Academic Guide to SBench 6 – Example 3

This example shows a simple example of importing two waveforms, performing basic analysis on them and then displaying them on an X-Y plot. This example assumes that you have already installed the SBench 6 software. It would also be helpful to have reviewed the SBench 6 manual sections outlined in the "Using SBench 6 as a Learning Tool" note.

Using the Spectrum Control Center to Create a Demo Card

If you have previously installed an M4i.6631-x8 arbitrary waveform generator demo card you can skip this step.

Open the Spectrum Control Center. The Spectrum Control center allows you to create a demo card based on any of Spectrum's broad line of digitizer and arbitrary waveform generator products and see them operate, even without hardware. Once the control center is open, click on the 'Add Demo card' button. Select and add an M4i.4451-x8 digitizer and an M4i.6631-x8 arbitrary waveform generator. As shown in Figure 1.

After adding the demo cards, click on the Quit bar.

Figure 1: Add a software simulated demo card to the system using the control center

Starting SBench 6

Open SBench 6. The Welcome to SBench 6 screen, shown in Figure 2, shows the two demo cards that were loaded previously. Click on the M4i.6631-x8, this is a dual channel arbitrary function generator, a check mark should appear. Click on the Start SBench6 bar.
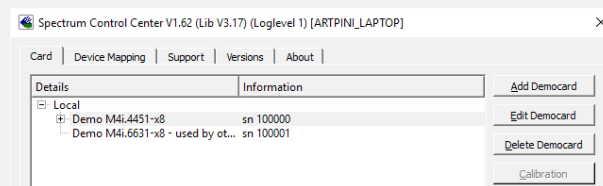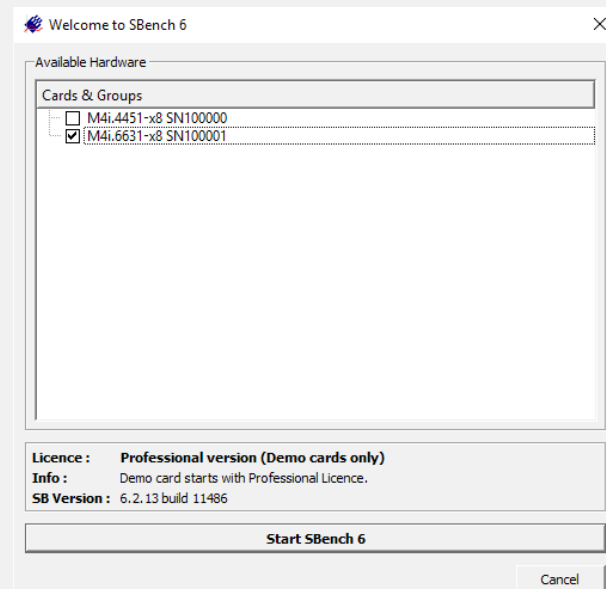

Figure 2: Card Selection in SBench 6

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SBench 6 will open as shown in Figure 3:
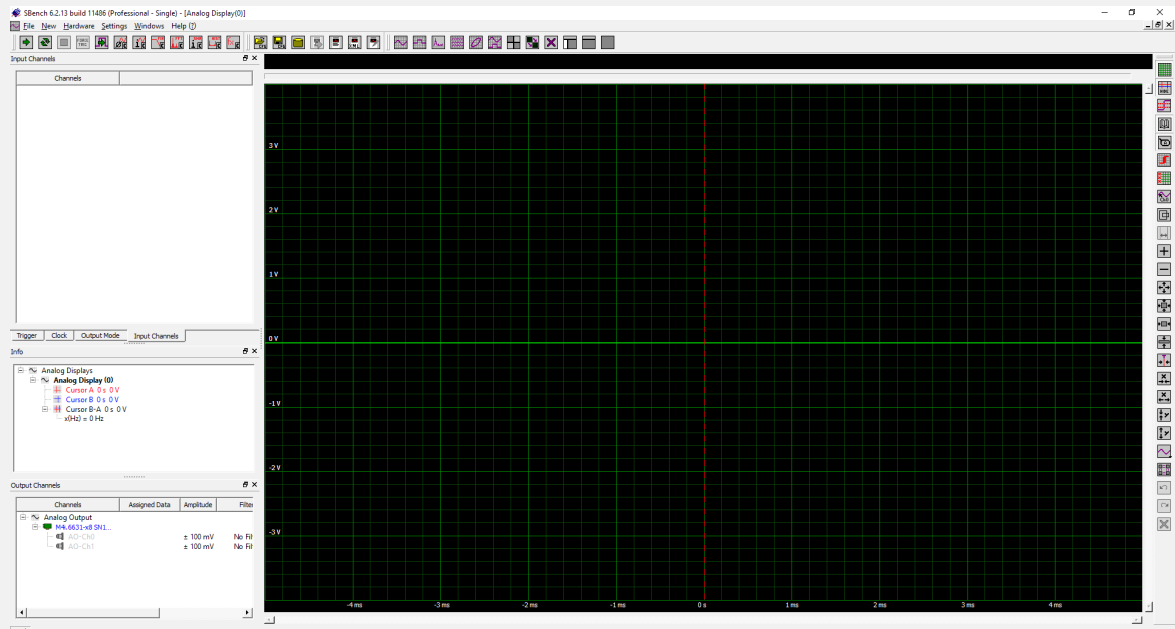
Importing an ASCII Waveform into SBench 6

SBench 6 can Import setups and data files from sources in a variety of formats. Since ASCII format is a common way of exchanging data we will import two waveforms in SBench 6 to illustrate the process. Spectrum has supplied two text files containing these waveforms named Chirp I.txt and Chirp Q.txt. These waveforms represent the in-phase (I) and Quadrature (Q) components of radar 'chirp' like waveform. The waveforms are 1024 samples long containing both time and amplitude data in a comma delimited format. The original sample rate is 1 GS/s or 1 ns per sample point. Copy these text files into a known location on your computer.

Figure 4 is a composite image showing the steps for importing the first waveform Chirp I.txt.
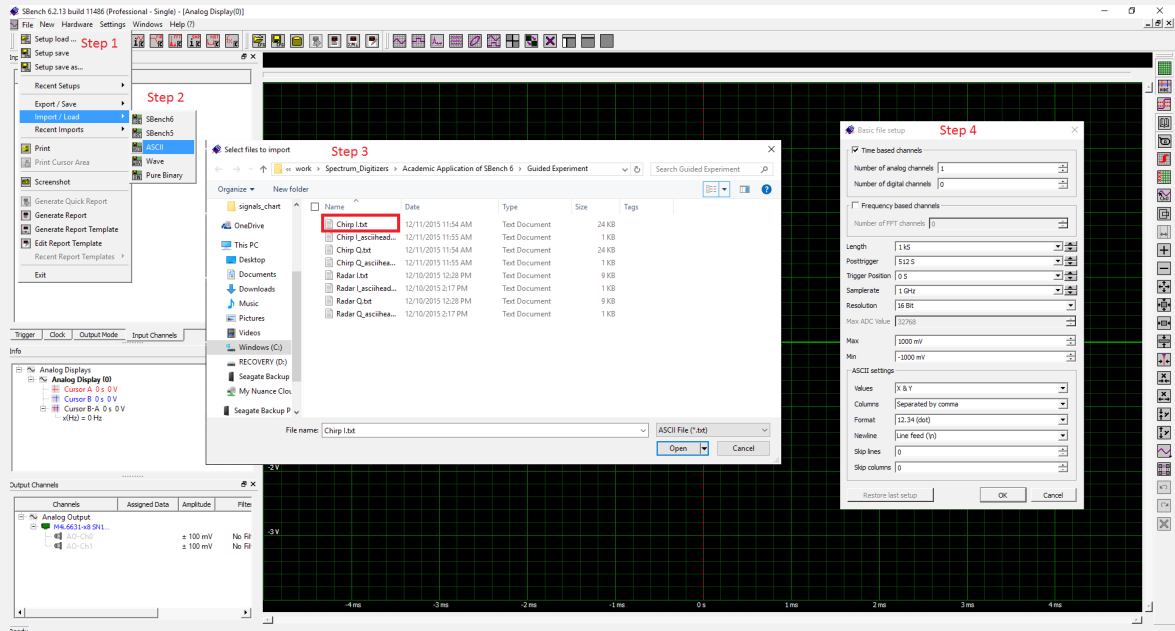
Figure 4: step by step guide to import the chirp signal from a text file

To Import the text file Chirp I.txt click on the file pull down menu and select Import/Load. A popup with five format selections will appear. Click on ASCII. The Select File to Import dialog will appear, navigate to the folder containing the text file Chirp I.txt. Select that file and click on Open. The file stage is to verify the information about the file in the Basic File Setup dialog, which appears next. Make sure that the details of the file are the same as shown in Figure 4, when they are click on OK. The file will be imported and appear in the Input Channels pane on the left of the SBench 6 screen as Chirp I.txt with a trace called Ch-0. Click on the trace name Ch-0 and drag it to the Analog Display Grid to view the waveform.
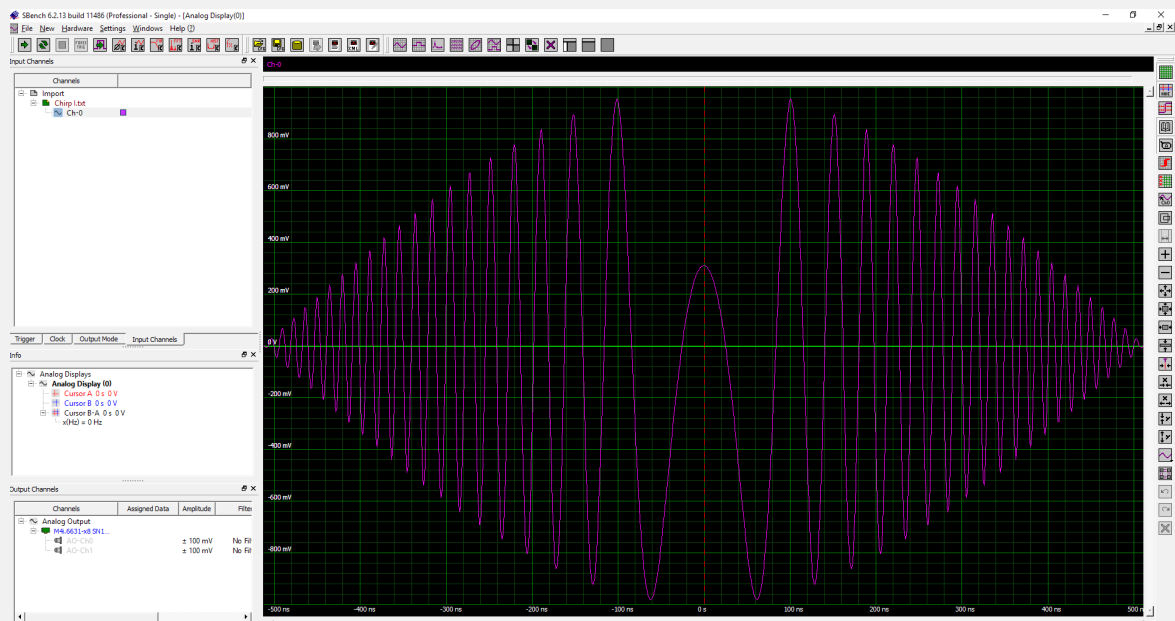

Figure 5: Imported Chirp signal

The Chirp I waveform is a radar-like 'chirp' meaning it is frequency modulated. In addition to frequency modulation a sinusoidal amplitude modulation is applied to control the spectral shaping of the pulse. Figure 5 shows the waveform as it should appear on your screen. It is paired with a quadrature component to form a complex phase modulated base band signal.

Importing the Chirp Q Waveform

Repeat the import process for the Chirp Q.txt file. Right click on the black bar above the analog display. There will be a popup with two selections Add Channel or Remove Channels. Click on Add Channels and select the Chirp Q waveform Ch-0_1. This is an alternative method to populate display grids and you should now have the two components overlapped as shown in Figure 6.
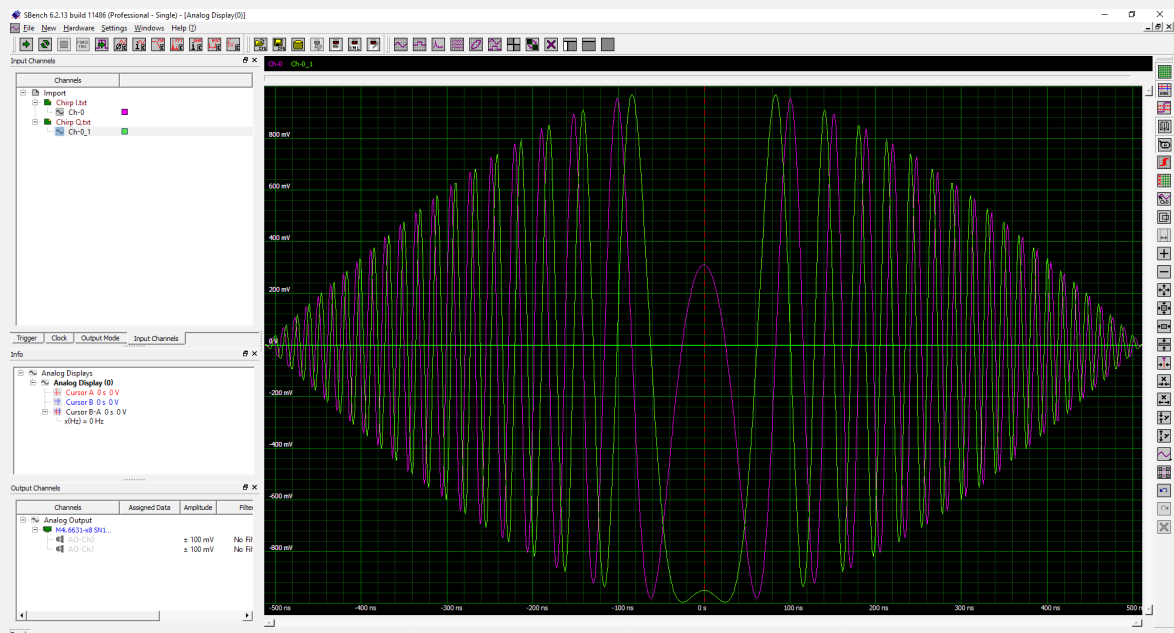

Figure 6:overlayed Chirp-I and Chirp-Q signal after importing into SBench 6

You can see that the phase relationship of the waveforms tracks across the entire duration. This is by design as they are quadrature components with a 90 degree phase difference. In practice when these two signals are added in quadrature the resultant signal has a phase vector that rotates. The amplitude modulation will cause the vector radius to increase and then decrease. If we plot the Chirp I vs. Chirp Q signals on an X-Y plot we can see this effect.

Creating an X-Y Display

Click on the X-Y display button on the main toolbar. The button is highlighted in red in Figure 7. Right click on the black bar above the grid and Add channels CH-0 and CH-0_1'
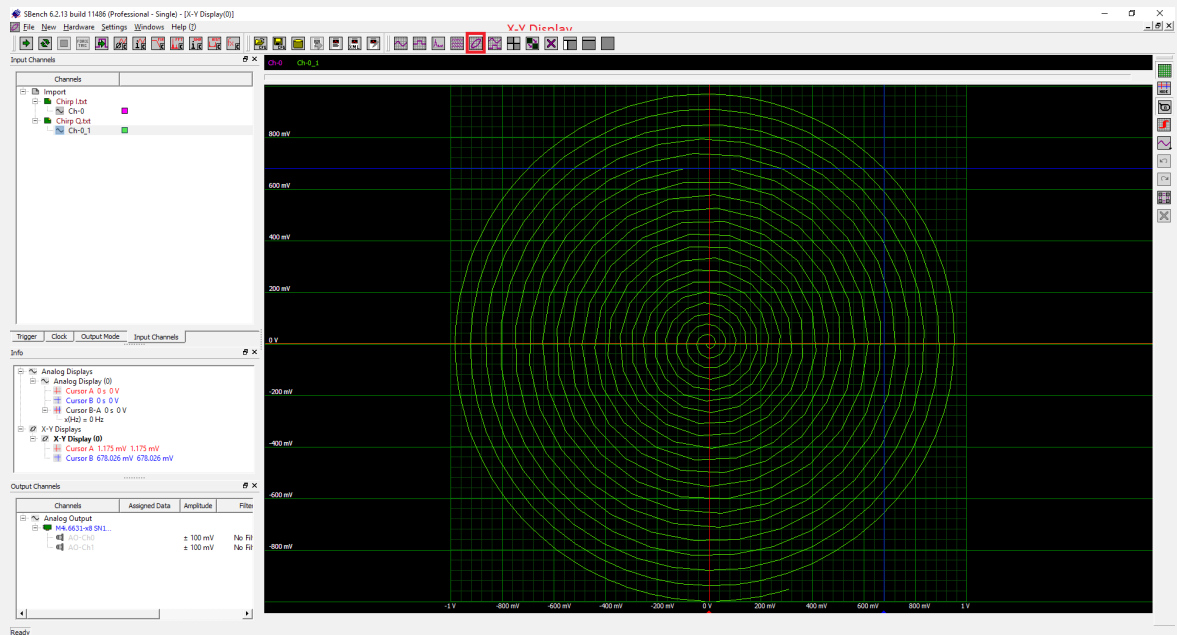
Figure 7: X-Y-display of the I and Q part of the chirp signal.

The spiral shape is the result of the complex modulation being used. This type of plot of the quadrature components of a radar signal is called a phase trajectory. Note the cursors have been applied to the X-Y display. The blue, Cursor B intersects at 678 mV, 678 mV. If you take the arc tangent of ratio of these X and Y coordinates you get the phase of the point of intersection. In this case it is 45 degrees.

Conclusion

We have imported two ASCII text files containing radar-like quadrature signals into SBench 6. We've learned two methods to populate display grids and investigated the use of the X-Y display to make some simple phase measurements. Now you are ready to import your own signals into SBench 6 and apply any of the signal processing tools.