A.1 - Pico Scope 7 Tutorial

The following sections include a walk-through tutorial for Pico Scope 7 and an associated laboratory exercise. These sections will give an overview of the important features required to conduct the laboratory exercises.

Watch tutorial video at [PicoScope Tutorial Video]



Figure A.1.1: Pico Scope interface.

A.1.1. Walk Through Tutorial for Pico Scope

i. Switch on the **TIMS-301 modelling system** to obtain 000 on the frequency counter screen.

ii. Connect a BNC from CH1 of the scope selector of the TIMS to channel A of the Pico Scope interface, i.e., either signal in channel A or signal in channel B of CH1 of the scope selector can go to channel A of the Pico Scope interface.

iii. Go to Start icon in Windows, go to all programs, search for Pico Technology and select **Pico Scope 7**.

iv. Connect a wire from 100 kHz sine of the master signals of the TIMS to channel A of the CH1. Toggle the front panel switch of the CH1 to A, i.e., signal in channel A of the CH1 can go to channel A of the Pico Scope interface.

v. Signal on the Pico Scope screen is 100 kHz sine. It does not look like a sine signal because it needs some adjustments. NOTE: To find the keywords/options mentioned below, move the cursor over various icons on the Pico Scope screen.

vi. Following are the four types of channels:

   a. **Channel A**: This channel is given in blue color.
   b. **Channel B**: This channel is given in red color.
   c. **Channel C**: This channel is given in green color.
   d. **Channel D**: This channel is given in yellow color.

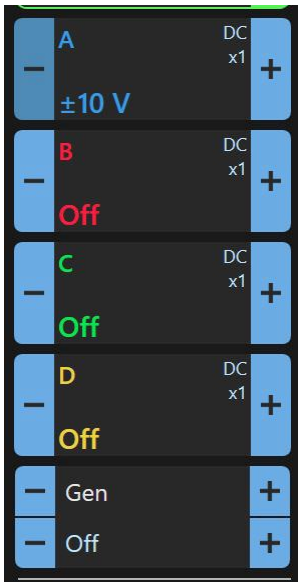


Figure A.1.2: Four channels on the Pico Scope screen.

vii. **Input range** for channel A is used to set the best amplitude resolution of the signal. It is set to auto by default, now change it to $\pm$ 500 mV.

viii. **Red exclamatory mark** at the top left corner of the screen indicates that the signal peaks are being clipped. To fix this, change the input range to $\pm$ 5 V.

ix. **Collection time** is used to set the number of cycles of the signal. It is set to 5 ms/div by default, now change it to 100 μs/div.

x. Under **channel options** (Click on the channel)for channel A, **resolution enhancement** is used to improve the signal resolution. The resolution enhancement is under the 'DSP' tab. Maximum number of bits is set to 8 by default, now change it to 12.

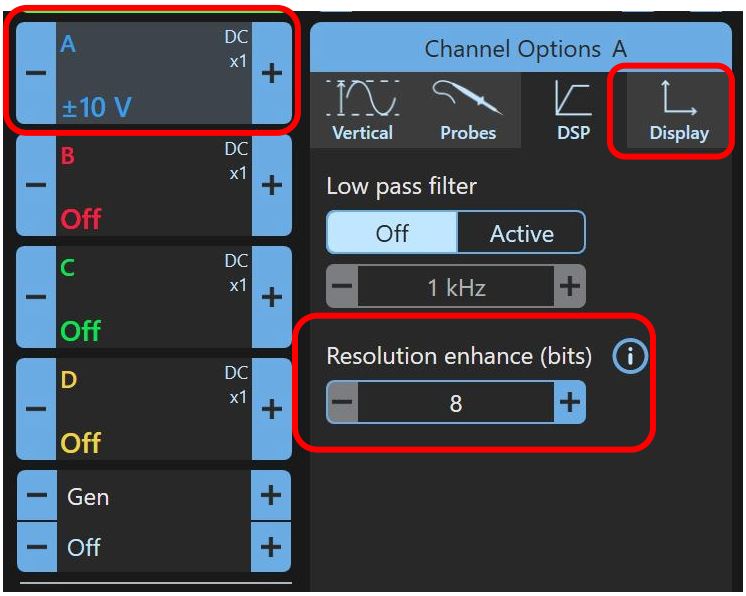


Figure A.1.3: Resolution enhancement for channel A.

xi. Following are the three modes of operation:

a. **Scope mode**: This mode shows the oscilloscope display, i.e., amplitude vs. time.

b. **Spectrum mode**: This mode shows the spectrum display, i.e., power vs. frequency.

c. **Persistence mode**: This mode shows the digital color display, i.e., amplitude vs. time.

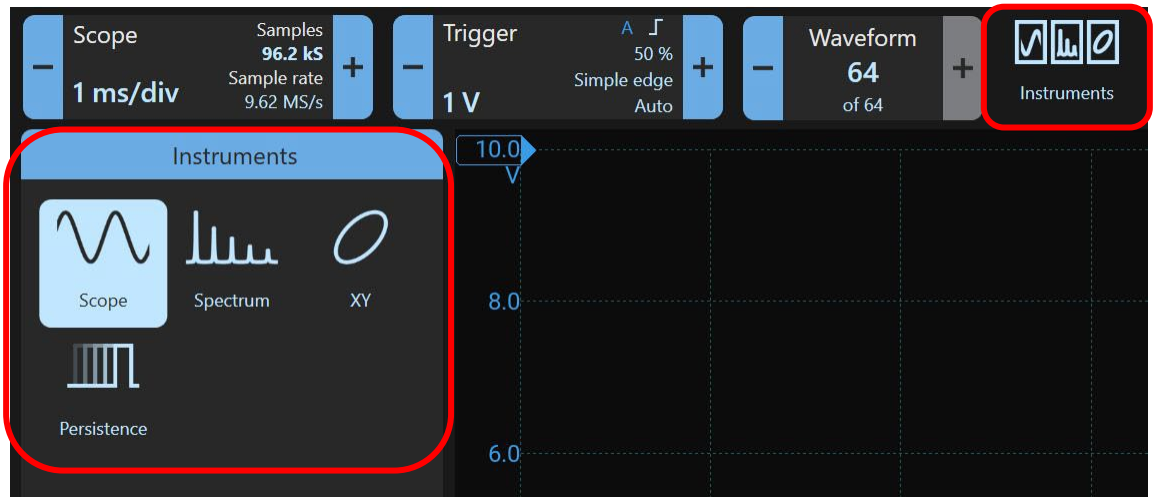


Figure A.1.4: Tool bar showing the three modes of operation, i.e., a, b and c.

xii. Following are the three types of views:

a. **Scope view**: This shows the oscilloscope display, i.e., amplitude vs. time.

b. **Spectrum view**: This shows the spectrum display, i.e., power vs. frequency.
c. **XY view**: This shows the V-I curve of one signal against the V-I curve of another signal.





Figure A.1.6: Scope view and spectrum view displayed simultaneously under the scope mode.

xiv. Select the spectrum view, under the views. Note you can select other view options instead and the view changes from e.g. spectrum to scope. Only scope view is displayed under the scope mode.

xv. Following are the two methods to perform signal measurements:

a. **Manual measurements**: Stop the signal by clicking on the **stop symbol (red)** at the bottom left corner of the screen. Observe the **white square cursors** at the bottom left corner of the screen. Drag the first cursor on to a signal peak and drag the second cursor on to another signal peak. A small window at the top of the screen will show the time difference between the two signal peaks. Observe the **blue square cursors** at the top left corner of the screen. Drag the first cursor to the maximum amplitude of the signal and drag the second cursor to the minimum amplitude of the

signal. A small window at the top of the screen will show the peak to peak voltage.

b. **Automatic measurements**: Start the signal by clicking on the **run symbol (green)** at the bottom left corner of the screen. Go to measurements and select **add measurement**. Since the signal is given to channel A of the Pico Scope interface, select the channel source as A for measurement. Select the type of measurement as peak to peak and select whole trace to measure. A window at the bottom of the screen will show the min, max and average values of the peak to peak measurement. Consider the average of 20 capture counts as the best result. NOTE: Results of the automatic measurements should be close to results of the manual measurements.



Figure A.1.7: Automatic measurements and manual measurements under the scope mode.

xvi. Go to measurements and select **delete measurement.** This will remove the automatic measurements. Cancel the small windows at the top of the screen to remove the manual measurements.

xvii. Alternatively, use the shortcut icons (green) at the bottom right corner of the screen to add or delete measurements.

xviii. **Windowed zoom** is used to zoom into a particular region of the signal. Select it and drag over a particular region of the signal. A small window at the bottom right corner of the screen will show region of interest. Close the small window to go back to the original scale of the screen.

xix. Select the **trigger** options as auto and A. Automatic trigger will give a stable signal on the screen.

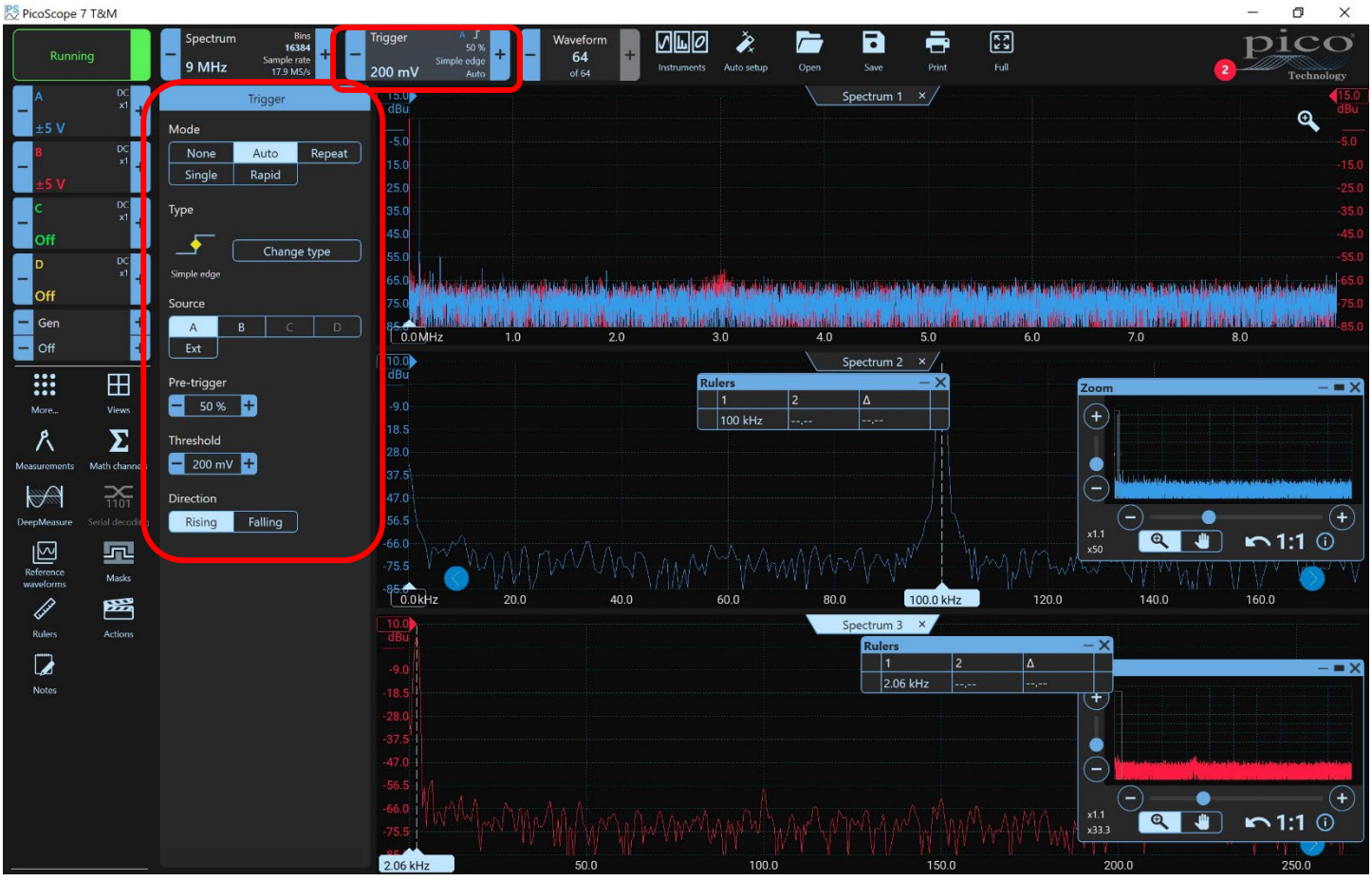


Figure A.1.8: Trigger options.

xx. Switch to the frequency domain by selecting the spectrum mode.

xxi. **Spectrum range** is used to set the span of peak frequencies under consideration. It is set to 15.63 MHz by default, now change it to 199.7 kHz to view the 100 kHz signal peak on the screen.

xxii. Select the windowed zoom to focus around 90 kHz to 110 kHz.

xxiii. Perform manual measurement and automatic measurement as explained in step **xv**, to observe the frequency at the signal peak.

xxiv. Switch to the persistence mode, change the collection time to 20 μs/div and confirm that the trigger options are set to auto and A.

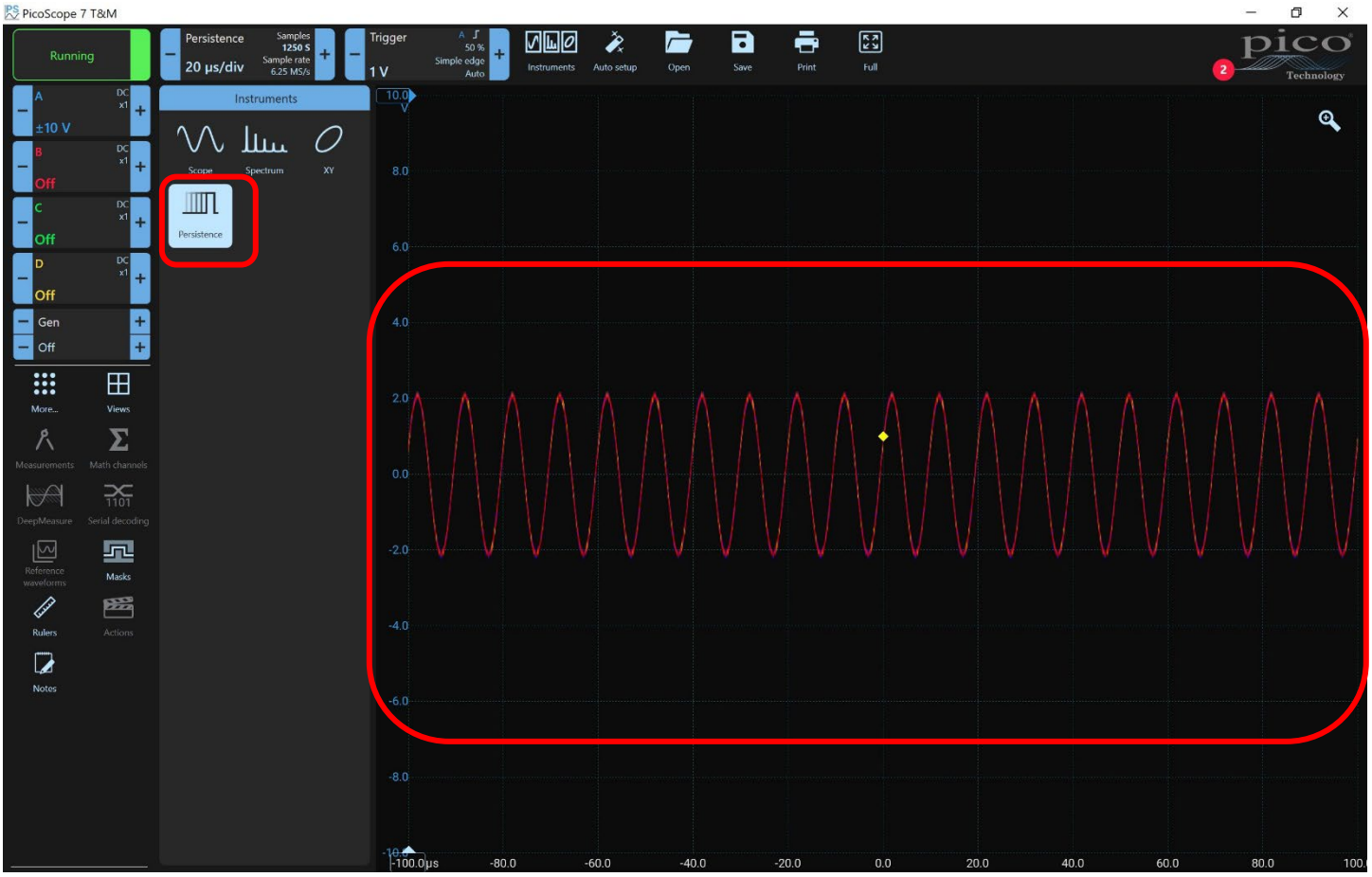


Figure A.1.9: Persistence mode.

A.1.2. Laboratory Exercise

i. Switch on the TIMS-301 modelling system to obtain 000 on the frequency counter screen.

ii. Connect a BNC from CH1 of the scope selector to channel A of the Pico Scope interface.

iii. Connect a BNC from CH2 of the scope selector to channel B of the Pico Scope interface.

iv. Start the Pico Scope 6 software. Insert an audio oscillator in one of the TIMS's tracks.

v. Connect a wire from sine of the audio oscillator to channel A of the CH1. Toggle the front panel switch of the CH1 to A. Turn the knob of the audio oscillator to generate 1 kHz sine signal.

vi. Connect a wire from 100 kHz sine of the master signals to channel A of the CH2. Toggle the front panel switch of the CH2 to A.

vii. Since there are two incoming signals, i.e., 1 kHz sine signal to channel A of the Pico Scope interface and 100 kHz sine signal to channel B of the Pico Scope interface, settings for channel A and channel B need to be changed.

viii. Under the scope mode, for channel A and channel B, change the input range to $\pm$ 5 V and select the maximum number of bits as 12. Change the collection time to 500 μs/div and change the trigger options to auto and B.

ix. Add two scope views under the scope mode. Select the second view, right click on it and disable B under channels. Select the third view, right click on it and disable A under channels. I.e., first view has signals from channel A and channel B, second view has signal from channel A and third view has signal from channel B.

x. Measure frequency of channel A and frequency of channel B.

xi. Take a screenshot of sine of the audio oscillator and 100 kHz sine of the master signals under the scope mode.

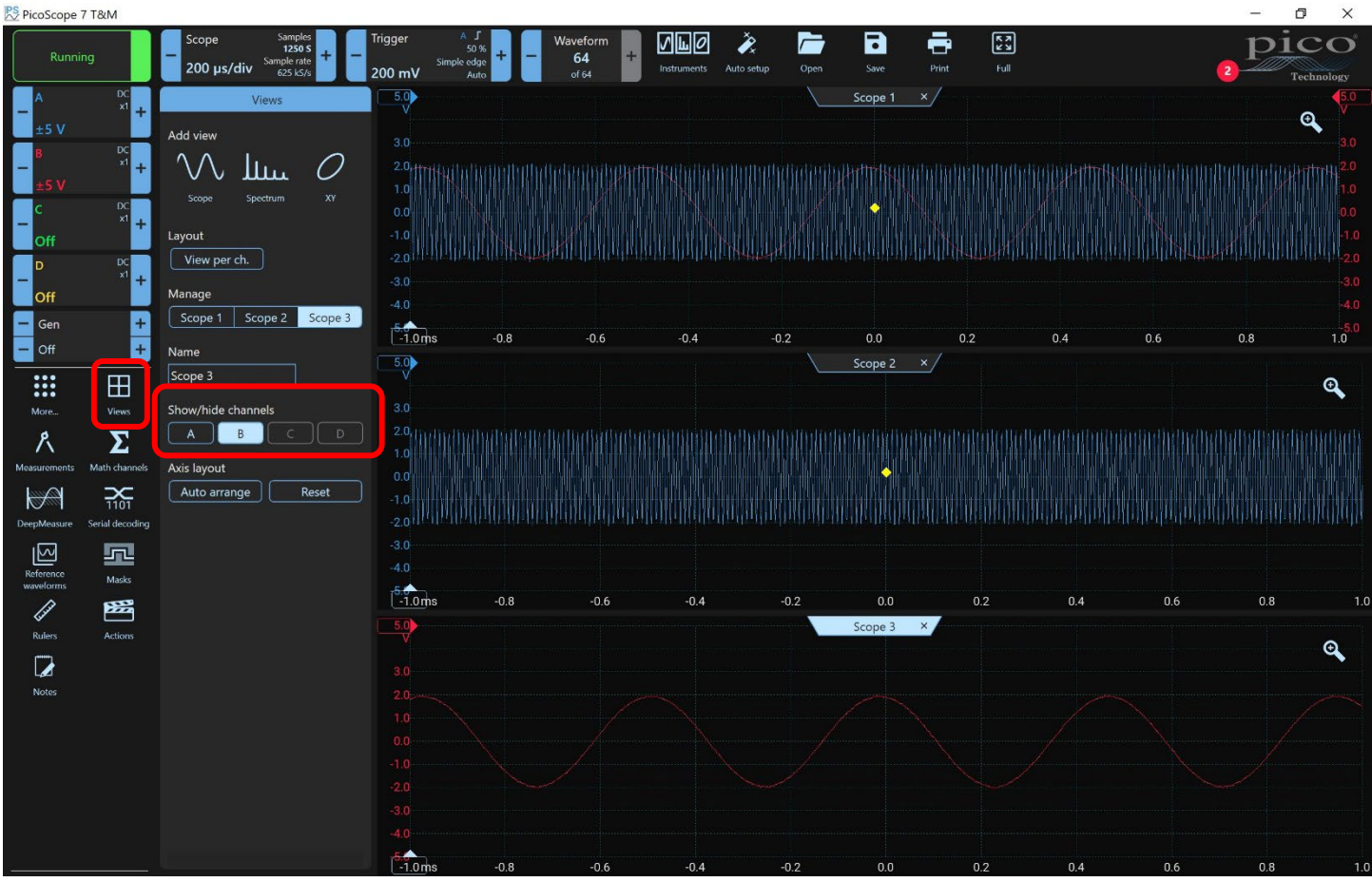


Figure A.1.10: Screenshot of sine of the audio oscillator and 100 kHz sine of the master signals under the scope mode, showing the two sine signals. Scope 1: 1 kHz sine signal and 100 kHz sine signal, Scope 2: 1 kHz sine signal and Scope 3: 100 kHz sine signal.

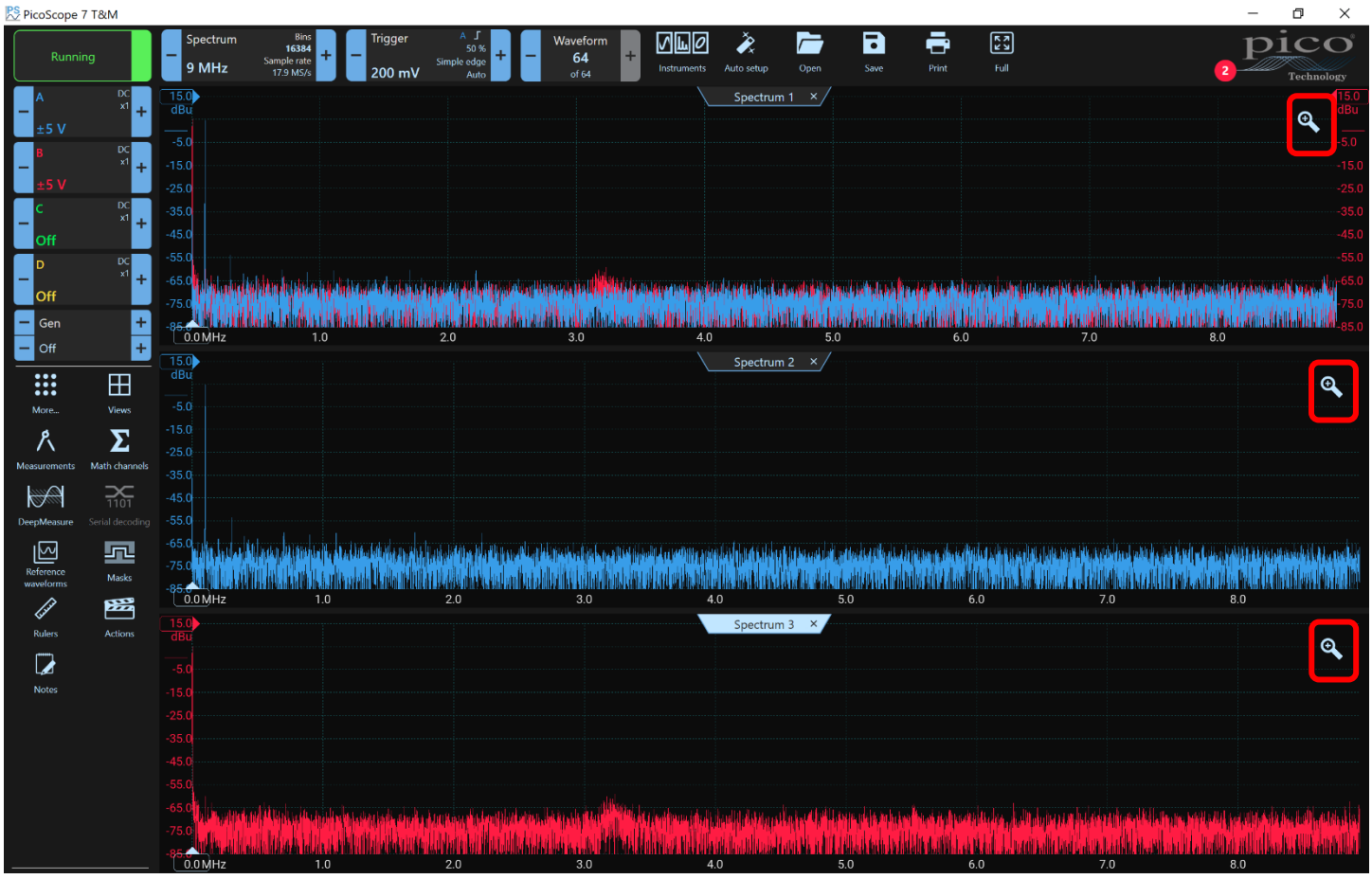
xii. Under the spectrum mode, for channel A and channel B, change the input range to $\pm$ 5 V. Change the spectrum range to 199.7 kHz and change the trigger options to auto and B.

xiii. Add two spectrum views under the spectrum mode. Select the second view, right click on it and disable B under channels. Select the third view, right click on it and disable A under channels. I.e., first view has signals from channel A and channel B, second view has signal from channel A and third view has signal from channel B.

xiv. Measure frequency of channel A and frequency of channel B.

xv. Select the windowed zoom to focus around 90 kHz to 110 kHz. Measure frequency at the signal peak.

xvi. Take a screenshot of sine of the audio oscillator and 100 kHz sine of the master signals under the spectrum mode.




PicoScope 7 T&M
Running
Spectrum
9 MHz
Bins
16384
Sample rate
17.9 MS/s
Trigger
200 mV
Simple edge
Auto
Waveform
64
of 64
Instruments
Auto setup
Open
Save
Print
Full
pico
Technology
Spectrum 1
Spectrum 2
Spectrum 3
Rulers
1
2
Δ
100 kHz
2.06 kHz
Zoom
x1.1
x50
x33.3
1:1
More...
Views
Measurements
Math channels
DeepMeasure
Serial decoding
Reference waveforms
Masks
Rulers
Actions
Notes

A.1.12.

Figure A.1.12: Screenshot of sine of the audio oscillator and 100 kHz sine of the master signals under the spectrum mode, showing the two signal peaks. Spectrum 1: 1 kHz signal peak and 100 kHz signal peak, Spectrum 2: 1 kHz signal peak and Spectrum 3: 100 kHz signal peak