Test ID 5-15 Utility Line Impedance Test Procedures Guide

Revision 1.1
Tektronix
October 13, 2010

Equipment Required

Table 1 lists the equipment required to perform the Utility Line Impedance Test measurement.

Table 1: Equipment required

Item	Qty.	Recommended equipment
Sampling oscilloscope	1 ea.	Tektronix DSA8200 (or TDS8000 / TDS8000B / CSA8000 / CSA8000B)
TDR sampling module	1 ea.	Tektronix 80E04
50 Ω SMA matched pair cable	1 ea,	Tektronix P/N:174-4866-00
50 Ω SMA terminator (male)	3 ea.	Tektronix P/N:015-1022-01
HEAC TDR-R adapter	2 ea.	Tektronix TF-HEAC-TDR-AR (Type A connector) TF-HEAC-TDR-CR (Type C connector)

NOTE: *To protect the sampling module from damage due to electro-overstress(EOS) and electrostatic discharge(ESD), a cable under test to discharge the static voltage completely from it before performing the procedures.*

While performing the following procedure, be sure to wear a grounded antistatic wrist strap to discharge the static voltage from your body.

This procedure is written assuming that the TDR module is inserted to CH1, CH2.
If the module is inserted to other channel, replace the channel number in this procedure.

Calibration

Compensation

Allow the sampling oscilloscope to warm up 20 minutes before compensation process.

(1) Click the **Utilities** on top menu, and then select the **Compensation**.

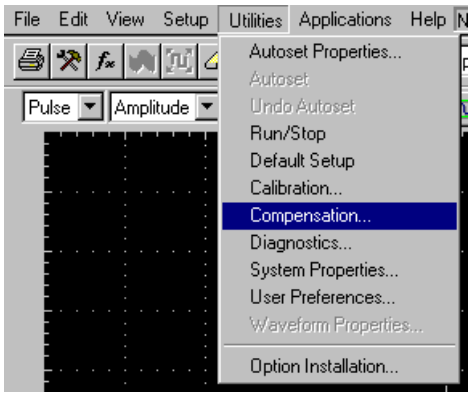

Figure 1: Utilities menu

(2) Click the **Execute** button on Compensation window.

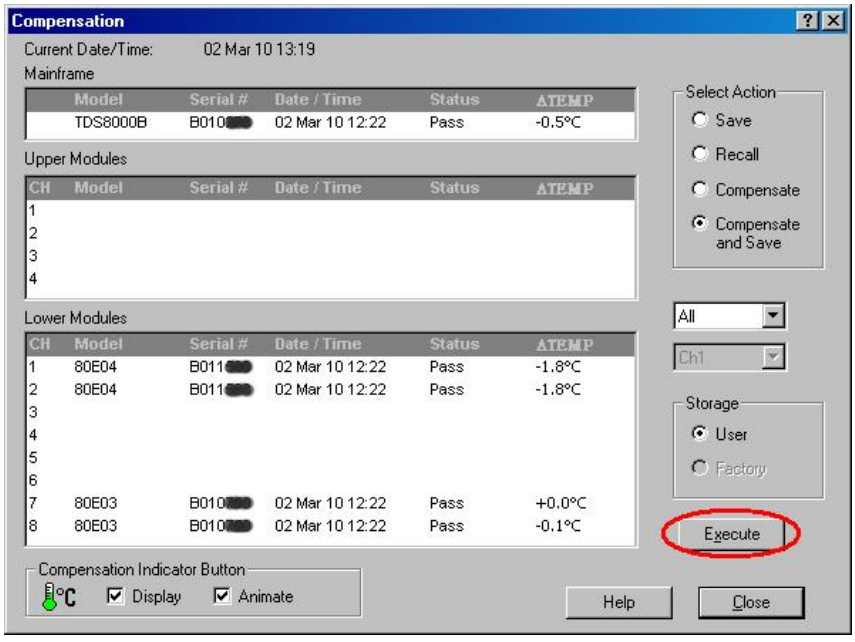

Figure 2: Compensation window.

(3) Start the test after thermometer is **green**. 

Test ID 5-15: Utility Line Impedance

Adjustment TDR Rise Time

(1) Connect the TDR module output CH1 to HEAC+ (J1) SMA connector on the input of the HEAC-TRD-R adapter with SMA cable, either channel of the matched pair SMA cable.

(2) Connect 50Ω terminator to HEAC- (J2) SMA connector (see Figure 3).

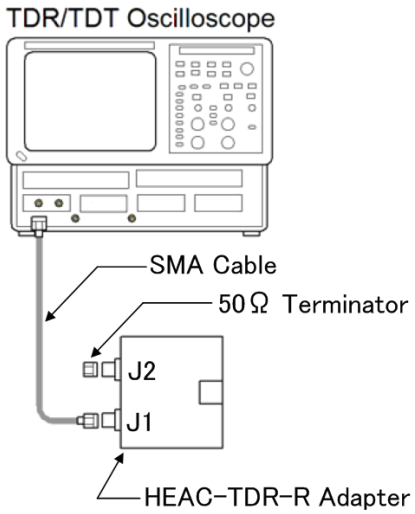

Figure 3: Utility Line Impedance Open Setup

(3) Press the **DEFAULT SETUP** button on the oscilloscope front-panel, and then click the **Yes** button.

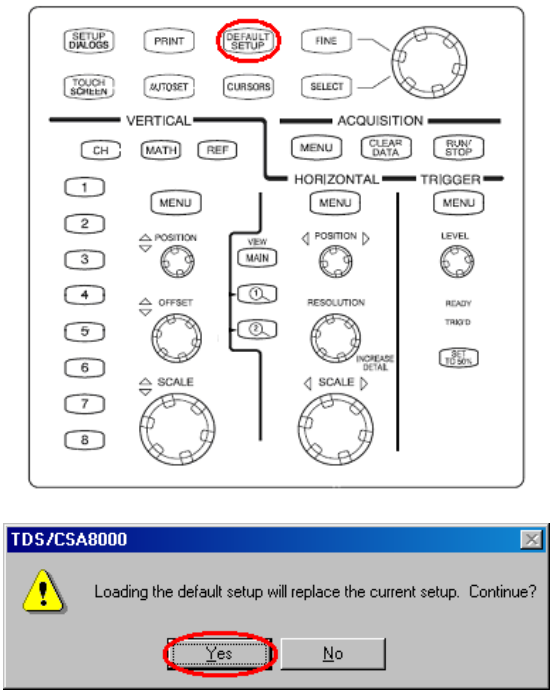

Figure 4: Front-panel button and default setup window

(4) Click Setups icon. 

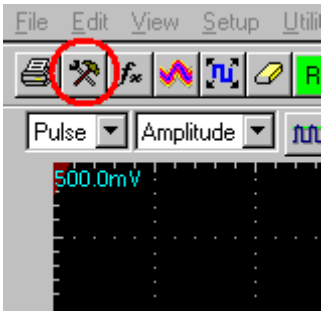

Figure 5: Setup icon

(5) Click the **TDR** tab on **Setups** window.

(6) Click the **Preset C1** button on **TDR** tab

(7) Select the **V** in **C1 ACQ Units** drop-down list box.

(8) Click the **Horz** tab on **Setups** window.

(9) Set the **Timebase Record Length** to **4000** on **Horz** tab.

(10) Set the **Timebase Horizontal Reference** to **50.0%** on **Horz** tab.

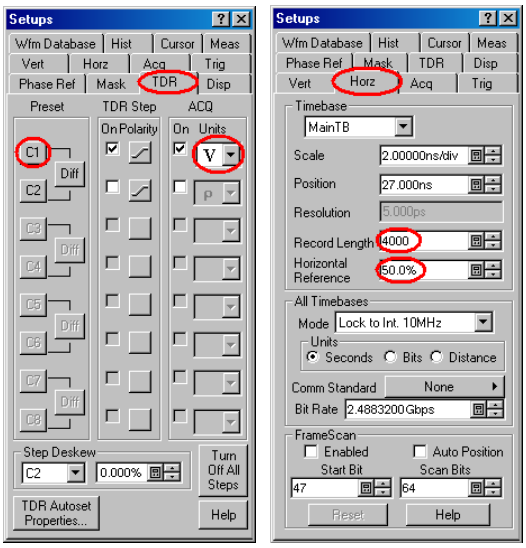

Figure 6: Setups windows

(11) Adjust the **HORIZONTAL POSITION** knob so that the edge of **C1** waveform is displayed at 5 major divisions from the left edge of the screen (see Figure 7).

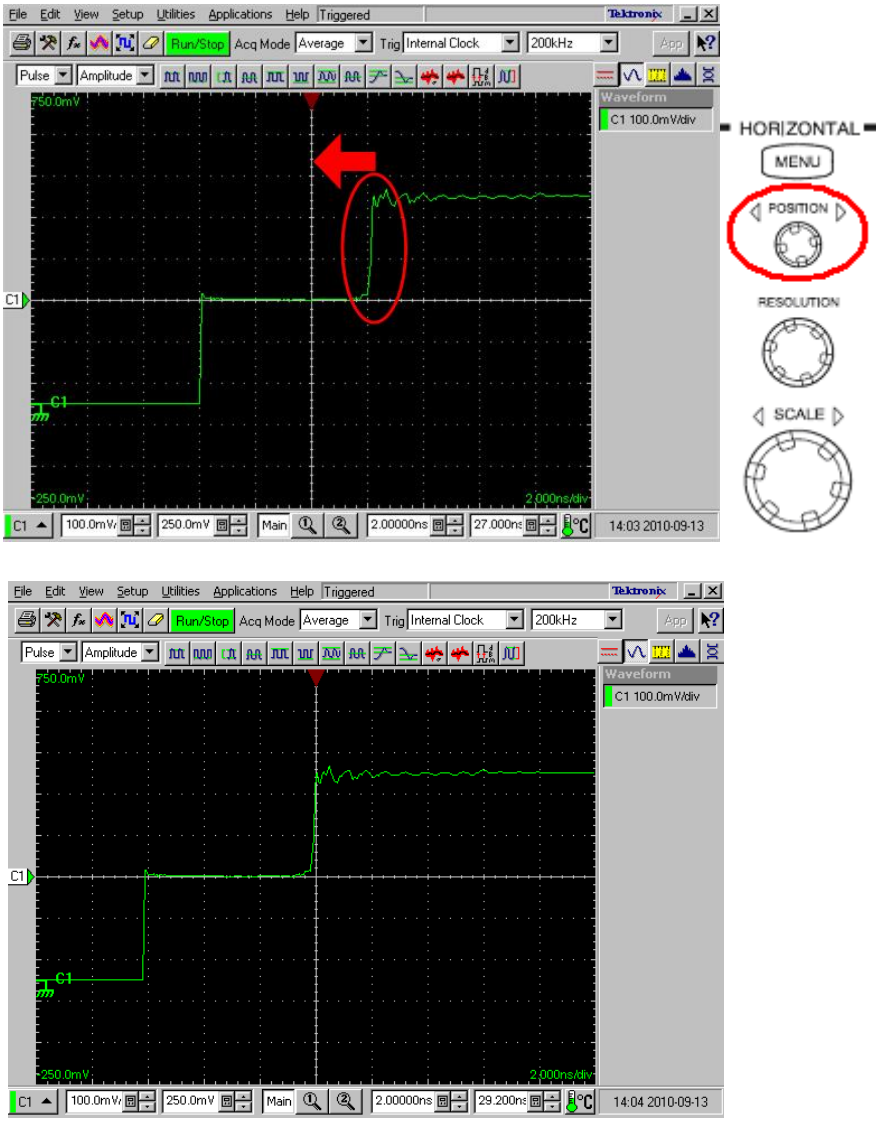

Figure 7: Setting Horizontal Position

(12) Adjust the **HORIZONTAL SCALE** knob so that the **Horizontal Main Scale** to 500 ps.

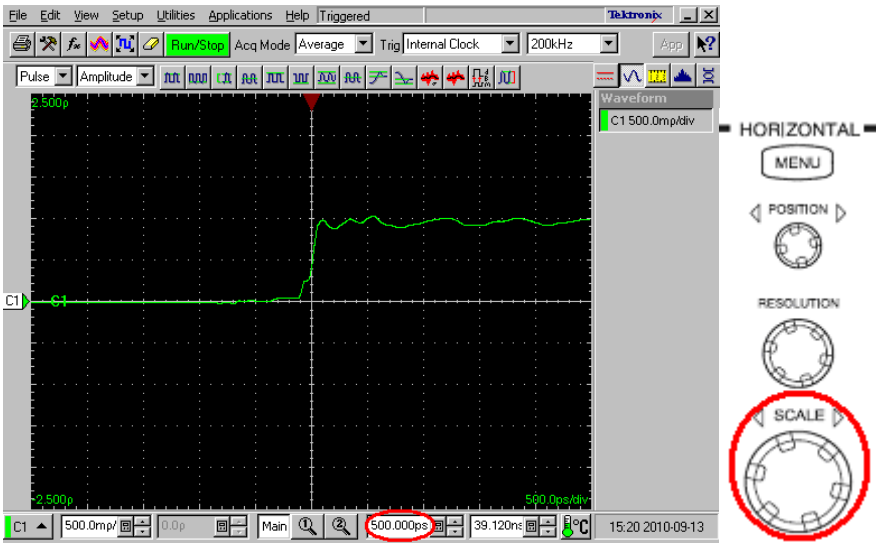

Figure 8: Setting Horizontal Scale

(13) Click the **Vert** tab on **Setups** window.

(14) Set the **Setup Scale** to **30 mV/div** and the **Setup Position** to **-4.000 div**.

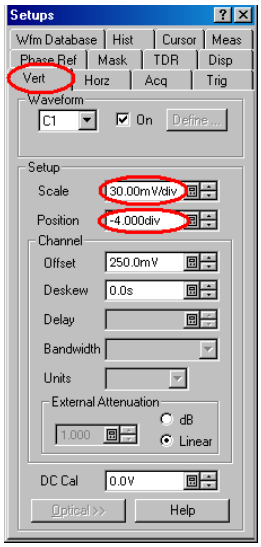

Figure 9: Vertical setups window

(15) Close **Setups Window**.

(16) Click the MATH icon. 

(17) Select the **M1** in **Math Waveform** drop-down list box on **Define Math** window.

(18) Enter "*Filter (C1)*" in the **Math Expression** filed on **Define Math** window.

(19) Select the **Centered** in **Filter Mode** drop-down list box on **Define Math** window.

(20) Set the **Math Waveform ON** check box for **M1** to ON in order to show the filtered single impedance waveform.

(21) Click the **OK** button on **Define Math** window.

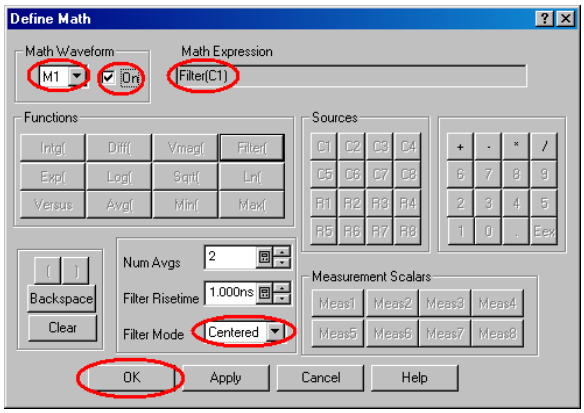

Figure 10: Defining filtered waveform

Figure 11: Rising edges of Filtered M1 and unfiltered C1

(22) Click the Setups icon. 

(23) Click the **Meas** tab on **Setups** window.

(24) Select the **Meas1** in drop-down list box on **Meas** tab.

(25) Click the **Select Meas** button, and then select **Pulse – Timing** > **Rise Time**.

(26) Click the **Source** tab on **Meas** tab

(27) Select the **Main M1** on **Source** tab.

(28) Set the **Meas1 ON** check box to on.

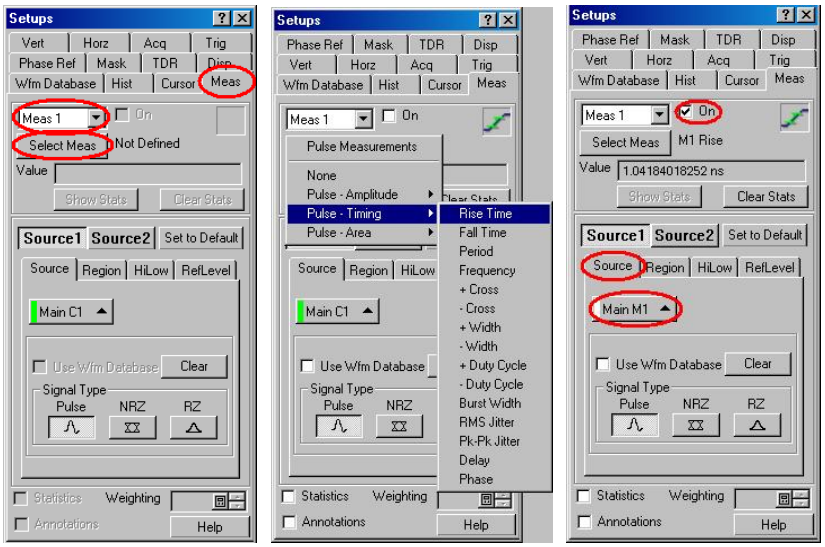

Figure 12: Measurement Setups window

(29) Close **Setups Window**.

(30) Click the MATH icon. 

(31) Adjust the **Filter Risetime** on **Define Math** window so that measurement value of **Rise M1** is equal to 1ns. If you cannot adjust the value to 1ns exactly, set it to the nearest value below 1ns.

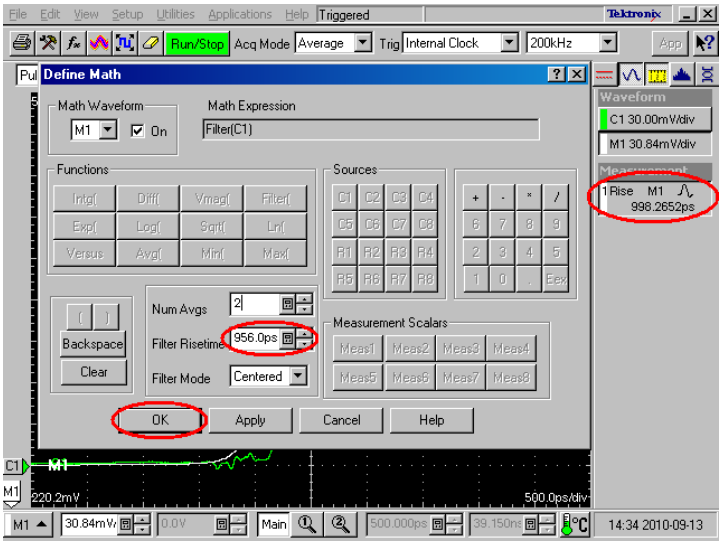

Figure 13: Setting Filter Risetime

(32) Click the **OK** button on **Define Math** window.

Defining Waveforms and Connecting Equipments

(1) Click the Setups icon. 

(2) Click the **TDR** tab on **Setups** window.

(3) Select the Ω in **C1 ACQ Units** drop-down list box.

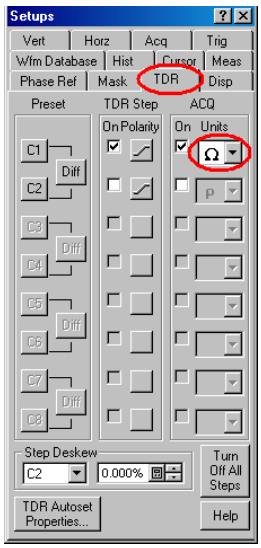

Figure 14: TDR Setup window

(4) Click the **Vert** tab on **Setups** window.

(5) Select **C1** in **Waveform** drop-down list box on **Vert** tab. (**C1** is the unfiltered single impedance waveform.)

(6) Set the **Setup Scale** to **10.00 Ω/div** and the **Setup Position** to **-5.000 div**.

(7) Select **M1** in **Waveform** drop-down list box on **Vert** tab. (**M1** is the filtered single impedance waveform.)

(8) Set the **Setup Scale** to **10.00 Ω/div** and the **Setup Position** to **-5.000 div**.

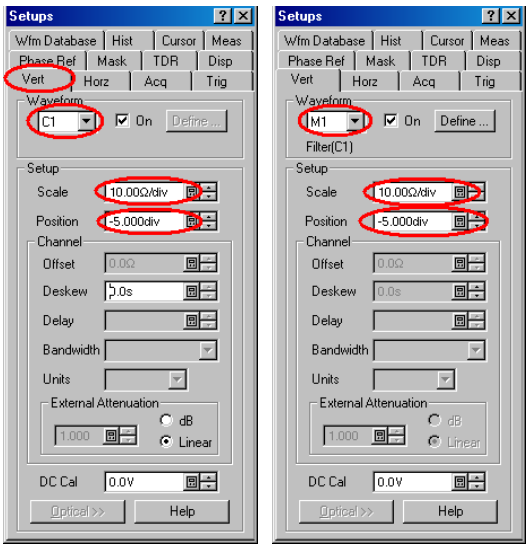

Figure 15: Vertical Setups window

Figure 16 :TDR Open Waveform

(9) Connect the near end of the cable to the first HEAC-TDR-R adapter.

(10) Connect the far end of the cable to the second HEAC-TDR-R adapter.

(11) Connect 50 Ω terminators to HEAC+ and HEAC– connectors on the far end of the HEAC-TRD-R adapter.

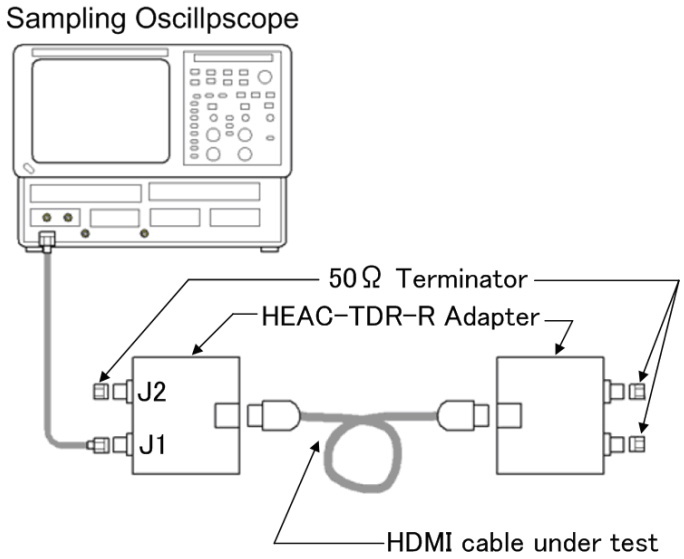

Figure 17: Utility Line Impedance Open Setup

Setting Horizontal Position

The unfiltered impedance waveform needs to be used in order to determine the horizontal reference position precisely during measuring impedance. This will reduce the impact of uncertainty on horizontal positioning caused by using the filtered impedance waveform.

(1) Adjust the **HORIZONTAL POSITION** knob so that **C1**, the unfiltered and single impedance waveform, change point is displayed at 2 major divisions from the left edge of the screen.

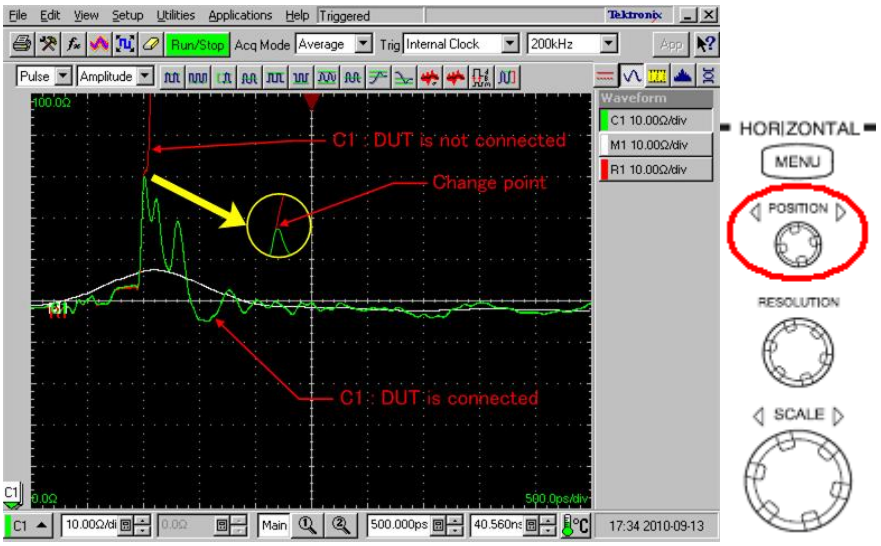

Figure 18: Setting Horizontal Position

Measuring Impedance

(1) Click the Setups icon. 

(2) Click the **Meas** tab on **Setups** window.

(3) Select the **Meas1** in drop-down list box on **Meas** tab.

(4) Click the **Select Meas** button, and then select **Pulse – Amplitude** > **Max**.

(5) Click the **Source** tab on **Meas** tab.

(6) Select the **Main M1** on **Source** tab.

(7) Set the **Meas1 ON** check box to on.

(8) Click the **Region** tab on **Meas** tab.

(9) Set the **Gates G1** to **20.00%** and the **Gates G2** to **70.00%** on **Region** tab.

(10) Set the **Gates On** check box to on.

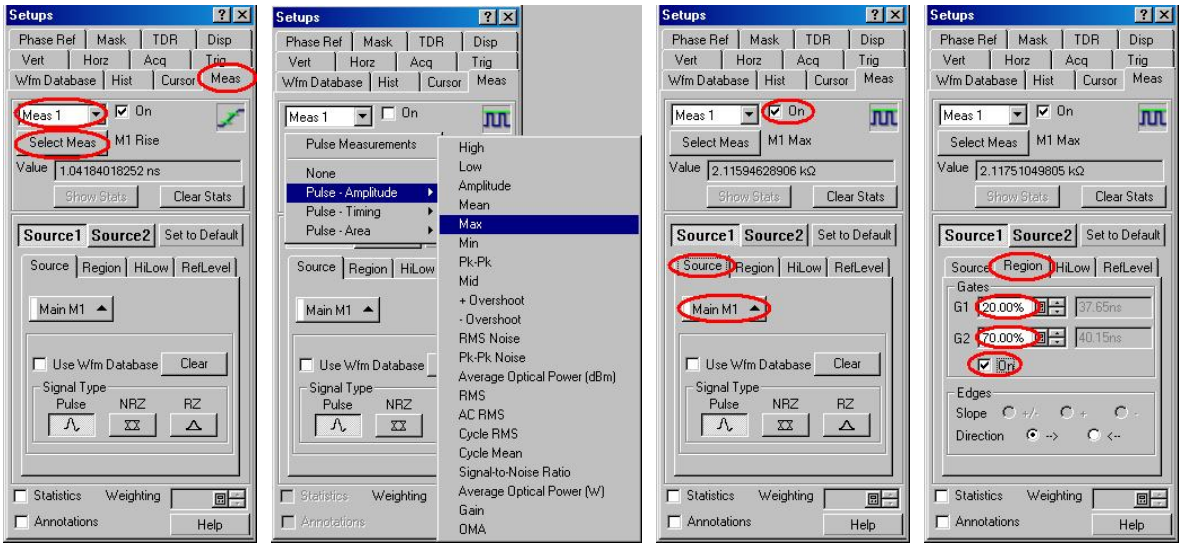

Figure 19: Measurement1 setups window

(11) Select the **Meas2** in drop-down list box on **Meas** tab.

(12) Click the **Select Meas** button, and then select **Pulse – Amplitude** > **Min**.

(13) Click the **Source** tab on **Meas** tab.

(14) Select the **Main M1** on **Source** tab.

(15) Set the **Meas1 ON** check box to on.

(16) Click the **Region** tab on **Meas** tab.

(17) Set the **Gates G1** to **20.00%** and the **Gates G2** to **70.00%** on **Region** tab.

(18) Set the **Gates On** check box to on.

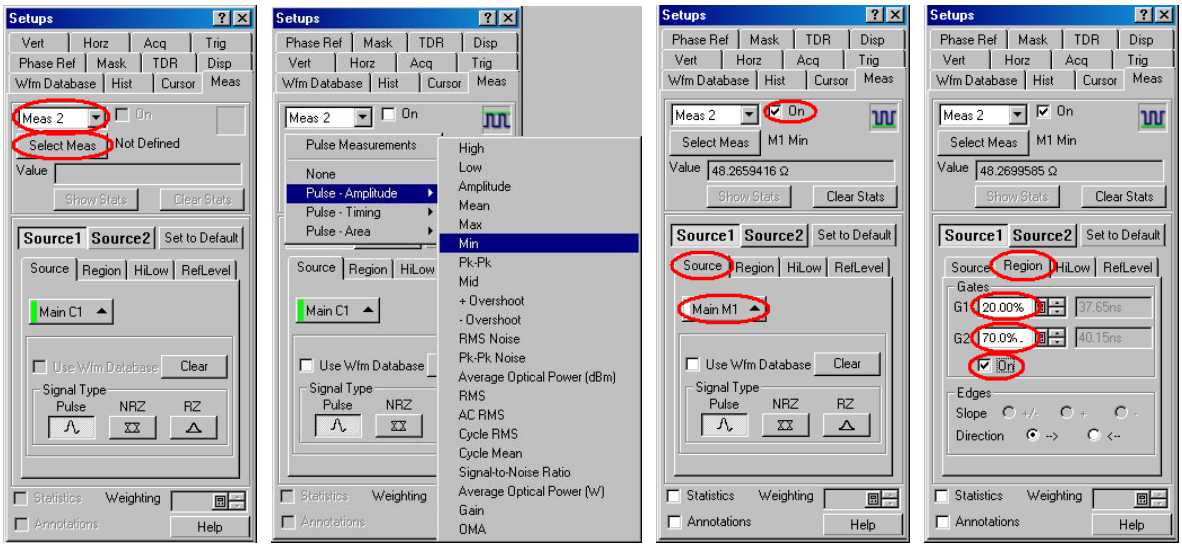

Figure 20: Measurement2 setups window

(19) Click the **Vert** tab on **Setups** window.

(20) Select **C1** in **Waveform** drop-down list box on **Vert** tab.

(21) Set the **Waveform On** check box for **C1** to OFF in order to hide the unfiltered single impedance waveform.

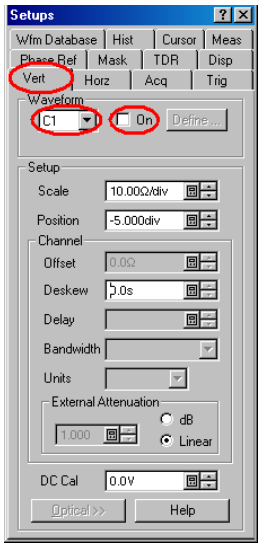

Figure 21: Vertical Setups window

(22) Utility Line Impedance is displayed as "**1 Max M1**" and **"2 Min M1**" on screen.

(23) If Utility Line Impedance max ("**1 Max M1**") is more than **74.25 Ω**, then fail.

(24) If Utility Line Impedance min ("**2 Min M1**") is less than **35.75 Ω**, then fail.

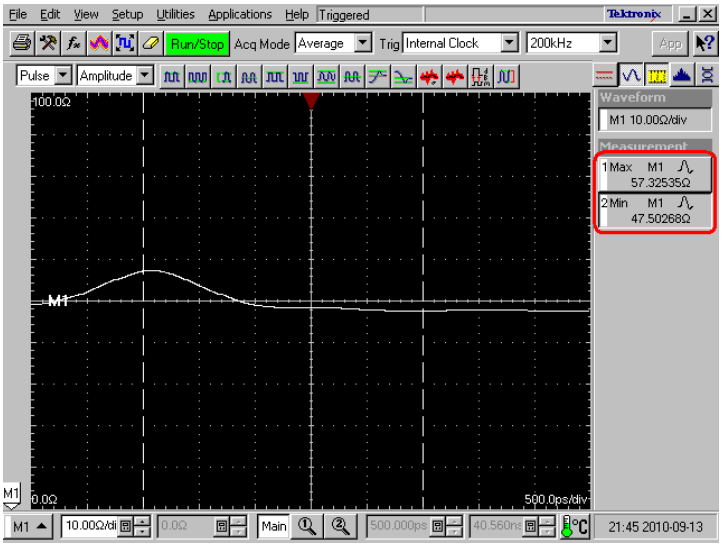

Figure 22: Result of Utility Line Impedance

(25) Swap the near-end connection and far-end connection of the cable assembly and repeat the test.

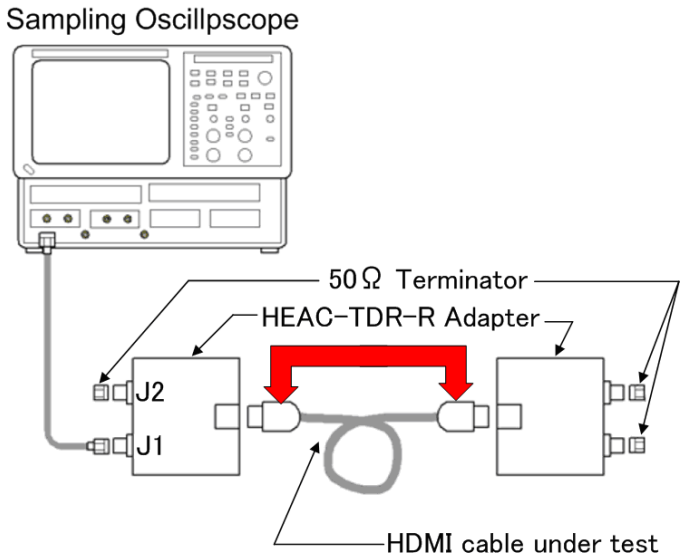

Figure 23: Swap near-end and far-end