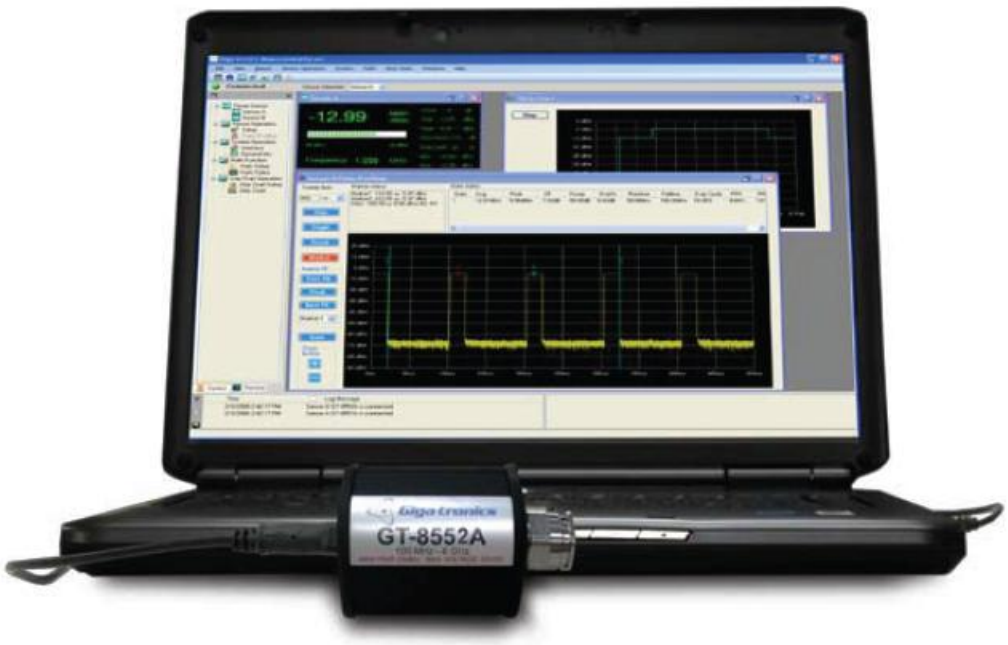
GT-8550A Series USB Power Sensors



Operation Manual

All technical data and specifications in this publication are subject to change without prior notice and do not represent a commitment on the part of Giga-tronics, Incorporated.

Warranty

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Regulatory compliance information

This product complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly.

89/336/EEC and 73/23/EEC	EMC Directive and Low Voltage Directive
EN61010-1 (1993)	Electrical Safety
EN61326-1 (1997)	EMC – Emissions and Immunity

Manufacturer's Name:
Giga-tronics, Incorporated

Manufacturer's Address
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U.S.A.

Type of Equipment:
USB Power Sensor

Model Series Number
GT-8550A

Model Numbers:
GT-8551A, GT-8552A, GT-8553A, GT-8554A, GT-8555A, and GT-8888A

Declaration of Conformity on file. Contact Giga-tronics at the following;

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1 Safety and Manual Conventions

This manual contains conventions regarding safety and equipment usage as described below.

1.1 Product Reference

Throughout this manual, the term “GT-8550A” refers to all models of power sensors within the GT-8550A Series, unless a specific model power sensor is referenced.

1.2 Personal Safety Alert

WARNING: Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

1.3 Equipment Safety Alert

CAUTION: Indicates a situation which can damage or adversely affect the GT-8550A or associated equipment.

1.4 Notes

Notes are denoted and used as follows:

NOTE: Highlights or amplifies an essential operating or maintenance procedure, practice, condition or statement.

2 Introduction

2.1 Overview

NOTE: In this manual, the GT-8550 Series USB Power Sensor is referred to generically as the "GT-8550A" for simplicity. The specific model of power sensor is used where necessary.

This manual provides information about the installation and operation of the GT-8550A Series USB Power Sensors. Product description, specifications, and support are included. Changes to this manual are recorded in Record of Changes to This Manual in the front section.

The GT-8550A features a frequency range to 26.5 GHz, wide dynamic range, fast measurement speed and a rugged body that connects directly to a desktop or laptop computer using a standard USB port and USB cable. A separate power meter is not required. The GT-8550A Series USB Power Sensors allow for immediate conversion of RF and microwave power into digital data right at the point of power sensing. The GT-8551A, GT-8552A, and GT-8555A models feature triggering capabilities. (Refer to the Specifications section on page 50).

The companion application software, Measurement Xpress (MX), provides a Graphical User Interface (GUI) to make power and other measurements.

The benefits of using Measurement Xpress are:

- Familiar Microsoft® Windows Interface
- Easy to read numbers and bar graphs
- Fast update rate allows real time circuit tuning
- Internal zero and cal – the sensor powers up ready to make measurements

If you wish to program the GT-8550A for automated testing, a Dynamic Link Library (DLL) is included in the USB flash drive (memory stick) that ships with the GT-8550A. Information for programming the GT-8550A is found in the GT-8550A Series USB Power Sensors Remote Operation and Programming Manual.

Sensor zeroing and meter reference calibration are not required. There is no user calibration. This reduces setup time and simplifies programming. Recommended calibration cycle is one (1) year.

A typical setup for measuring RF power using the GT-8550A Series Power Sensor is shown in Figure 1.

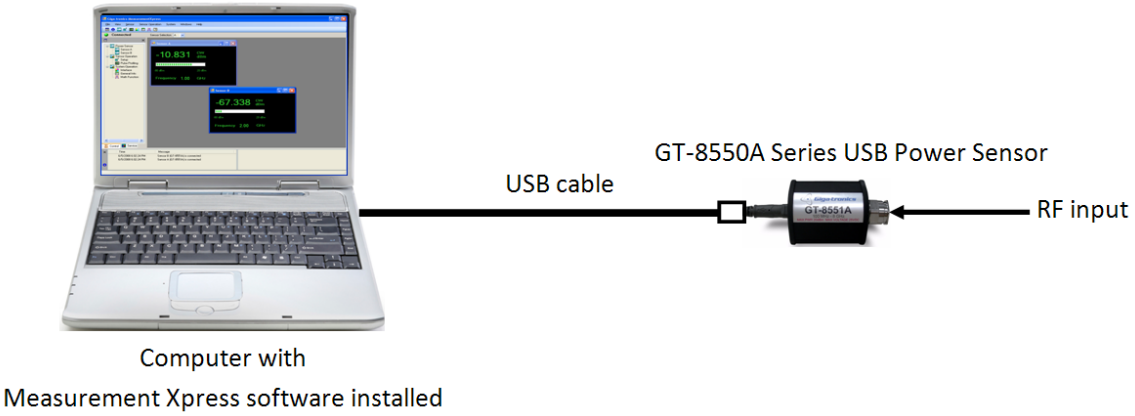


Figure 1. GT-8550A Series Power Sensor Measurement Setup

2.2 Sensors in the GT-8550A Series

The table below lists the basic parameters of the six models of power sensor in the GT-8550A Series.

Table 1: GT-8550A Series Power Sensors: Basic Specifications and Applications

GT-8550A Series Power Sensors: Basic Specifications and Applications				
Parameter	**Power Sensor Model**			
	GT-8551A	**GT-8552A, GT-8555A**	**GT-8553A, GT-8554A**	**GT-8888A**
Frequency Range	100 MHz to 8 GHz [1]	100 MHz to 8 GHz [1] 100 MHz to 20 GHz	10 MHz to 18 GHz 10 MHz to 26.5 GHz	10 MHz to 8 GHz [1]
Measurements	CW, Modulation • BAP [2] • MAP [2] • PAP [2] • Crest factor	CW, Pulse • Pulse Profiling • Markers • Gating	CW • Average Power	CW • Average Power
Dynamic range	-60 to +20 dBm	-60 to +20 dBm -40 to +20 dBm	-50 to +20 dBm	-60 to +20 dBm
Applications	Wireless communications and component testing that use modulated signals.	• Aerospace and defense: EW, ECM, ECCM, and radar testing • Features Pulse Profiling	Accurate power measurement of continuous wave (CW) RF and microwave signals	Economical power measurement of CW signals up to 10 GHz

[1] Operational to 10 GHz
[2] These are explained in section 2.5 on page 4.

2.3 Receiving and Inspection

Upon arrival, inspect the contents of the GT-8550A shipping container. The GT-8550A consists of:

- Sensor: there are six models of power sensors to choose from. These are described in Table 1 on the previous page.
- USB cable to connect the sensor to a computer (supplied with sensor)
- USB flash drive containing:
  - Measurement Xpress software (this may also be downloaded from the website www.gigatronics.com)
  - Files to enable programming the GT-8550A Series USB Power Sensor.

2.4 Computer Requirements for Measurement Xpress Software

Table 2 below shows the requirements of the computer used with the GT-8550A Series USB Power Sensors.

Table 2: Computer Requirements for Measurement Xpress Software

Computer Requirement for Measurement Xpress Software	
Parameter	**Specification**
Type of computer	IBM-compatible
Operating System [1]	Microsoft® Windows XP or Windows Vista or Windows 7 [2]
Processor speed	> 500 MHz
RAM	> 256 MB
USB interface [3]	USB 2.0 minimum

[1] There are separate installation files for 32 bit and 64 bit Operating Systems.

[2] Microsoft® .Net Framework 4.0 (or above) is required on 64 bit Operating Systems.

[3] See section 2.6 on page 7 for USB considerations.

2.5 Measurement Modes

This section explains the measurement modes listed in Table 1 on page 3.

2.5.1 Continuous Wave (CW)

Use CW for measuring un-modulated CW RF signals.

2.5.2 Burst Average Power (BAP)

The Burst Average Power (BAP) mode measures the average power during an RF burst (See Figure 2). This mode is very useful for measurement of pulse modulated signals which are not flat or have amplitude modulation during the pulse ON period, as in the case of TDMA (Time Division Multiple Access) communications signals. In this mode, the sensor (GT-8551A, GT-8552A, or GT-8555A) recognizes the beginning and end of a burst of RF power and takes an average of the power during that burst. The RF level can vary over a wide range during the burst as long as it remains above a noise threshold, which is automatically calculated by Measurement Xpress. As soon as the RF power drops below the noise threshold, the RF burst is complete and all further readings are discarded until the next burst starts.

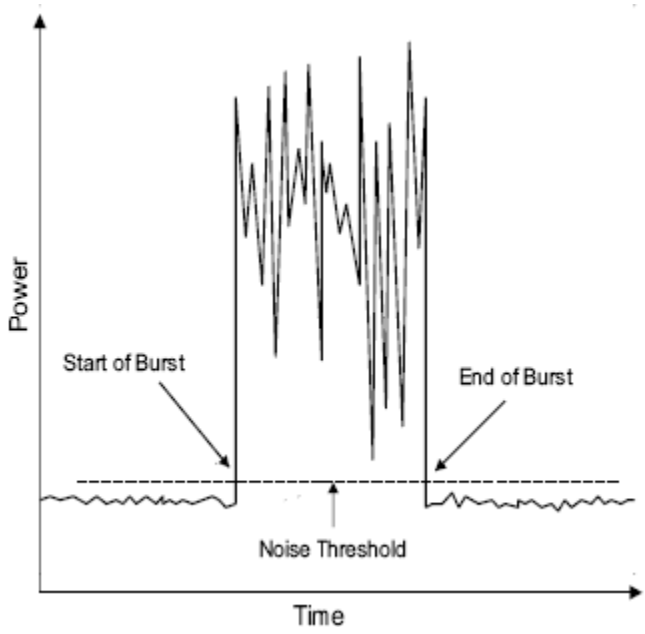


Figure 2. Burst Measurement

In BAP mode, the sensor automatically determines which portions of the signal are in the pulse and which are not. In computing the average power, the sensor uses only those portions that are within the pulse. The result is that, independent of the signal's pulse duty cycle, the meter always reads the average power in the pulse or burst. As with the PAP mode, when measuring a pulse modulated signal with 50% duty cycle, the reading in the BAP mode would be 3 dB higher than in the MAP mode. However, in the BAP mode, the signal's duty cycle can change dynamically in time without affecting the meter reading. In the PAP mode, the duty cycle factor must be entered to match the duty cycle of the pulsed signal.

NOTE: BAP Mode requires a minimum pulse on or off time as determined by the power sensor pulse width specification.

2.5.3 Modulated Average Power (MAP)

The Modulated Average Power (MAP) mode measures RF signals which are amplitude modulated, pulse modulated, or both. In the MAP mode the sensor (GT-8551A, GT-8552A, or GT-8555A) calculates the average RF power received by the sensor over a period of time controlled by the time constant of the internal digital filter. The result is comparable to measurement by a thermal power sensor.

In this mode, the sensor measures the average power of CW and modulated signals, such as:

- AM
- Two-tone
- Multi-carrier
- Pulse modulation
- Digital modulation (QPSK, QAM, etc.)

For example, if an RF signal is pulse modulated at 50 Hz with a 10% duty cycle is measured with the averaging factor set to 128, the measured power reading will be 10% of the peak power during pulse ON periods. If the signal is modulated at a low pulse rate (below about 1 kHz), the sensor will synchronize the readings precisely with the start of a pulse so that each displayed reading is averaged over a whole number of pulses (there are no fractional pulses included in the measurement). This eliminates a significant amount of noise from the readings. However, even though the filter settling time has been set to a long time constant of 2.56 seconds, the update rate of the reading will be much faster; even the first reading will be very close to the fully settled value.

2.5.4 Pulse Average Power (PAP)

The Pulse Average Power (PAP) mode is similar to the MAP mode, but it measures pulse-modulated signals having a known duty cycle. Specify this duty cycle and the sensor (GT-8551A, GT-8552A, or GT-8555A) will automatically correct the measurements so that the displayed readings indicate the peak RF power during pulse ON periods. For example, when measuring a pulse modulated signal with 50% duty cycle, MAP mode would give a reading 3 dB lower than the reading that would be given by PAP mode with the duty cycle factor set to 50%.

NOTE: The duty cycle correction presumes a perfectly rectangular profile for the RF pulse shape. Any abnormality such as overshoot, undershoot, slow rise time or fall time, inaccuracy of the duty cycle, or deviation from a flat pulse response will cause errors in the indicated reading.

2.6 USB Considerations

Under normal circumstances, the Universal Serial Bus (USB) provides adequate power for the sensor. However, when the application requires a longer cable (greater than 3 to 5 meters), an active or self-powered hub may be required. The sensor electronics are powered by the USB and typically draws 450 mA at a nominal 5 VDC. An active hub will compensate for the DC voltage drop beyond approximately 3 to 5 meters. An active hub is recommended when using a portable computer to conserve battery life, or when powering multiple sensors.

The GT-8550A Series USB Power Sensors are compliant with USB standard 2.0 and above. The following information is provided for reference when selecting a hub:

USB Hub Considerations:

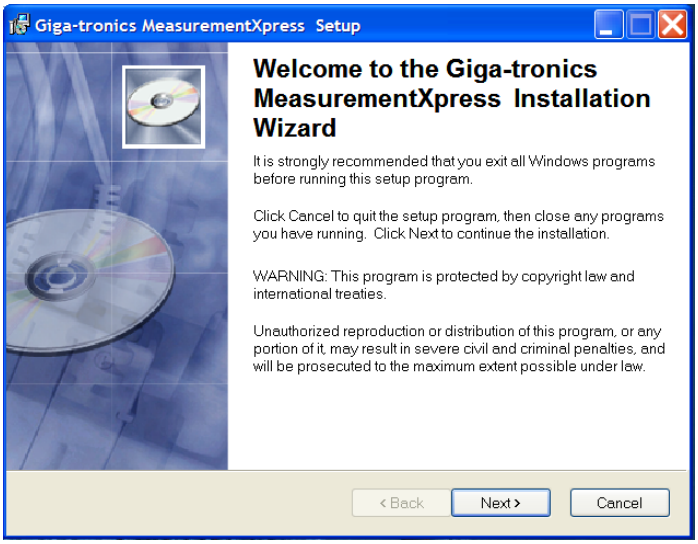
- *Bus-powered hub:* Draws a maximum of 100 mA at power up and 500 mA during normal operation.
- *Self-powered hub:* Draws a maximum of 100 mA and *must* supply 600 mA to each port.
- *Low power, bus-powered functions:* Draws a maximum of 100 mA (often applies to portable computers
- *High power, bus-powered functions:* Self-powered hubs: draws a maximum of 100 mA and *must* supply 500 mA to each port
- *Suspended device:* Draws a maximum of 0.5 mA.

2.7 Install Measurement Xpress

This section describes how to install the Measurement Xpress software on a computer.

NOTE: Refer to Table 2 on page 4 for the requirements for the computer in which Measurement Xpress will be installed.

Table 3: Installation Procedure for Measurement Xpress

Install Measurement Xpress	
Step	**Action**
1.	Connect the GT-8550A Flash Drive to a USB port on the computer.
2.	Locate and run MXsetup.exe on the GT-8550A Flash Drive. The first setup window is displayed (see Figure 3). ***Note:*** *The installation file for 64 bit systems ends with "_x64.exe".*  **Figure 3. Measurement Xpress Installation: Welcome Screen**
3.	Click Next in the setup window.

Install Measurement Xpress	
Step	**Action**
4.	In the License Agreement window, read the license agreement, then click on "I accept the license agreement," then click Next.

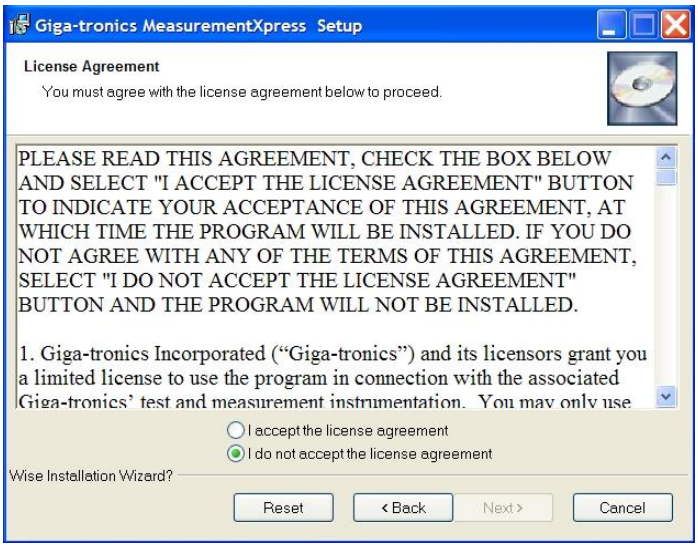


Figure 4. Measurement Xpress Installation: License Agreement

5.	In the User Information window, fill in the user information fields, then click Next.

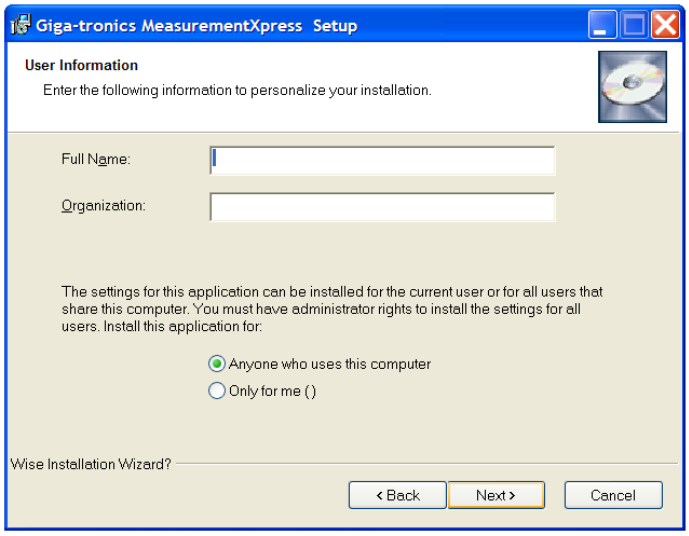


Figure 5. Measurement Xpress Installation: User Information

Install Measurement Xpress	
Step	**Action**
6.	In the Destination Folder window, you can leave the destination folder set for the default, or use Browse to select another folder. When you have made your choice, click Next.

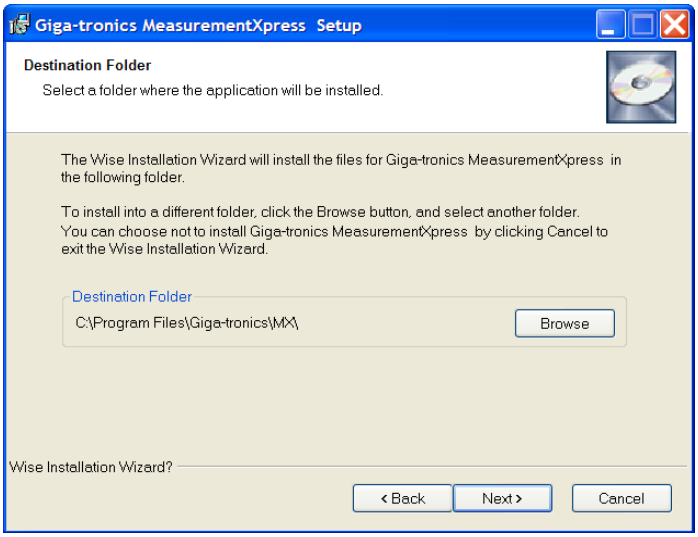


Figure 6. Measurement Xpress Installation: Destination Folder

7.	In the Ready to Install window, click Next to proceed with the installation.

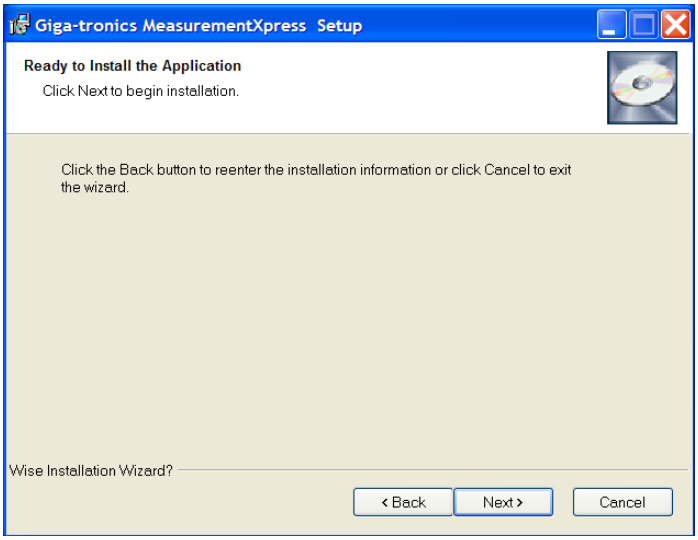
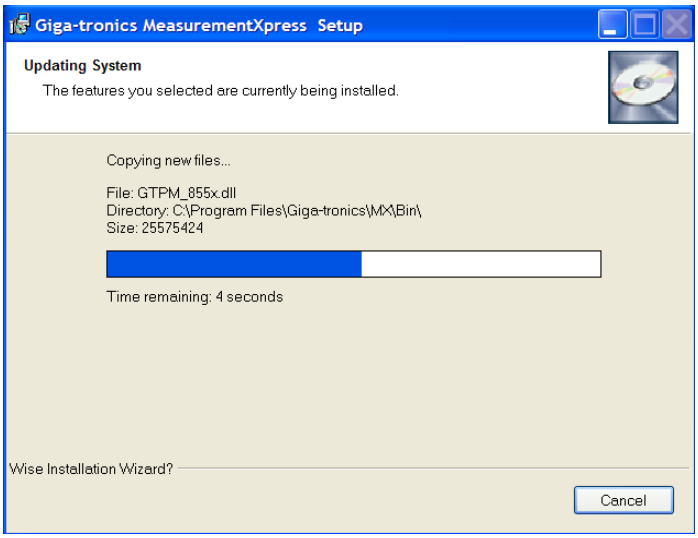
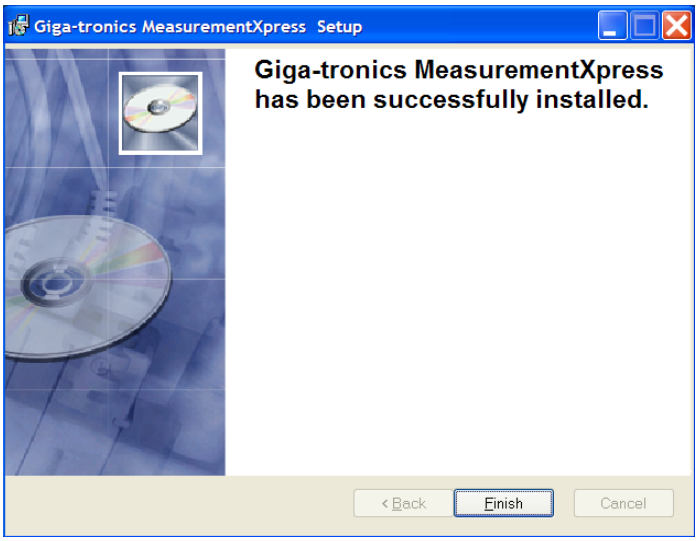


Figure 7. Measurement Xpress Installation: Ready to Install

Install Measurement Xpress	
Step	**Action**
8.	Measurement Xpress installs on your computer.  Figure 8. Measurement Xpress Installation: Installation Begins
9.	The Successful Installation window appears when Measurement Xpress has completed its installation.  Figure 9. Measurement Xpress: Installation Successful
End of Procedure	

2.8 Install the GT-8550A Series USB Power Sensors

CAUTION **ESD-SENSITIVE DEVICE**

Observe Electro-Static Discharge precautions when handling the GT-8550A Series USB Power Sensor:

- Work at an ESD-safe workstation
- Keep the power sensor in an anti-static bag when not using it.
- Handle the power sensor with appropriate anti-static clothing and wrist strap, or other discharge path.

NOTE: Measurement Xpress software MUST be installed on the computer BEFORE the GT-8550A Series USB Power Sensors are connected to the computer.

After Measurement Xpress has been installed, there are two methods for configuring the computer for using the power sensors:

- Automatic installation: Simply connect the USB power sensor to a USB port on the computer, and follow the prompts in the Hardware Wizard. To use this method, go to Table 4 below.
- Manual installation: Installing the device manually is recommended only if your computer is unable to properly identify the correct driver. To use this method, go to Table 5 on page 13.

Multiple Sensors: To install multiple sensors (up to 12), perform the installation procedure completely for each sensor.

Table 4: Power Sensor Installation (Automatic)

Automatic Installation of a Power Sensor	
Step	**Action**
1.	Verify that Measurement Xpress is installed, but not launched on your computer.
2.	Connect the supplied USB cable to the USB sensor.
3.	Connect the other end of the USB cable to a USB port on your computer. Observe that the green LED on the end of the sensor illuminates. This indicates that the sensor is properly connected to the computer's USB port. (Trigger input applies to GT-8551A, GT-8552A, and GT-8555A only)

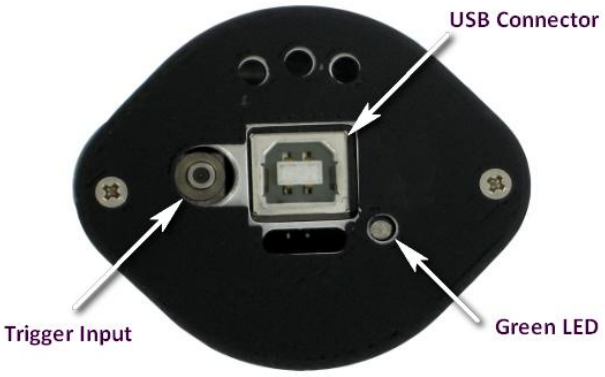


Figure 10. Back End of USB Power Sensor

Automatic Installation of a Power Sensor	
Step	**Action**
4.	The Hardware Wizard opens on the computer.
5.	Click on the Install the Software automatically option, then click Next.
6.	After the software identifies the Giga-tronics GTPM-855x device, click Next to complete the installation process.
7.	When the installation completes, select “Finish” to close the Hardware Update Wizard. The power sensor is now ready for use with Measurement Xpress.
End of Procedure	

Table 5: Power Sensor Installation (Manual)

Manual Installation of a Power Sensor	
Step	**Action**
1.	After connecting the USB power sensor, the computer will indicate “Found New Hardware” and automatically open the Hardware Wizard to configure the USB device driver for the power sensor.
2.	Select “Install from a list or specific location (Advanced)” and click Next to continue.
3.	In the following window, select “Don’t search, I will choose the driver to install,” then click Next.
4.	Select the Giga-tronics device, then click “Have Disk”.
5.	Select GTPM_855X.inf and click Open to continue.
6.	Select “Next” to continue the installation process.
7.	When the installation completes, select “Finish” to close the Hardware Update Wizard. The power sensor is now ready for use with Measurement Xpress.
End of procedure	

2.9 Start Measurement Xpress

Table 6: Starting Measurement Xpress

Start Measurement Xpress	
Step	**Action**
1.	Connect a GT-8550A Power Sensor to a USB port on your computer. A green LED illuminates on the sensor, indicating that it is properly connected to the computer.
2.	Start Measurement Xpress. Figure 11 shows the initial Measurement Xpress window. The Connection Selection window opens every time you start Measurement Xpress. This window shows which (if any) USB power sensors are connected to the computer. In the Connection Selection window, click on OK to continue. ***Please be patient:*** This operation may require a few minutes depending on variables such as the PC configuration and number of sensors.

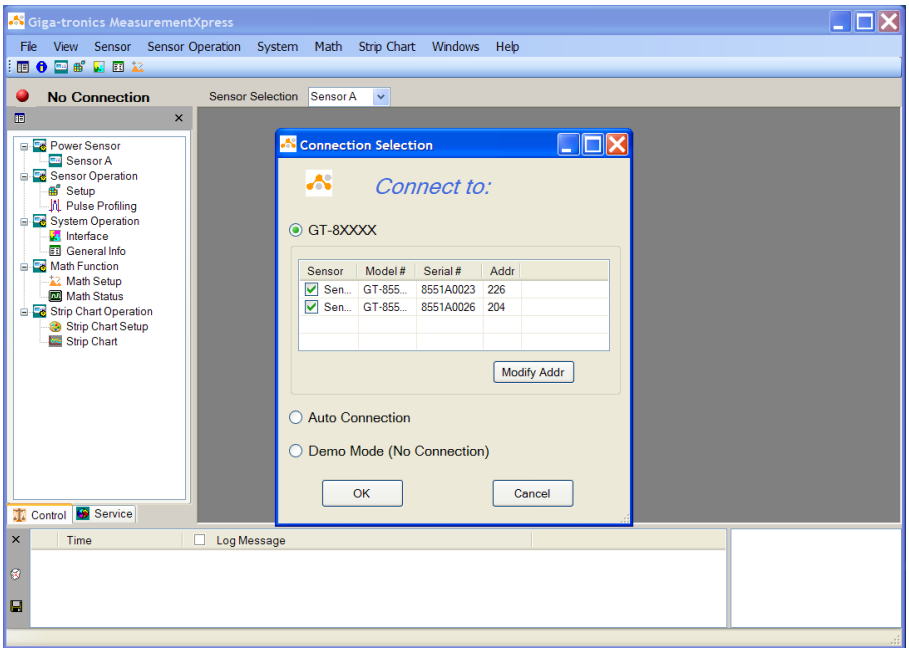
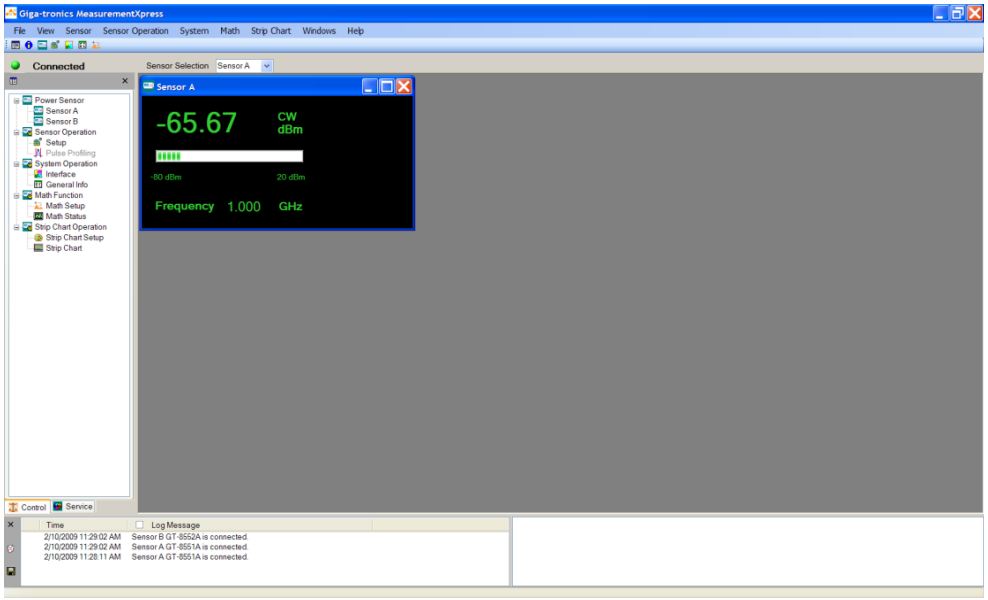
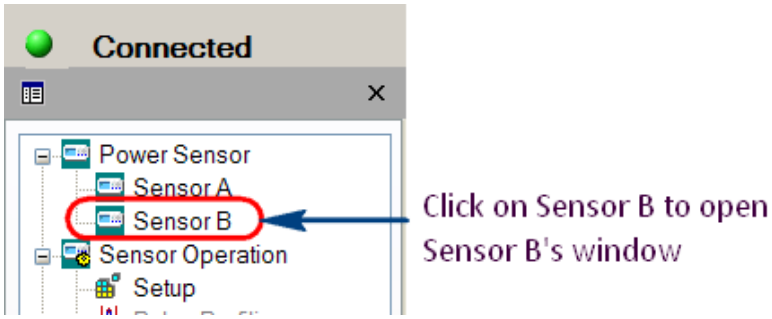


Figure 11. Measurement Xpress Initial Display

Start Measurement Xpress	
Step	**Action**
3.	The Connection Selection window disappears, and a Sensor window appears (see Figure 12).  Figure 12. Measurement Xpress with Sensor Window
4.	If there are multiple sensors connected to the computer, you can open a window for each of them at any time. In the Navigation window, click on the sensor that you want to open (in this case, Sensor B). See Figure 13. ***NOTE:*** Figure 12 and Figure 13 show Measurement Xpress with two sensors connected. In practice, there can be up to 12 sensors connected for Measurement Xpress.  Figure 13. Open a Sensor Window
End of Procedure	

3 Using Measurement Xpress

3.1 Overview

This chapter describes in detail the Measurement Xpress (MX) Graphical User Interface (GUI).

3.2 Main Areas of the Measurement Xpress GUI

Figure 14 below shows Measurement Xpress with two sensors connected to the computer. The main areas of the GUI are bordered in red.

The next sections describe each of the main areas shown in Figure 14.

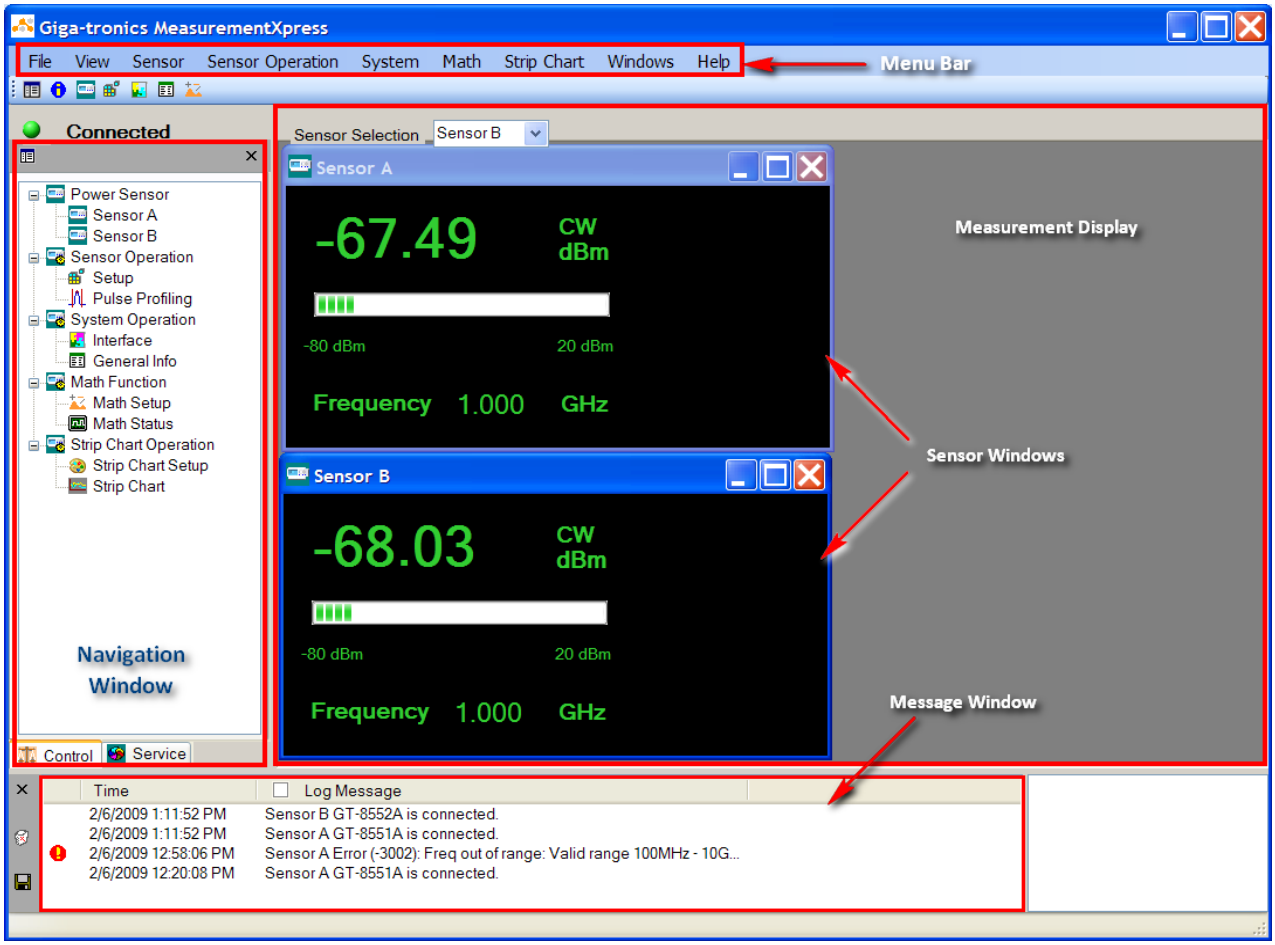


Figure 14. Measurement Xpress GUI

3.3 Menu Bar

This section describes in detail the menus in the Menu Bar.

NOTE: Where a mouse click on a menu item leads to a selection, the symbol > is used. For example, clicking on File in the Menu Bar reveals the selection Exit. This is shown by:

File > Exit.

Table 7: Measurement Xpress Menu Bar

Measurement Xpress Menu Bar	
Parameter Name	**Description**
File > Exit	Closes Measurement Xpress
View > Navigation Window Or	Opens the Navigation Window (opens by default upon launch of Measurement Xpress).
View > Message Window	Opens the Message Window (opens by default upon launch of Measurement Xpress).
Sensor > Sensor A Or Sensor > Sensor B	Clicking on the Sensor menu item shows the sensors that are connected to the computer. Clicking on a selection opens that sensor window. Figure 15 shows two sensor windows opened.

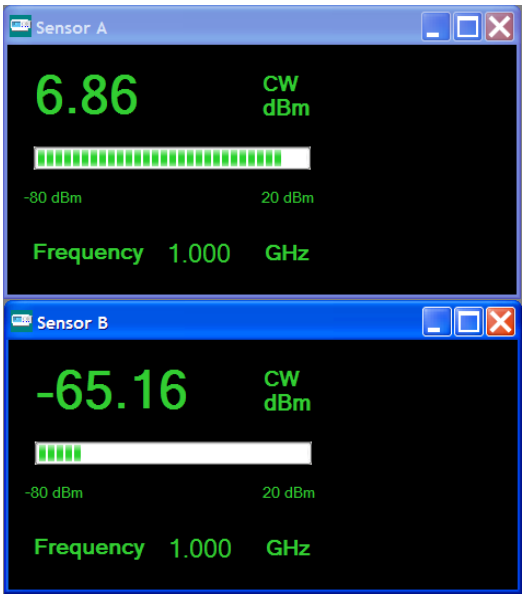


Figure 15. Sensor Windows

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Sensor Operation > Setup	**Sensor Setup/General tab:** Figure 16 shows the Sensor Setup window that opens when you select Setup.

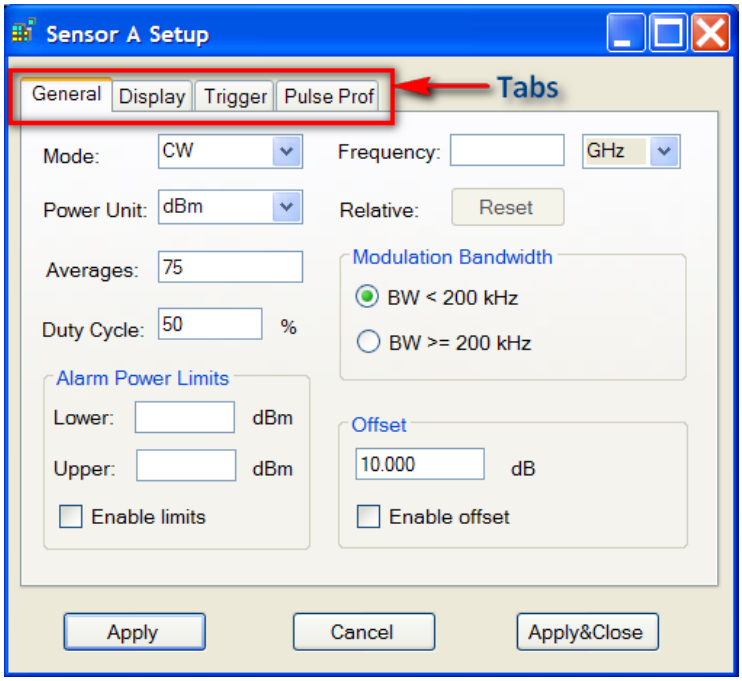


Figure 16. Sensor Setup Window, General Tab

- Mode: selects the measurement mode. The model of GT-8550A sensor determines the type of measurements you can make. The measurement mode choices are:
  - CW
  - MAP
  - BAP
  - PAP

These measurement modes are explained in section 2.5 on page 4.

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Sensor Operation > Setup	**General tab (continued):** refer to Figure 16 on page 18**.** • ***Power Unit***: selects the measurement unit that best suits your application. • ***Averages***: use when measuring a CW signal that varies in power over time. Minimal averaging is 1, which averages the power measurement over approximately 0.5 ms. If the signal's power variation is slower, a greater average number must be used. Generally, the correct Averaging setting can be found by starting with a small number, and increasing it until CW readings stabilize. • ***Duty Cycle***: available only in PAP measurement mode (see section 2.5.4 on page 6). Enter the duty cycle of the signal to ensure accurate readings. • ***Alarm Power Limits (Upper and Lower)***: allows you to select power levels for activating the alarm. • ***Enable limits***: activates the alarm according to the limits set in the previous item. • ***Frequency***: sets the frequency of the measured signal. • ***Relative (Reset)***: Power Unit must be set to dB Relative to enable this function. Whenever you click on Relative (Reset), the power indication in the Sensor window updates to show the RF power at the moment the Reset button was clicked. This is useful if the power level of the signal is drifting. • ***Modulation Bandwidth:*** this is a form of anti-alias which filters the readings. To enable this filter, select "BW > = 200 kHz." • ***Offset:*** offsets the readings by the amount entered into "dB" field. • ***Enable Offset:*** enables offset.

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Sensor Operation > Setup	**Sensor Setup/Display Tab** The settings in this window determine the information displayed in the Sensor Windows. Figure 17 shows all of the settings in the Display tab selected, and Figure 18 shows the result of selecting all display options.

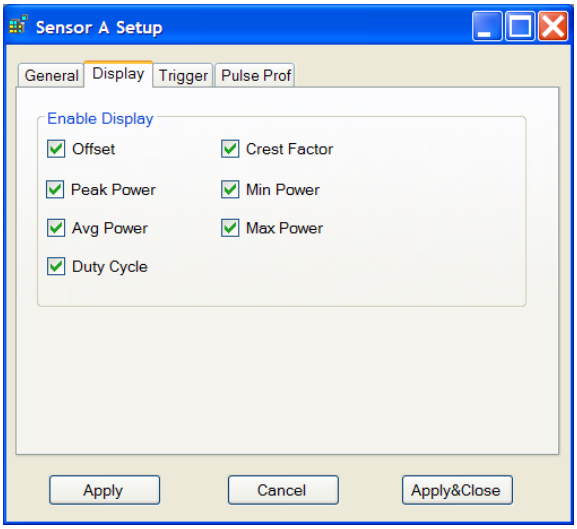


Figure 17. Sensor Setup Window/Display Tab

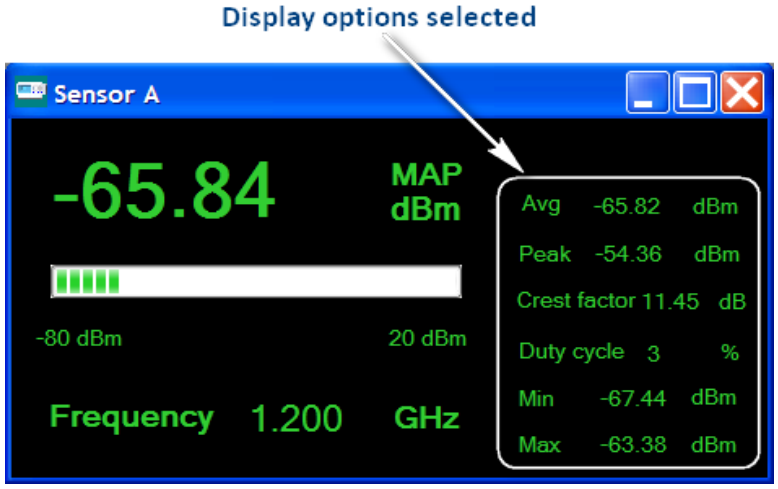
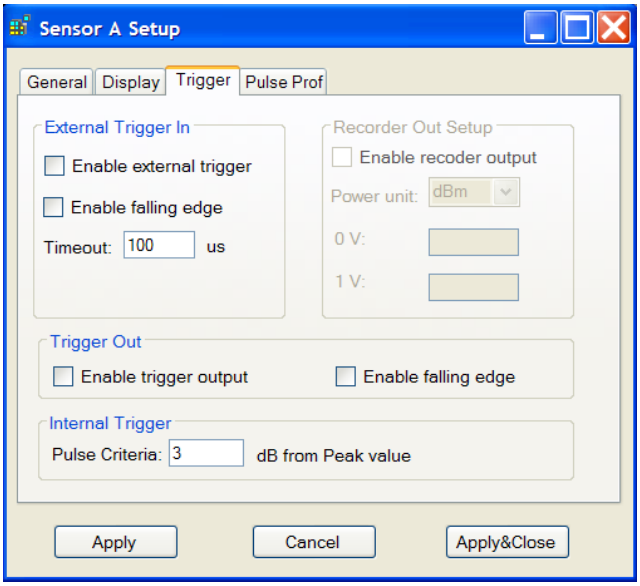
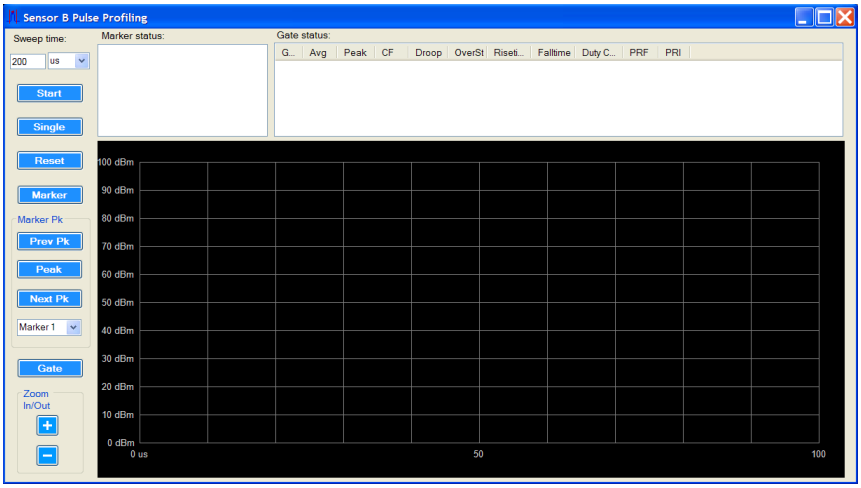


Figure 18. Sensor Window with All Display Options Selected

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Sensor Operation > Setup	**Sensor Setup/Display Tab, Continued** When CW mode is selected on the General tab, only Offset, Min Power, and Max Power is available as a selection. When any other measurement mode is selected, all of the following selections are available: • Offset: • Peak Power: • Avg Power: • Duty Cycle: • Crest Factor: • Min Power: • Max Power:
	Sensor Setup/Trigger Tab The settings in this window configure the external and internal triggers, and the recorder output. See Figure 19 below.  **Figure 19. Sensor Setup Window/Display Tab**

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Sensor Operation > Setup	**Sensor Setup/Trigger tab, Continued** External Trigger In: • *Enable External Trigger:* • *Enable Falling Edge:* • *Timeout:* Internal Trigger: • *Pulse Criteria* NOTE: Trigger out and Recorder Out features are not active at this time, but may be made available on future power USB sensor models.
Sensor Operation > Pulse Profiling	Selecting Pulse Profiling opens the Pulse Profiling window (see Figure 20 below). ***NOTE:*** The Pulse Profiling window and functions are described in detail in section 3.9 starting on page 39.  **Figure 20. Pulse Profiling Window**

Measurement Xpress Menu Bar	
Parameter Name	**Description**
System > Interface	Selecting System/Interface (see Figure 21) opens the Connection Interface window (see Figure 22).

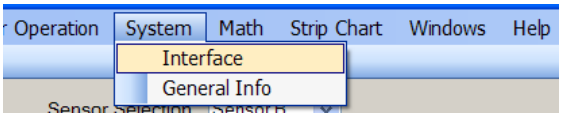


Figure 21. Selecting System/Interface

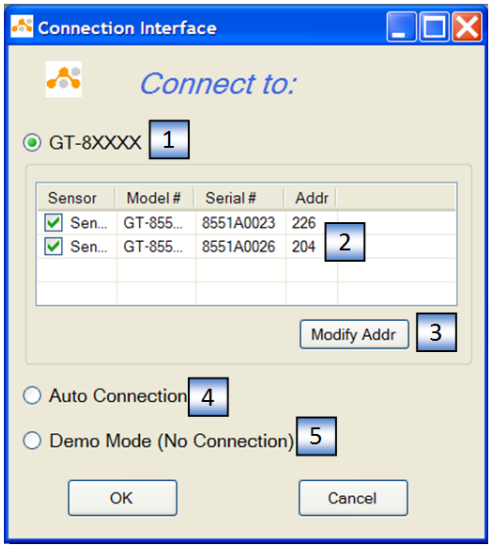


Figure 22. Connection Interface Window

1 Identifies the available sensors by model number.

2 Allows you to select or deselect the connection of sensors to Measurement Xpress.

3 Allows you to change the USB port address of a sensor.

4 Allows for Measurement Xpress to automatically detect and configure sensors.

5 Allows you to run Measurment Xpress with out sensors, for the purpose of learning about, or demonstrating, Measurement Xpress.

Measurement Xpress Menu Bar	
Parameter Name	**Description**
System > General Info	Selecting General Info from the System menu opens the General Information window (see Figure 23).

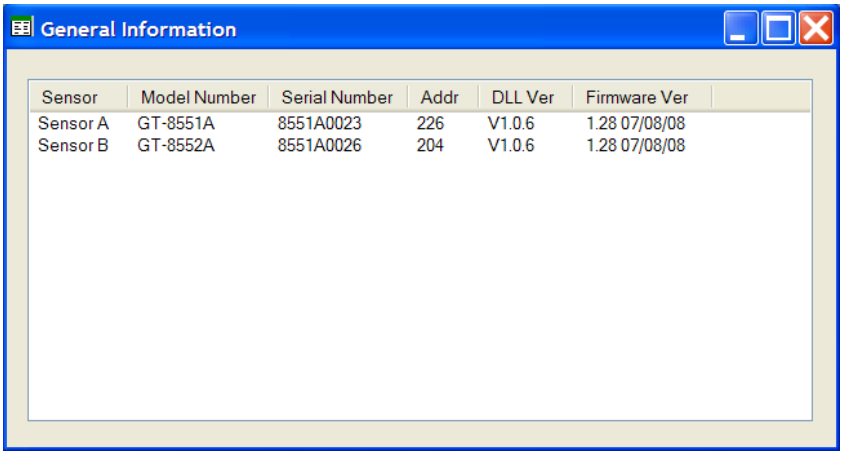
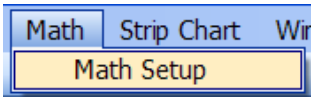
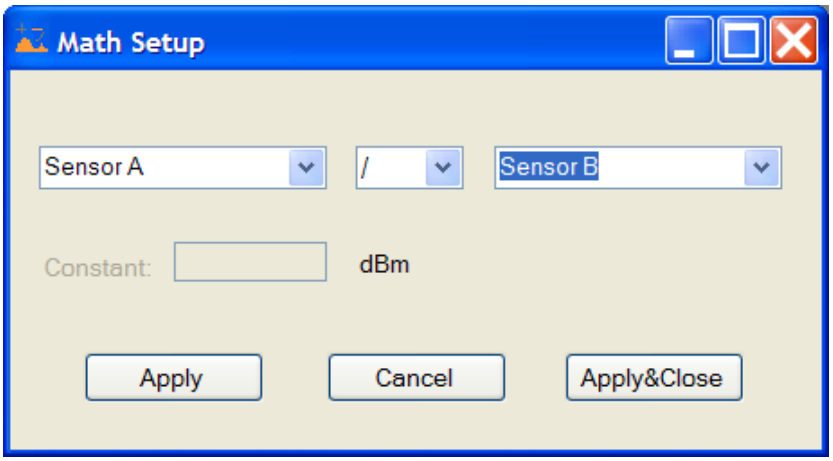


Figure 23. General Information Window

Information in this window includes:

- Sensor letter assignments (A, B)
- The model number of the GT-8550A Power Sensor connected to the computer.
- The serial number(s) of the GT-8550A Power Sensors connected to the computer.
- The address of the USB ports the GT-8550A Power Sensors are connected to.
- The version of the Giga-tronics Dynamic Link Library (DLL) installed in the computer.
- The version of the Giga-tronics firmware installed in the computer.

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Math > Math Setup	Selecting Math > Math Setup (see Figure 24) from the Menu Bar opens the Math Setup window (see Figure 25).  Figure 24. Selecting Math/Math Setup from the Menu Bar  Figure 25. Math Setup Window This window allows you to apply basic math operations between two GT-8550A Power Sensors, or between a sensor and a constant. The operations are: • Addition (+) • Subtraction (-) • Ratio (/)

Measurement Xpress Menu Bar	
Parameter Name	**Description**
Strip Chart > Strip Chart Setup	Selecting Strip Chart > Strip Chart Setup (see Figure 26) opens the Strip Chart Setup window (see Figure 27).

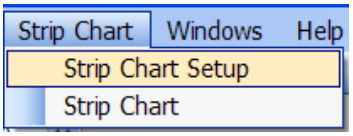


Figure 26. Selecting Strip Chart/Strip Chart Setup

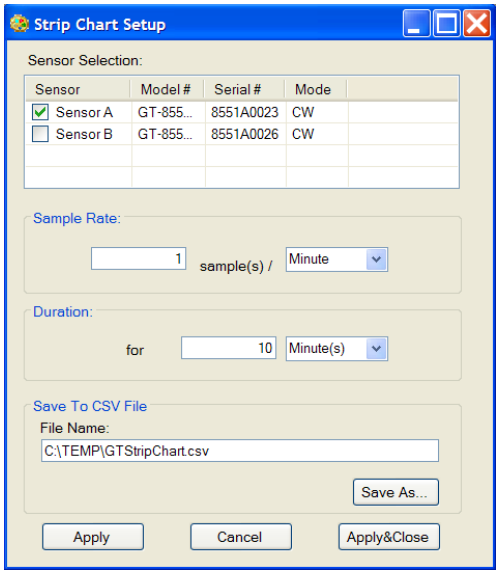
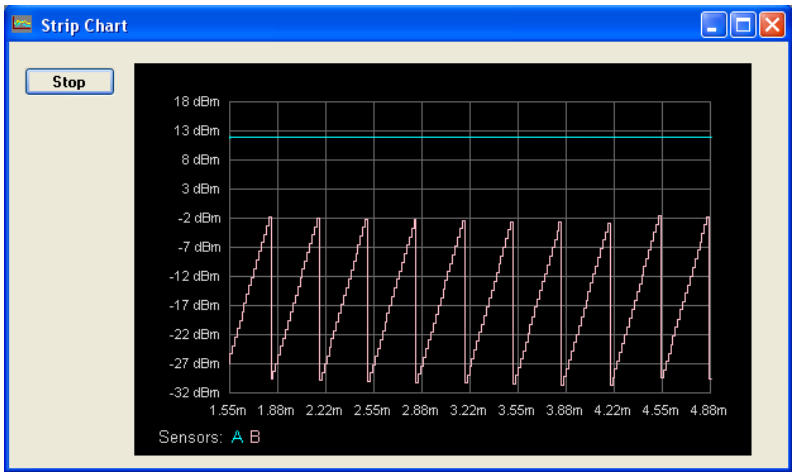


Figure 27. Strip Chart Setup Window

The settings for this window are:

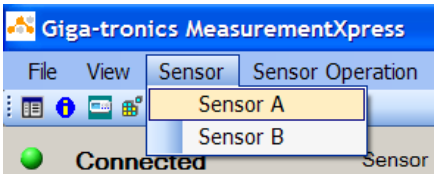
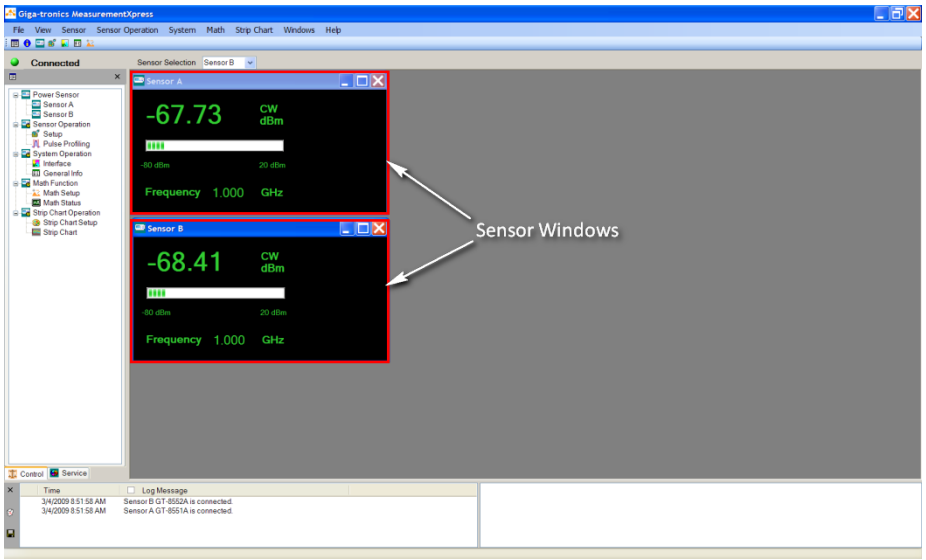
- Sensors: Select which sensors to use for the strip chart.
- Sample Rate:
  - Samples per second, minute, hour, day
- Duration: The amount of time the strip chart will record
- Name and save: Allows you to name and save individual strip chart files.

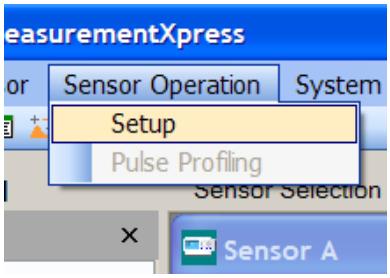
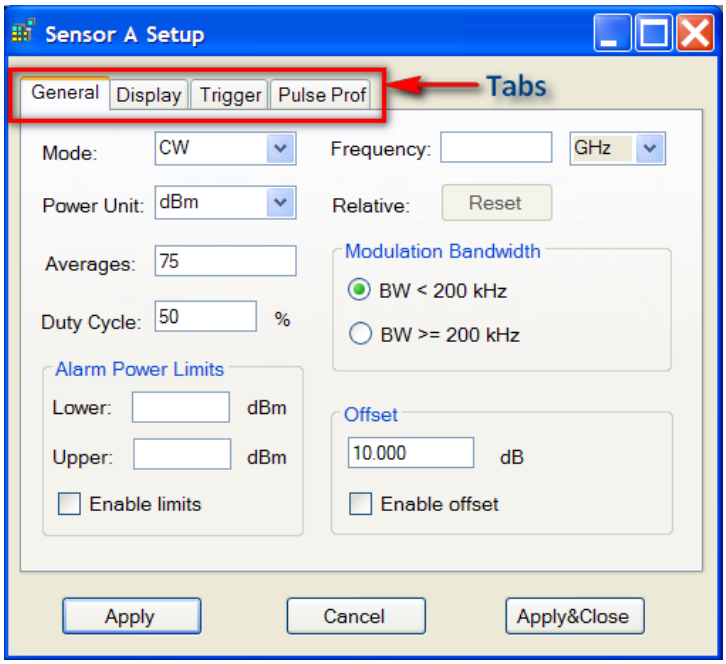
Measurement Xpress Menu Bar	
Parameter Name	**Description**
Strip Chart > Strip Chart	Selecting Strip Chart > Strip Chart opens the Strip Chart window as shown in Figure 28. Notice the following: • Two sensors are shown, A and B, and they are color-coded. • Sensor A is detecting a constant power source • Sensor B is detecting a source that is ramping in power approximately every 14 seconds.  Figure 28. Strip Chart Window
Windows	Allows you to configure the layout of the Measurement Xpress GUI
Help/About	Displays information about the version of Measurement Xpress you are using.
End of Procedure	

3.4 Configure the GT-8550A Series USB Power Sensors

Before any measurements are made in Measurement Xpress, the GT-8550A Power Sensors must be configured. This section describes how to configure the power sensors.

Table 8: Configure the GT-8550A Series USB Power Sensor

Configure the GT-8550A Series USB Power Sensors	
Step	**Action**
1.	Install the GT-8550A Power Sensors as described in section 2.8 on page 12.
2.	Start Measurement Xpress as described in section 2.9 on page 14.
3.	Open a sensor window for each sensor connected to the computer: On the Menu Bar, select Sensor > Sensor *X* (where *X* is any sensor that doesn't have a sensor window opened).  **Figure 29. Opening Sensor Windows**
4.	Repeat the previous step until all sensors connected to the computer have an open sensor window in the display area. Figure 30 shows sensor windows open for two sensors. ***NOTE:*** When you open Sensor Windows, you can drag and dock them to a convenient location, as shown in Figure 30.  **Figure 30. Two GT-8550A Power Sensors Connected to the Computer**
5.	Click on a Sensor Window to select that sensor for configuration.

Configure the GT-8550A Series USB Power Sensors	
Step	**Action**
6.	On the Menu Bar, select Sensor Operation > Setup (see Figure 31).  Figure 31. Select Sensor Operation/Setup
7.	The Sensor Setup window appears (see Figure 32).  Figure 32. Sensor Setup Window
8.	Configure the Sensor Setup window according to your testing needs. Complete information on configuring the Sensor Setup Window is available starting on page 18.
9.	When you have finished configuring the sensor, click on Apply&Close to apply the settings to the sensor.
10.	If you want to configure other sensors, repeat these instructions, starting at Step 5.
End of Procedure	

3.5 Measure CW Power

This section describes how to use Measurement Xpress to make CW power measurements.

Table 9: Measure CW Power

Measure CW Power	
Step	**Action**
1.	If necessary, do the following: • Connect the GT-8550A USB Power Sensors to the computer (see section 2.8 on page 12). • Configure the sensors (see section 3.4 on page 28).
CAUTION	**DO NOT APPLY EXCESSIVE POWER TO THE GT-8550A SERIES USB POWER SENSORS.** • Read the specifications for the power sensor (see Table 1 on page 3) • Know the approximate power level of the signal of interest before applying it to the GT-8550A.
2.	Before connecting the RF signal to the GT-8550A Power Sensor, de-energize (turn OFF) the RF signal.
3.	Connect the GT-8550A Power Sensor to the RF source.
4.	There are different ways to measure CW power. Choose among the following: • To determine RF power: use the Sensor window (see Figure 15 on page 17). • If you want to view a CW source that is changing over time: use the Strip Chart (see page 26).
End of Procedure	

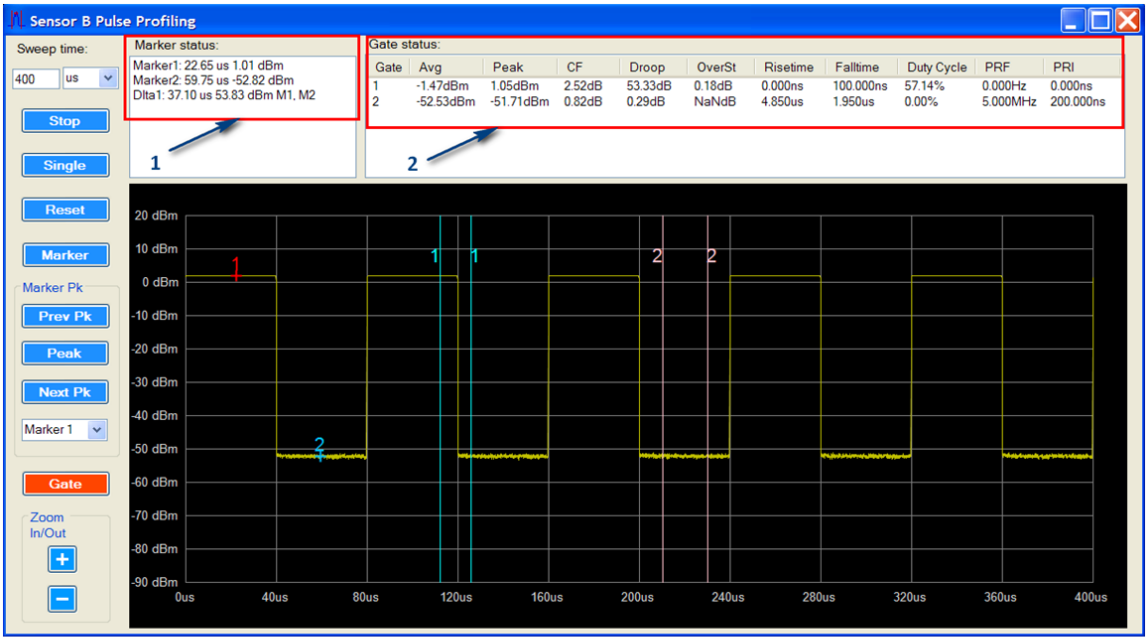
3.6 Measure Pulse Power

Measurement Xpress makes it possible to measure and view different aspects of pulse power. We recommend that you review the different pulse-power measuring methods offered by Measurement Xpress in section 2.5 starting on page 4, and the appropriate sensor for the measurement.

Table 10: Measure Pulse Power

Measure Pulse Power	
Step	**Action**
1.	If necessary, do the following: • Connect the appropriate GT-8550A Series USB Power Sensors to the computer (see section 2.8 on page 12). • Configure the sensors for making pulse measurements according to your test needs (see section 3.4 on page 28).
CAUTION	**DO NOT APPLY EXCESSIVE POWER TO THE GT-8550A SERIES USB POWER SENSORS.** • Read the specifications for the power sensor (see Table 1 on page 3) • Know the approximate power level of the signal of interest before applying it to the GT-8550A.
2.	Before connecting the RF signal to the GT-8550A Power Sensor, de-energize (turn OFF) the RF signal.
3.	Connect the GT-8550A Power Sensor to the RF source.
4.	Energize the RF signal.
5.	Figure 33 shows the Sensor A window under the following example conditions: • Sensor type: GT-8552A USB Power Sensor • RF input: square wave; pulse period, 80 us; pulse width, 40 us; power, 1 dBm • Measurement settings: note the settings in the Sensor Window bordered in red (see Figure 33 below).  Figure 33. Sensor A Window

Measure Pulse Power	
Step	**Action**
6.	Figure 34 uses Pulse Profiling to display the same signal shown in Figure 33 on the page 31. Note the use of markers and a gate. Figure 34 includes blow-ups of the Marker Status and Gate Status panes.



1

Marker status:

Marker1: 22.65 us 1.01 dBm
Marker2: 59.75 us -52.82 dBm
Dlta1: 37.10 us 53.83 dBm M1, M2

2

Gate status:

Gate	Avg	Peak	CF	Droop	OverSt	Risetime	Falltime	Duty Cycle	PRF	PRI
1	-1.47dBm	1.05dBm	2.52dB	53.33dB	0.18dB	0.000ns	100.000ns	57.14%	0.000Hz	0.000ns
2	-52.53dBm	-51.71dBm	0.82dB	0.29dB	NaNdB	4.850us	1.950us	0.00%	5.000MHz	200.000ns

Figure 34. Pulse Profiling

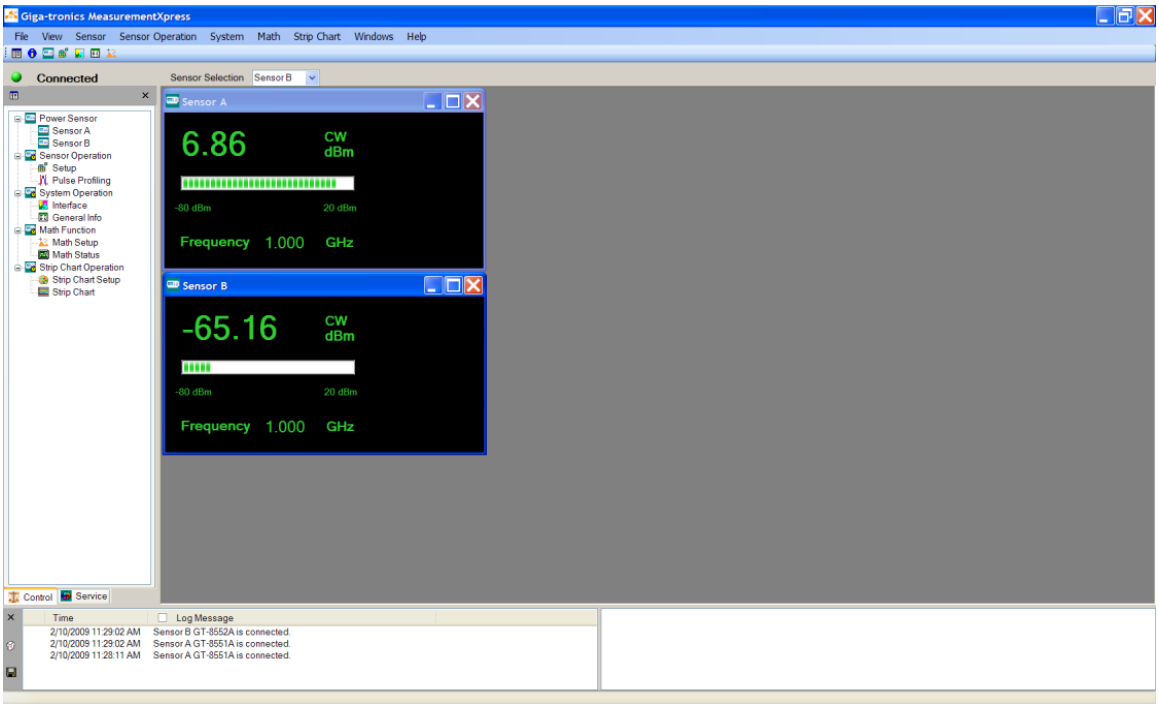
End of Procedure

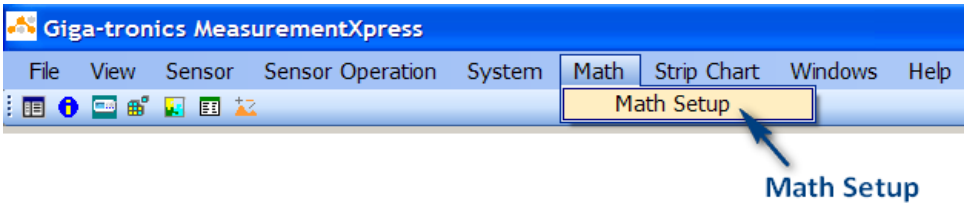
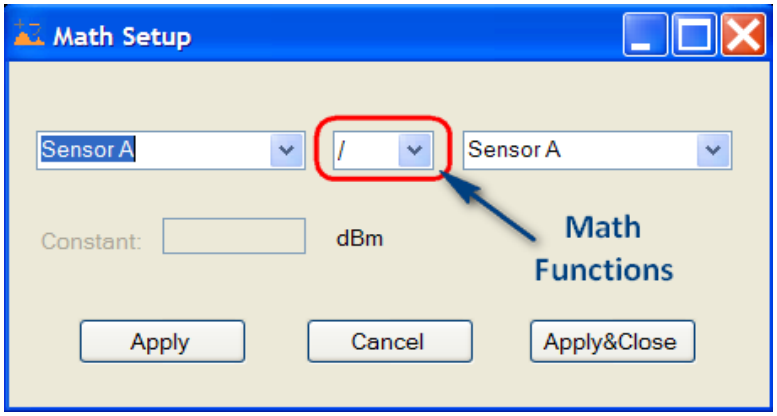
3.7 Use the Math Functions

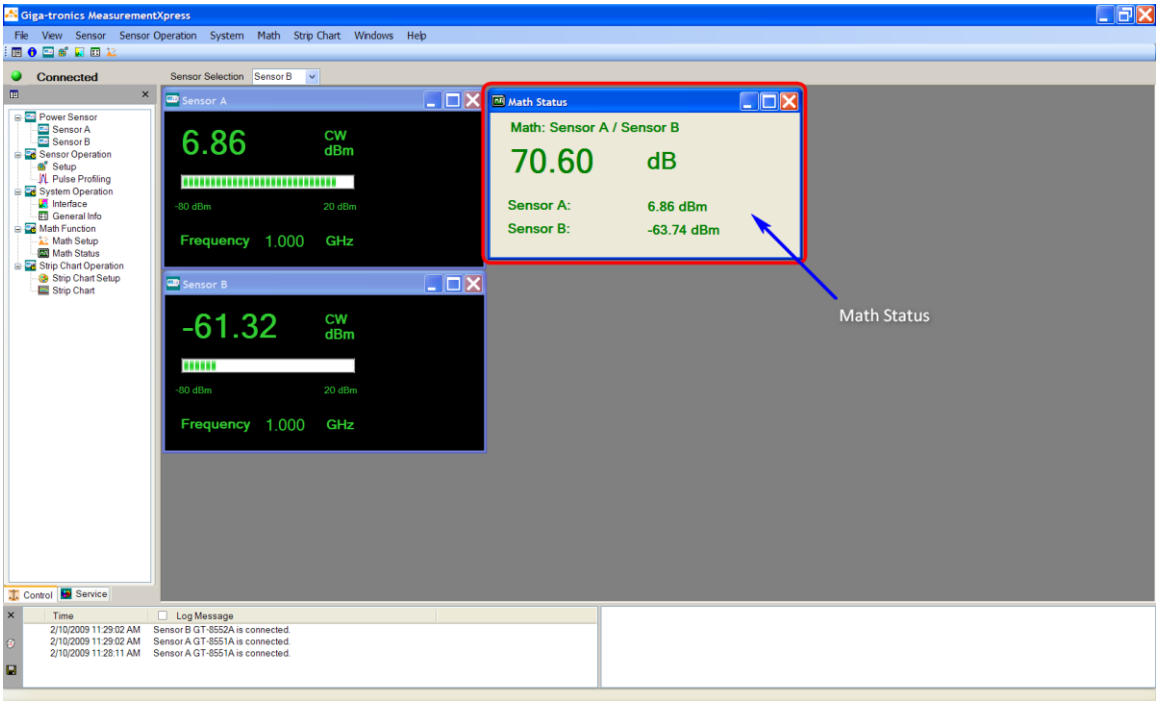
This procedure describes how to use the math functions of Measurement Xpress. The math functions enable you to add, subtract, or divide the outputs of two sensors, or of one sensor to a settable constant.

To demonstrate the Math functions, we will connect a 1 dBm, 1 GHz CW signal to a GT-8550A Power Sensor.

Table 11: User the Math Functions

Use the Math Functions	
Step	**Action**
1.	If necessary, do the following: • Connect the GT-8550A Power Sensor to the computer (see section 2.8 on page 12). • Configure the sensors for making CW measurements (see section 3.4 on page 28).
CAUTION	**DO NOT APPLY EXCESSIVE POWER TO THE GT-8550A SERIES USB POWER SENSORS.** • Read the specifications for the power sensor (see Table 1 on page 3) • Know the approximate power level of the signal of interest before applying it to the GT-8550A.
2.	Setup Measurement Xpress to display sensor windows for both USB power sensors. See Figure 35.  Figure 35. Measurement Xpress with Two Power Sensors

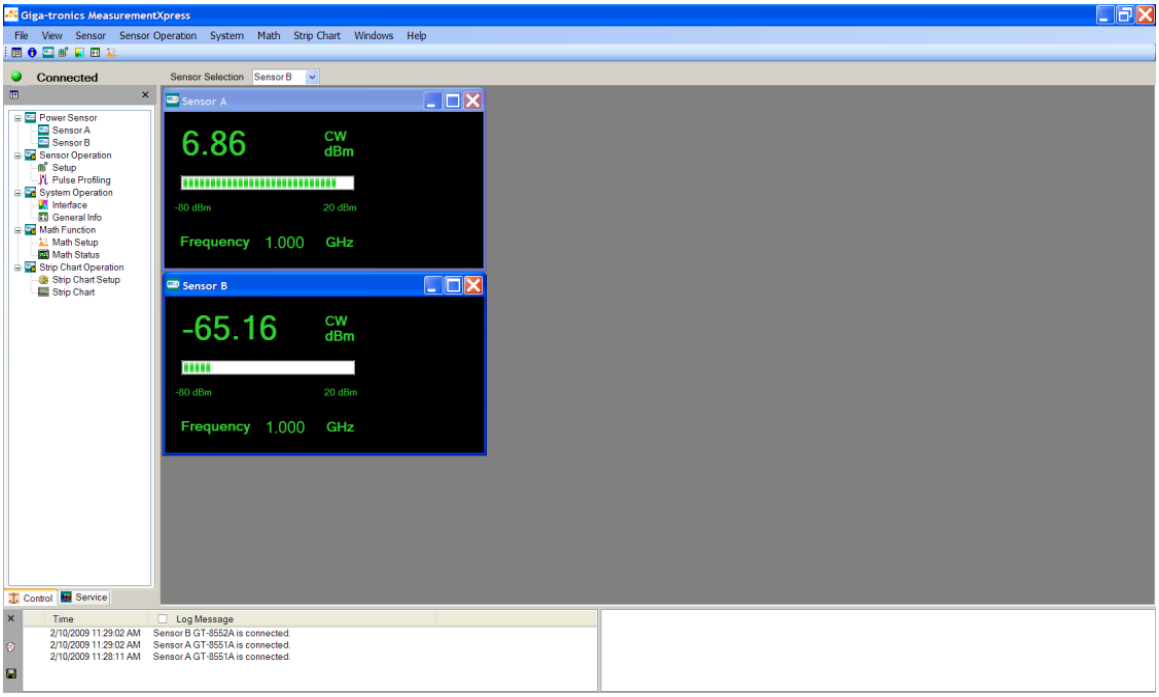
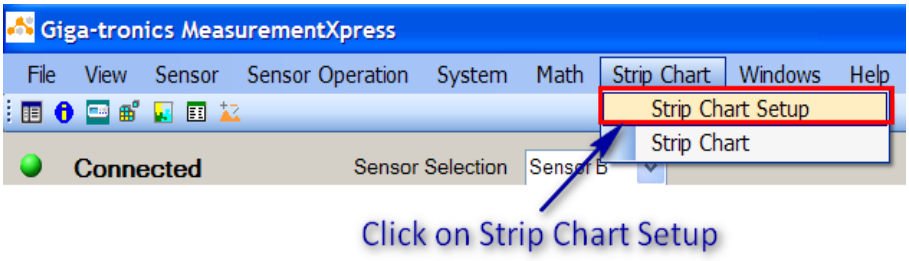
Use the Math Functions	
Step	**Action**
3.	On the Menu bar, click on Math > Math Setup (see Figure 36).  Figure 36. Select math Setup
4.	The Math Setup window opens (see Figure 37). In this window: • Select the relationship between the sensors. • In the middle field in the window, click the down arrow (V) to select the math function you require (/, +, or –). • Click on Apply&Close.  Figure 37. Math Setup Window

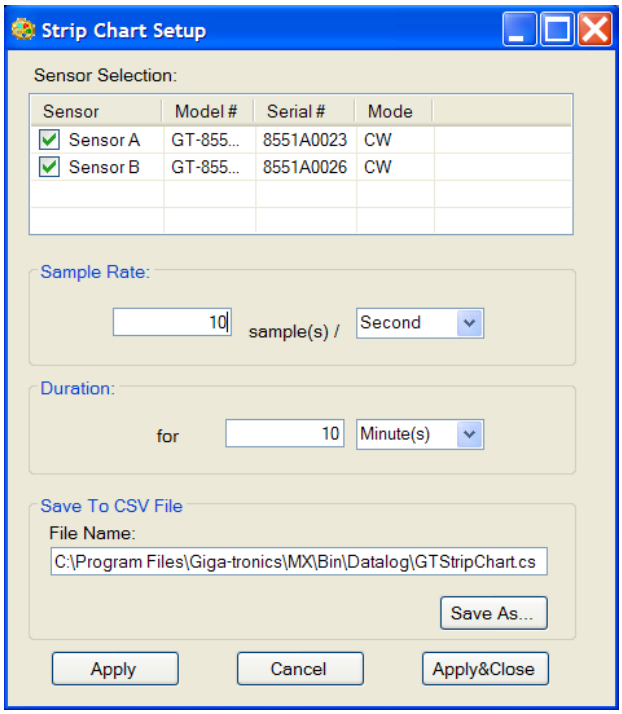
Use the Math Functions	
Step	**Action**
5.	The Math Setup window closes, and the Math Status window opens (see Figure 38). Notice that the Math Status window constantly updates the resultant value as the individual sensor outputs change.  Figure 38. Math Status Window
6.	You can close the Math Status window anytime by clicking on the **X** in the upper right-hand corner of the window.
End of Procedure	

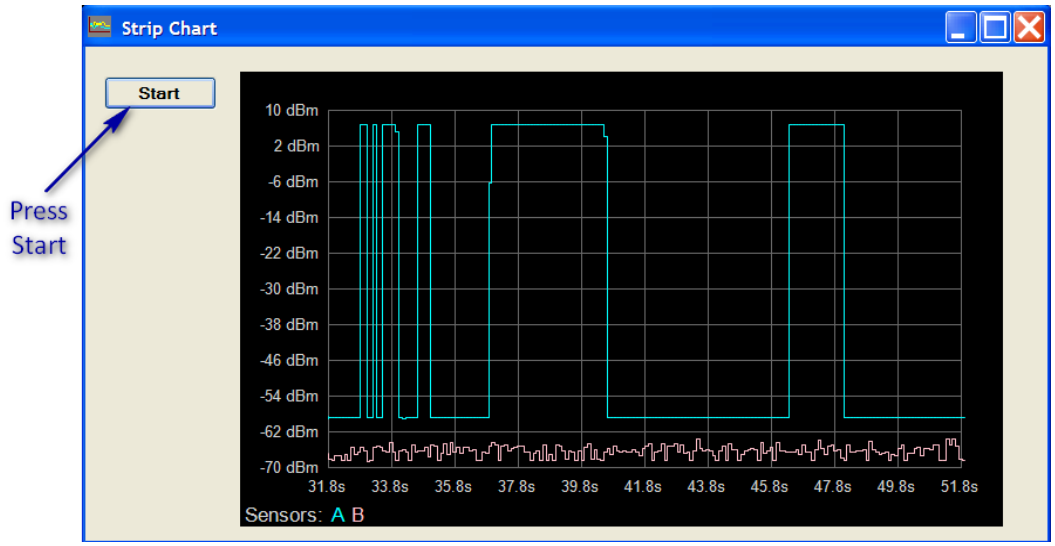
3.8 Use the Strip Chart Function

This section describes how to use the Strip Chart function of Measurement Xpress.

Table 12: Use the Strip Chart Function

Use the Strip Chart Function	
Step	**Action**
1.	Configure the power sensors according to your application. Figure 39 below shows Measurement Xpress configured to display two sensors.  Figure 39. Measurement Xpress Configured to Display Two Power Sensors
2.	On the Menu bar, click on Strip Chart > Strip Chart Setup (see Figure 40).  Figure 40. Selecting Strip Chart Setup

Use the Strip Chart Function	
Step	**Action**
3.	The Strip Chart Setup dialog box opens. Configure the strip chart (see Figure 41): • Select which sensor(s) the strip chart will record. • Select the Sample Rate • Select the Duration • Name and save the file for the strip chart file. There are no name or location restrictions on naming and saving these files. • ***NOTE:*** The Strip Chart saves the information as a Comma Separated Values (CSV) file, which can be opened in Microsoft Excel.  Figure 41. Strip Chart Setup
4.	Click Apply&Close to apply the settings and close the Strip Chart Setup window.

Use the Strip Chart Function	
Step	**Action**
5.	The strip chart window opens. Click on Start to begin recording on the strip chart (see Figure 42). Note the following about Figure 42: • Both power sensors are shown, and each is color-coded: Sensor A is blue, and Sensor B is pink.  Figure 42. The Strip Chart Window
6.	When you clicked on Start in the Strip Chart window, Start changed to Stop. Press Stop anytime to stop the strip chart.
End of Procedure	

3.9 The Pulse Profiling Window

This section describes the parameter you can set and view in the Pulse Profiling window (see Figure 43 below).

To open the Pulse Profiling window, you must use a GT-8552A or GT-8555A USB Power Sensor. When the sensor is connected to the computer, and its sensor window is open and selected, the Pulse Profiling function is enabled both in the Menu Bar, and in the Navigation Window (Sensor Operation/Pulse Profiling). Click on either of these to open the Pulse Profiling window.

The settings and features available for the Pulse Profiling are described on the following pages.

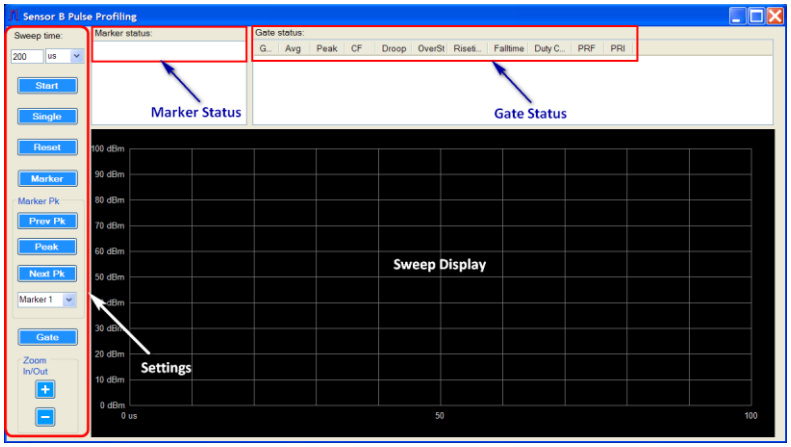
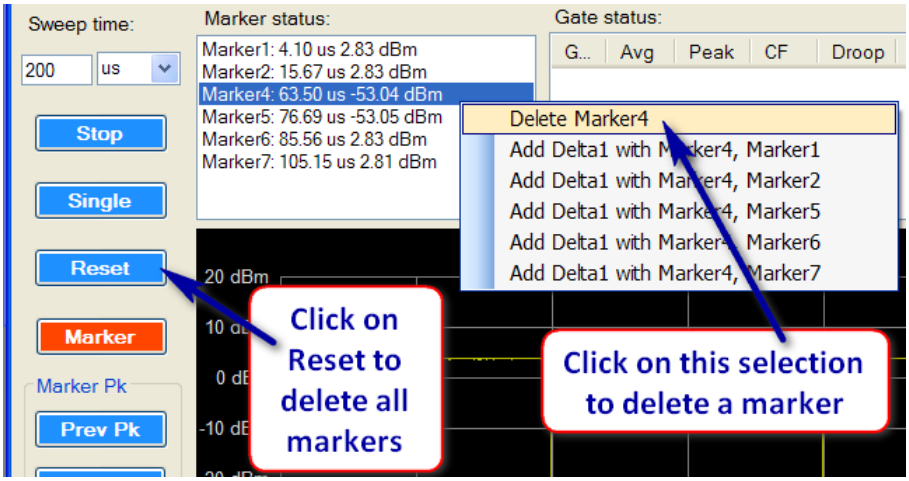
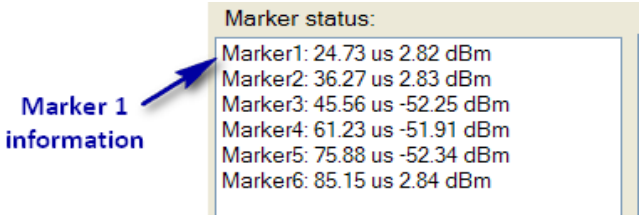


Figure 43. Pulse Profiling Window

Table 13: The Pulse Profiling Window

The Pulse Profiling Window	
Parameter	**Description**
Settings:	
Sweep time	Allows you to enter the duration of a sweep.
Start/Stop	Starts and stops the sweep. This is a toggled selection; clicking on it changes it to the opposite state.
Single	Starts a single sweep.
Reset	Removes all markers and gates from the display.

The Pulse Profiling Window	
Parameter	**Description**
Settings: Marker	Clicking on this button allows you to place up to ten markers on the display. When you click on the Marker button, its color changes to red. You can then place markers anywhere on the display. Note that the markers are color-coded. **NOTE:** to delete markers, see Figure 44**.** • To delete all markers, click on Reset in Settings. • To delete individual markers, select a marker in the Marker Status area, then right-click on the selection to display more options, and left-click on Delete MarkerX.  Figure 44. Deleting Markers
Settings: Marker (continued)	***Marker information:*** For each marker placed on the sweep display, a line of information appears in the Marker status pane. The information for each marker is updated regularly (see Figure 45).  Figure 45. Marker Status Pane

The Pulse Profiling Window	
Parameter	**Description**
Settings: Marker (continued)	***Enable delta between markers:*** To view the difference (delta) between markers (see Figure 46): 1. Click on one of the markers in the Marker Status pane. 2. Right-click on the selected marker to open the options pane. 3. Select one of the delta options.

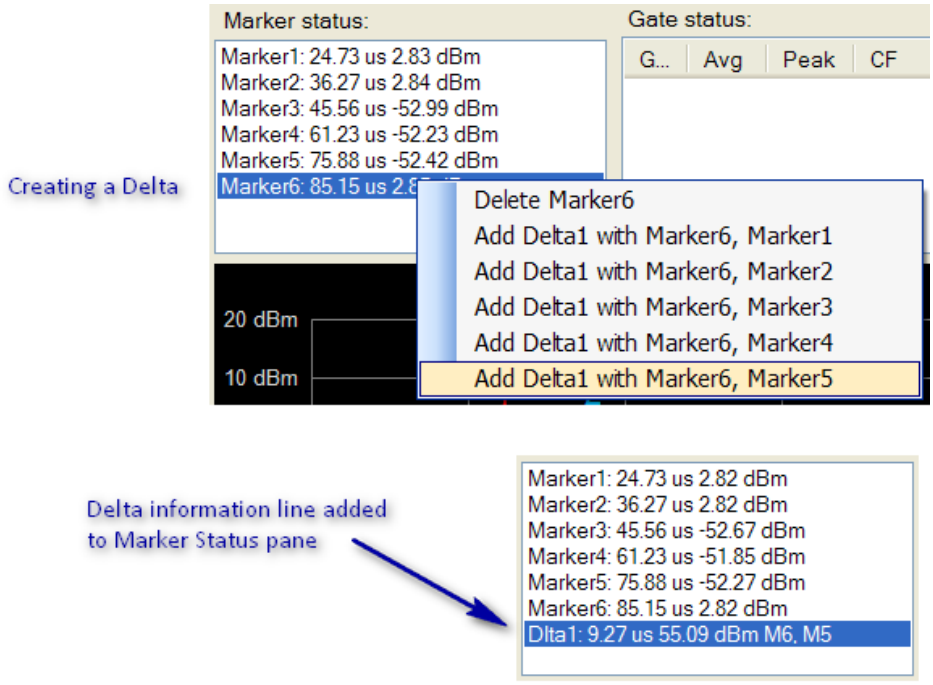
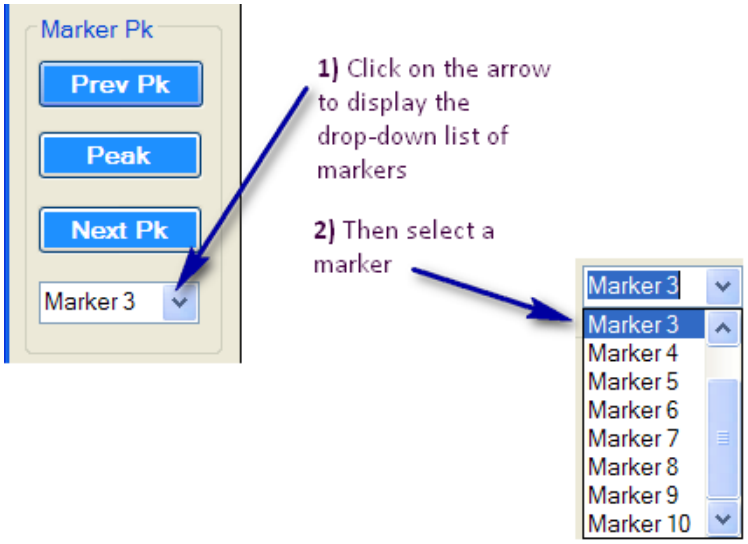
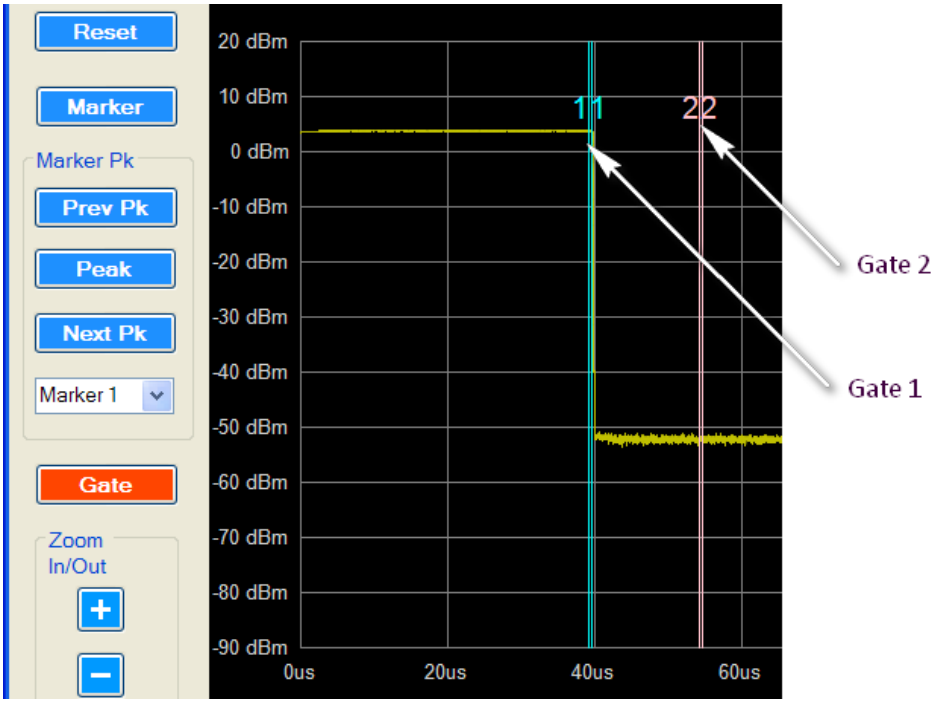
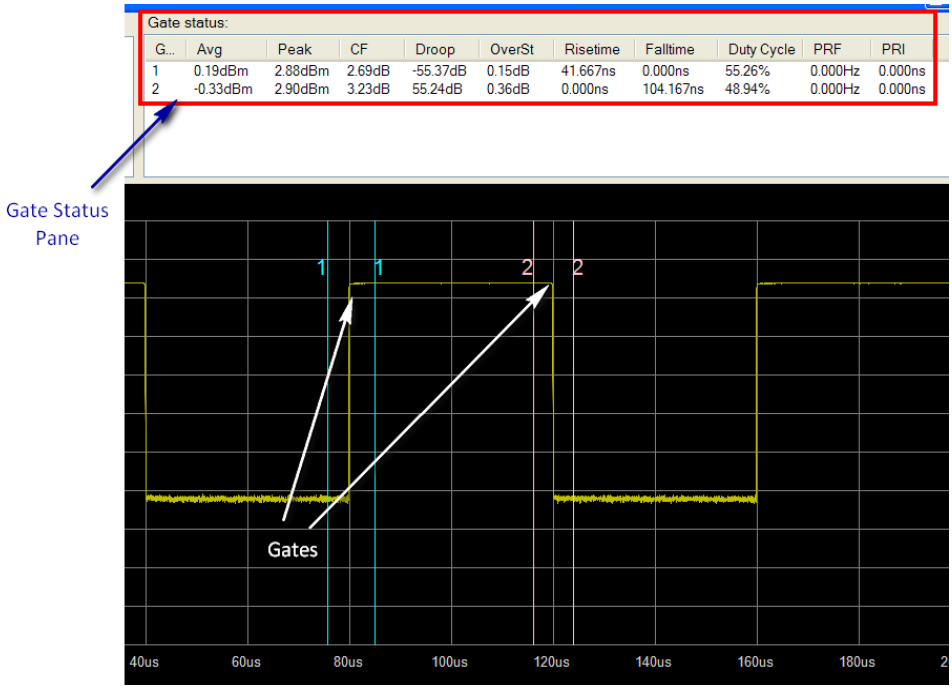
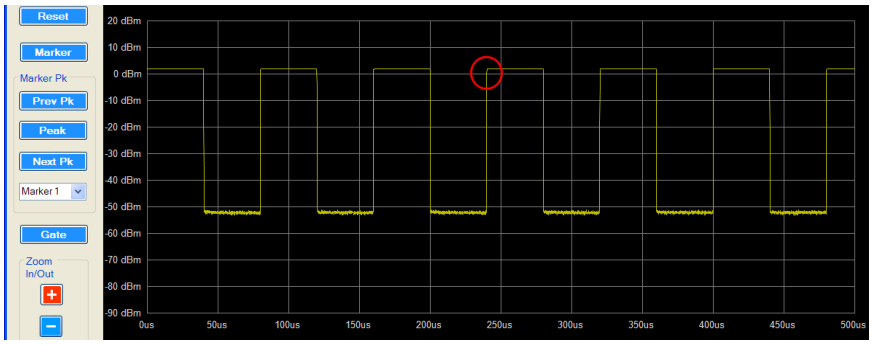
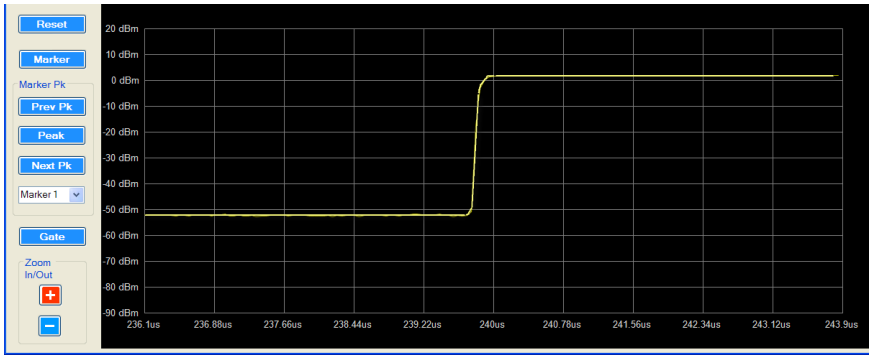


Figure 46. Turning On Delta Between Markers

The Pulse Profiling Window	
Parameter	**Description**
Settings: Marker (continued)	***All peak settings:*** To apply a peak setting to a marker, first select the marker you want to apply the peak setting to as shown in Figure 47.  Figure 47. Selecting a Marker for Peak Setting
Prev Pk	Places the selected marker at the previous peak.
Peak	Places the marker at the highest point of the signal.
Next Peak	Places a marker at the next peak in the sweep.

The Pulse Profiling Window	
Parameter	**Description**
Settings: Gate	Clicking on Gate enables you to place up to six gates anywhere on the sweep display. Figure 48 shows two gates on the sweep display. ***To place gates:*** 1. Click on the Gate button in the Navigation Window (the Gate button turns red). 2. Mouse-click at those points on the sweep display where you want to place a gate. ***To adjust the width of a gate*** ***NOTE:*** In order to view information within a gate, you must adjust its width after placing it, as follows***:*** 1. Click and hold on one of the vertical lines of the gate, and drag it to the desired point on the sweep display. Do the same action on the other vertical line of the gate. 2. Perform Step 1 on the other gates if desired.  Figure 48. Gates

The Pulse Profiling Window	
Parameter	**Description**
Settings: Gate	***Gate information:*** After adjusting the width of a gate, you can view the gate's information in the Gate Status pane (see Figure 49).  Figure 49. Gate Status Pane

The Pulse Profiling Window	
Parameter	**Description**
Settings: Zoom In/Out	Zoom In/Out gives you the ability to magnify areas of interest of the sweep in Pulse Profiling. o zoom in on a point: 1 Click on **+** under Zoom In/Out (see Figure 50). Note that the **+** turns red. 2 Place the mouse cursor on the sweep display where you want the magnification to be centered (the red circle was added to the figure to show the cursor placement; it doesn't appear in the application). 3 Click on the chosen point on the sweep display until you achieve the desired level of magnification (see Figure 51). Use Zoom Out (**-**) to fine-tune the display.  Figure 50. Clicking on Plus (+)  Figure 51. Sweep Magnified by Using Zoom In To return the display to normal, either click on Zoom Out until you have restored the normal display, or click Reset. ***NOTE:*** Clicking Reset will also delete all Markers and Gates.
End of Procedure	

3.10 Use Pulse Profiling

The Pulse Profiling function is a powerful feature of Measurement Xpress. Pulse Profiling allows you to see and measure many aspects of pulse waveforms. The following procedure describes how to use the Pulse Profiling function.

NOTE: To enable Pulse Profiling, you must use a GT-8552A or GT-8555A USB Power Sensor.

Table 14: Measurement Xpress: Use Pulse Profiling

Measurement Xpress: Use Pulse Profiling	
Step	**Action**
1.	You must use a GT-8552A or GT-8555A USB Power Sensor to enable Pulse Profiling. Connect a GT-8552A or GT-8555A to a USB port on the computer.
2.	Start Measurement Xpress.
CAUTION	**DO NOT APPLY EXCESSIVE POWER TO THE GT-8552A or GT-8555A USB POWER SENSOR.** • Read the specifications for the power sensor (see Table 1 on page 3) • Know the approximate power level of the signal of interest before applying it to the GT-8552A or GT-8555A.
3.	Connect the signal of interest to the RF connector on the end of the GT-8552A or GT-8555A power sensor.
4.	If there is more than one GT-8550A Power Sensor connected to the computer, select the GT-8552A or GT-8555A in order to enable Pulse Profiling.
5.	Configure the measurement settings by opening the Sensor Setup Window: 1. In the Navigation pane, click on Setup (under Sensor Operation). 2. Configure the settings in the Sensor Setup window as desired. 3. Close the Sensor Setup window.

Measurement Xpress: Use Pulse Profiling	
Step	**Action**
6.	In the Navigation Window, click on Pulse Profiling to open the Pulse Profiling window (see Figure 52).

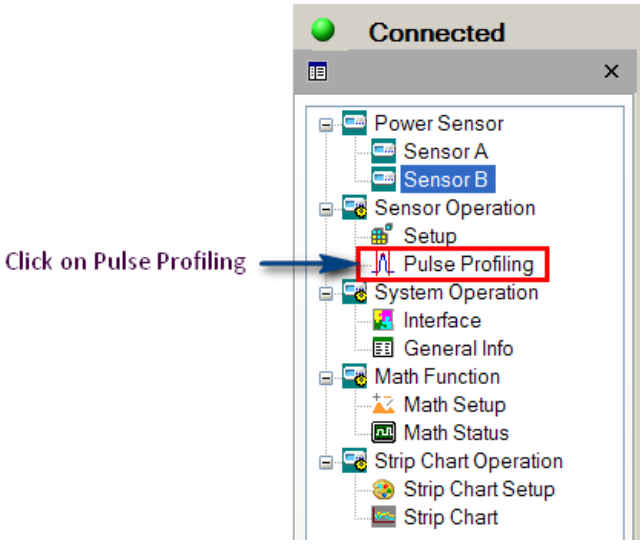


Figure 52. Opening the Pulse Profiling Window

7.	The Pulse Profiling window opens (see Figure 53). To view pulses, click on Start in the Pulse Profiling window.

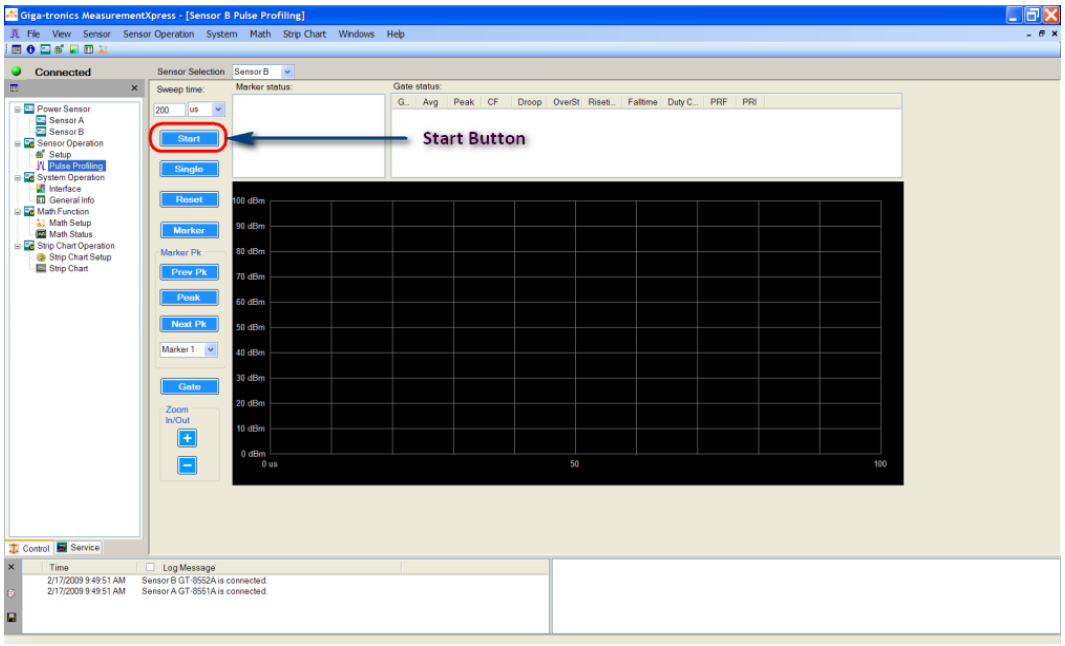
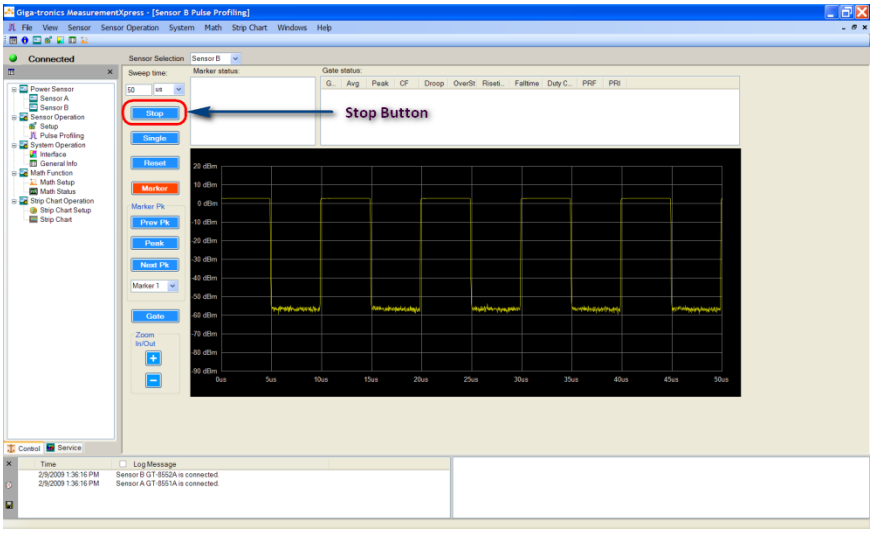


Figure 53. Pulse Profiling Window (Before Start is clicked)

Measurement Xpress: Use Pulse Profiling	
Step	**Action**
8.	When you click on the Start button, you can view pulses (see Figure 54). Notice that the Start button changes to the Stop button. This button toggles states whenever it is clicked.  Figure 54. Pulse Profiling Window (After Start is clicked)
9.	If necessary, adjust the Sweep Time to get a better view of the pulses of interest.  Figure 55. Adjust Sweep Time

Measurement Xpress: Use Pulse Profiling	
Step	**Action**
10.	You can now place markers and gates to obtain the information you desire from the sweep display. Refer to section 3.9 starting on page 39 for details on placing and using markers and gates.Figure 56 shows a sweep with two markers and two gates, and their data shown in the Marker Status and Gate Status panes.
11.	You can close the Pulse Profiling window at any time by clicking on the **X** in the upper right-hand corner of the window.
End of Procedure	

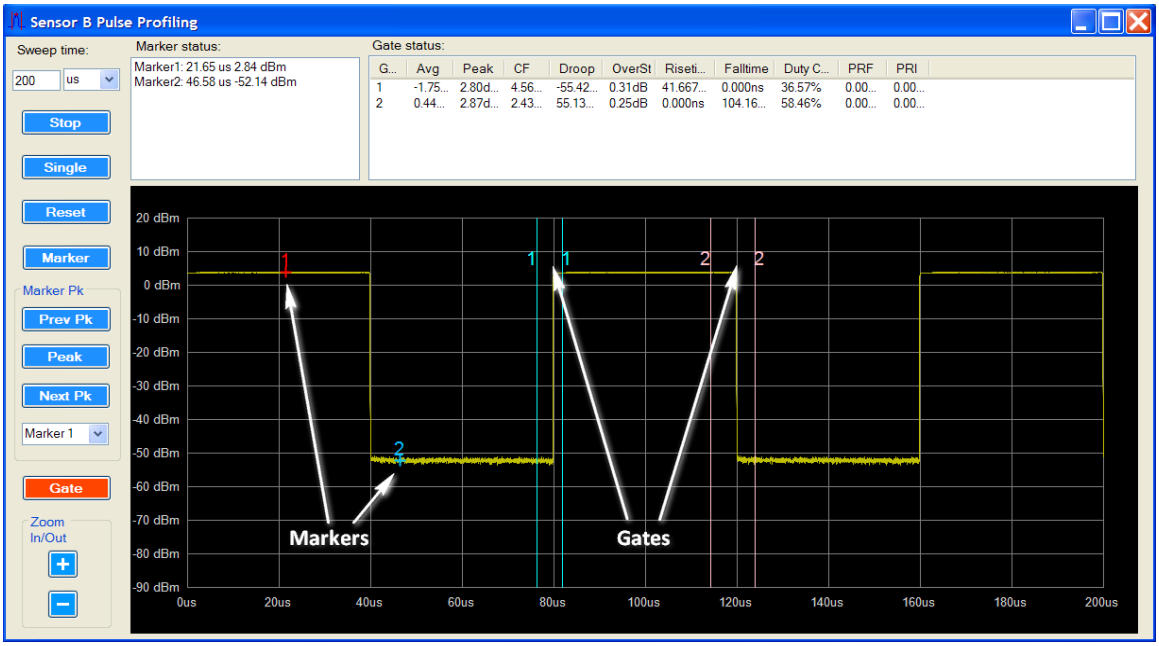


Figure 56. Markers and Gates on the Pulse Profiling Window

4 Specifications

4.1 General Specifications for all GT-8550A Series Power Sensors

Table 15: General Sensor Specifications

General Sensor Specifications		
Parameter	**Specification**	
USB voltage	+4.5 V to +5.5 V	
USB power	450 mA typical, 500 mA maximum	
Operating temperature	0 °C to 50 °C	
Storage temperature	-20 °C to +75 °C	
USB cable length	15 ft. (5 m) maximum	
Dimensions (GT-8551A, GT-8552A, GT-8888A)	2” H x 2.5” W x 3” D (50 mm H x 65 mm W x 75 mm D)	
Dimensions (GT-8553A, GT-8554A, GT-8555A)	2” H x 2.5” W x 3.5” D (50 mm H x 65 mm W x 90 mm D)	
Weight	< 1 lbs (< 0.5 kg)	
Environmental	MIL-PRF-28800F, Class 3 WEEE compliant, RoHS compliant	
Safety	EN 61010 and CE compliant	
Emissions	EN 61326 and FCC compliant	
Video bandwidth	GT-8551A, GT-8552A, and GT-8555A: 10 MHz minimum	GT-8553A, GT-8554A and GT-8888A: 100 Hz typical
Measurement speed	2000 Reading/second typical	
Maximum peak-to-average ratio	GT-8551A, GT-8552A, GT-8553A, GT-8554A, GT-8888A: 70 dB typical GT-8555A: 55 dB typical	
RF Input Connector	GT-8551A, GT-8552A, GT-8553A, GT-8888A: Low VSWR, Type-N (m) GT-8554A, GT-8555A: Low VSWR, SMA (m)	
USB Port	Rugged 4-Pin USB	
Frequency range		
GT-8551A and GT-8552A	100 MHz to 8 GHz, operational to 10 GHz	
GT-8553A	10 MHz to 18 GHz	
GT-8554A	10 MHz to 26.5 GHz	
GT-8555A	100 MHz to 20 GHz	
GT-8888A	10 MHz to 8 GHz, operational to 10 GHz	

Continued on next Page

General Sensor Specifications			
Parameter	**Specification**		
Dynamic range			
GT-8551A, GT-8552A and GT-8888A	100 MHz to 6 GHz: -60 dBm to +20 dBm	6 GHz to 8 GHz: -50 dBm to +20 dBm	
GT-8553A and GT-8554A	-50 dBm to +20 dBm		
GT-8555A	-40 dBm to +20 dBm		
Maximum peak input power (damage level)	+23 dBm (200 mW) Maximum input voltage: 25 VDC		
VSWR			
GT-8551A	100 MHz to 250 MHz: 1.18:1	250 MHz to 8 GHz: 1.15:1	8 GHz to 10 GHz: 1.18:1 typical
GT-8552A	100 MHz to 250 MHz: 1.18:1	250 MHz to 8 GHz: 1.15:1	8 GHz to 10 GHz: 1.18:1 typical
GT-8553A	10 MHz to 10 GHz: 1.20:1	10 GHz to 18 GHz: 1.30:1	
GT-8554A	10 MHz to 10 GHz: 1.20:1	10 GHz to 26.5 GHz: 1.30:1	
GT-8555A	100 MHz to 10 GHz: 1.20:1	10 GHz to 20 GHz: 1.29:1	
GT-8888A	10 MHz to 8 GHz: 1.15:1	8 GHz to 10 GHz: 1.18:1 typical	
Trigger Input function (applies only to GT-8551A, GT-8552A, and GT-8555A sensors)			
Rate	1 Hz to 750 kHz		
Resolution	20.8 ns		
Modes	Single or Continuous		
Trigger Source	Internal or External		
Internal Trigger Level Range	-20 dBm to +20 dBm (Manual or Auto)		
External Trigger Input	TTL compatible, rising or falling edge		
Operating Input Levels	0.0 V to 0.8 V (low), 2.0 V to 5.0 V (high), +/- 10 µA		
Maximum Input Levels	-0.5 V (low) to 5.5 V (high)		
Trigger Off Time	1 µs minimum for reliable triggering		

Table 16: General Sensor Measurement Capabilities

General Sensor Measurement Capabilities	
Parameter	**Measurement Capability**
Strip Chart Mode	Multiple Sensor, Adjustable Rate and Duration, and Data Logging Output File (CSV)
Statistical Chart Mode	Adjustable Rate, Duration, Range and Resolution, Histogram, CDF and CCDF
Math Functions	Ratio, Sum and Difference between sensors or between sensors and a constant
Other Capabilities	Selectable Power Units, Relative Function, Offset Function, Adjustable Averaging, Upper and Lower Alarm Limits, and Min and Max Hold

4.2 Sensor Measurement Uncertainty Factors

4.2.1 Accuracy

Measurement uncertainty is computed from the individual cal factor, mismatch, linearity, noise and temperature error factors, and can be computed as either worst case (sum of the applicable error terms) or RSS, representing the most probable error, where RSS is the square root of the sum of the squares of the error terms.

Accuracy is typically < 2 % (RSS) mid-band with source VSWR 1.2:1 (or better) at 25 °C +/- 5 °C.

This section presents correction factors for various aspects of sensor measurements.

Table 17: GT-8551A Measurement Uncertainty Factors

GT-8551A Measurement Uncertainty Factors					
Parameter	**Specification**				
Calibration Factor	100 MHz to 0.5 GHz		0.5 GHz to 8 GHz		
-60 to +20 dBm	4 %		1.7 %		
Linearity	100 MHz to 2 GHz		2 GHz to 8 GHz		
+15 to +20 dBm	7 %		5 %		
+10 to +15 dBm	5 %		3 %		
-60 to +10 dBm	3 %		2 %		
Noise [1]	100 MHz to 6 GHz		6 GHz to 8 GHz		
-30 to +20 dBm	0.02 %		0.04 %		
-50 to -30 dBm	0.04 %		0.15 %		
-60 to -50 dBm	0.11 %		N/A		
Temperature	0 °C to 10 °C	10 °C to 20 °C	20 °C to 30 °C	30 °C to 40 °C	40 °C to 50 °C
-60 to 0 dBm	1 %	0.75 %	0 %	0.75 %	1 %
0 to +10 dBm	2 %	1.75 %	0 %	1.75 %	2 %
+10 to +20 dBm	4 %	3.75 %	0 %	3.75 %	4 %
Zero Offset	100 MHz to 8 GHz				
-60 to +20 dBm	0.35 nW typical at 25 °C, 1.7 nW typical at 0 °C to 50 °C				

[1] Noise measured with a 5 second integration time.

Table 18: GT-8552A Measurement Uncertainty Factors

GT-8552A Measurement Uncertainty Factors					
Parameter	**Specification**				
Calibration Factor	100 MHz to 0.5 GHz		0.5 GHz to 8 GHz		
-60 to +20 dBm	4 %		1.7 %		
Linearity	100 MHz to 2 GHz		2 GHz to 8 GHz		
+15 to +20 dBm	7 %		5 %		
+10 to +15 dBm	5 %		3 %		
-60 to +10 dBm	3 %		2 %		
Noise [1]	100 MHz to 6 GHz		6 GHz to 8 GHz		
-30 to +20 dBm	0.02 %		0.04 %		
-50 to -30 dBm	0.04 %		0.15 %		
-60 to -50 dBm	0.11 %		N/A		
Temperature	0 °C to 10 °C	10 °C to 20 °C	20 °C to 30 °C	30 °C to 40 °C	40 °C to 50 °C
-60 to 0 dBm	1 %	0.75 %	0 %	0.75 %	1 %
0 to +10 dBm	2 %	1.75 %	0 %	1.75 %	2 %
+10 to +20 dBm	4 %	3.75 %	0 %	3.75 %	4 %
Zero Offset	100 MHz to 8 GHz				
-60 to +20 dBm	0.35 nW typical at 25 °C, 1.7 nW typical at 0 °C to 50 °C				

[1] Noise measured with a 5 second integration time.

Table 19: GT-8553A Measurement Uncertainty Factors

GT-8553A Measurement Uncertainty Factors					
Parameter	**Specification**				
Calibration Factor	10 MHz to 1.0 GHz		1 GHz to 10 GHz		10 GHz to 18 GHz
-50 to +20 dBm	1.8 %		1.7 %		1.9 %
Linearity	10 MHz to 18 GHz				
+15 to +20 dBm	3 %				
-15 to +15 dBm	2.5 %				
-50 to -15 dBm	2 %				
Noise [1]	10 MHz to 18 GHz				
-30 to +20 dBm	0.1 %				
-40 to -30 dBm	0.25 %				
-50 to -40 dBm	0.5 %				
Temperature	0 °C to 10 °C	10 °C to 20 °C	20 °C to 30 °C	30 °C to 40 °C	40 °C to 50 °C
-50 to +20 dBm	2 %	0.75 %	0 %	0.75 %	2 %
Zero Offset	10 MHz to 18 GHz				
-50 to +20 dBm	1 nW typical at 25 °C, 5 nW typical at 0 °C to 50 °C				

[1] Noise measured with a 5 second integration time.

Table 20: GT-8554A Measurement Uncertainty Factors

GT-8554A Measurement Uncertainty Factors					
Parameter	**Specification**				
Calibration Factor	10 MHz to 10 GHz		10 GHz to 18 GHz		18 GHz to 26.5 GHz
-50 to +20 dBm	2.5 %		2.7 %		3.7 %
Linearity	10 MHz to 26.5 GHz				
+15 to +20 dBm	3 %				
-15 to +15 dBm	2.5 %				
-50 to -15 dBm	2 %				
Noise [1]	10 MHz to 26.5 GHz				
-30 to +20 dBm	0.1 %				
-40 to -30 dBm	0.25 %				
-50 to -40 dBm	0.5 %				
Temperature	0 °C to 10 °C	10 °C to 20 °C	20 °C to 30 °C	30 °C to 40 °C	40 °C to 50 °C
-50 to +20 dBm	2 %	0.75 %	0 %	0.75 %	2 %
Zero Offset	10 MHz to 26.5 GHz				
-50 to +20 dBm	1 nW typical at 25 °C, 5 nW typical at 0 °C to 50 °C				

[1] Noise measured with a 5 second integration time.

Table 21: GT-8555A Measurement Uncertainty Factors

GT-8555A Measurement Uncertainty Factors					
Parameter	**Specification**				
Calibration Factor	100 MHz to 0.5 GHz	0.5 GHz to 12.5 GHz	12.5 GHz to 18 GHz	18 GHz to 20 GHz	
-40 to +20 dBm	4 %	2.6 %	3.2 %	3.5 %	
Linearity	100 MHz to 2 GHz	2 GHz to 20 GHz			
+15 to +20 dBm	7 %	6 %			
+5 to +15 dBm	5 %	4 %			
-40 to +5 dBm	3 %	2 %			
Noise [1]	100 MHz to 20 GHz				
-30 to +20 dBm	0.25 %				
-40 to -30 dBm	0.50 %				
Temperature	0 °C to 10 °C	10 °C to 20 °C	20 °C to 30 °C	30 °C to 40 °C	40 °C to 50 °C
-40 to +20 dBm	2.5 %	1.25 %	0 %	1.25 %	2.5 %
Zero Offset	100 MHz to 20 GHz				
-40 to +20 dBm	0.25 nW typical at 25 °C, 0.75 nW typical at 0 °C to 50 °C				

[1] Noise measured with a 5 second integration time.

Table 22: GT-8888A Measurement Uncertainty Factors

GT-8888A Measurement Uncertainty Factors					
Parameter	**Specification**				
Calibration Factor	10 MHz to 0.1 GHz	0.1 GHz to 0.5 GHz	0.5 GHz to 8 GHz		
-60 to +20 dBm	7 %	4 %	1.7 %		
Linearity	10 MHz to 2 GHz	2 GHz to 8 GHz			
+15 to +20 dBm	7 %	5 %			
+10 to +15 dBm	5 %	3 %			
-60 to +10 dBm	3 %	2 %			
Noise [1]	10 MHz to 0.1 GHz	0.1 GHz to 6 GHz	6 GHz to 8 GHz		
-30 to +20 dBm	0.22 %	0.02 %	0.04 %		
-50 to -30 dBm	0.22 %	0.04 %	0.15 %		
-60 to -50 dBm	0.44 %	0.11 %	N/A		
Temperature	0 °C to 10 °C	10 °C to 20 °C	20 °C to 30 °C	30 °C to 40 °C	40 °C to 50 °C
-60 to 0 dBm	1 %	0.75%	0 %	0.75 %	1 %
0 to +10 dBm	2 %	1.75 %	0 %	1.75 %	2 %
+10 to +20 dBm	4 %	3.75 %	0 %	3.75 %	4 %
Zero Offset	10 MHz to 8 GHz				
-60 to +20 dBm	0.35 nW typical at 25 °C, 1.7 nW typical at 0 °C to 50 °C				

[1] Noise measured with a 5 second integration time.

4.3 Additional Technical Specifications

Table 23: GT-8551A Additional Measurement Capabilities

GT-8551A Additional Measurement Capabilities	
Parameter	**Measurement Capability**
BAP Mode	Pulse Power, Peak Power, Average Power, Duty Cycle and Crest Factor
MAP Mode	Peak Power, Average Power, Duty Cycle and Crest Factor
PAP Mode	Duty Cycle Corrected Power, Peak Power, Average Power and Crest Factor

Table 24: GT-8552A and GT-8555A Additional Technical Specifications

GT-8552A and GT-8555A Additional Technical Specifications	
Parameter	**Specification**
Sample Rate	48 MS/s
Rise/Fall Time	< 55 ns (10% to 90%) at 4 GHz
Minimum Pulse Width [1]	100 nS typical
Minimum Duty Cycle [2]	0.01%

[1] The minimum pulse width is the recommended minimum pulse width viewable on the power meter, where power measurements are meaningful and accurate, but not warranted.

[2] The minimum duty cycle is the recommended minimum duty cycle viewable on the power meter, where power measurements are meaningful and accurate, but not warranted.

Table 25: GT-8552A and GT-8555A Additional Measurement Capabilities

GT-8552A and GT-8555A Additional Measurement Capabilities	
Parameter	**Measurement Capability**
Pulse Profiling Gated Measurements	Peak Power, Average Power, Crest Factor, Droop, Overshoot, Rise Time and Fall Time, Duty Cycle, Pulse Repetition Frequency, Pulse Repetition Interval and Pulse Width
Pulse Profiling Marker Measurements	Peak Power and Delta Markers
BAP Mode	Pulse Power, Peak Power, Average Power, Duty Cycle and Crest Factor
MAP Mode	Peak Power, Average Power, Duty Cycle and Crest Factor
PAP Mode	Duty Cycle Corrected Power, Peak Power, Average Power and Crest Factor

End of Document