Quick Start Guide for the

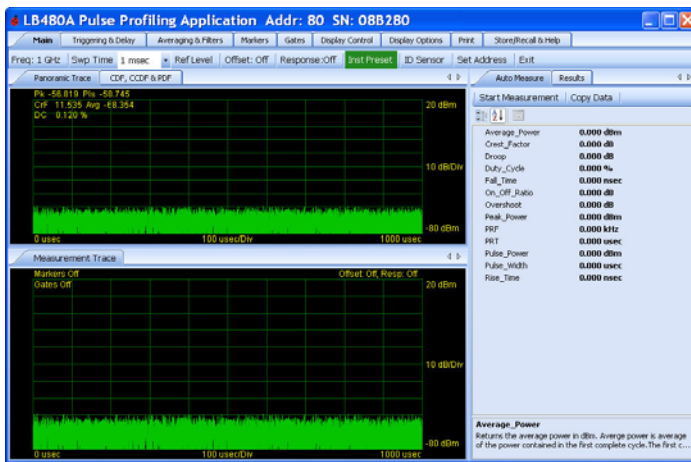# PULSE PROFILING APPLICATION

MODEL LB480A

**LB480A Model USB PowerSensor+™**

Quick Start Guide PPA

1. Introduction

This document provides information to install and quickly start using your PowerSensor+™. You will need the sensor with USB cable; a compatible computer with available USB 2.0 port; and the software CDs (2). (Alternately, the application may be supplied on a USB flash drive).

There is one media labeled *Pulse Profiling Application Installation* and the other is labeled *Power Meter Application Installation*. The LB480A is capable of running either application depending on your needs. The installation is essentially the same process for both applications. However, this document will address the P*ulse Profiling Application* specifically. Pulse profiling is a more powerful and interactive tool that allows for the complete characterization of a modulated signal. The *Power Meter Application* is a more straight forward presentation. It is intended to emulate a traditional power meter. It provides basic CW measurements as well as modulation measurements including pulse power, average power, peak power, duty cycle and crest factor. An example of the display panel for each application is shown below. There is an example of the *Power Meter Application* at the end of this installation procedure if you choose to load it instead. (*Reference the LBXXXA Quick Start Guide or Product Manual for the* **Power Meter Application** *for operating information*).
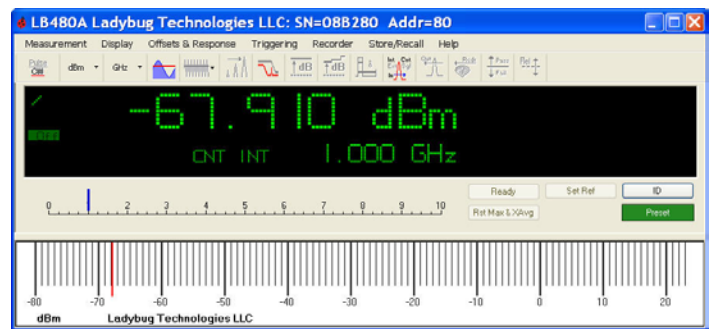
Pulse Profiling Application   Power Meter Application

2. Installing the Software and the Sensor

Operating System and Computer Requirements

The PowerSensor+™ line of products is compatible with Windows 2000 (SP2 or greater) and Windows XP operating systems. Support is available for other test development environments.

Recommended PC configuration:
Pentium D
1G RAM
1.0 GHz Processor
CD Drive
*USB 2.0 Port**

* The USB port or hub *must* supply 500 mA @ 5 V for power sensor operation. *Refer to the USB Considerations section of the product manual to determine if your computer has a USB 2.0 port(s).*

Installation Procedure
Install the Software

Do not connect the sensor until instructed to do so. Complete the following steps in sequence to install the software and to connect the sensor:

1. Insert the Ladybug *Pulse Profiling Application Installation* CD into the computer drive. The installation should start automatically. (Alternately, the application may be supplied on a USB flash drive).

2. (Optional) If the installation does not start automatically, select *Start* > *Run* and type *D:\setup.exe* (where D:\ is the media drive) then press *OK*.

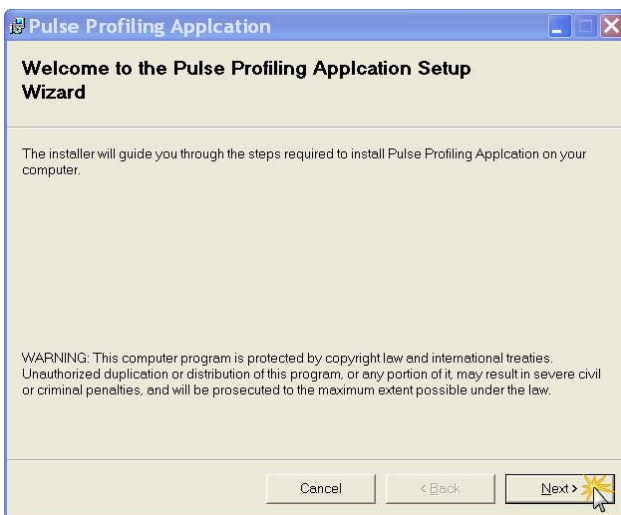3. The installer below will open and guide you through the procedure. Select *Next* to continue.

Figure 1. Start of installation software – Welcome

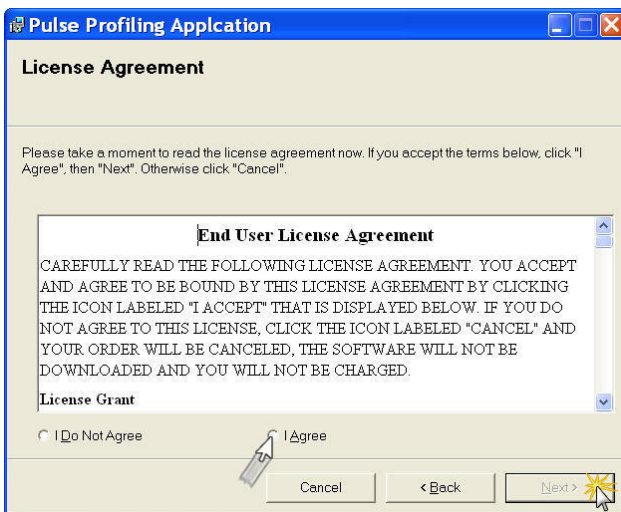4. Choose the license agreement option and select *Next* to continue.

Figure 2. License agreement option

5. Select the installation folder location and user accessibility options. The default path is as shown below. Select *Next* to continue.
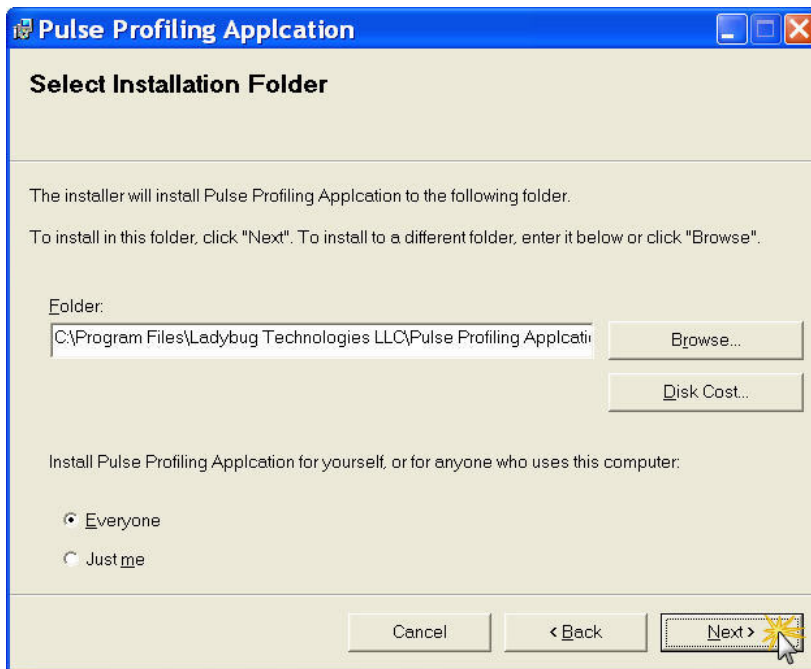

Figure 3. Select installation folder

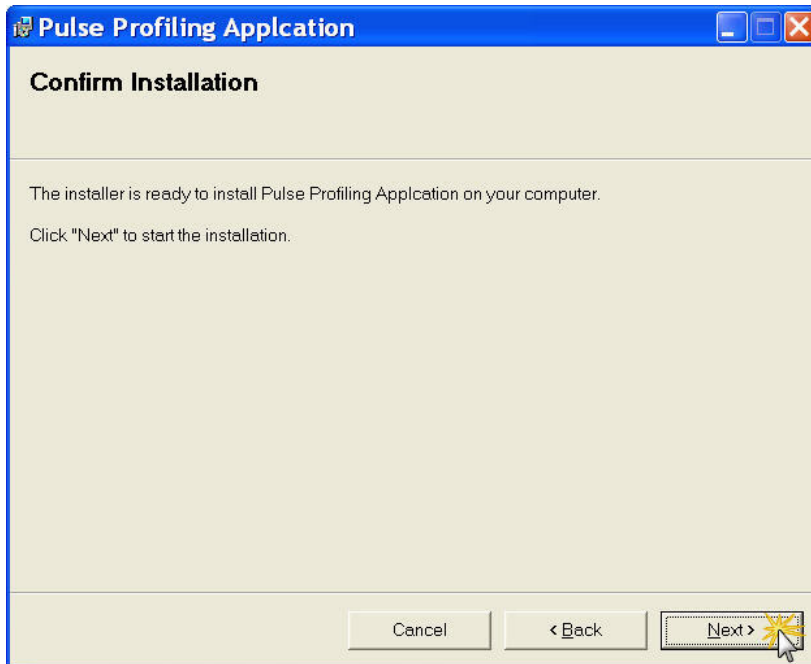6. The installer is ready to install the software on your computer. Select *Next* to continue.

Figure 4. Confirm installation
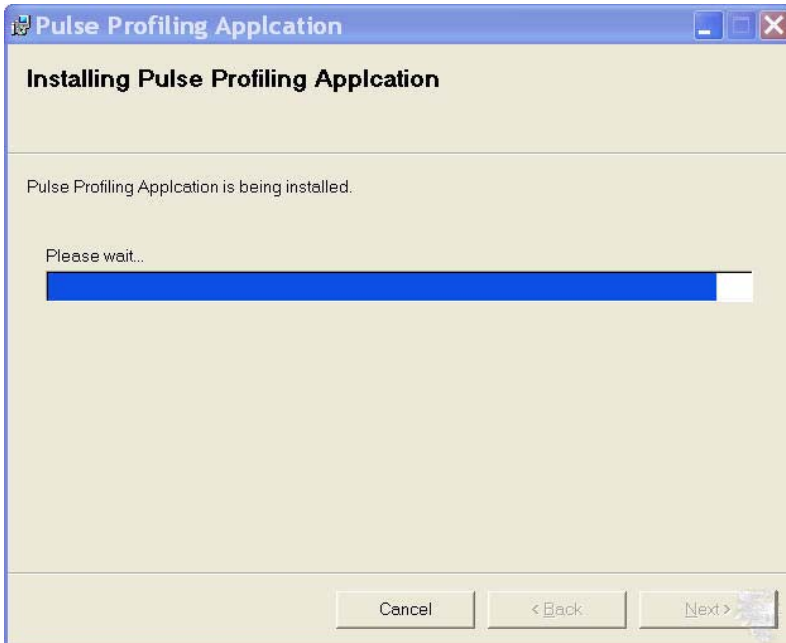
7. The software will install on your computer.

Figure 5. Installing the device

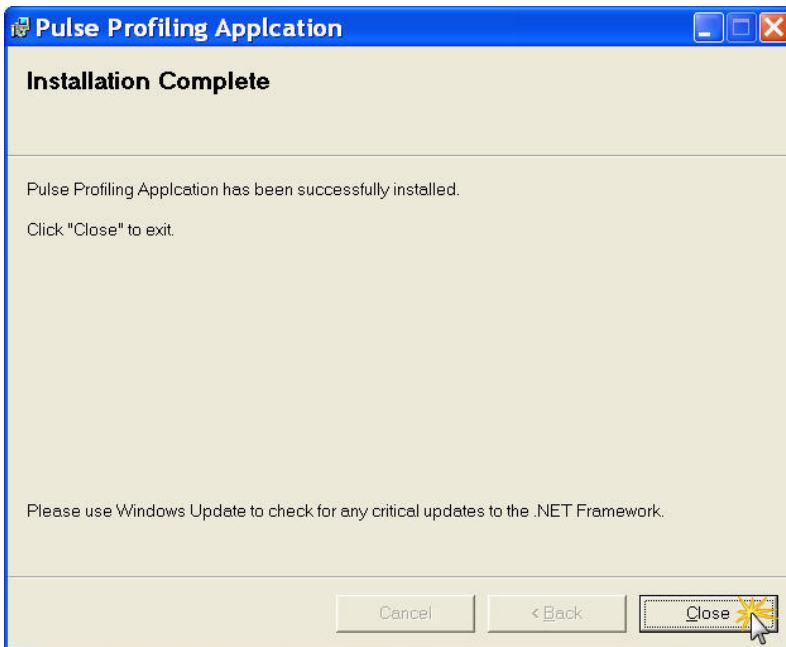8. The installation process will indicate completion. Select *Close* to exit.

Figure 6. Installation Complete

Connect the Sensor

9. Connect the sensor to the computer using the USB cable at this time. You may connect directly to the computer or through a hub. The USB port or hub must supply 500 mA @ 5 VDC for meter-sensor operation. The diagram below shows various options for connecting the sensor(s) to the computer.
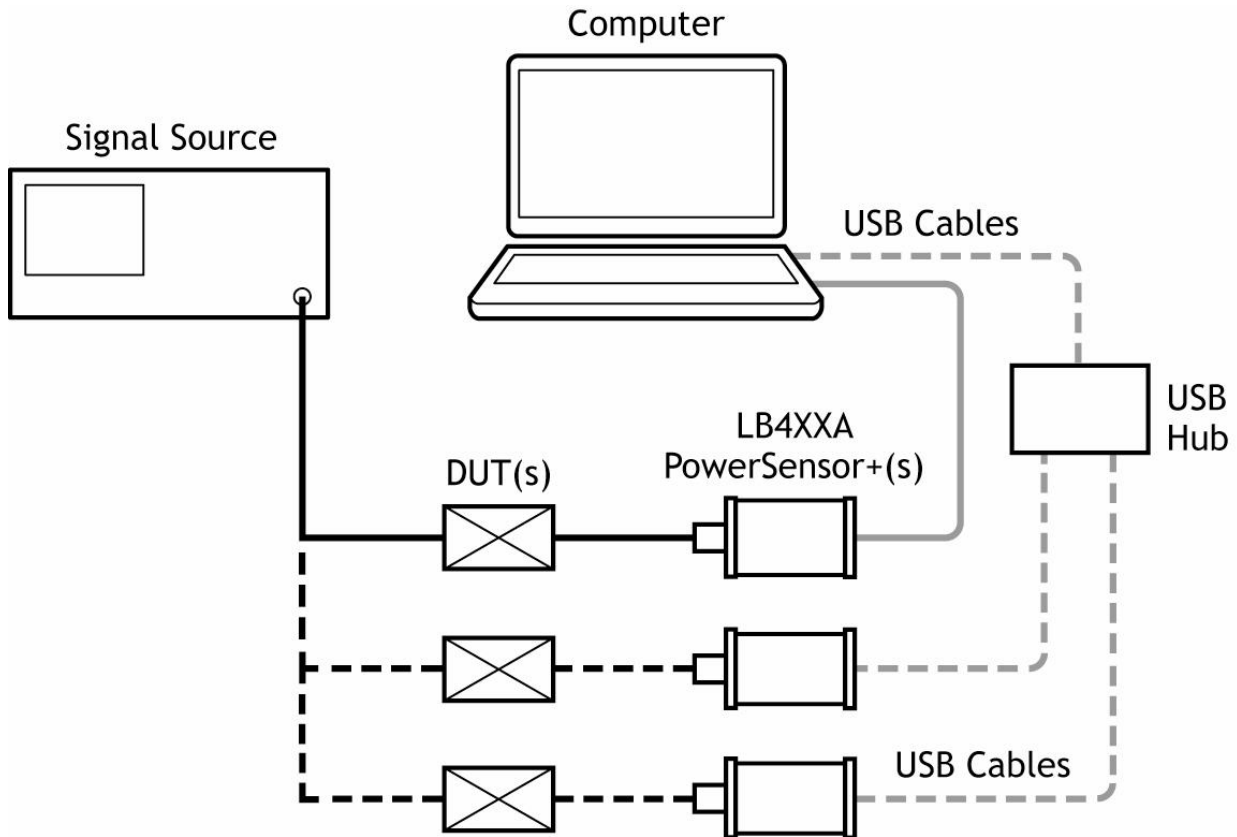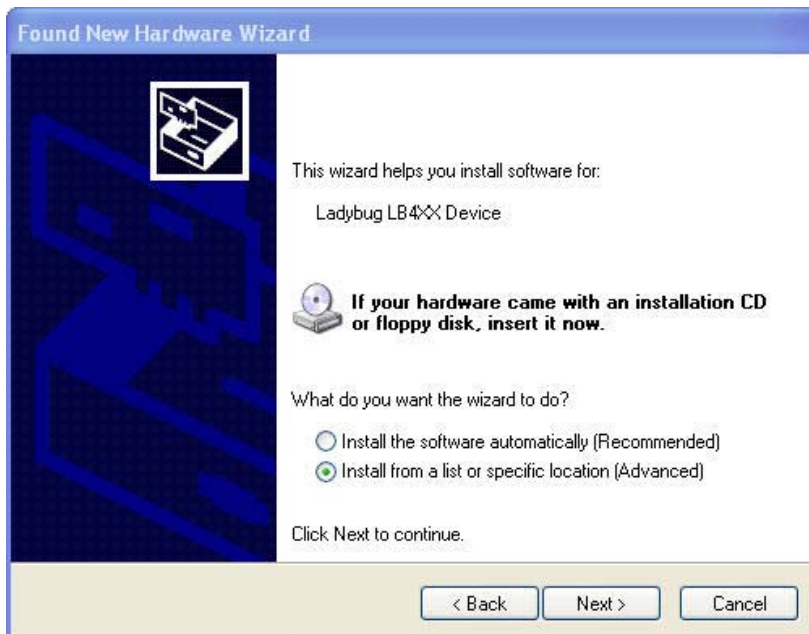
10. After a few moments the computer will indicate *Found New Hardware* and the hardware wizard should open automatically to establish the USB configuration for the sensor(s). Select *No, not this time* to connect to Windows Update as shown below then click *Next* to continue.
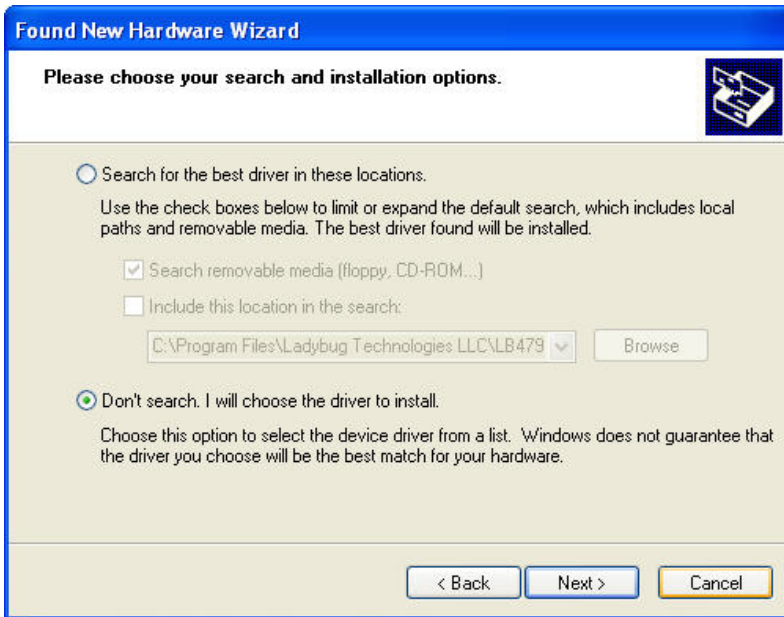

11. Select *Install from a specific location (Advanced)* as shown below then click *Next* to continue.
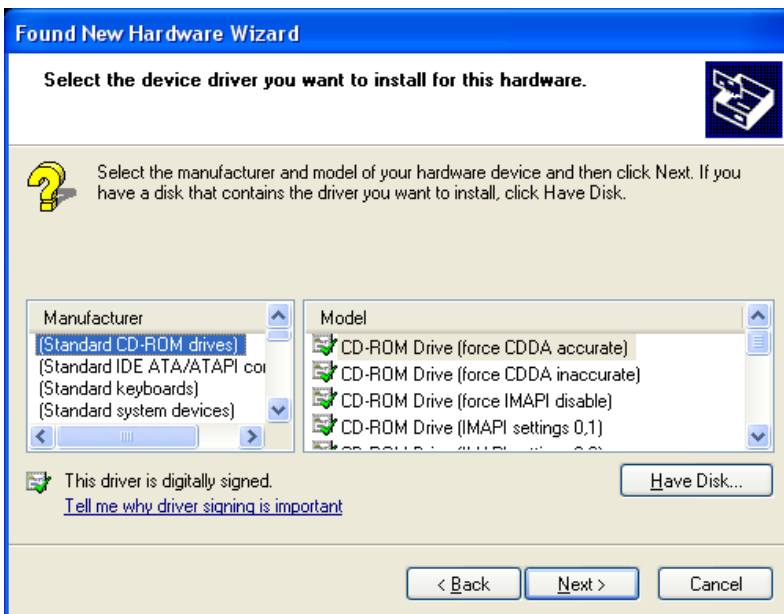
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12. Select **Don't search, I will choose the driver to install** as shown below then click **Next** to continue.

NOTE: The following steps assume this to be an initial installation of a PowerSensor+™. You can jump to step 21 if you are installing more sensors or you have previously completed an installation on the computer.

13. Click **Have Disk** as shown below. Do not choose **Next** or **Cancel** as you will return to this screen after loading the driver software from its specified location.
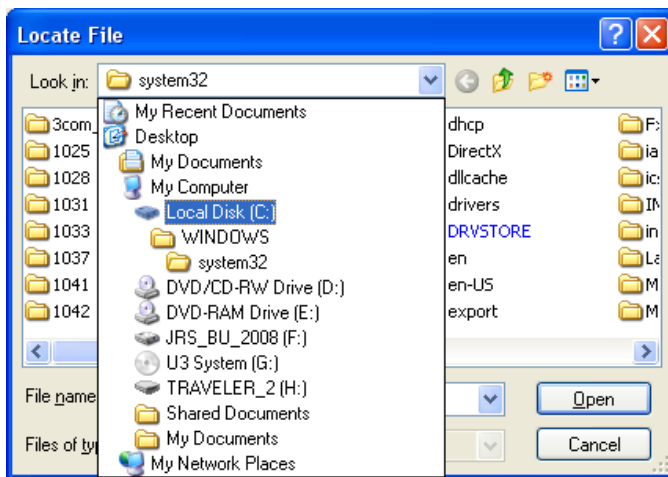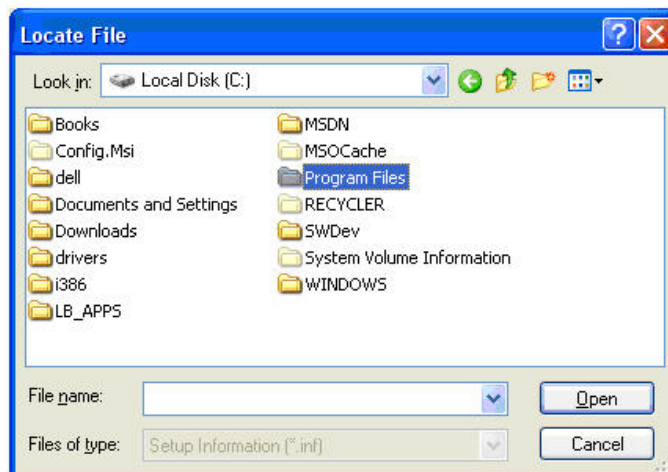
14. Click *Browse* without entering a path as shown below. The default path is C:\Program Files\Ladybug Technologies LLC\Pulse Profiling Application\ LB4XX_2K.inf. Be sure to browse to this location and *do not* cut and paste the path name here.
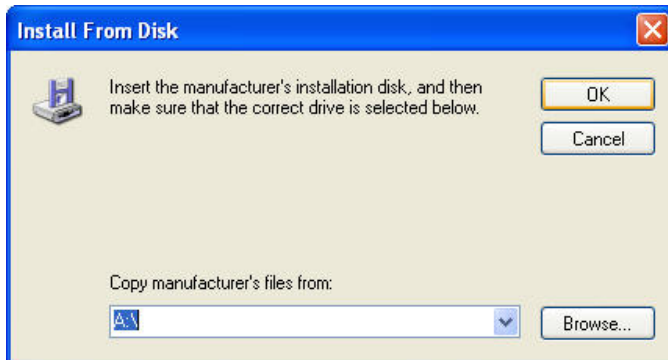
15. Select *Local Disk (C:)* (or the drive on which the application was installed) then click *Open*.
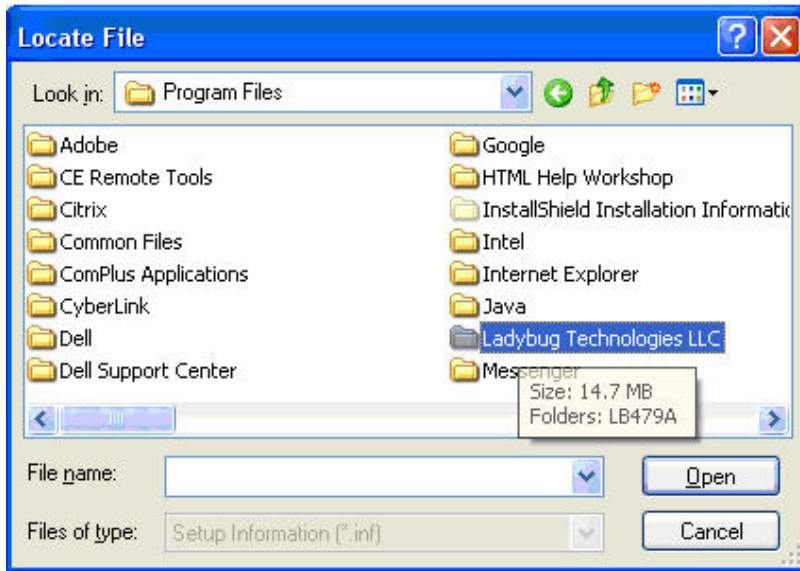

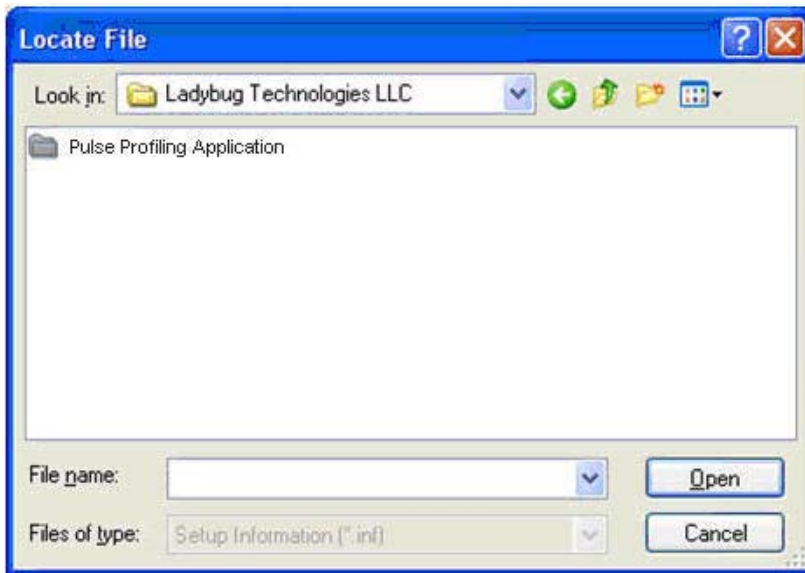16. Select the *Program Files* folder as shown below then click *Open*.

17. Select the *Ladybug Technologies LLC* folder as shown below then click *Open*.

18. Select the *Pulse Profiling Application* folder as shown below then click *Open*.

19. Select *LB4XX_2K.inf* file as shown below then click *Open*.
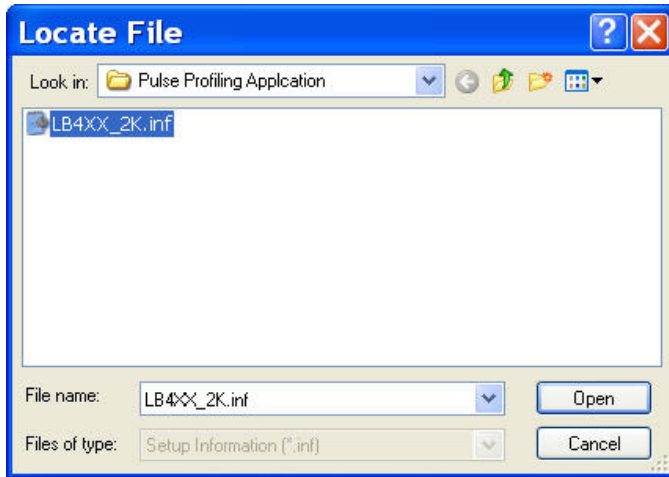
20. The driver path will be listed as shown below. The default path is C:\Program Files\Ladybug Technologies LLC\Pulse Profiling Application\ LB4XX_2K.inf. Click *OK* to continue.
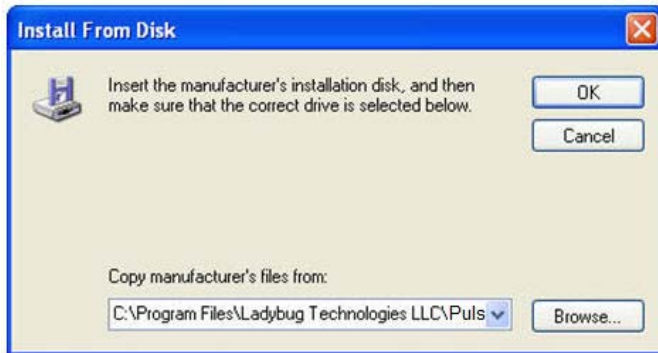
21. Click *Next* to continue the process as shown below.
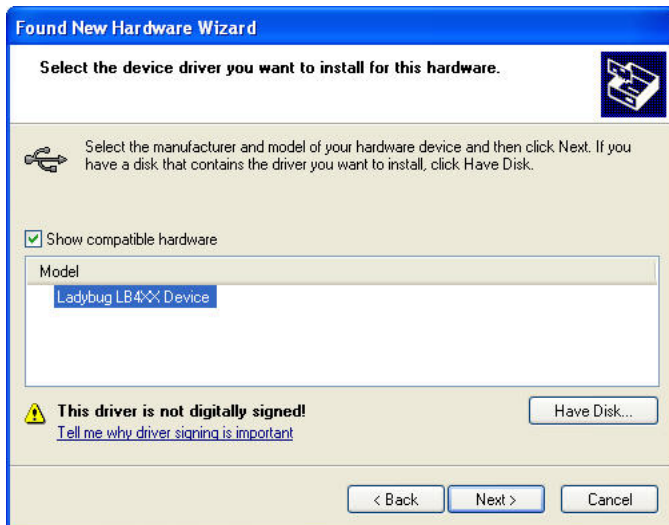
22. The window below will appear briefly as the software is installed.

23. Click *Finish* as shown below to complete the hardware installation then proceed to the following steps to launch the application software.

24. The above procedure can be repeated for multiple sensors. Repeat from step 9 if more sensors need to be configured.

25. Click the LadyBug shortcut icon on the computer desktop to start the application.

26. The Select Device window will appear as shown below to indicate the sensor(s) connected by serial number. The six-digit serial number is located under the USB port on the sensor body. Click the **Id** button to blink the LED on the sensor. Select the unit serial number and click *OK* to continue.


The calibration window below will appear briefly after the device is selected.

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27. The default pulse profile measurement interface will open as shown below. The top graph is called the Panorama view (power versus time) and the bottom is the Measurement view. You will see only the noise floor on the display if your sensor is not connected to a stimulus.
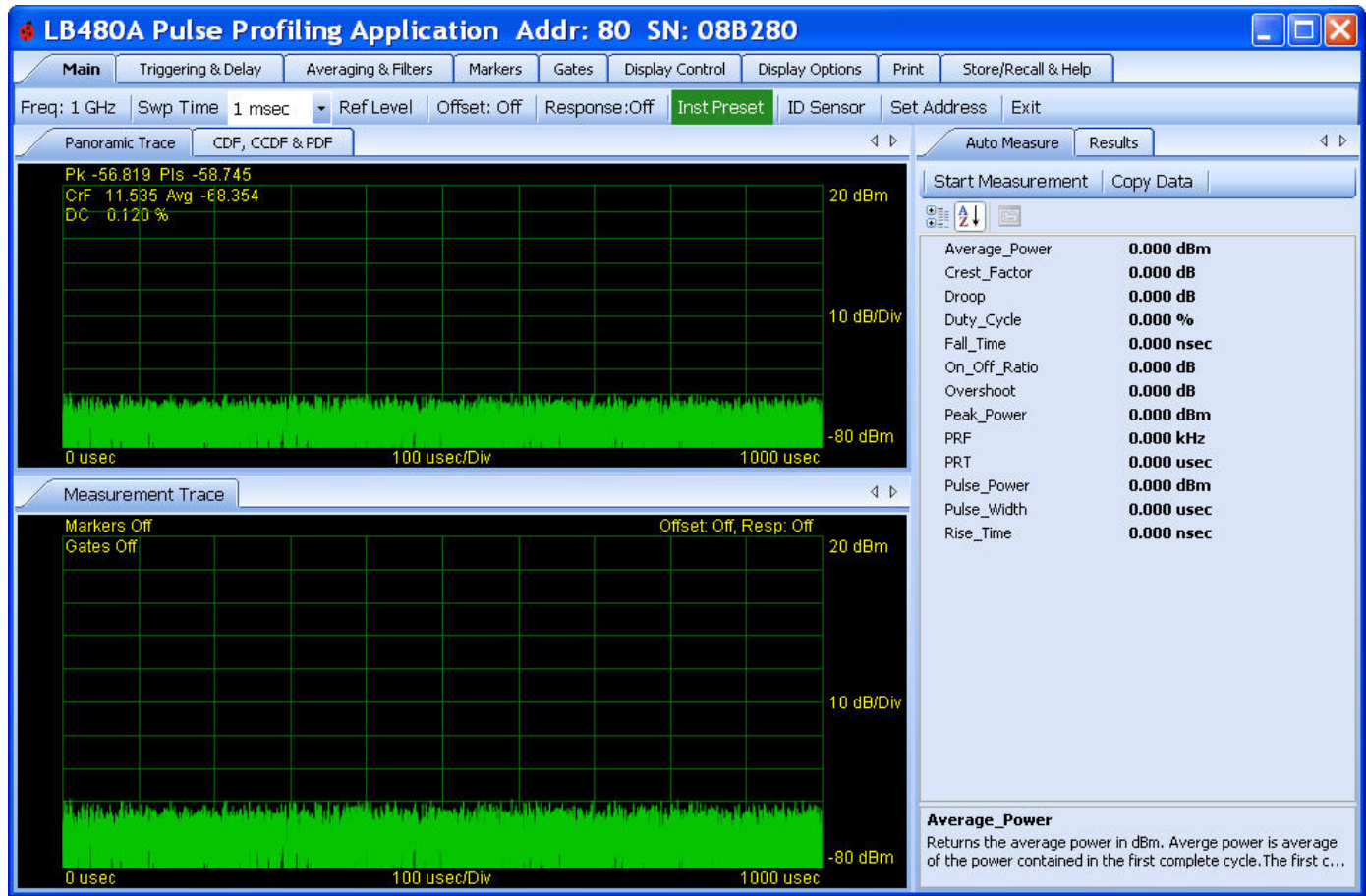
SPECIAL NOTE: You will see a power panel similar to that shown below if you chose the ***Power Meter Application*** instead of the ***Pulse Profiling Application***. Refer to the LBXXXA Series documentation for operating information.
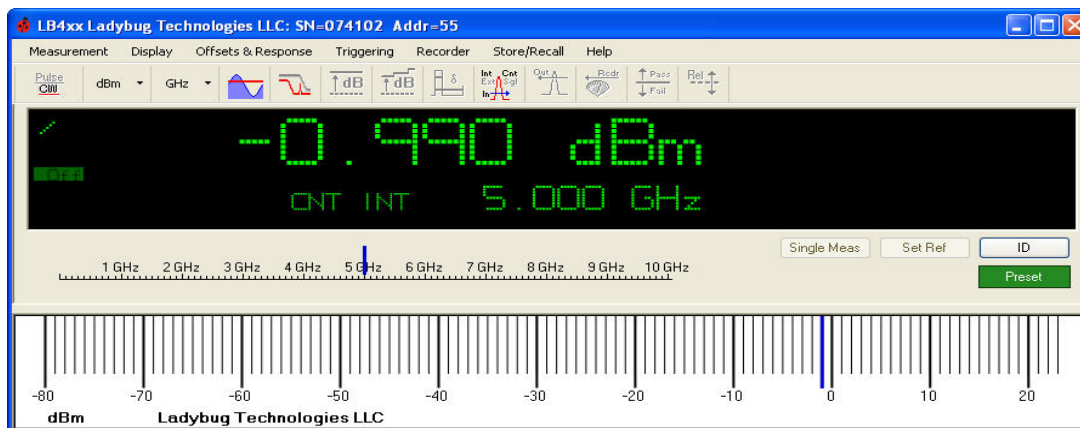
28. The software and hardware installation process is now complete. Continue to the next section, "Getting Started", to quickly start making measurements.

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3. Getting Started

Operating Precautions

The RF input connector on the sensor must be clean and undamaged as well as the mating connector(s).

WARNING: **DO NOT EXCEED +23dBm, 200mW, or 3.15VRMS. Refer to the specifications in the LB480A data sheet for maximum allowable limits.**

The Display Panel

The elements of the default display are shown below with no signal applied to the sensor. The top graph is called the Panorama View and the bottom is the Measurement View. The X-axis indicates 0 – 1000 usec (1 msec) sweep time versus power in both views. You can highlight a portion of the Panorama by clicking and dragging the cursor directly on the Panorama View. An expanded view of this highlighted segment will be shown in the Measurement View. This allows for a detailed examination of the highlighted portion of the signal. We will quickly jump to making a measurement using an example input. First, we will demonstrate some of the *Display Control* features.
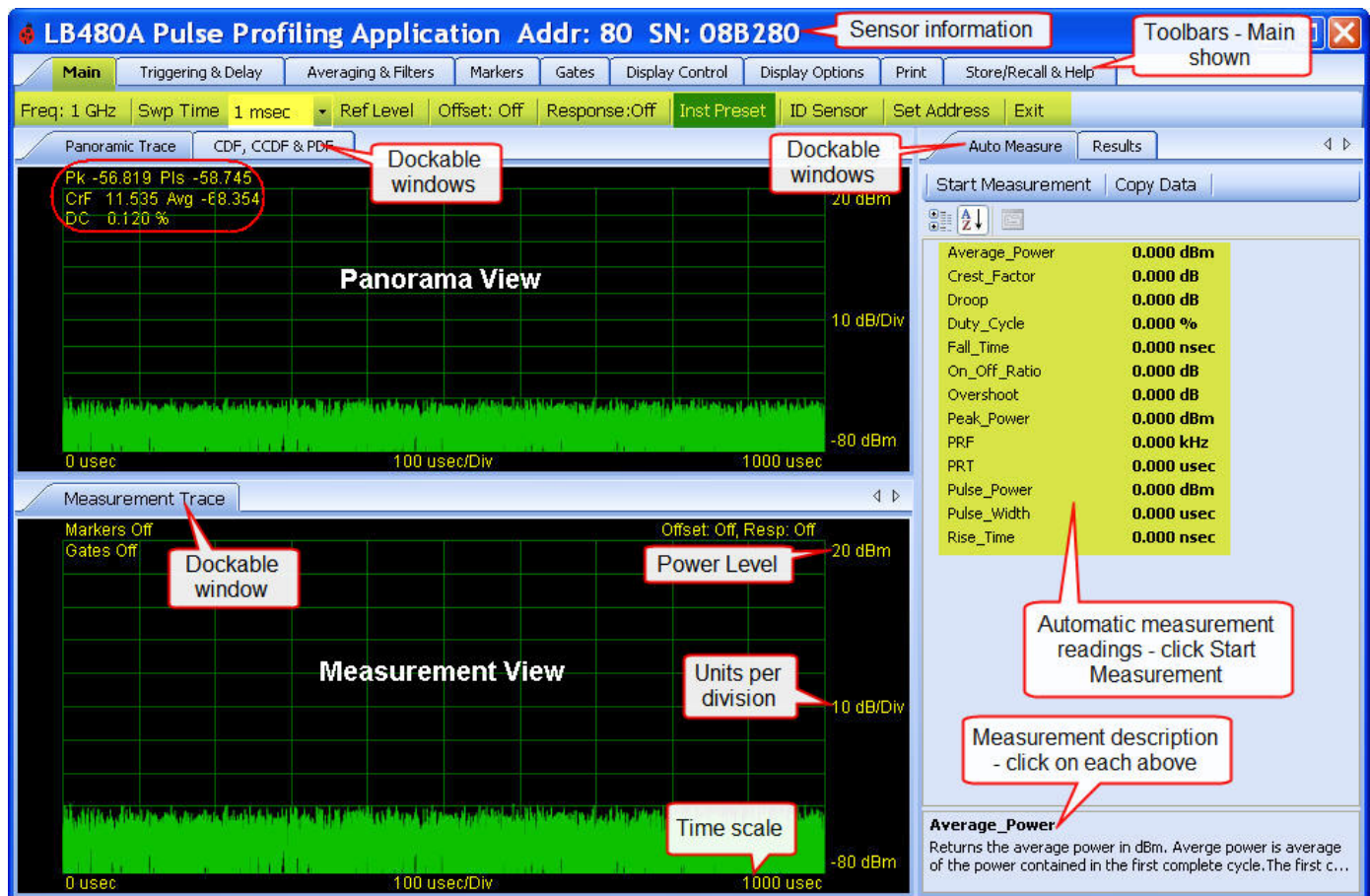
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Highlight and Auto Measure

Provide an input to the sensor with the parameters given below (or similar) for the following demonstration:

- Carrier Frequency = 1 GHz (default)
- Modulation = ~50 kHz Pulse
- Duty Cycle = ~10%
- Pulse Width = ~2 usec
- Power = ~-20 dBm
- Sweep Time = 1 msec (default)

Select the *Display Control* tool as shown below. Click and drag the mouse cursor to highlight a segment of the *Panoramic Trace*. This highlighted segment will appear as the *Measurement Trace*. Click *Reset* and notice that you are viewing the entire span again in the Measurement view. Select the *Results* tab next to the *Auto Measure* pane as shown and notice the same display controls.

From the *Auto Measure* pane click *Start Measurement*. We have just measured the thirteen parameters of our input signal as shown in the inlay below. There must be at least two complete cycles of the pulse in the Measurement view to make an acceptable automatic measurement. *Auto Measure* takes one sweep then reports the measurement values. You must click *Start Measurement* each time to update the measurement readings.

The remainder of this Quick Start Guide will focus on showing you how to make these same measurements manually using markers and gates from the *Results* pane and the toolbars.

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You can also click and drag to highlight in the Measurement view as shown below. Then you can *Reset* in the *Results* pane to see the entire span once again. You can size the panes and panel along the borders as is typically done and you can dock the display windows *(See the Dockable Windows feature in the product manual).* The *Display Options* toolbar allows setting of font size, color, theme, etc.
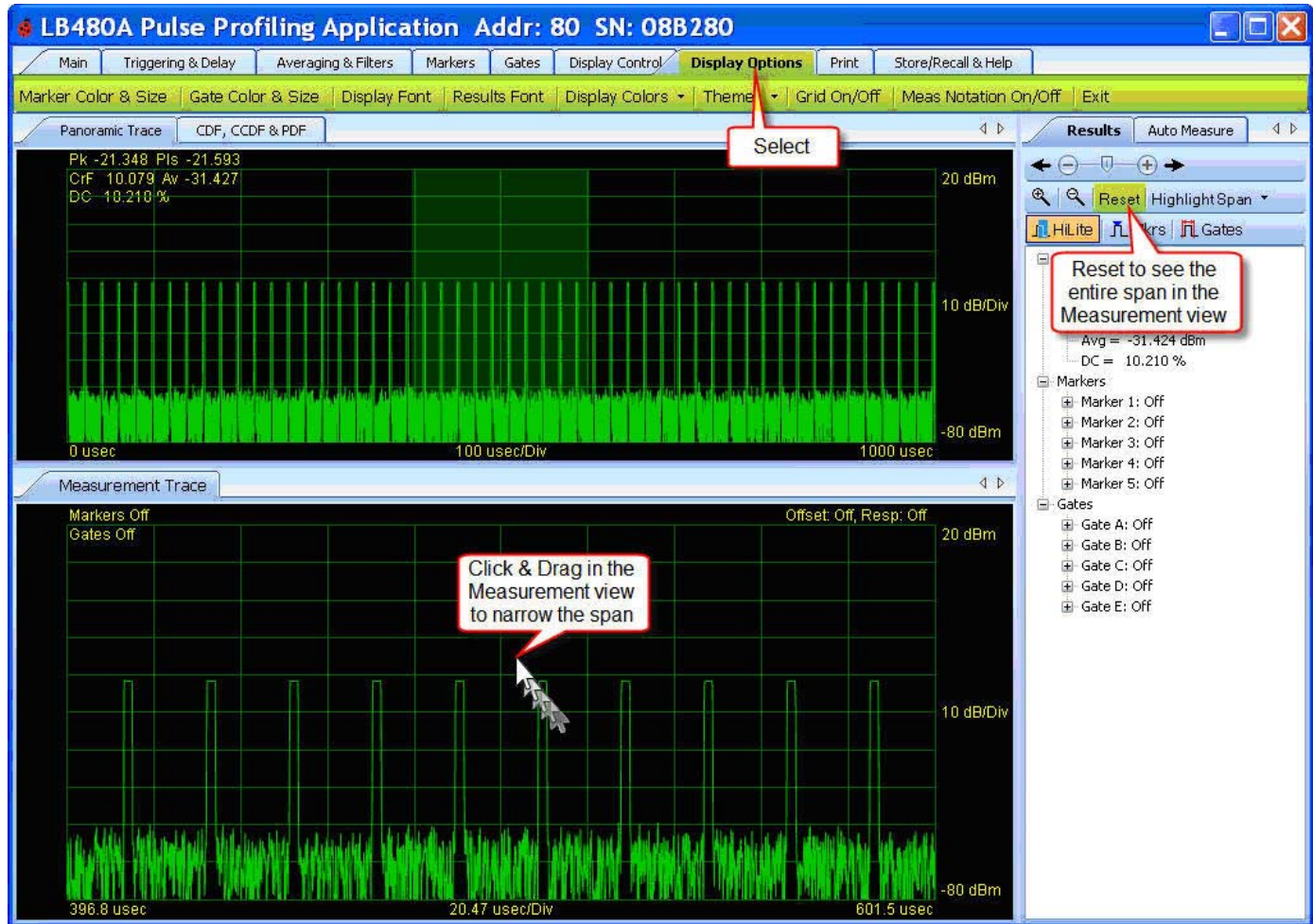
Notice that the start/stop times in the Measurement view are not round numbers. It is difficult to get even start/stop numbers with the mouse but using it is very convenient. The next section demonstrates how to get well defined and precise start, stop and span numbers.

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The example below shows how to precisely highlight a portion of the span using the *Highlight Span* feature. First select the span percentage (10%) then enter the start time (200 usec) - a three step process. Observe the start and stop times in the Measurement view.

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Markers

Markers are one way to take measurements. We will start by showing a very simple marker measurement. Select *Markers* from the toolbar as shown below. Click on the *Marker 1* down arrow to enter this pointer mode by selecting a marker type (Normal or Delta). Alternately, you can right-click on the individual marker in the *Results* pane to select the marker type. Notice that the pointer mode switches from *Highlight* to *Markers* in the *Results* pane. You can still highlight or select a portion of the trace in the Panorama view and then position the marker in the Measurement view using the mouse. However, you must switch back to *Highlight* mode if you want to highlight in the Measurement view. Notice that the marker value (time and power) is also displayed above the left edge of the grid in the Measurement view.

This should give you some sense of how the user interface operates. We will revisit markers in more detail in the next section. For now, turn off all markers from the toolbar and then proceed to the next section - Measurement Basics.
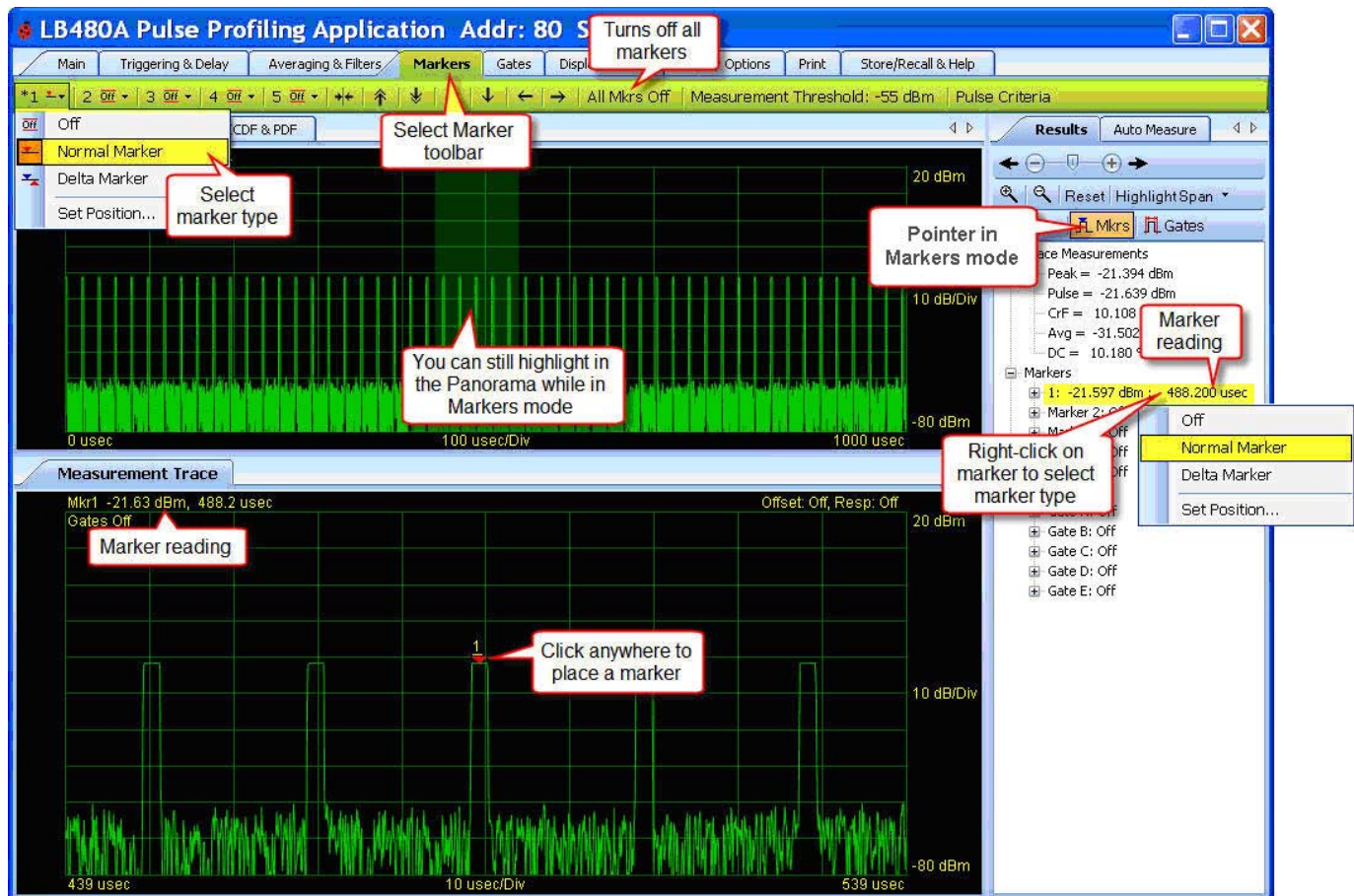
4. Measurement Basics

The Main Toolbar

The *Main* toolbar shown below allows setting of the *Frequency*, *Sweep Time*, and *Reference Level & Resolution*. The *Reference Level* selections apply to the Measurement view only and *Resolution* applies to both views.The *Reference Level & Resolution* settings only affect how the data is displayed. There is provision for offsetting the data over the measurement range. Select *Offset* to enter a value and to enable/disable this functionality. It is important to note that reference level and offsets are very different.The reference and resolution settings only change the formatting of the data whereas offsets modify the measured values. *Frequency Response* allows you to enter frequency dependent offsets so as you change the input frequency the offset will coinside with this frequency change. Offsets must be enabled for functionality. Refer to the product manual for more information on the toolbars – see *Related Information* at the end of this document.
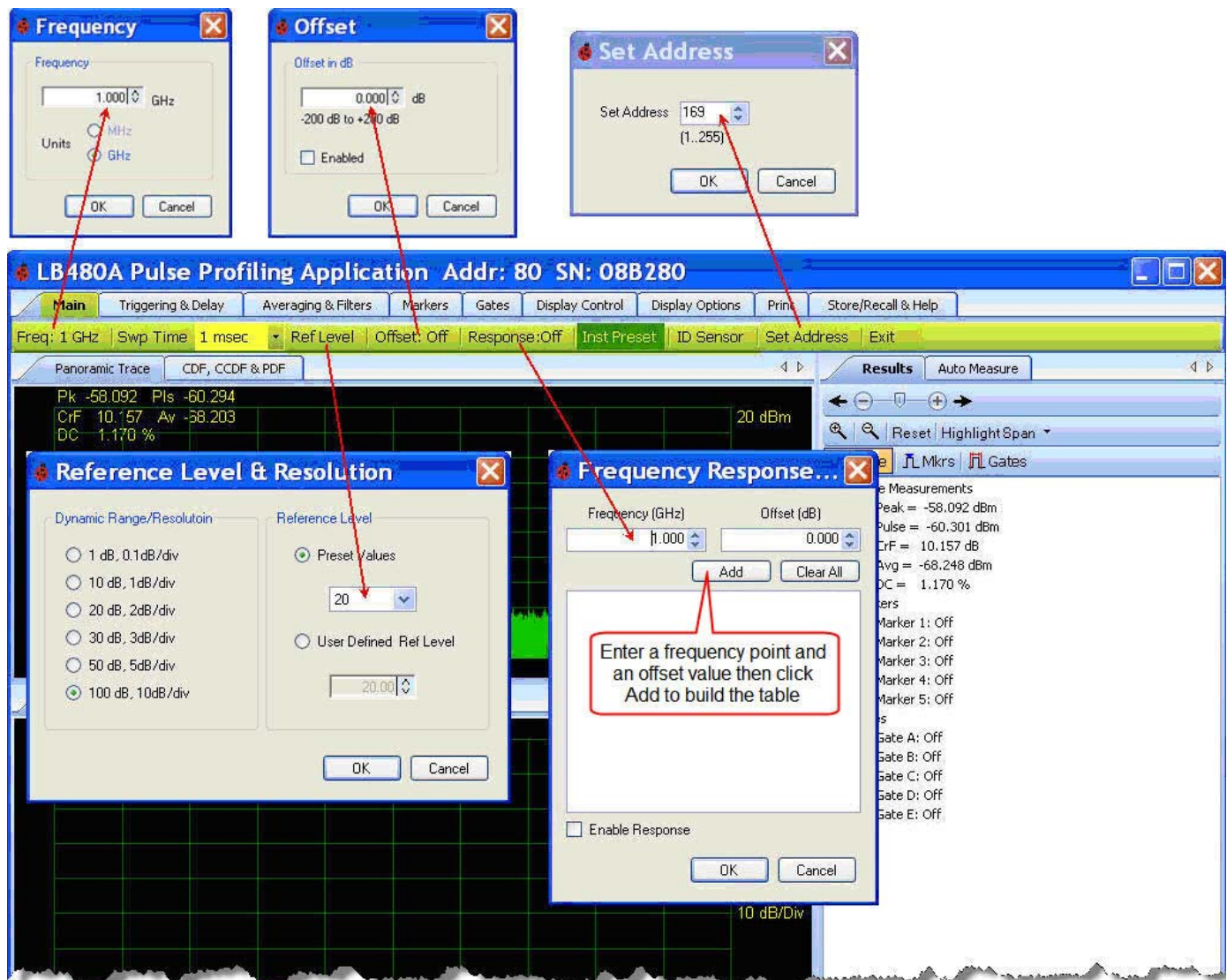
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More about Markers

The next two screen shots demonstrate the *Normal Marker* and *Delta Marker* functions in that order. First, highlight a single pulse in the measurement view as shown below. Zoom in on the pulse to position the marker for a pulse width measurement. Now select *Markers* from the toolbar and click *1 > Normal Marker* from the drop down. Notice that *Marker 1* appears at center graticule. Also, it is active indicated by an asterisk (*) next to the number on the toolbar; and the marker number is underlined in the display. Move the marker to the left of the pulse as shown.
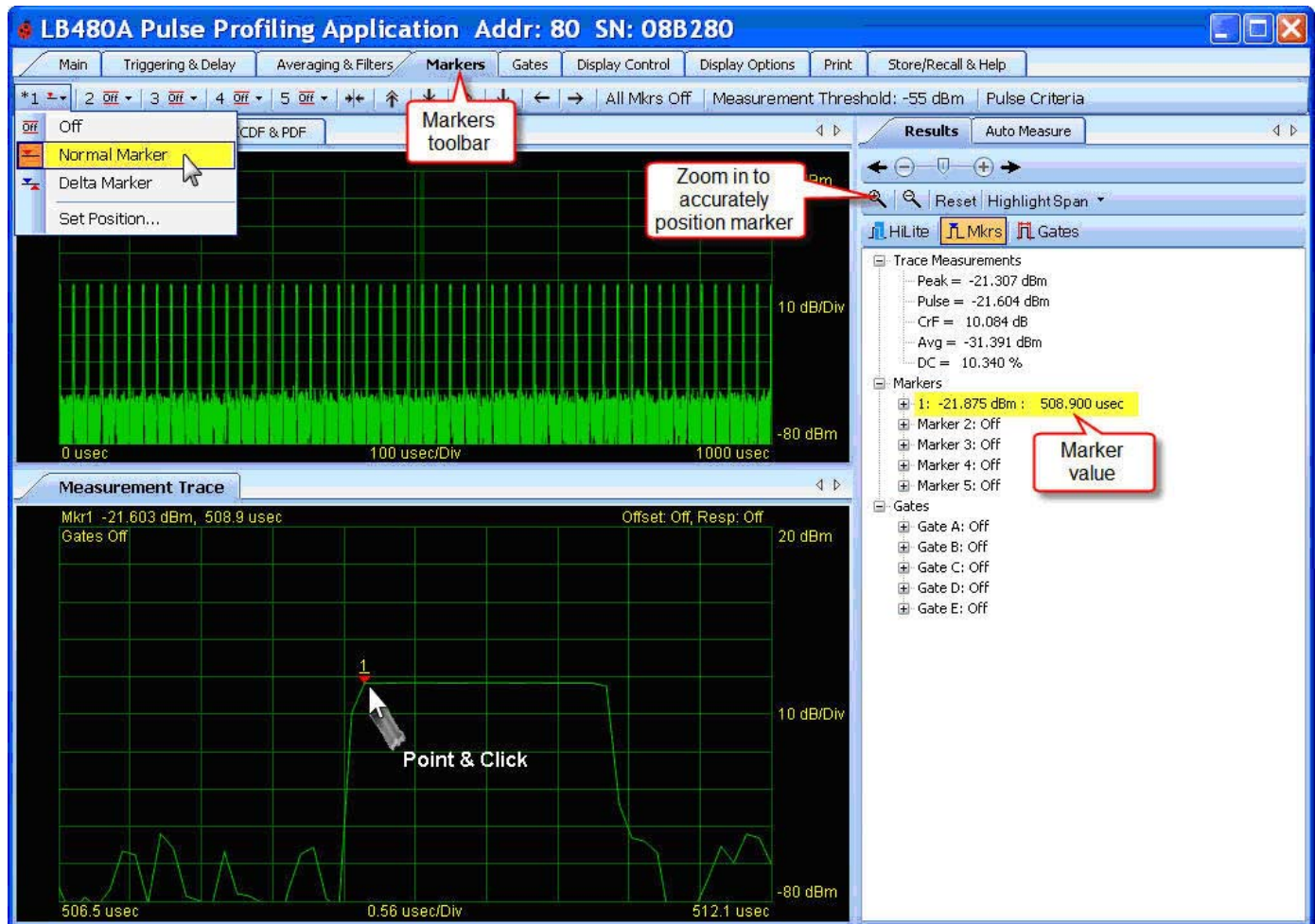
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Now select *Delta Marker* from the *Markers 1* drop down as shown below. Notice a second marker appears just below the normal marker. Position this *Delta Marker 1* on the right edge of the pulse as shown. The *Delta Marker 1* value (Dmk1) is visible above the left edge of the grid in the Measurement view as well as in the *Results* pane. Expand the marker tree in the *Results* pane if it is not visible. This then is the approximate pulse width of the signal utilizing markers. (Compare this value to the automatic measurement of about 2 usec).

Pulse width measurements are normally defined as the time between the 3 dB points on the rising and falling edges of a pulse. The accuracy of a measurement like this is highly dependent on the placement of the markers. Placing markers at the precise 3 dB down points can be problematic for pulses with very fast rise and fall times.
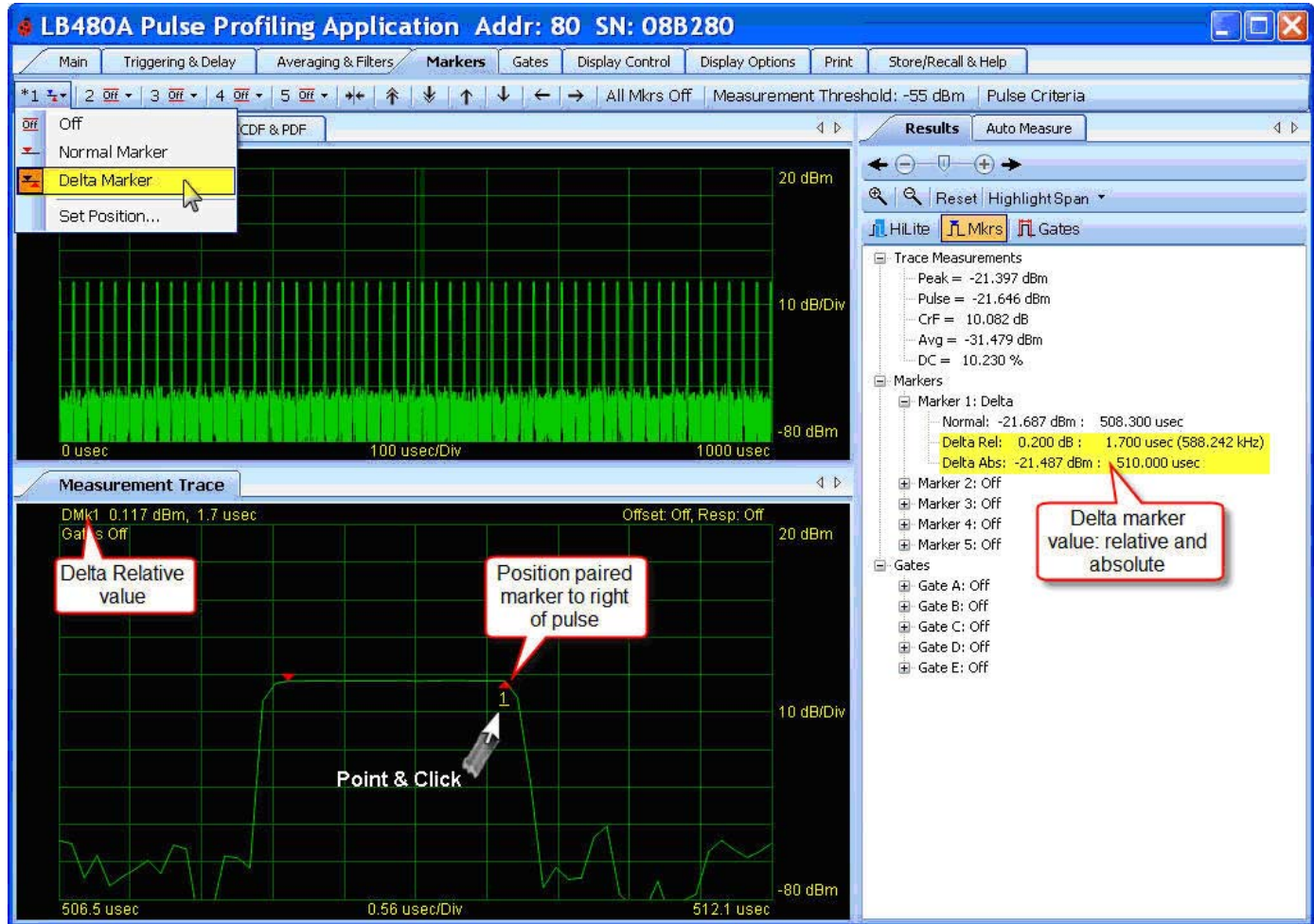
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Next we will compare this to the same pulse width measurement using gates. But first, switch **Marker 1** back to **Normal Marker**. Now click **Center trace on marker** on the marker search tool as shown below. Notice that when you click this button the trace becomes centered at that marker position in the Measurement view. You can also jump to minimum or maximum peak value or next directional peak value using this tool.
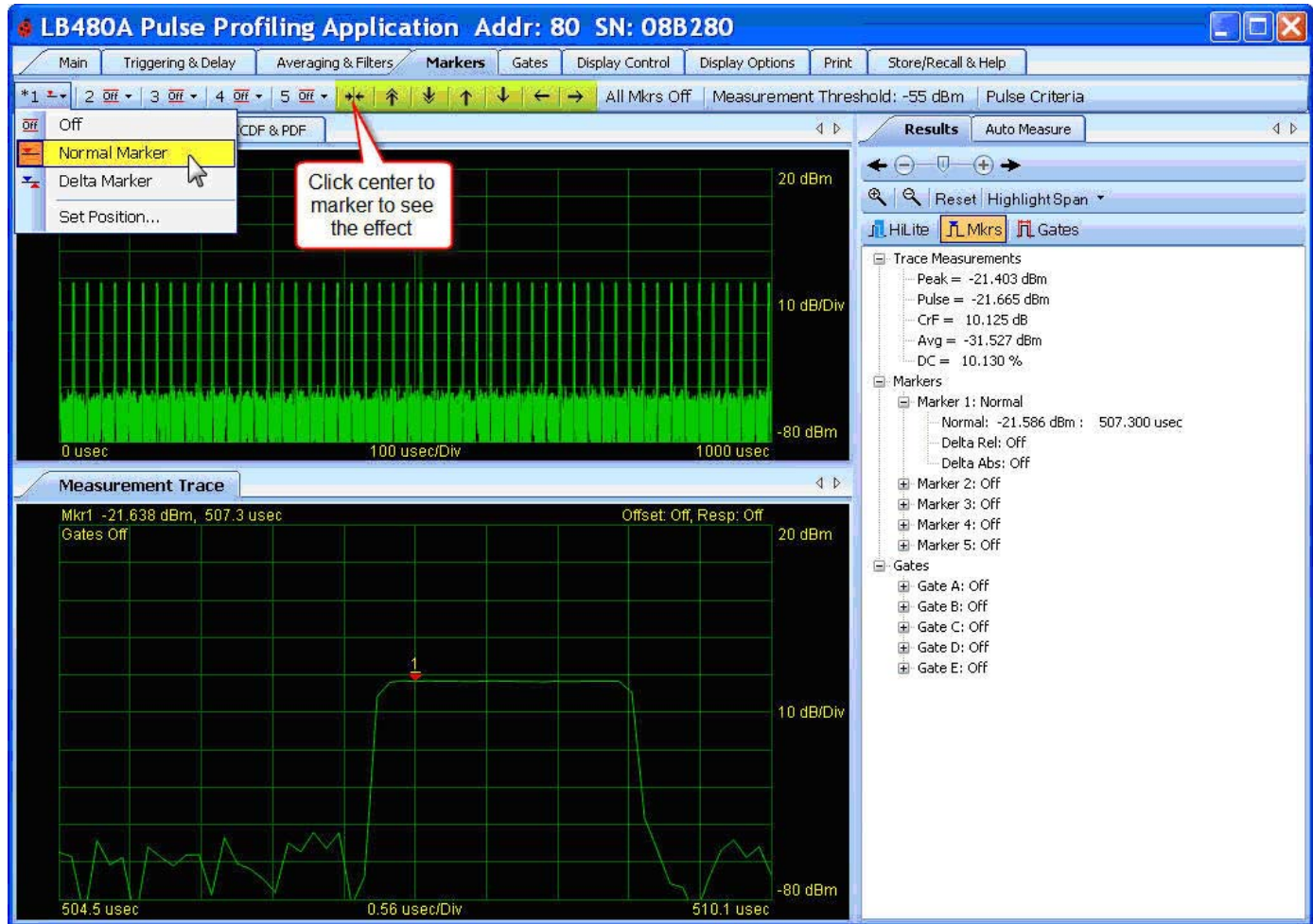

NOTE: Only one marker can be active at a time. There are (5) marker pairs that function as just described. An active marker will have an asterisk (*) next to the number in the toolbar and it will be underlined and appear slightly larger in the display.

Gates

We will now make a pulse width measurement using gates as shown in the next two screen shots. Select **Gates** from the toolbar and select **Pulse Width** from the **Gate A** drop down as shown below. The **Gate A** pair will activate and appear at the center of the Measurement view. Expand the **Gate A** tree in the **Results** pane. You can also see a list of measurements if you right-click on the gate in the **Results** pane – just like markers.
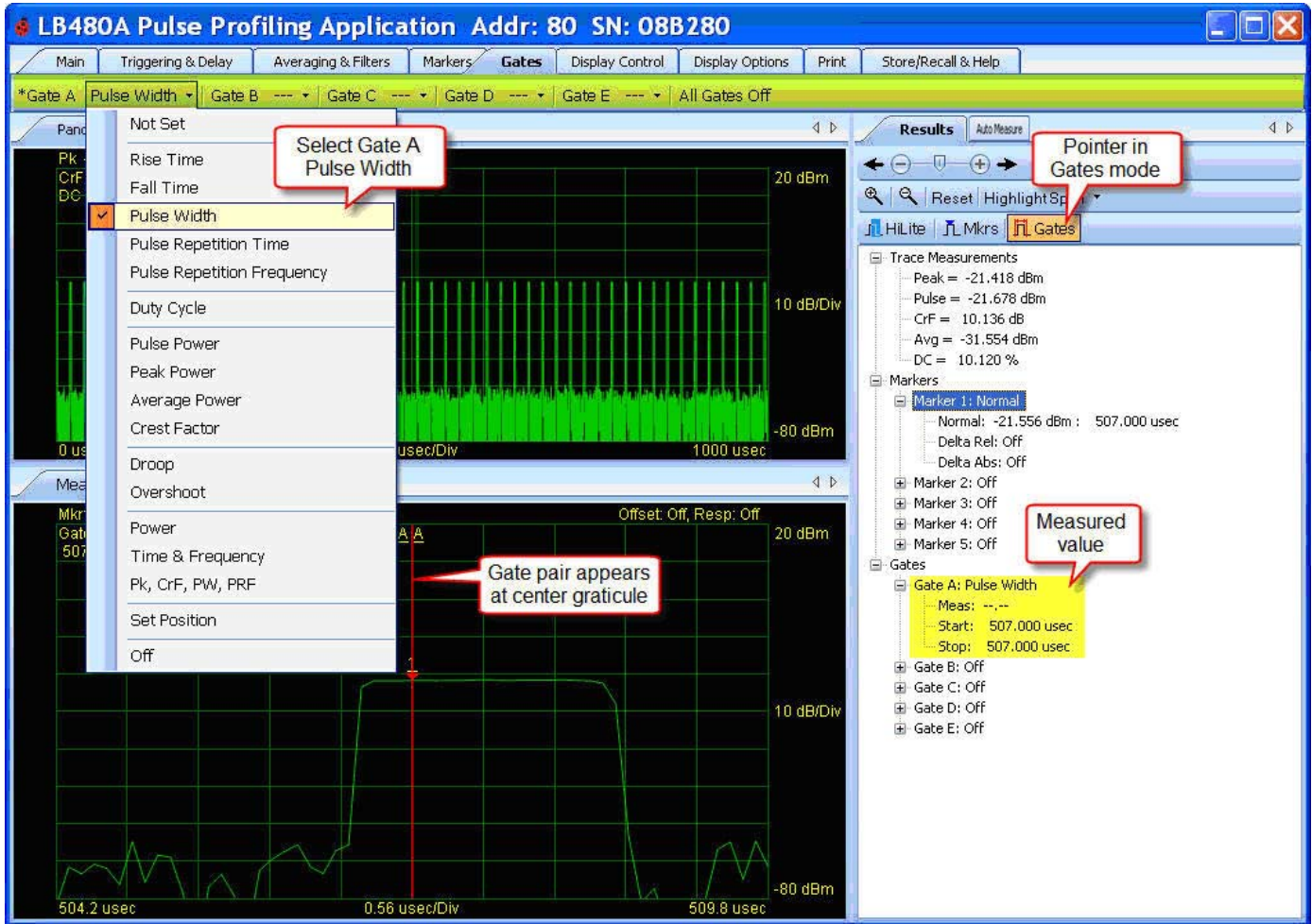
Now click to the left and right on the *Measurement Trace* to set the gate pair end points as shown below. The measured value will appear in the field for the individual gate in the *Results* pane. A dashed line (--.--) will appear if the gate cannot take a measurement for some reason. Adjust the gate end points accordingly to get a reading. A complete cycle of the incoming signal must be gated for periodic measurements such as duty cycle and frequency. Notice that as long as the gate includes a complete pulse, you can move the gates around and the measurement remains stable. This is unlike the marker measurement that changed as the markers were moved. When using the gates, an algorithm examines the trace making a pulse measurement if a well defined pulse is found.
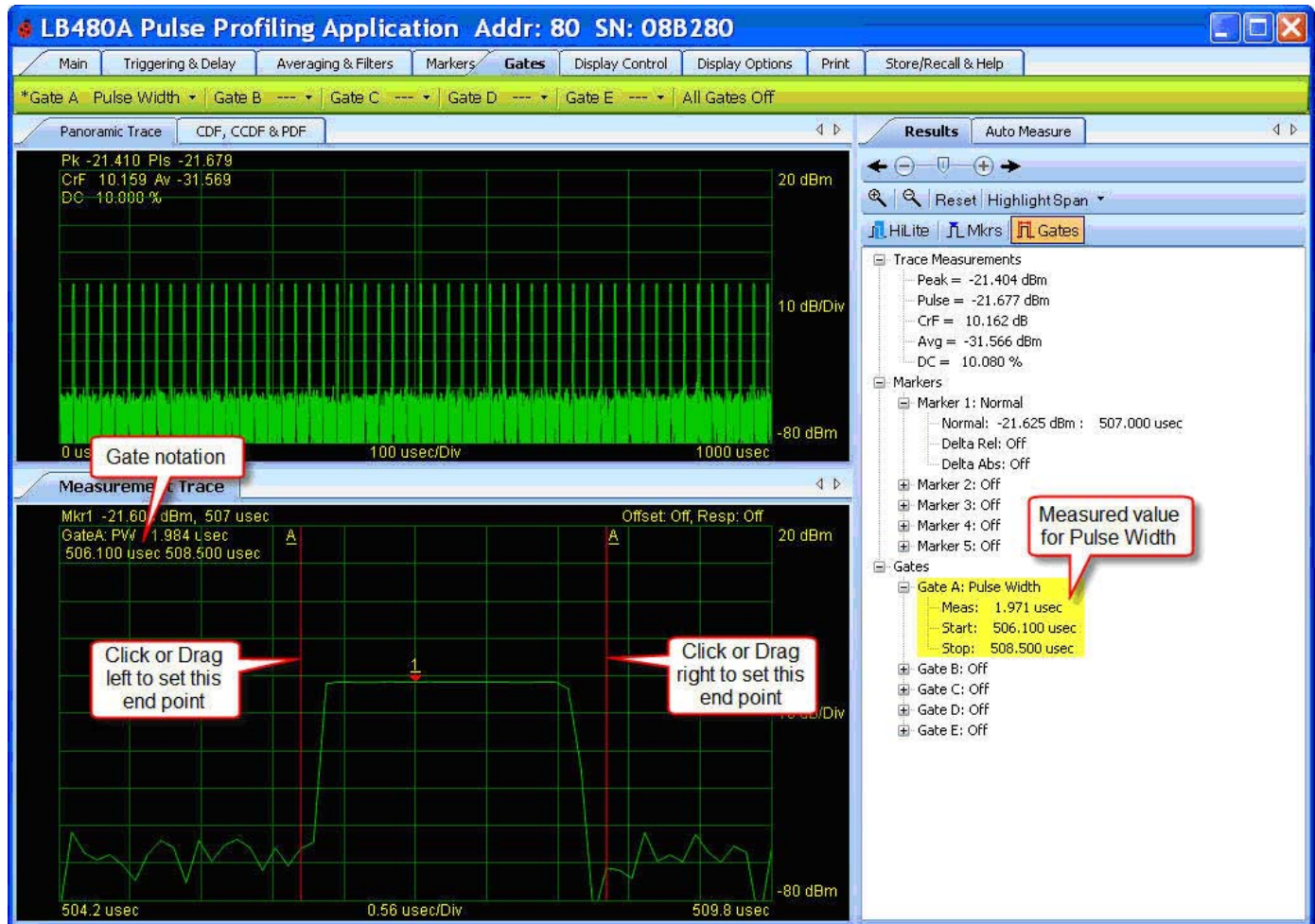
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A PRF measurement is shown below. Notice the measurements that are available from each gate pulldown. You can also right-click on the individual gate in the *Results* pane to see the list of measurements. For this measurement the gate must include one or more complete cycles. Remember as mentioned previously, if the gate is not correctly setup you will get a dashed line (--.--). This indicates that the selected region of the trace does not yield a valid PRF measurement.
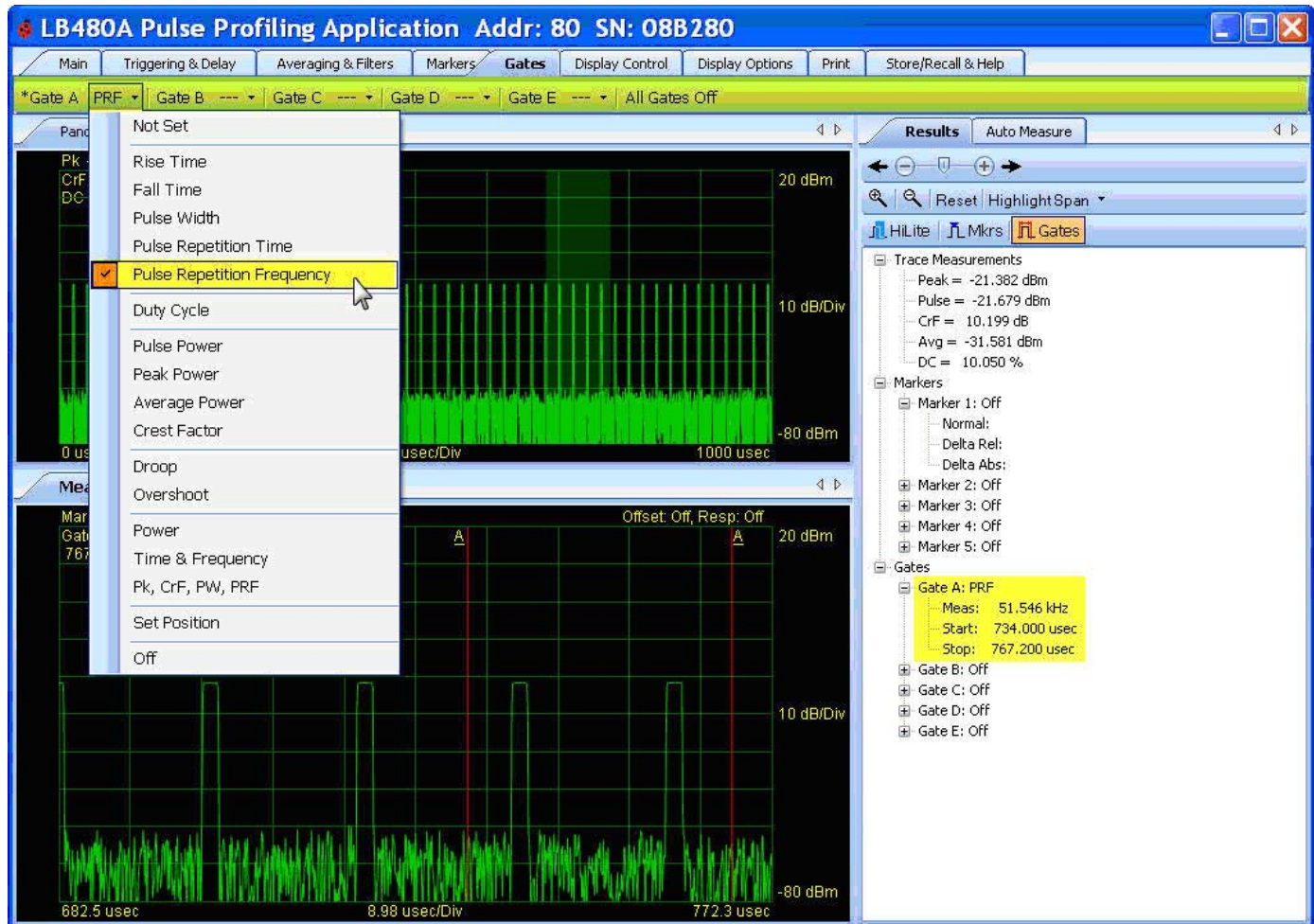

NOTE: Only one gate can be active at a time. There are (5) gate pairs that function as just described. An active gate will have an asterisk (*) next to the letter in the toolbar and it will be underlined and appear slightly larger in the display.

Gate Positioning

The diagram below shows the general gate placements for a number of measurements. Pulse width and pulse power measurements are less sensitive to gate positioning than rise and fall time. The first cycle of a pulse train is measured for PRT, PRF and duty cycle measurements. Again, these measurements are less sensitive to gate positioning than rise and fall time.
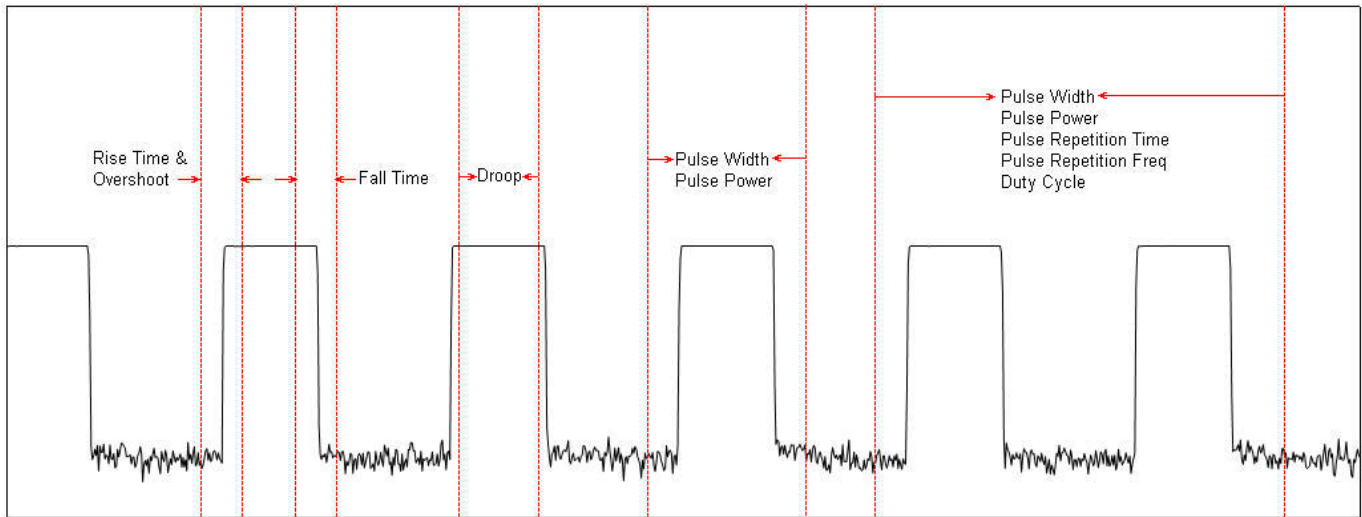
Triggering & Delay

Various triggering methods are provided from this toolbar shown below. We have been using the default internal automatic trigger in our demonstration. This method of triggering should suffice for much of your testing. It functions by sampling the measurement space, establishes a suitable trigger level, then takes the measurement. When using *Internal Auto* you can easily trigger on signals as low as -50 dBm and often as low as -53 dBm. Positive or negative *Edge* triggering can be selected as well as *Continuous* or *Single* sweep.
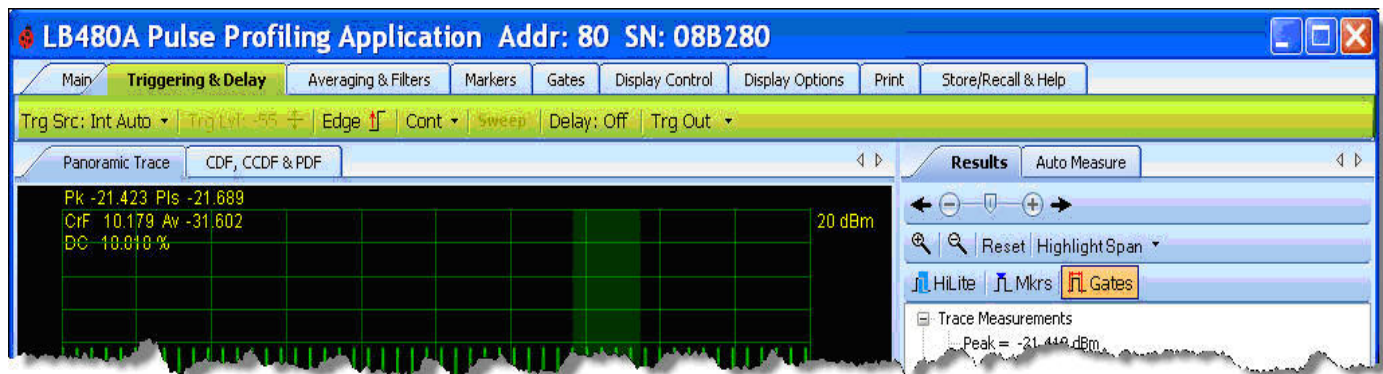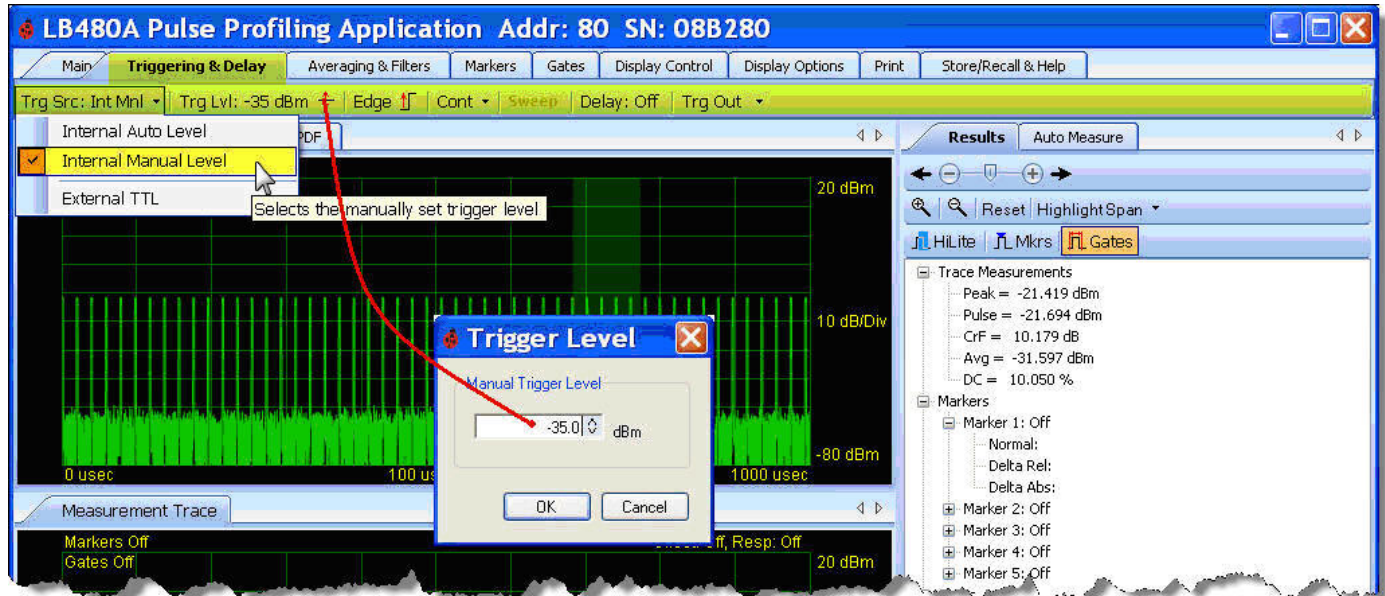
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Next we will demonstrate the manual trigger feature by adjusting the trigger level and observing the effect on the display.

The internal manual trigger mode triggers on the incoming signals. *Internal Manual Level* gives the user some control over the portion of the signal being viewed. This is especially useful for signals with long sloping edges or varied signal levels.

Select **Trg Src > Internal Manual Level** from the **Triggering & Delay** toolbar as shown below. Click on the **Trg Lvl** tool to set the level. Enter -35 (dBm) in the **Trigger Level** dialog box and click OK. There should be no change in the display since our input is around -20 dBm.

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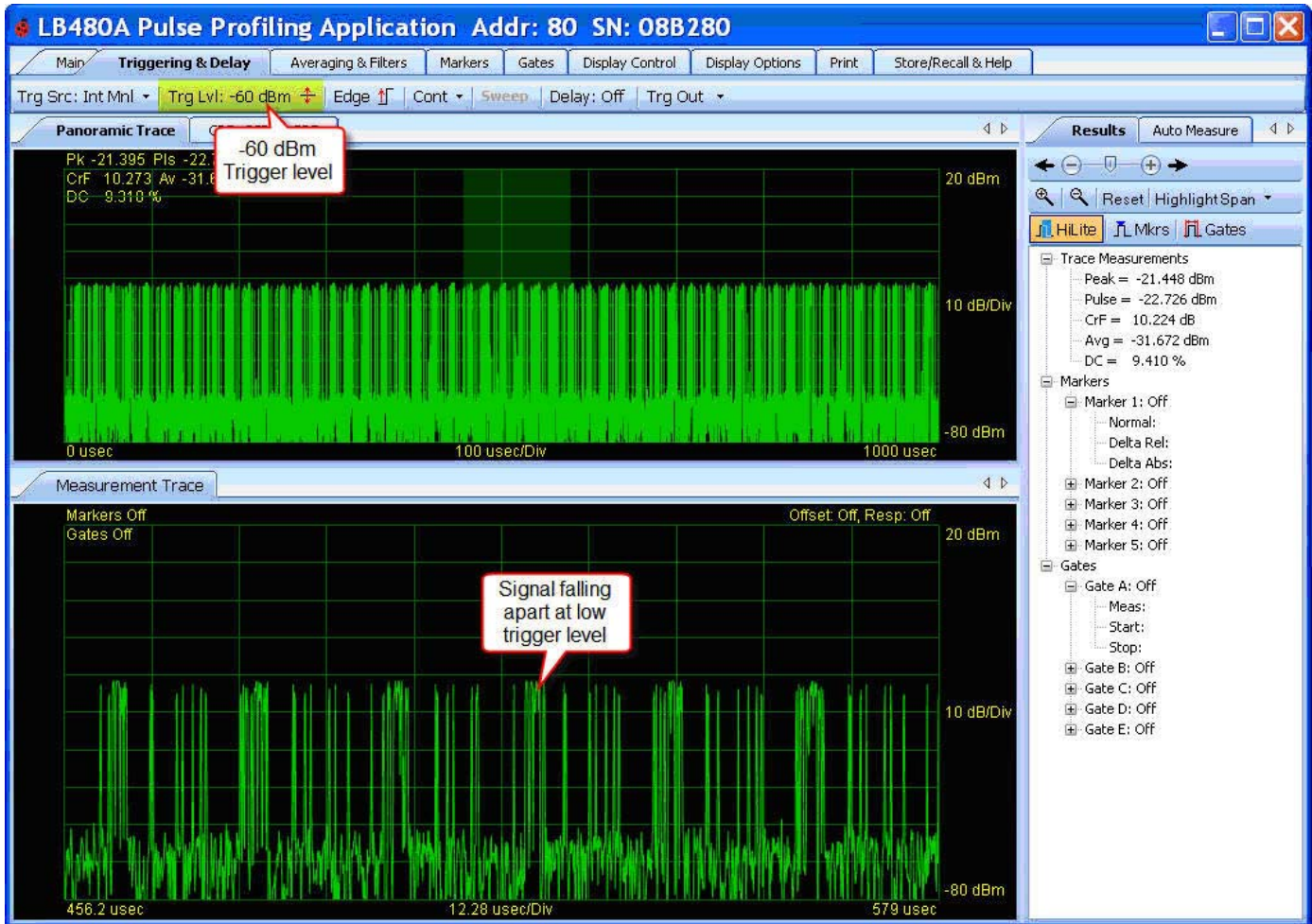
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Now raise the trigger level to 0 dBm. Notice that the display is no longer updating because our signal is approximately -20 dBm (well below the trigger level of 0 dBm). Also notice the (*Trigger?*) notation above the Measurement view grid indicating the problem as shown below. In this case there is no signal power at 0.0 dBm. So we would expect that we would not get any signal, and that is exactly what has happened.
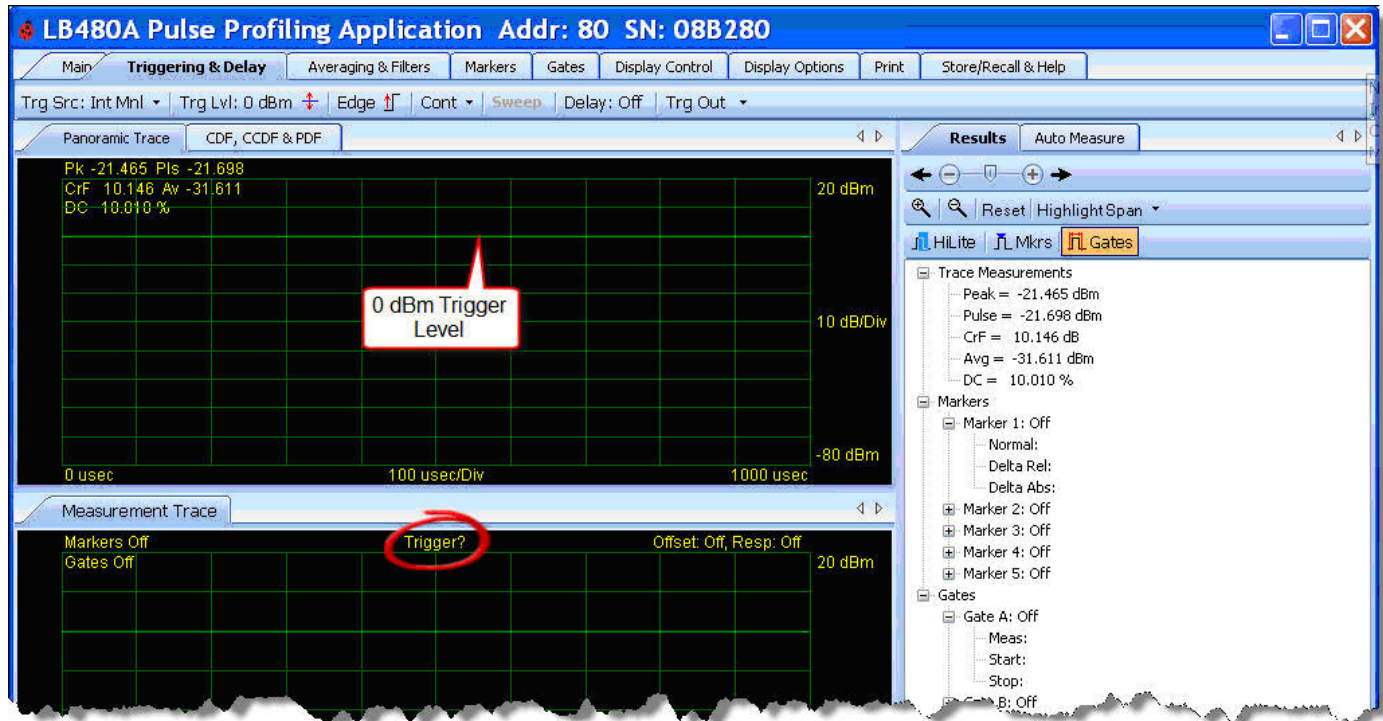
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Finally, change the trigger level to -60 dBm. The trace starts to break up as shown below since we are triggering on noise (as well as signal) during the sampling process. Using internal manual trigger requires some knowledge of the incoming signal.


NOTE: Refer to the *LB480A Product Manual for the Pulse Profiling Application* for the instrument default state under the heading *Instrument Preset*.
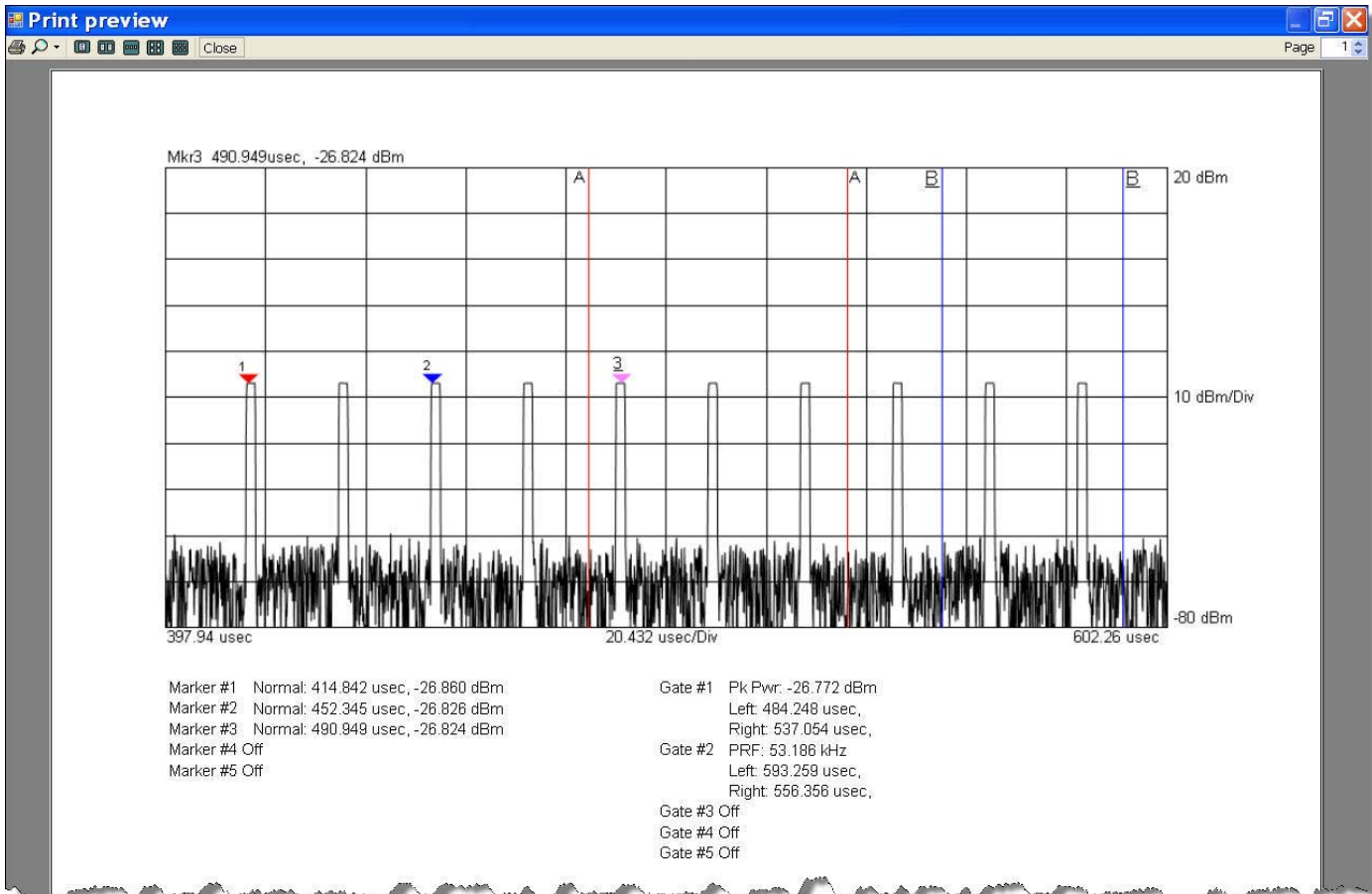
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Print Toolbar

The **Print** toolbar allows you to print the panorama, measurement or statistical displays (CDF, CCDF & PDF) separately. **Print** supports both color or black and white as shown below.
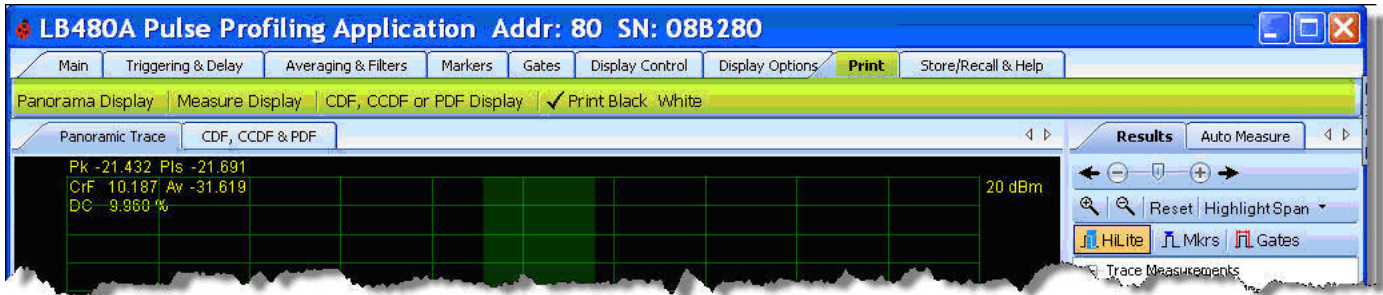
Shown below is an example of the **Measure Display** printout which includes all the marker and gate values.
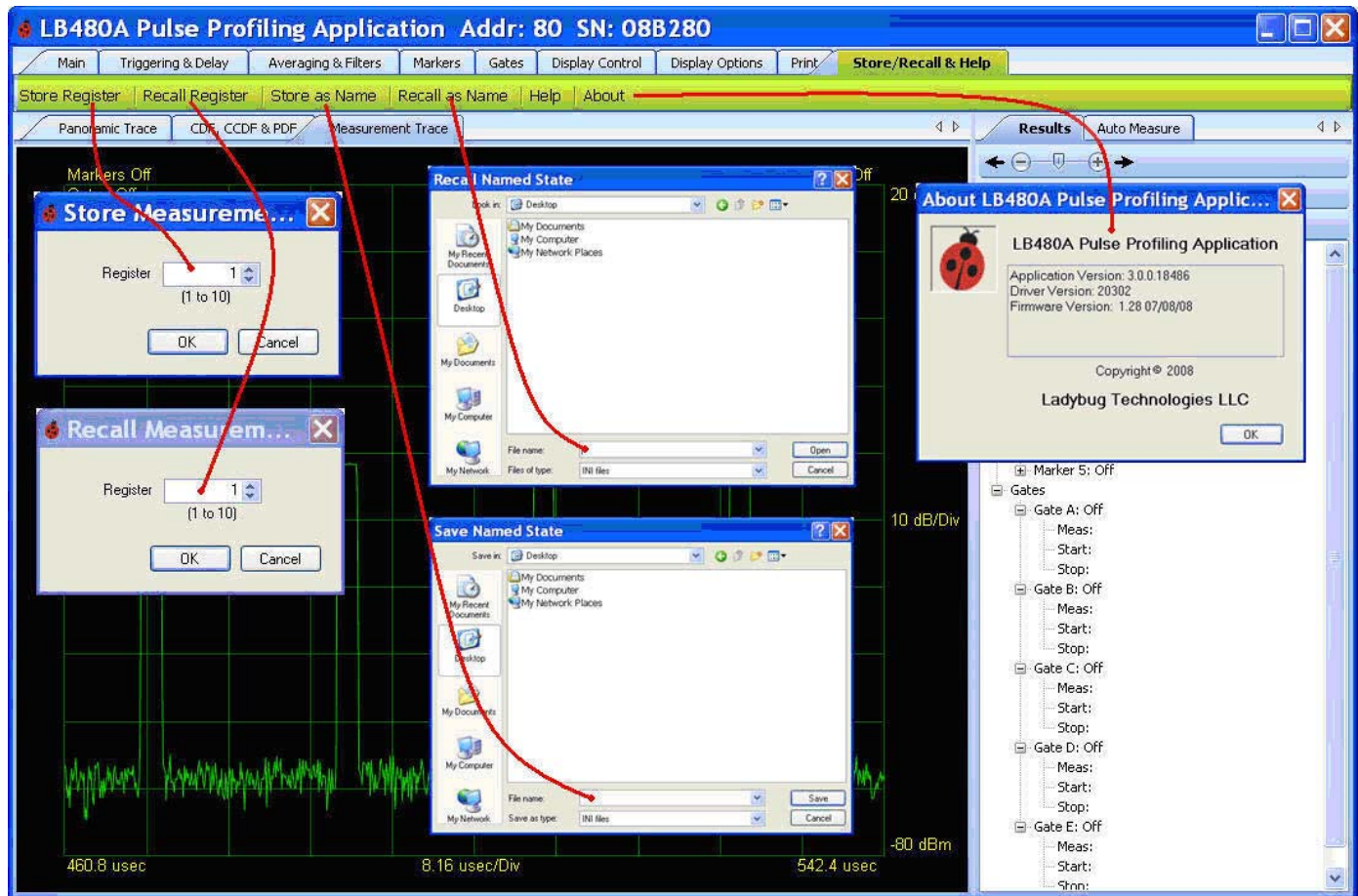
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Store/Recall & Help

This toolbar allows you to *Store/Recall* up to 10 measurement states or save/recall a file by name as shown below. The *Help* button provides product support. The *About* button lists the version of the software, driver and firmware.

Related Information

This document was intended to touch on the basics of instrument operation. Refer to the documents below for more detailed information regarding the LB480A Pulse Profiling PowerSensor+™.

- o LB480A Product Manual for the Pulse Profiling Application
- o LB4XXA Programming Guide
- o LB480A Data Sheet

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