Peter A. Dranishnikov Lab 6 (Manual ref. #7) EEL3112C section 01

Parameters:

Capacitor C	9.05×10^{-9}
Resistor 1 kΩ	975.3 Ω
Sense Resistor Red	9.985 Ω
Sense Resistor Black	9.929 Ω
Sense Resistor Green	9.919 Ω
Inductor L	9.96×10^{-3} H
Frequency f	10000 Hz
Time t	0.0001 s
Frequency ω	62831.8530717959 rad/s
V_{in}	5

RC Circuit:

Ω	theory	exp	% dev
Xc	-1758.6181557116	-1897.916386448	7.92%
z mag	852.9174510965	897.6660682226	5.25%
z theta	-29.0120121462	-28.44	1.97%

A	theory mag	theory theta (deg)	exp mag	exp delay (s)	exp theta (deg)	%dev mag	%dev theta
i_c	0.0028431414	90	2.634×10^{-3}	-2.470×10^{-5}	91.080	7.36%	1.20%
i_r	0.0051266277	0	4.815×10^{-3}	0.000	0.000	6.08%	0%
i_{in}	0.005862232	29.0120121462	5.570×10^{-3}	-7.900×10^{-6}	28.440	4.98%	1.97%

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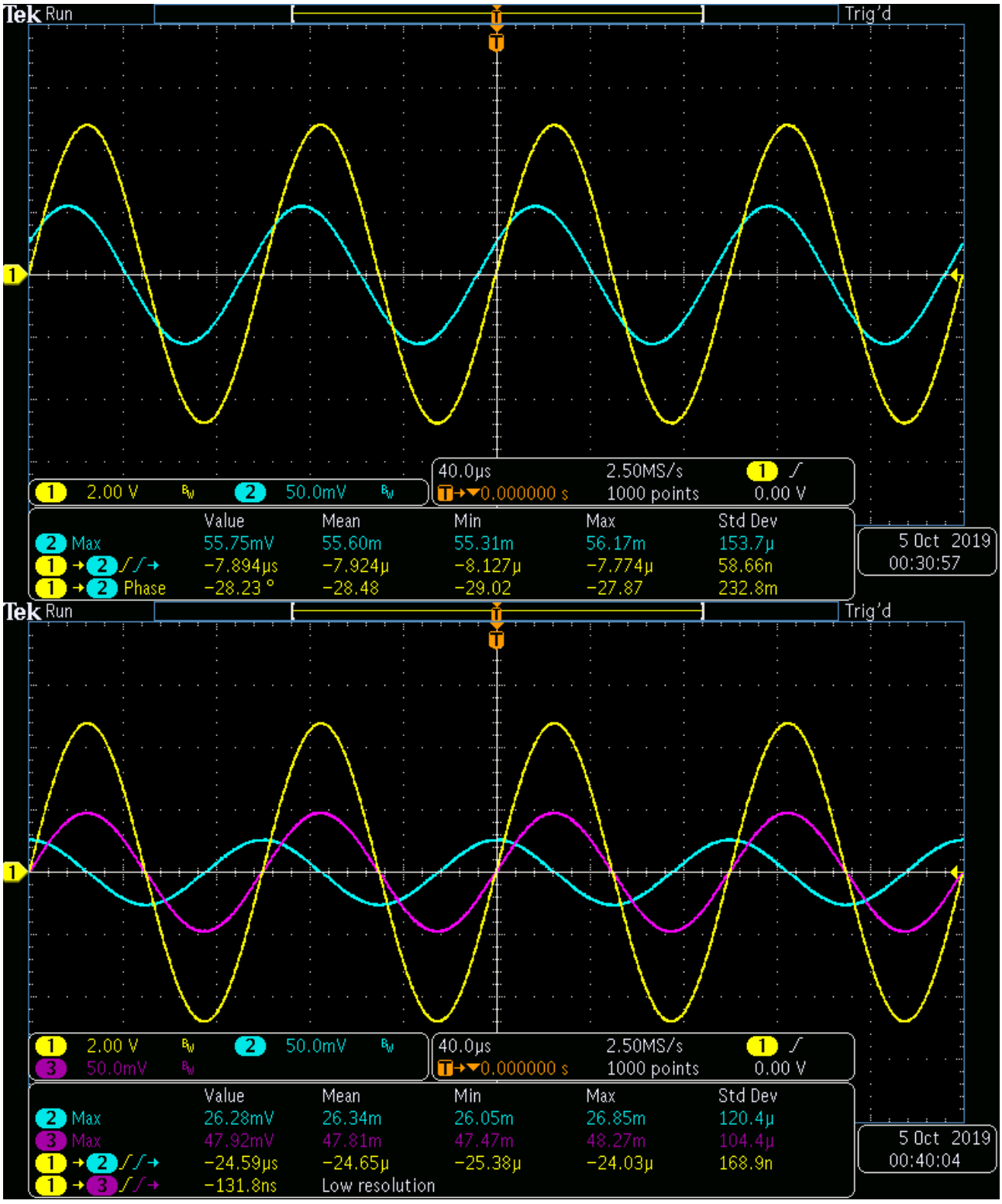

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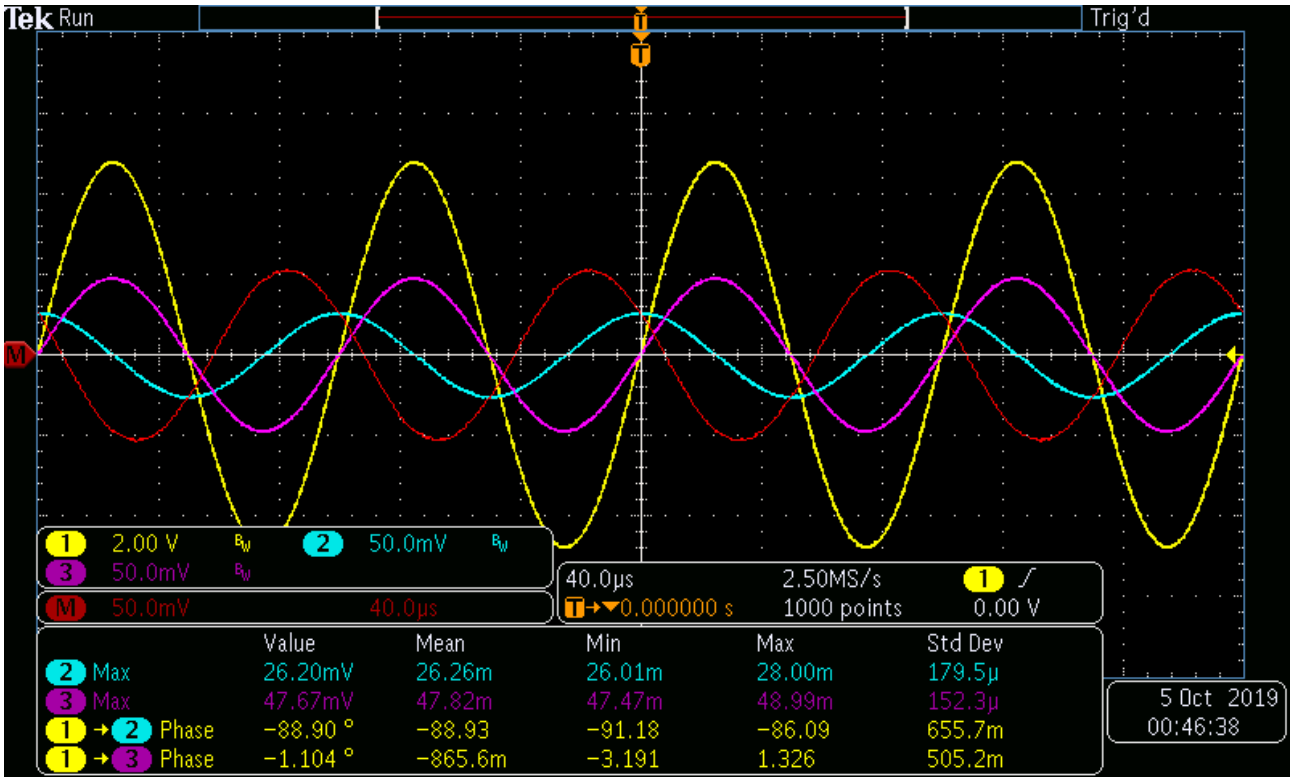

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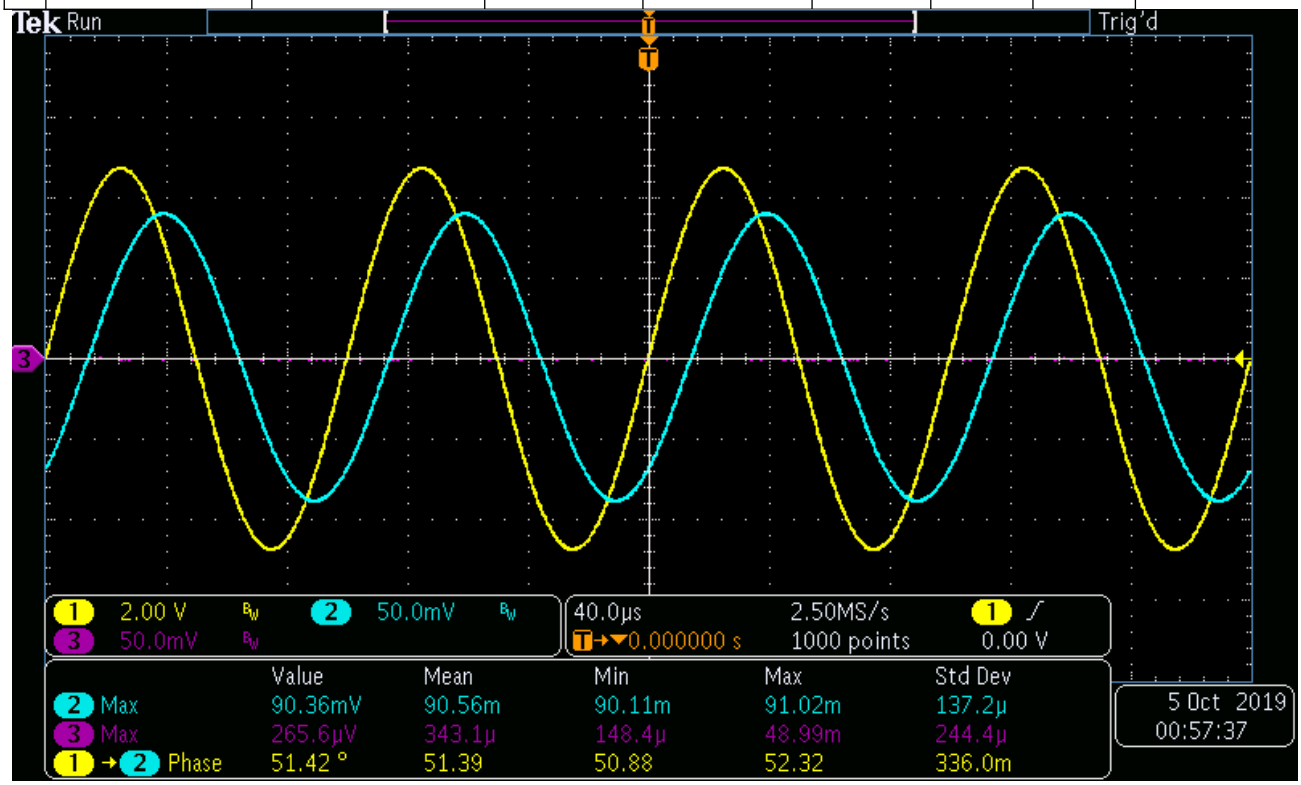
RL Circuit:

Ω	theory	exp	% dev

xl	625.8052565951	651.0196404099	4.03%
z mag	526.7019459512	552.1811154059	4.84%
z theta	57.3135729489	51.696	9.80%

A	theory mag	theory theta	exp mag	exp delay (s)	exp theta (deg)	%dev mag	%dev theta

i_L	0.007989706	-90	7.666×10^{-3}	-7.597×10^{-5}	-86.508	4.05%	3.88%
i_r	0.0051266277	0	4.740×10^{-3}	0.000	0.000	7.54%	0%
i_{in}	0.009493035	-57.3135729489	9.055×10^{-3}	-8.564×10^{-5}	-51.696	4.61%	9.80%



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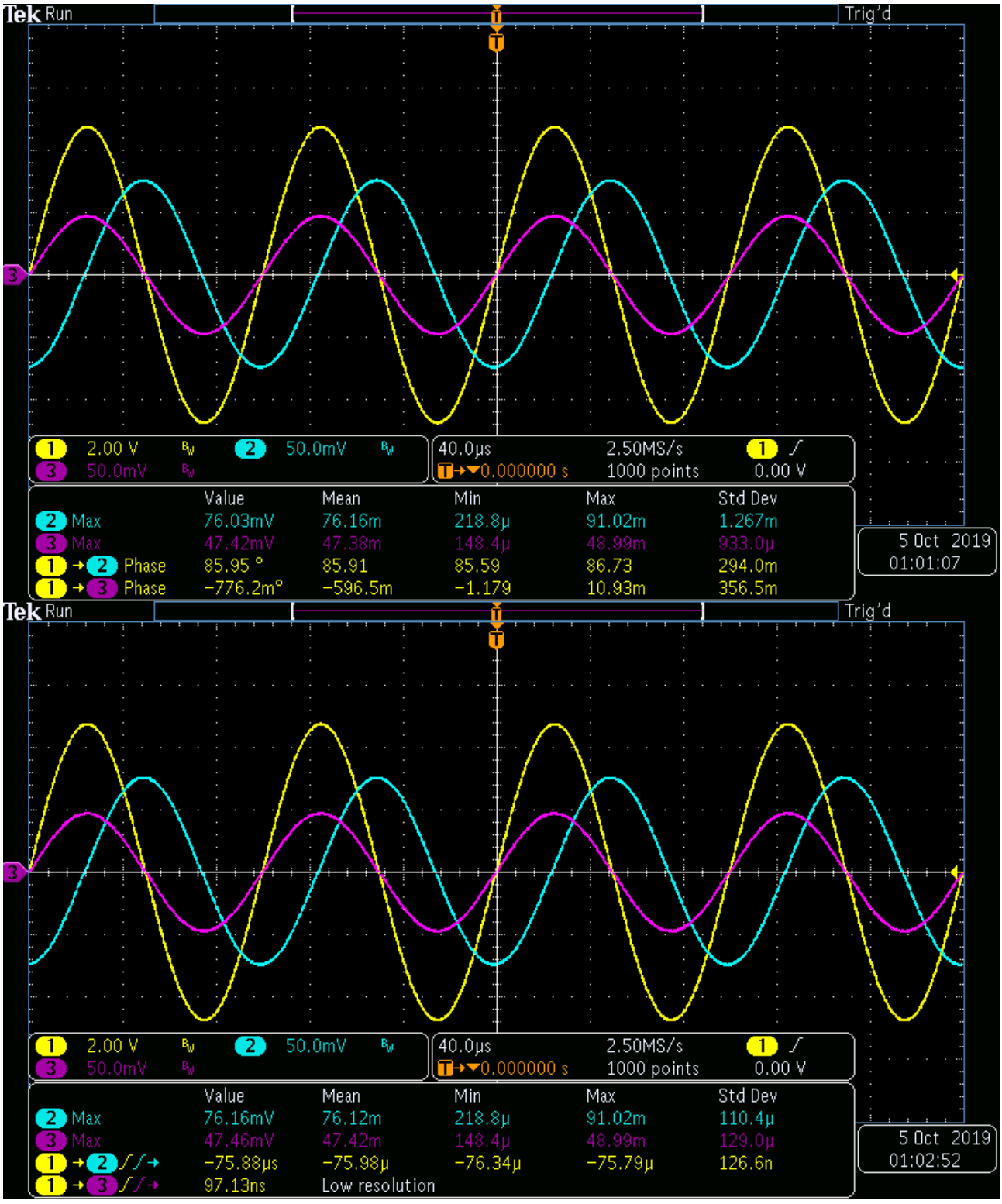

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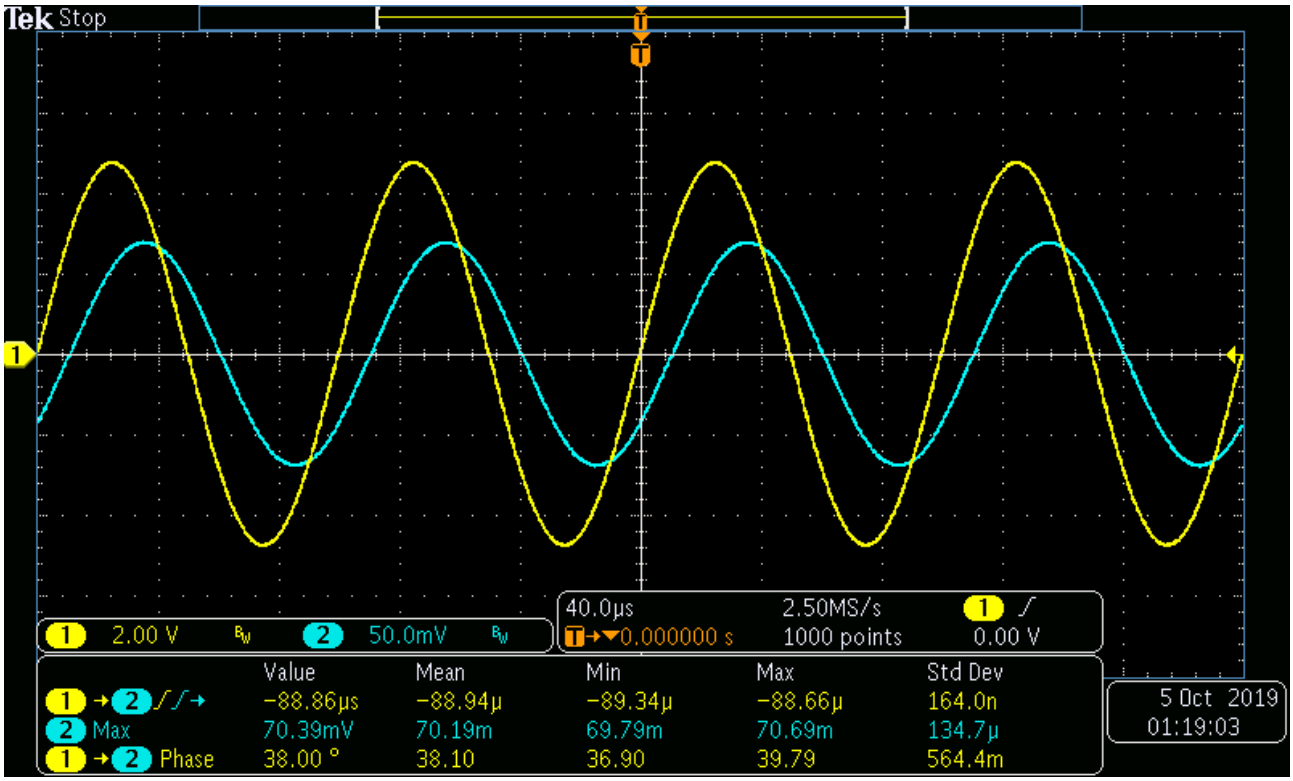
RLC Circuit:

Ω	theory	exp	% dev

xc	-1758.6181557116	-1914.7388595972	8.88%
xl	625.8052565951	647.7491148672	3.51%
z mag	688.3015783482	706.9136151562	2.70%
z theta	45.1111923205	40.104	11.10%

A	theory mag	theory theta	exp mag	exp delay (s)	exp theta (deg)	%dev mag	%dev theta

i_c	0.0028431414	90	2.611×10^{-3}	-2.525×10^{-5}	90.900	8.16%	1.00%
i_L	0.007989706	-90	7.705×10^{-3}	-7.596×10^{-5}	-93.456	3.56%	3.84%
i_r	0.0051266277	0	4.771×10^{-3}	0	0.000	6.94%	0%
i_{in}	0.0072642576	-45.1111923205	7.073×10^{-3}	-8.886×10^{-5}	-40.104	2.63%	11.10%



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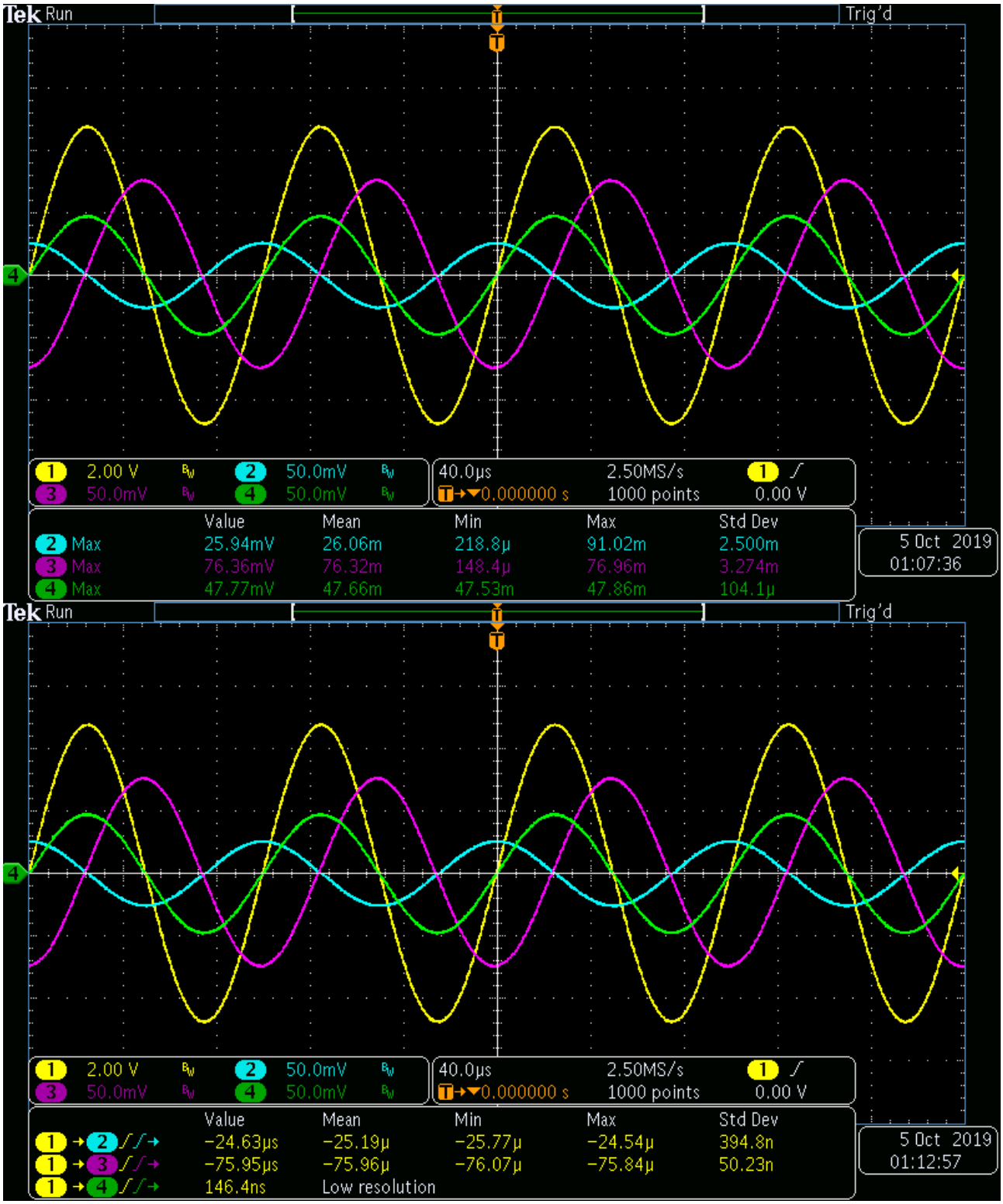

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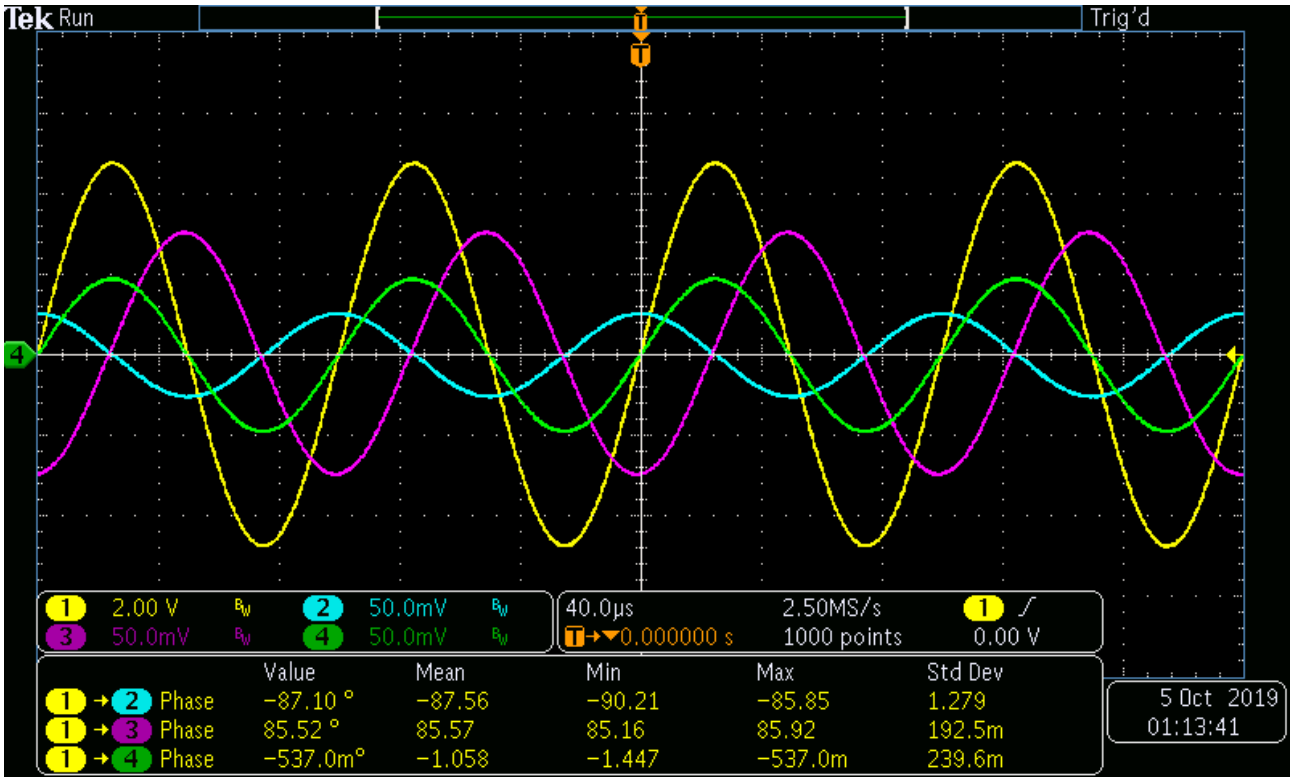
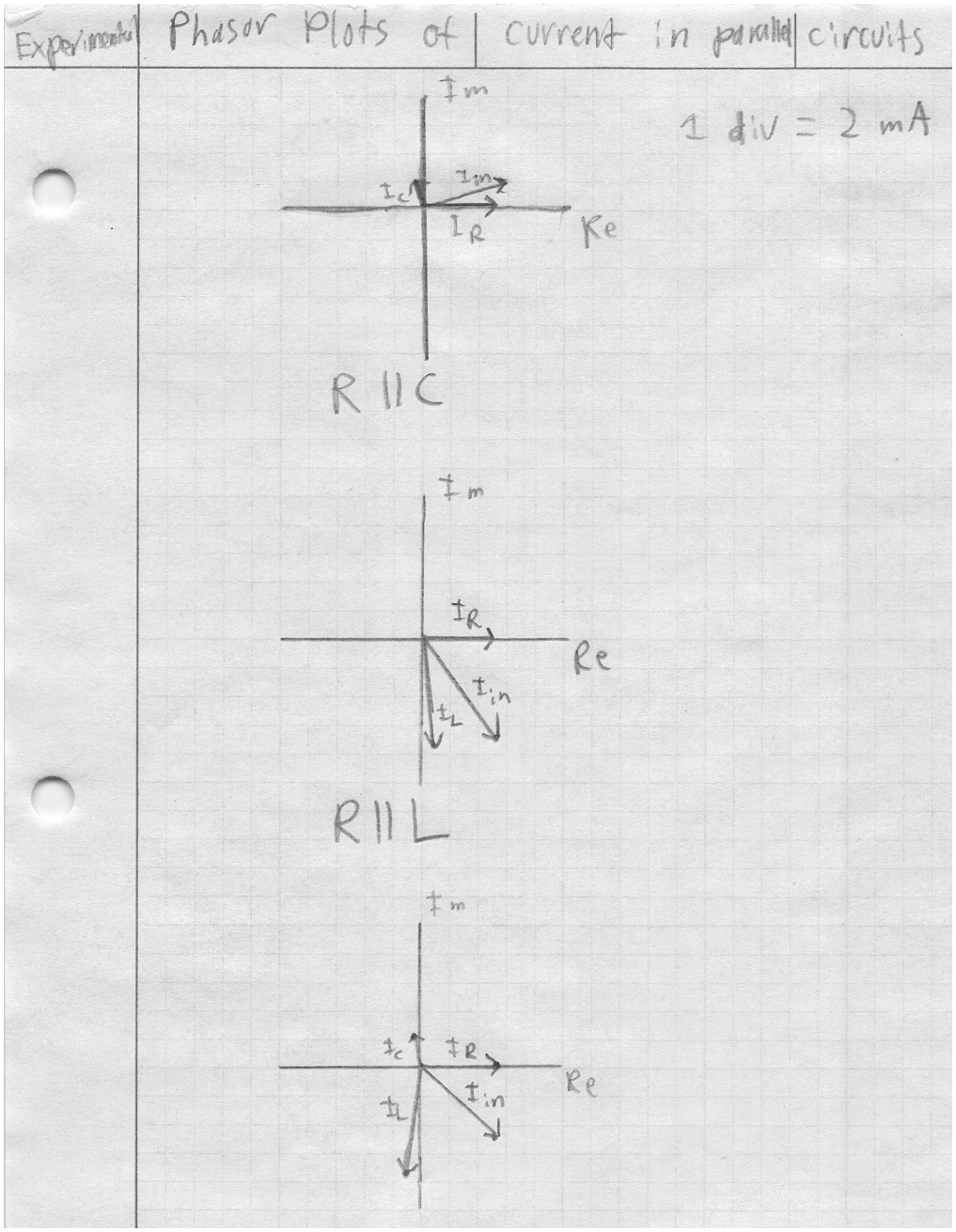


Phasor Plots:



R || L || C

Questions:

1. What is the phase relationship between R, L, and C components in a parallel AC circuit?
   All components' current is 90 degrees out of phase from each other (Resistor and inductor, resistor and capacitor) with differing magnitudes.
2. Based on measurements, does Kirchhoff's Current Law apply to the three tested circuits (show work)?
   Circuit 1
   $0.002634\angle 91.080 + 0.004815\angle 0 \approx 0.005570\angle 28.440$ A
   $-0.00004965+j0.002634 + 0.004815 \approx 0.00490+j0.002653$ A
   Circuit 2
   $0.007666\angle -86.508 + 0.004740\angle 0 \approx 0.009055\angle -51.696$ A
   $0.0004669-j0.007652 + 0.00474 \approx 0.005613-j0.007106$ A
   Circuit 3
   $0.002611\angle 90.900 + 0.007705\angle -93.456 + 0.004771\angle 0$
   $\approx 0.007073\angle -40.104$ A
   $-0.00004101+j0.002611 - 0.0004645-j0.007691 + 0.004771$
   $\approx 0.005410-j0.004556$ A
3. In general, how would the phasor diagram of Figure 7.1 change if the frequency was raised?
   As the frequency is increased, the capacitative reactance decreases. The capacitor current has an inverse relationship with its reactance, so the capacitor current phasor would lengthen towards the value of the source voltage.
4. In general, how would the phasor diagram of Figure 7.2 change if the frequency was lowered?
   As the frequency is decreased, the inductive reactance decreases, so the inductor current phasor would shorten towards the origin.