# ESM Calibration and Testing Using the Giga-tronics 2400C and 2500B Series Microwave Signal Generators

## Product Note

**Frequency switching speed as fast as 350 microseconds per point.**


The Giga-tronics 2400C and 2500B Series Microwave Signal Generators have a list sweep mode that creates the needed test signals to adequately stimulate your ESM receiver.

## Overview

There are very many specialized measurements needed when testing or calibrating an Electronic Support Measures (ESM) system. One critical measurement the receiver needs to make is to be able to detect a number of frequencies across a wide band in a given period of time, often synchronized to a GPS clock.

## Test Signal

Typically a microwave signal generator is used to provide the test signals for this type of measurement. These test signals consist of many continuous wave (CW) signals at various frequencies and/or amplitudes. Additionally, the test signal frequencies and amplitudes are likely not to be in a linear ascending or descending values. Moreover, the test signals switch between different frequencies and/or amplitudes very quickly. In some cases, switching between frequencies and/or amplitudes in a matter of microseconds.

## Giga-tronics 2400C and 2500B Microwave Signal Generators

The Giga-tronics 2400C and 2500B Series Microwave Signal Generators have a list sweep mode that creates the needed test signal to adequately stimulate your ESM receiver for you to make the required measurements. The signal generator's list sweep mode gives you the ability to create a list of arbitrary frequency, amplitude, and dwell time values and sweep the RF output based on this list of values you've created.

The signal generator provides a couple of different ways to create this list of values. One way to create the list is to use SCPI commands. One disadvantage of using SCPI, is the time required to send, parse, and process the command before switching can begin. In addition, separate commands are required to change individual settings, which will require additional time to process the separate commands. For example, two commands are needed when switching frequency and amplitude. Another way to create a list is to use Automation Xpress, which is a much faster approach.

## Automation Xpress

Automation Xpress (AX) is free software that runs on the PC and can be used to control and program the signal generator. Automation Xpress provides a graphical user interface and an Application Programming Interface (API) in the form of a Dynamic Link Library (DLL). AX can be used to set and control the same functions that be controlled on the front panel and more.

## Creating a List Using Automation Xpress

Using AX, you may create a list of frequencies and/or amplitudes two different ways. One way is by defining all required parameters and saving this data as a text file. You may then use the "List Controller" menu in AX to upload the list that is to be downloaded to the signal generator. The second method of creating a list is to use the "List Editor" menu in AX. This approach automatically creates a table of values based on the initial conditions that are set, such as setting a beginning and ending frequency value and the step size. Once the lists are created, they can be saved and downloaded to the instrument each time a new test is required.

### Example

### Test Signal Setup

Figure 1 below shows the "List Editor" set up screen from Automation Xpress. It shows a start frequency of 2 GHz and stop frequency of 3 GHz, a 2 mS step or dwell time, and 200 points between the start and stop frequencies. Alternatively, the configuration could have been set up to increment a specific frequency step size. By using 200 points and a 2 mS dwell, we can easily calculate that the complete list should be completed in 400 mS.

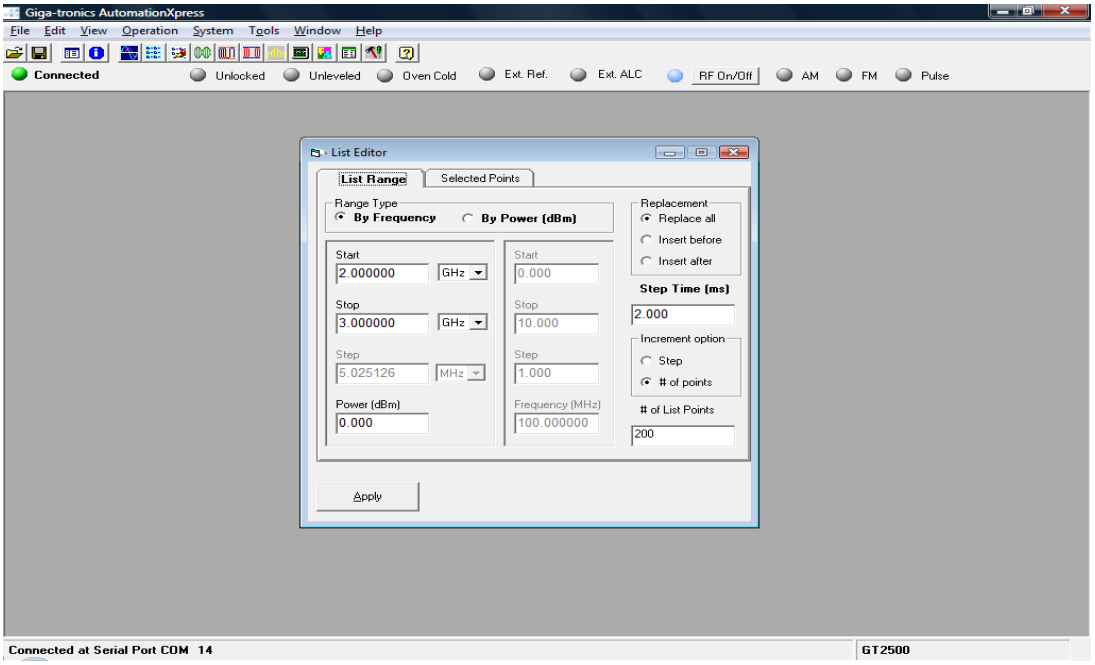


**Figure 1:** "List Editor" menu in Automation Xpress

The list is created when the Apply button in “List Editor” is pressed. After this happens, the “List Controller” menu opens automatically with the list shown and allows you to further refine your list by changing the parameters for each point (see Figure 2). For this example, the power level is changed for the first two frequency points from 0 dBm to -10 dBm to demonstrate the versatility of the “List Editor”. Additionally, changing the power for these two points shows the precise timing of the signal generator using a peak power meter to make some simple measurements.

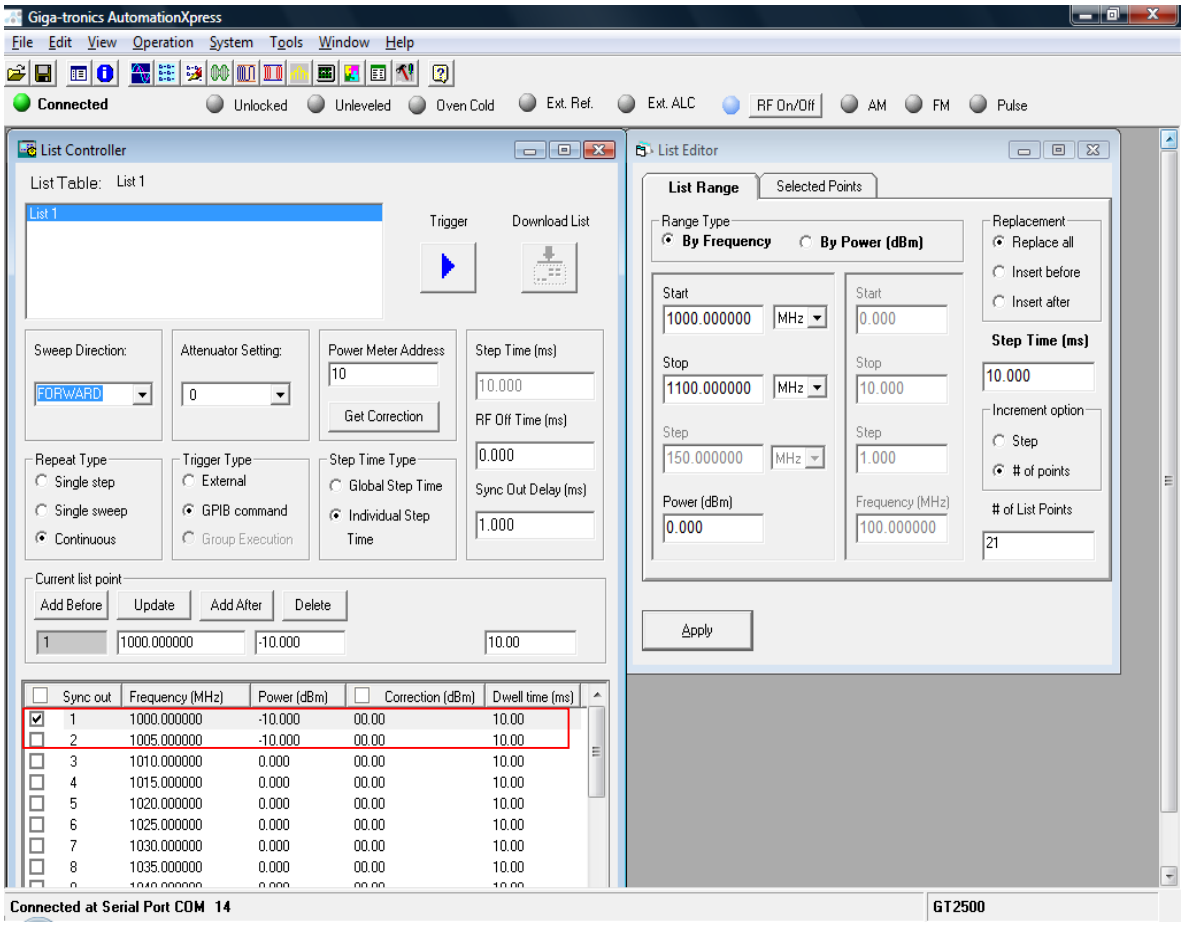


**Figure 2:** “List Controller” menu. Note the setting of -10 dBm for the first two frequencies

## Measurement Setup

The test signal is measured using the Giga-tronics GT-8552A USB Peak Power Sensor, which is able to measure fast pulses and display power versus time. The measurement shown below demonstrates that there are no transients over the displayed frequency range (see Figure 3).

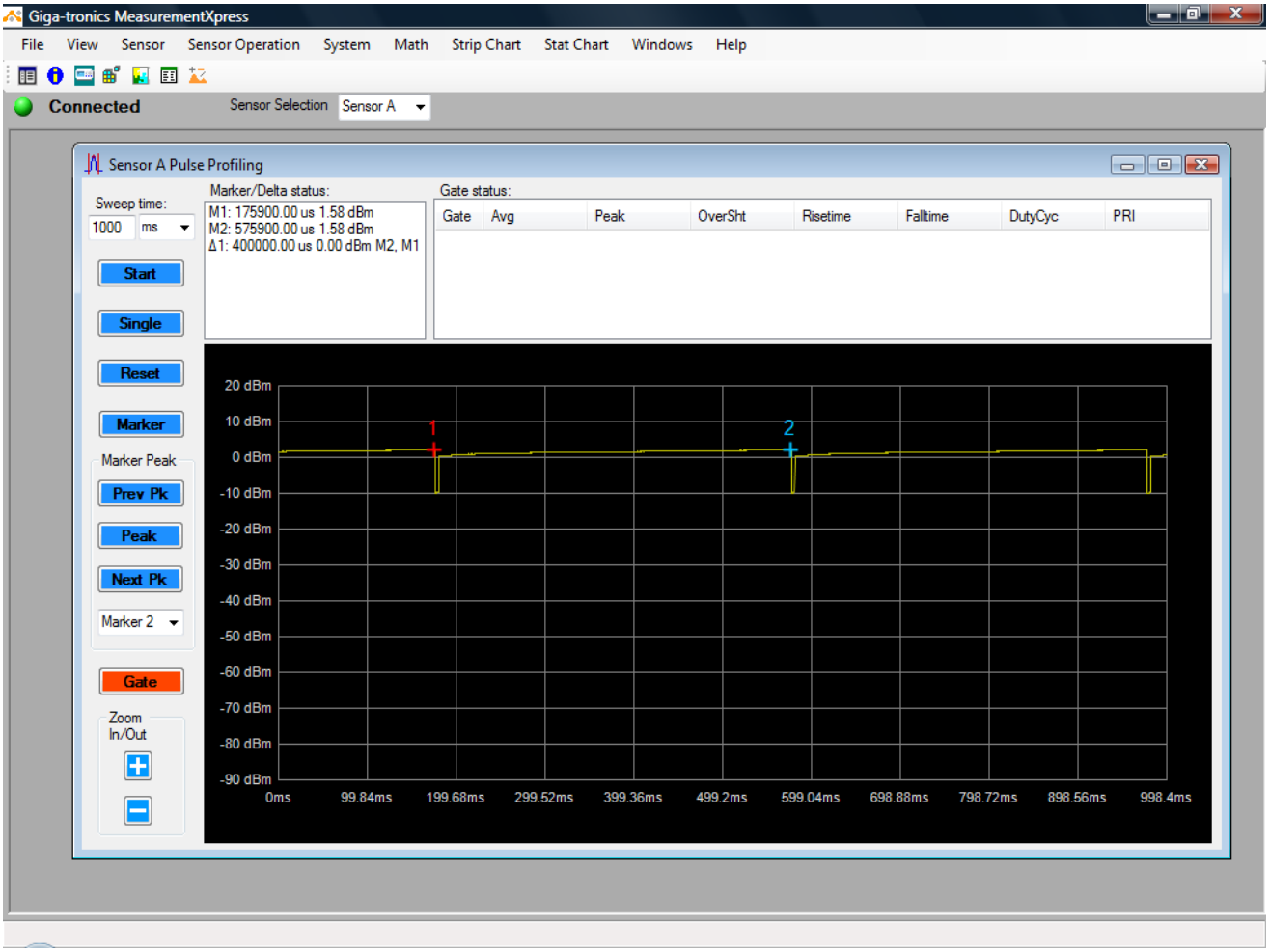


**Figure 3**: Measured results of the 2 to 3 GHz 200 point list, with a dwell time set to 2 ms for each point. Measured with Measurement Xpress.

The delta time display in the “Marker/Delta” Status window in Measurement Xpress shows that all 200 steps were completed in precisely 400 mS. Even if the signal generator is triggered from a precise GPS clock, the list of frequencies will be transmitted at the precise time necessary to stay coordinated with an ESM receiver, which would also be synchronized to a GPS clock.

Another test signal was set up at the same start and stop frequencies, but using a 100 MHz sweep of 21 steps and 10 mS per step. The measured results are shown in Figure 4. Notice that the result of 210 mS was measured and is what was expected.

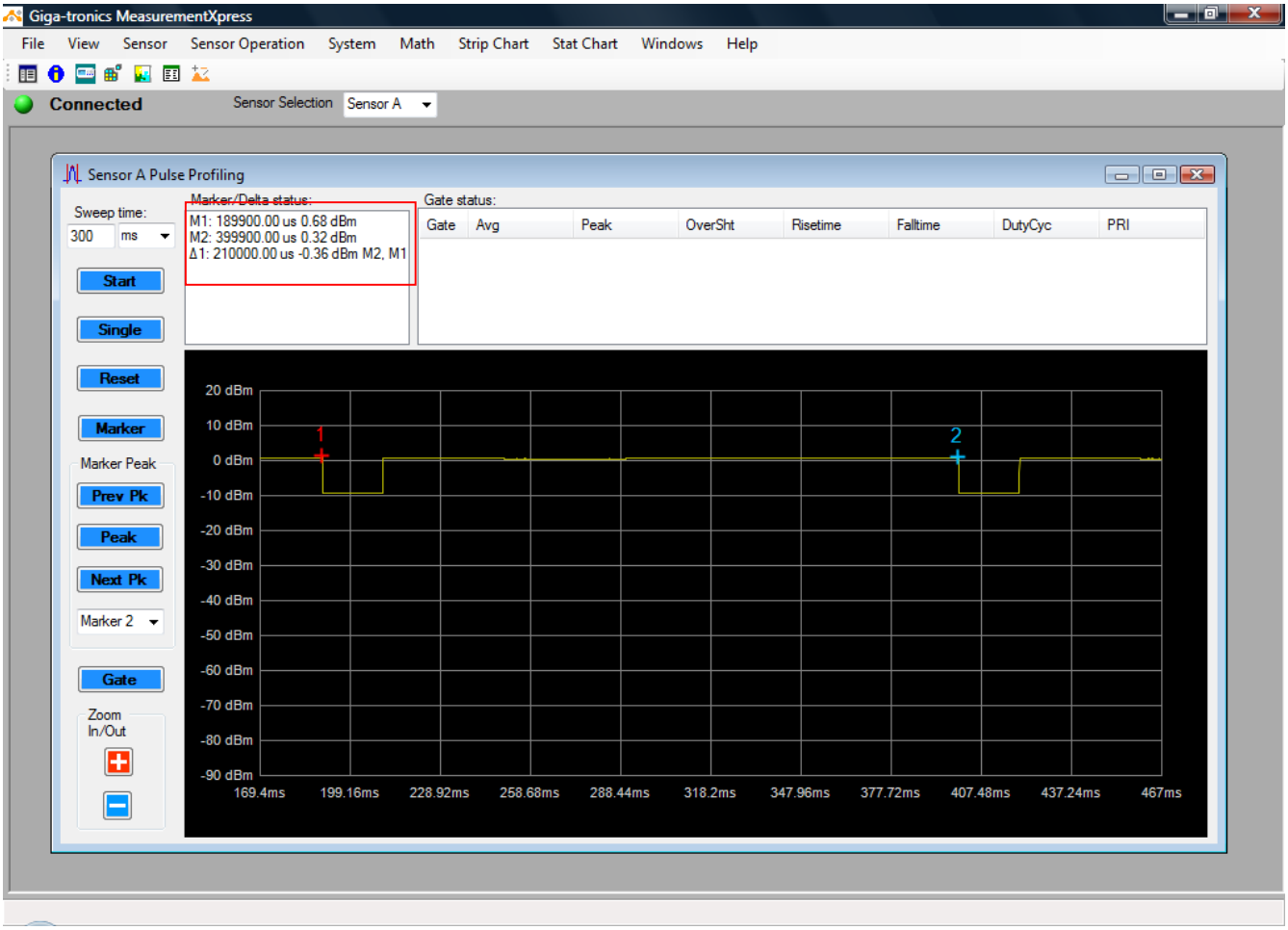


**Figure 4:** Measured results of test signal with 100 MHz sweep of 21 steps and 10 mS per step using Measurement Xpress

## Summary:

The Giga-tronics 2400C and 2500B Series Microwave Signal Generators have a list sweep mode that creates the needed test signal to adequately stimulate your ESM receiver.

Below are some specifications for the List Mode:

| List Mode Specifications | | |
|---|---|---|
| Number of Points | 4000 | |
| Frequency Settling | < 350 µs for ΔF ≤ 500 MHz (550 µs for 2500B model) | |
| Amplitude Settling | < 500 µs | |
| Digital Sweep | Trigger Modes | External, GPIB GET, Software |
| | Sweep Modes | Continuous, Single Step, Single Sweep |
| Step Time | Standard | 150 µs to 1 sec |
| | Option 31 | 2 ms to 1 sec |
| Sync Out Delay | 50 µs to 10 ms | |

## For more information:

More information about the products mentioned in this technical brief may be found from our website.
www.gigatronics.com

2400C Series Microwave Signal Generator Data Sheet

- http://www.gigatronics.com/downloads/datasheets/2400C-ds.pdf

2500B Series Microwave Signal Generator Data Sheet

- http://www.gigatronics.com/downloads/datasheets/2500B-ds.pdf

GT-8552A USB Power Sensor Data Sheet

- http://www.gigatronics.com/downloads/datasheets/GT8552A-ds.pdf