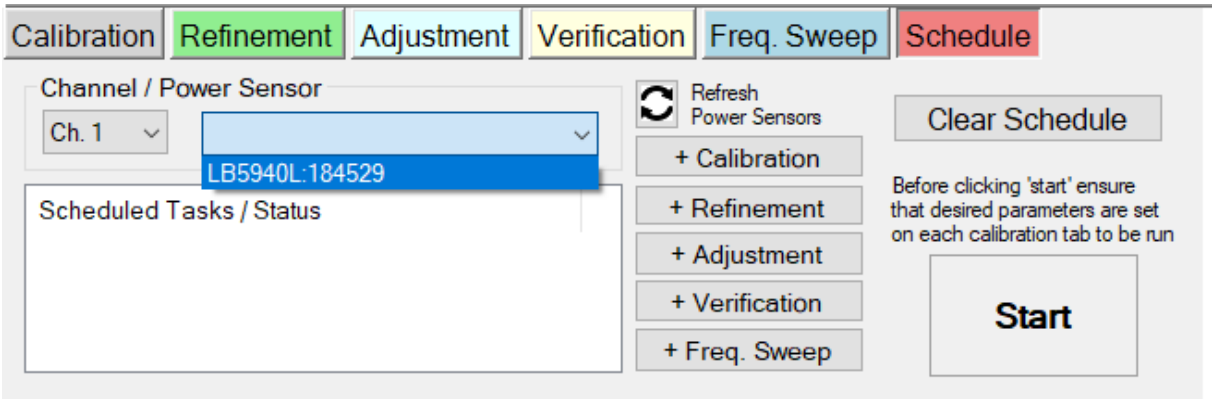
The following instructions show how to run the full calibration process using the 'schedule' mode. This will run the exact same calibration as in the 'Full Calibration of a Device' section, but will automate the switching between calibration tasks and between channels to calibrate (for multi-channel devices).

1. Switch to the refinement tab and ensure the tolerance is set to 0.35dB, Additional Points is set to '3' and the frequency range to calibrate matches the calibrated frequency range of the DUT model (the frequency range can be verified by clicking 'Open Device Settings' on the 'Calibration' tab).

2. Switch to the 'Freq. Sweep' tab and ensure the tolerance is set to 0.35 and the frequency and power range to be tested match the frequency and power range calibrated for the connected model. Also check that number of frequencies to be tested is equivalent to 40MHz steps across the set frequency range. (The calibrated power range can be verified by reading back the list of calibrated power levels from the 'ALCDAC' or 'Attenuator' tabs).

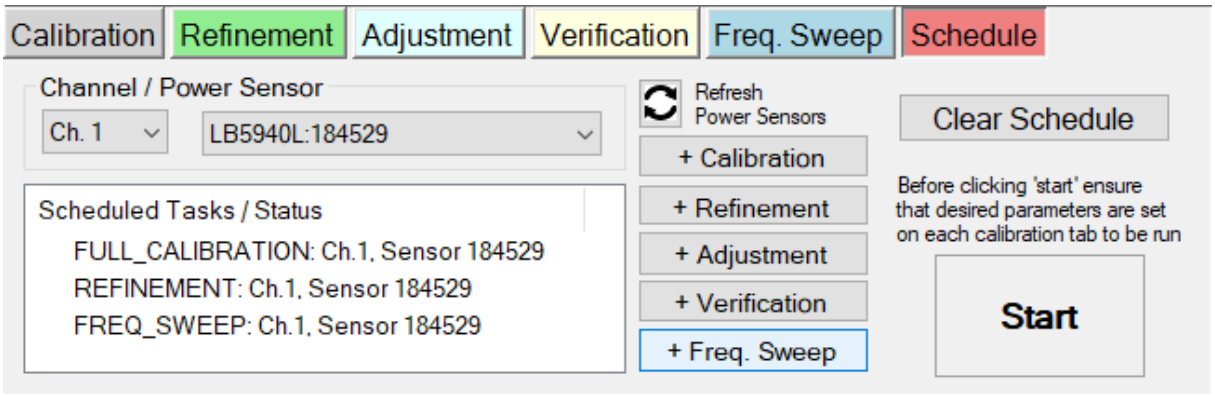
3. Open the 'Schedule' tab and select the channel to be calibrated and the serial number of the sensor (from the 'Channel / Power Sensor' dropdown menus).

If running a multi-channel calibration then rather than selecting a channel number from the dropdown, select the 'All' option. This will open the 'Power Sensor Assignment' dialog. Select and assign a power sensor to each device channel you wish to calibrate. For any channels you wish to omit, then leave the entry blank.
Close the dialog and then continue following the instructions below.



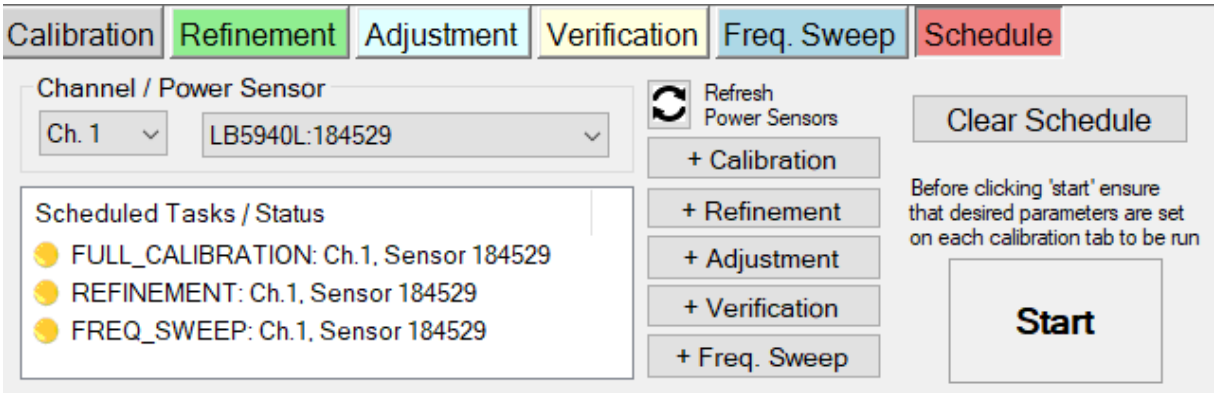
4. Next, click buttons '+ Calibration' followed by '+ Refinement', followed by '+ Frequency Sweep'. You should now observe the following under 'Scheduled Tasks / Status':

If you're running a multi-channel calibration then all tasks will be added for each channel to be calibrated (sorted by channel number).

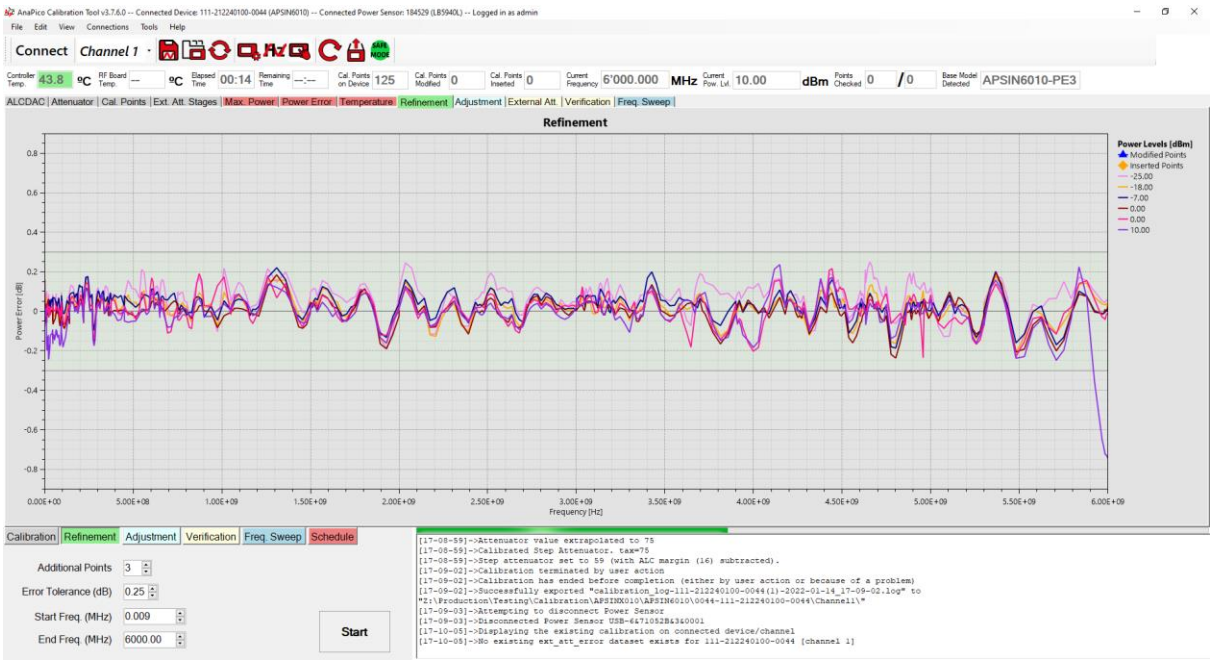


5. Switch back to the 'Schedule' tab and click the 'Start' Button. The calibration tool which immediately start performing the list of task you have programmed. As tasks complete, you may check on 'Schedule' tab: they will be marked with a tick. Pending tasks appear with an amber beacon and failed tasks will be marked with a red beacon.

   If running a multi-channel calibration and you've assigned the same power meter to 2 or more sequential channels, a message will appear asking you to re-connect the power sensor to the next channel to be calibrated. Follow the on-screen instructions and click 'OK' when you've switched the sensor over to the channel requested.
   If at any point during a scheduled calibration the 'Stop' button is clicked for the current task, the current and all pending tasks will be terminated and the UI will return to displaying the schedule tab.



6. Verify that all calibration tasks have completed successfully. For the refinement and frequency sweep, open the refinement and frequency sweep tabs and ensure all plotted points are within the displayed green tolerance band. A small number of very slight outliers might be acceptable, but ensure the tolerance is within the specified accuracy within the datasheet for the device.



7.  Ensure that when opening the device results directory with this toolbar button, all calibration, refinement and frequency sweep files are present. There should be 2 CSV files, one beginning with ‘calibration-‘, one with ‘refinement-‘. Check the timestamps of these files are consistent with the calibration run.
   Ensure there are PNG image files showing the plotted output from the refinement and frequency sweep tabs.
   Ensure there are log files ‘calibration_log’, ‘refinement_log’ and ‘freq_sweep_log’ with appropriate timestamps.

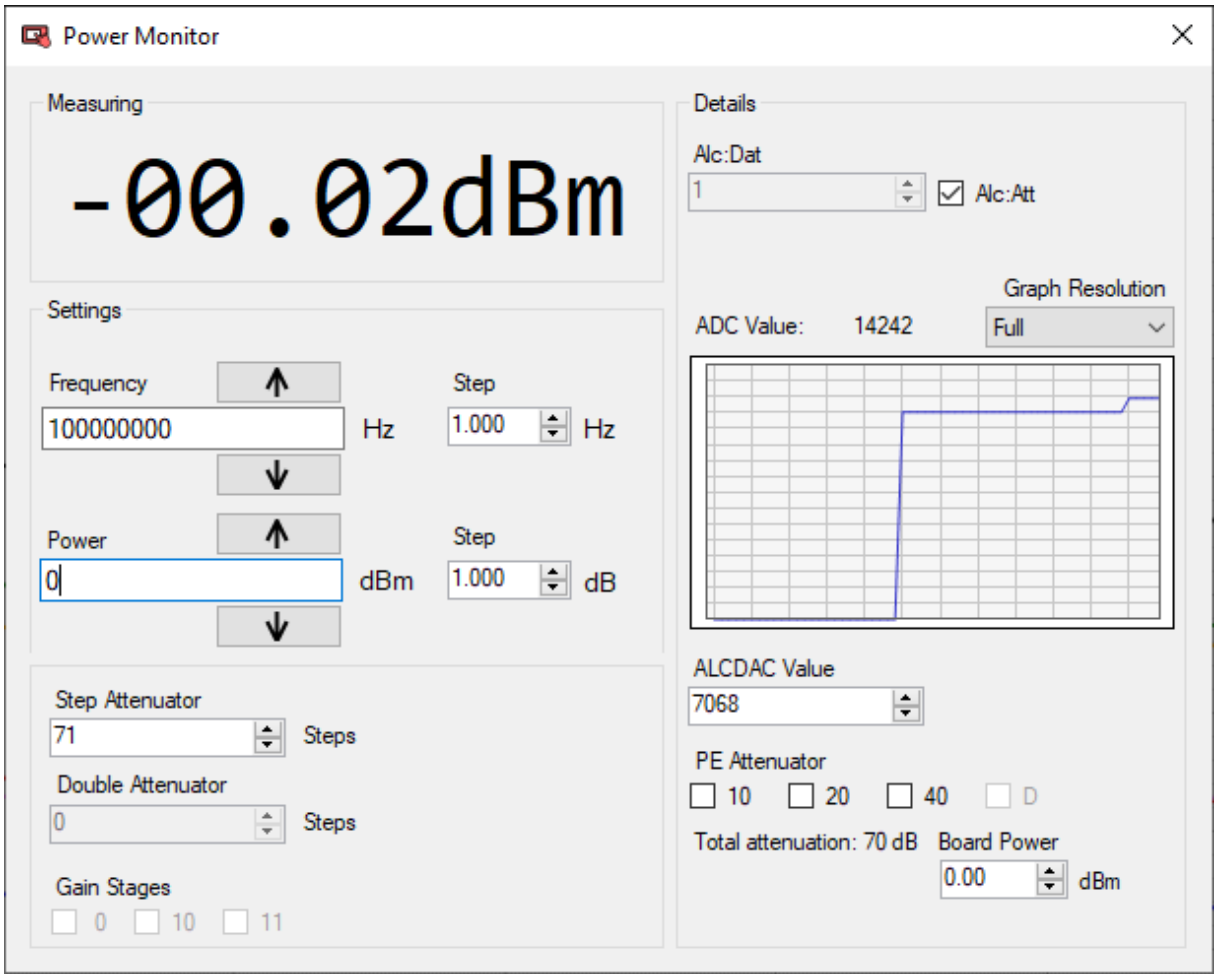
   If any calibration files are missing then please follow the section below ‘Re-Export files to the Calibration Directory’.

8. Click the ‘Connect’ button on the toolbar and then click the ‘Disconnect’ button under both the Device and Power Sensor lists. Alternatively, click the ‘disconnect all’ button on the toolbar 

Manually Verify Calibration

Manually checking the power output may be useful if, during an adjustment or refinement task, the observed power error is outside of the specified tolerances from the datasheet for the model being calibrated. This can be particularly useful in helping to determine whether observed calibration inaccuracies are down to problems with the hardware versus problems with the sensor measurements during calibration or problems with the calibration software.

-  Open the 'Power Monitor' tool from the toolbar.



- A continuous power output is displayed from the connected sensor. If this displays 'N/C' then ensure a power sensor is connected within the 'Connections'->'Device Connections' (menu item).

- Enter the desired frequency to verify, followed by the units i.e. ‘10’ followed by ‘h’ for Hz, ‘k’ for kHz, ‘m’ for MHz or ‘g’ for GHz (or omit the units to keep the current unit displayed). Now press the enter key.

- Enter the desired power output to verify in dBm and press the enter key.

- Any time the frequency or power settings are changed, all other displayed settings will be updated to those from the active calibration table on the DUT. *All other settings can be programmed individually and will not influence one another when modified.*

- Read the displayed power output from the sensor and compare with the expected power output.

- If required, finely adjust the output using the up/down arrows on the ‘ALCDAC Value’ setting.

- The ‘Step Attenuator’ setting can be used to adjust the power output by approximately 0.5dB per step.

- PE stages can be switched in and checked individually using the corresponding checkbox next to ‘PE Attenuator’.

- Available range of the ALC detector can be checked by reading the ‘ADC Value’ and accompanying graph. When ‘graph resolution’ is set to ‘Full’ this displays the full available range of the detector from 0 to 16383.

- When adjusting the ‘ALCDAC Value’ setting, sensitivity may be lost as the extremes of the ALC detector range are reached. The point at which sensitivity loss occurs will vary depending on hardware / ALC Detector Attenuator setting and frequency.

- Frequency/power can be adjusted finely with the up/down arrows. The step-size with each click will depend on the corresponding ‘Step’ which has been set.

Upload an existing Calibration

If a problem occurs during calibration, it may be necessary to upload the previous calibration to the device.

1.  Click the ‘Browse/Upload Calibration’ icon on the toolbar.

2. Open the ‘Archive’ directory in the folder which appears.

3. Sort the files by date modified and select the most recent file starting with ‘calibration_backup’ and click ‘open’.

4. The calibration will be uploaded to the device and a confirmation will appear when the upload was successful.

5. Click OK.

Re-Export files to the Calibration Directory

This function is useful if your calibration results directory exists on a shared network drive, for example, and the drive was unavailable when a calibration completed. In this case a local backup will have been created of the missing files. Follow the below procedure to recover these missing files.

1.  Click this button on the toolbar if there are missing files within the device results directory for a calibration you have recently run. If the calibration files can be found within the local backup then they will be exported to the designated directory for the device.

2. Read the log output to see if any missing files were exported.