Digital Oscilloscope Memo

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***Abstract*— THE purpose of this memo is to discuss several parameters on the digital oscilloscope and how they effect readings and measurements. The oscilloscope will then be used to simultaneously measure two channels of information from an LRC circuit to observe the circuit's response to a range of frequencies.**

CONTENTS

I. THEORY

II. METHODOLOGY

1) The signal generator was initialized with the frequency given in Table I and connected to channel 1 of the oscilloscope.
2) The self-calibration function on the oscilloscope was activated. The probes were then calibrated as well.
3) The circuit shown in **??** was constructed, with the initial values described in Table I. Several settings were modified, and the changes and effects were recorded.
4) Using the auto-measuring display, the data in Table **??**.

Table I
GIVEN LAB PARAMETERS

Wave Type	Sine
Frequency	100 kHz
Peak to Peak Voltage	12 V
Resistance	12kΩ
Inductance	17 mH
Capacitance	220μF
DC Offset	0 V

III. DATA

A. Parameter Variations

AC / DC Coupling:
1x / 10x Probe:
Invert On / Off

B. Auto Measuring

RMS Voltage: 4.17 V Peak to Peak Amplitude: 11.8 V
Period: 1 ms Frequency: (100 ± 0.2) kHz

C. Triggering

Triggering Type:	Edge
Triggering Source:	Ch. 2
Triggering Mode:	Auto

D. Dual Signals

The component from the circuit chosen for measurement on Channel 2 was the 17 mH capacitor. In order to exhibit a discernible response in the capacitor, the frequency was adjusted. The following measurements were taken with a 28.850 Hz sine wave.
Peak to Peak measurements for both channels:

Ch.1 Peak to Peak:	11.4 V
Ch.2 Peak to Peak:	9.76 mV

Additional measurements taken:

T_S(Peak to Peak, Source): 34.40 ms
T_C(Peak to Peak, Capacitor): 34.80 ms

Phase shift between both channels:

$$\Delta t = 8.400\text{ms} \qquad \theta = 1.534 \text{ rad} = 87.9^\circ$$

Where θ is given by $2\pi\frac{\Delta t}{T}$ or $2\pi f \Delta t$ in radians or $360\frac{\Delta t}{T}$ in degrees, Δt is the distance in the time domain between two identical points on the adjacent waves, T is the period (time in seconds it takes for a single wave to repeat), and f is the frequency of the generator..

IV. ANALYSIS

Inductive Reactance: $X_L = 2\pi f L$.
Capacitive Reactance: $X_C = 1/2\pi f C$.
Resonant Frequency: $f_0 = 1/2\pi\sqrt{LC}$

APPENDIX A
DERIVATION