05 Resonance

Build a series RLC circuit, keep the output voltage value of AC source unchanged, and adjust frequency of the source signal.

A Report By

Kibria Golam

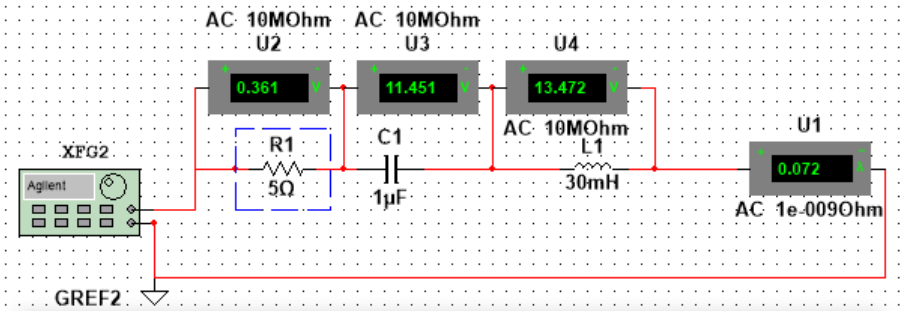
2019380163

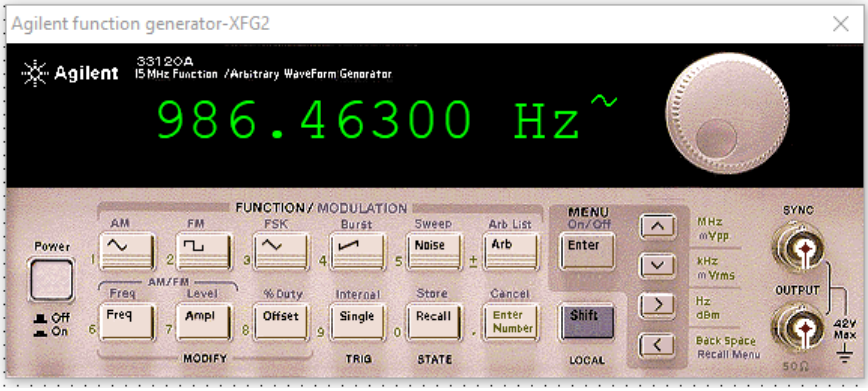
1. When current of resistor reaches maximum $I_{max,}$ the resonance frequency is found. When current of resistor reaches $0.707I_{max}$ the half power frequency is found.

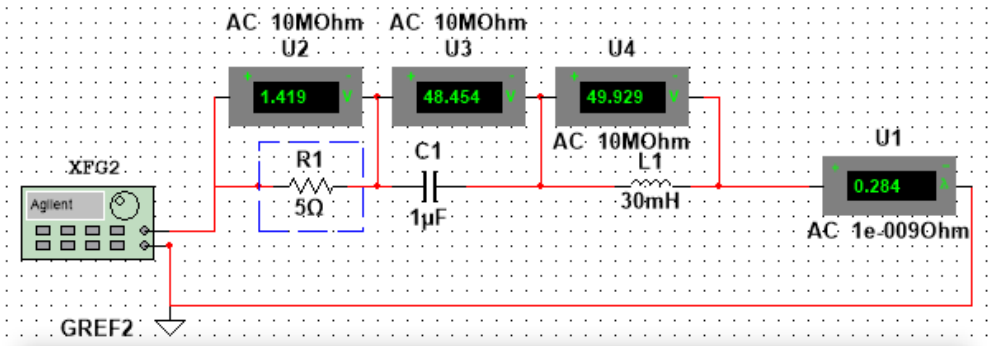
Table 1

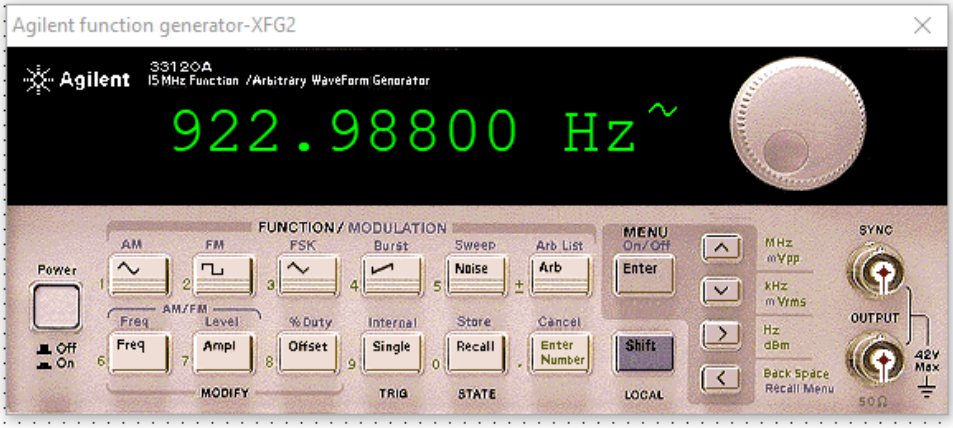
R=5-ohm, L=30mH, C= 1uF

f/Hz			f1	896.463	f0	909.726	f2	922.988	
Ir/A			i1	0.072	i0	0.412	i2	0.284	


AC 10MOhm
U2
0.361
AC 10MOhm
U3
11.451
U4
13.472
AC 10MOhm
L1
30mH
U1
0.072
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
GREF2


Agilent function generator-XFG2
Agilent
33120A
15 MHz Function / Arbitrary WaveForm Generator
986.46300 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
MENU
On/Off
Enter
Power
Off
On
AM/FM
Freq
Level
Ampl
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
Shift
MODIFY
TRIG
STATE
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω


AC 10MOhm
U2
1.419
AC 10MOhm
U3
48.454
U4
49.929
AC 10MOhm
L1
30mH
U1
0.284
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
GREF2


Agilent function generator-XFG2
Agilent
33120A
15 MHz Function / Arbitrary WaveForm Generator
922.98800 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
MENU
On/Off
Enter
Power
Off
On
AM/FM
Freq
Level
Ampl
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
Shift
MODIFY
TRIG
STATE
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω

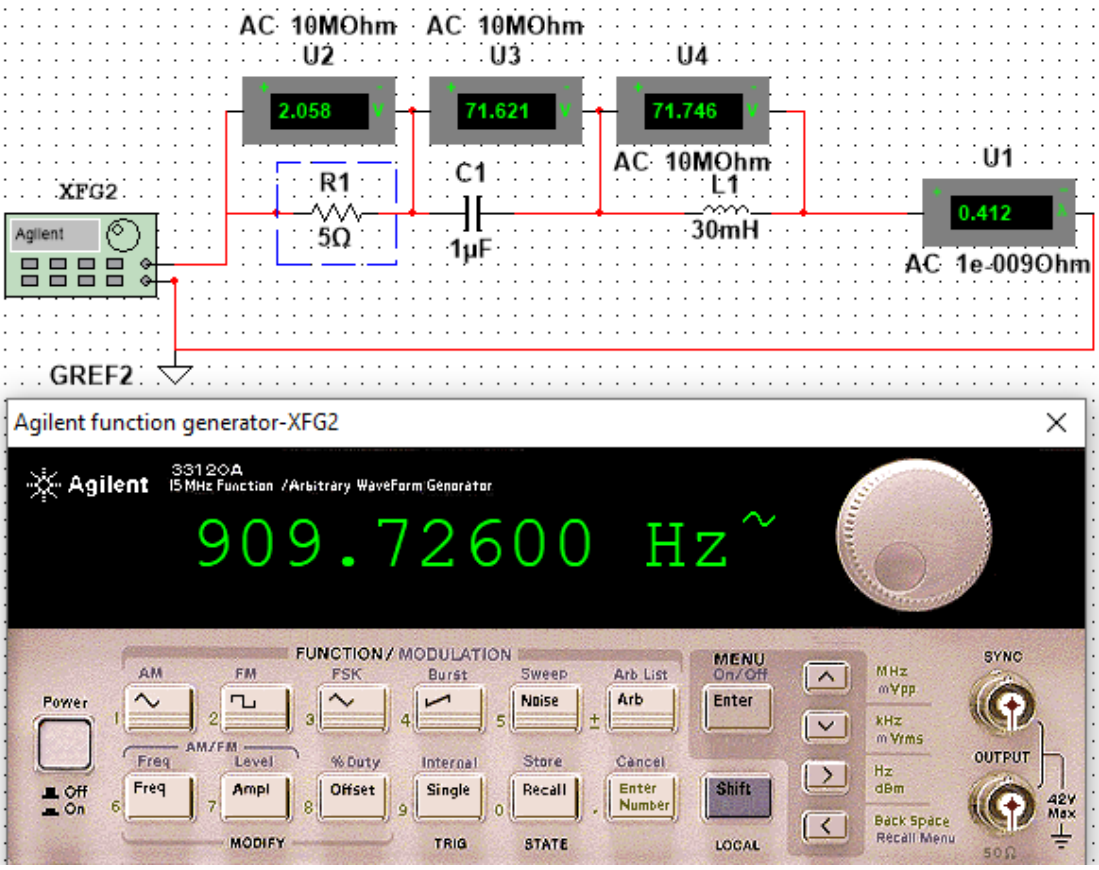
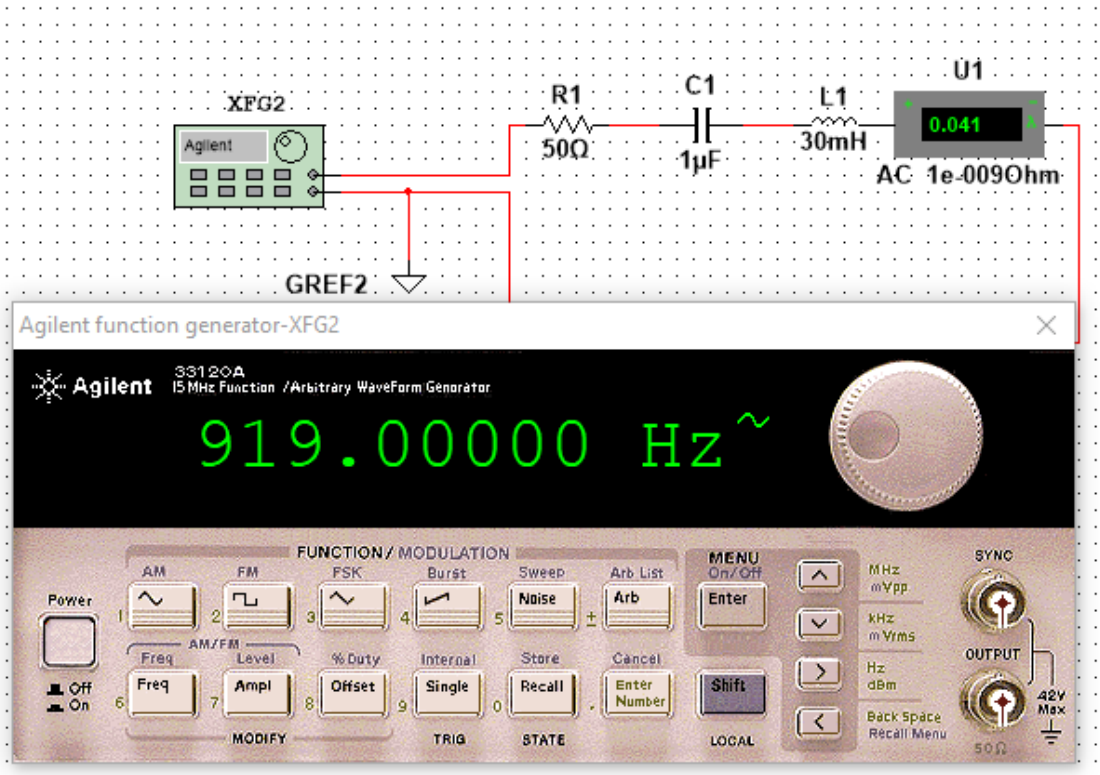

AC 10MOhm
U2
2.058
AC 10MOhm
U3
71.621
U4
71.746
AC 10MOhm
U1
0.412
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
L1
30mH
GREF2
Agilent function generator-XFG2
Agilent
33120A
15 MHz Function /Arbitrary WaveForm Generator
909.72600 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
AM/FM
Freq
Level
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
MODIFY
TRIG
STATE
MENU
On/Off
Enter
Shift
LOCAL
Power
Off
On
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω

Table 2

R=50-ohm, L=30mH, C= 1uF

f/Hz			f1	786.37	f0	919	f2	1051.63	
Ir/A			i1	0.029	i0	0.041	i2	0.029	

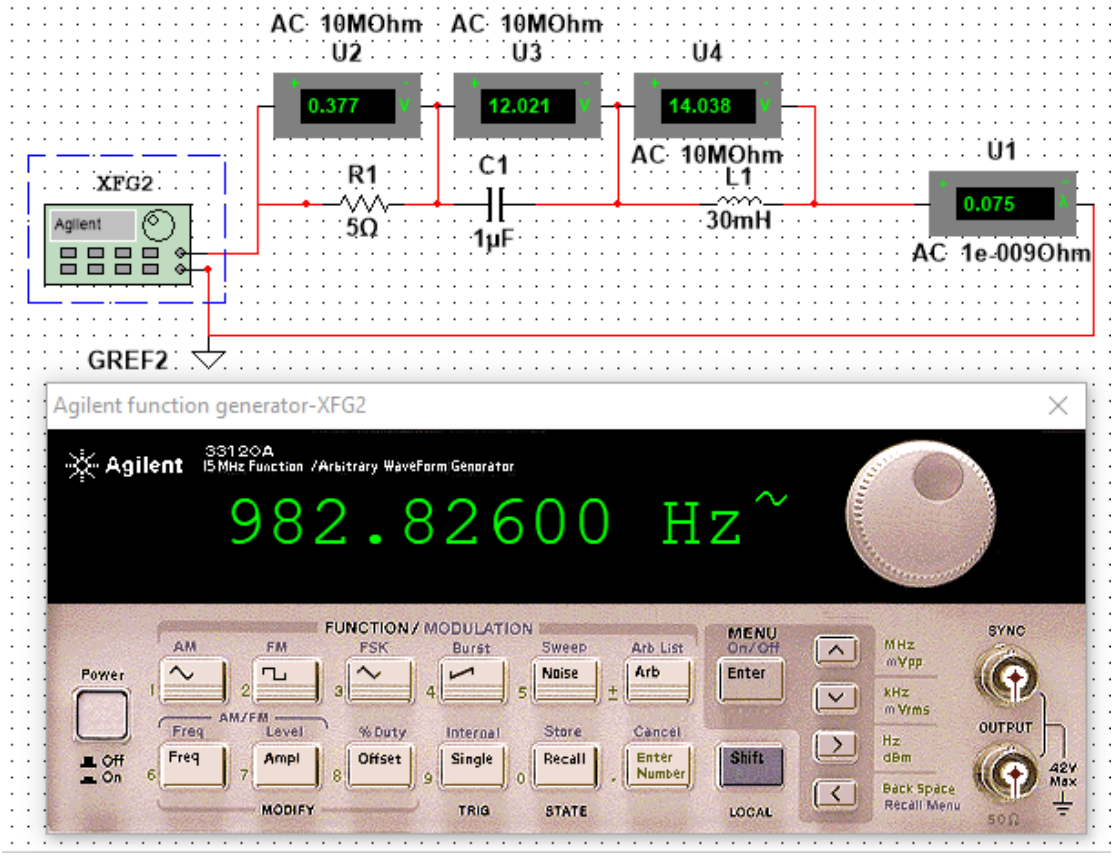


2. When voltage of resistor reaches maximum U_{max} , the resonance frequency is found. When current of resistor reaches $0.707I_{max}$ the half power frequency is found.

Table 3

R=5-ohm, L=30mH, C= 1uF

f/Hz			f1	892.826	f0	906.089	f2	919.351	
Ur/A			U1	0.377	U0	2.016	U2	1.623	



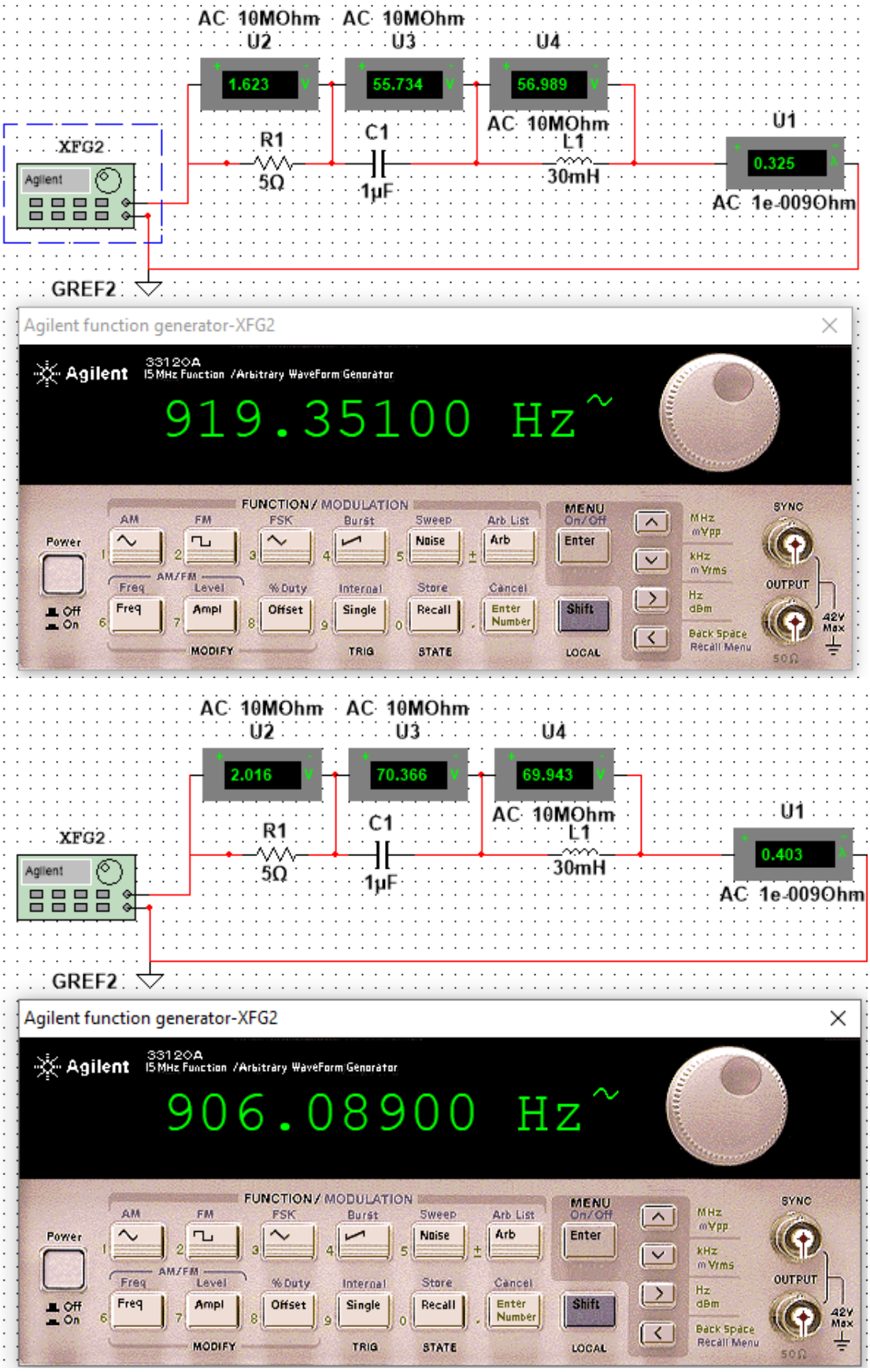
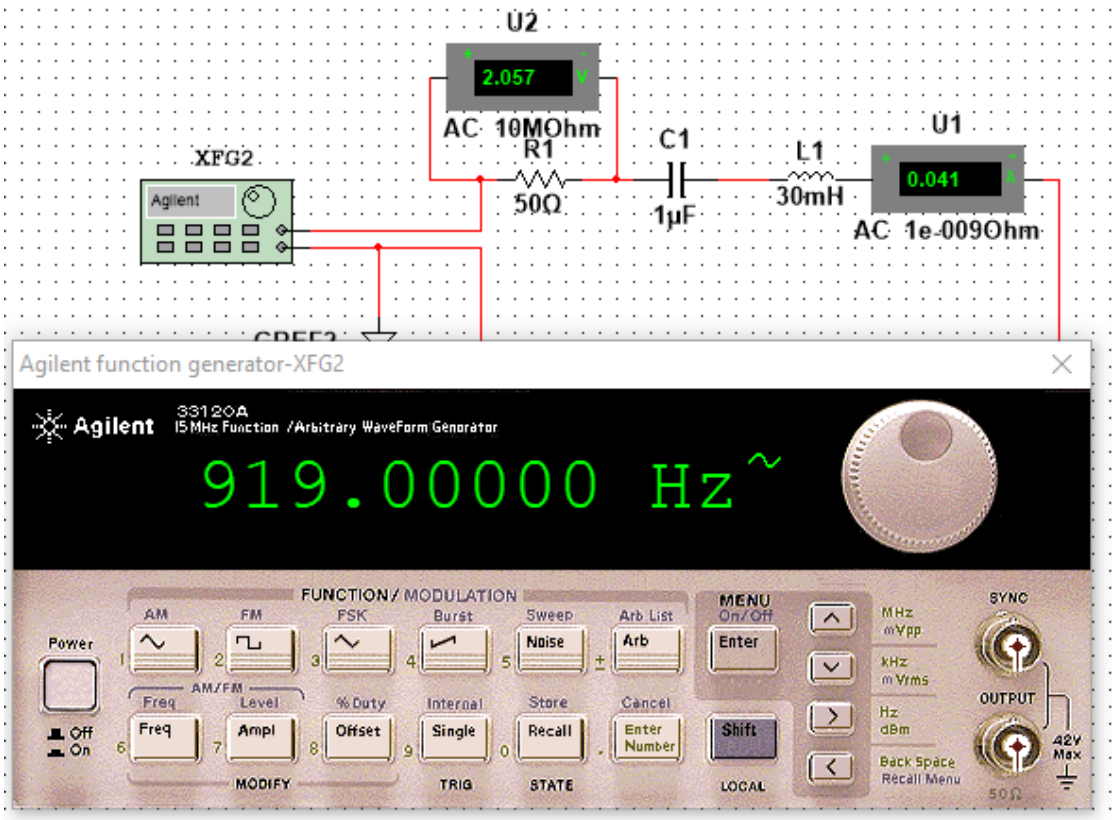

AC 10MOhm
U2
1.623
AC 10MOhm
U3
55.734
U4
56.989
AC 10MOhm
L1
30mH
U1
0.325
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
GREF2
Agilent function generator-XFG2
Agilent
33120A
15 MHz Function /Arbitrary WaveForm Generator
919.35100 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
MENU
On/Off
Enter
Power
Off
On
AM/FM
Freq
Level
Ampl
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
Shift
MODIFY
TRIG
STATE
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω
AC 10MOhm
U2
2.016
AC 10MOhm
U3
70.366
U4
69.943
AC 10MOhm
L1
30mH
U1
0.403
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
GREF2
Agilent function generator-XFG2
Agilent
33120A
15 MHz Function /Arbitrary WaveForm Generator
906.08900 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
MENU
On/Off
Enter
Power
Off
On
AM/FM
Freq
Level
Ampl
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
Shift
MODIFY
TRIG
STATE
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω

Table 4

R=50-ohm, L=30mH, C= 1uF

f/Hz			f1	786.37	f0	919	f2	1051.63	
Ur/A			U1	1.464	U0	2.057	U2	1.453	

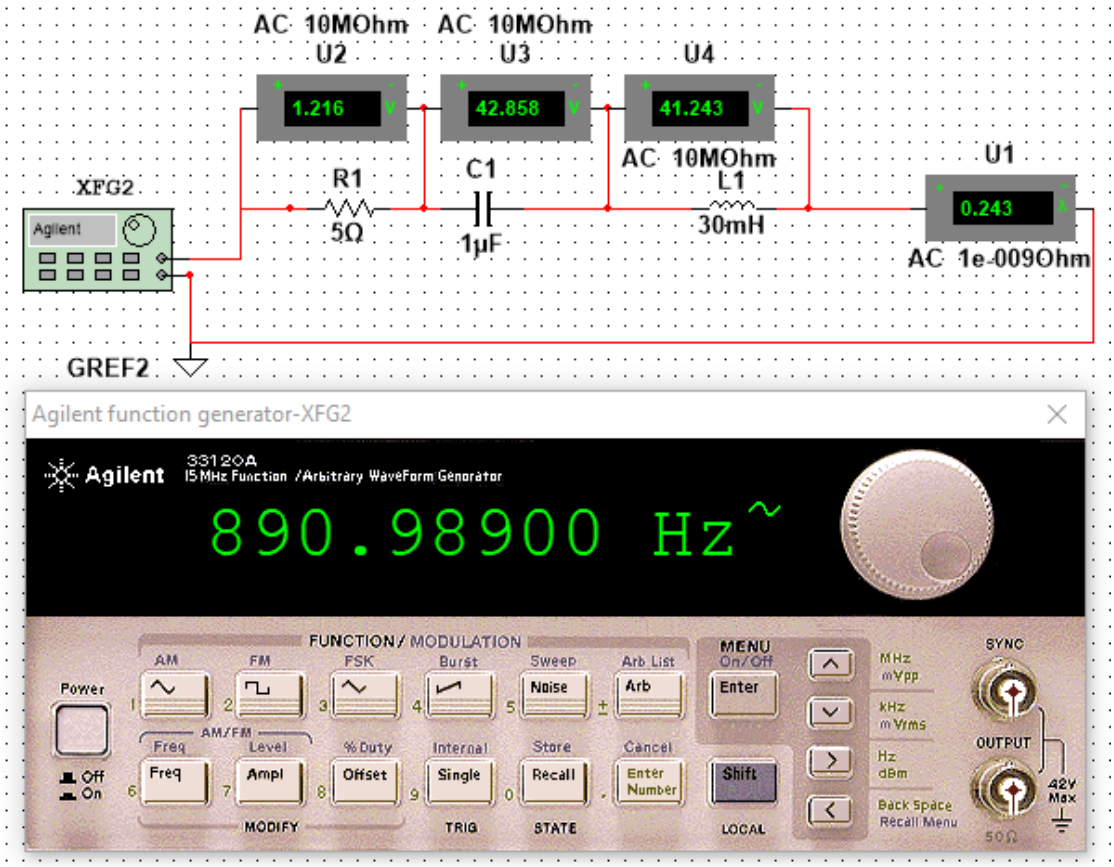


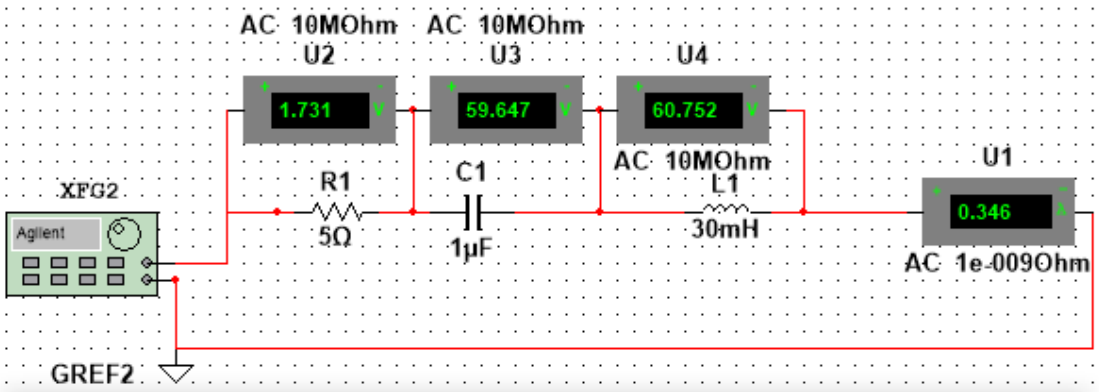
3. When voltage values on inductor and capacitor are the same, the resonance frequency is found. Record maximum voltage Umax on resistor, then found half power frequency.

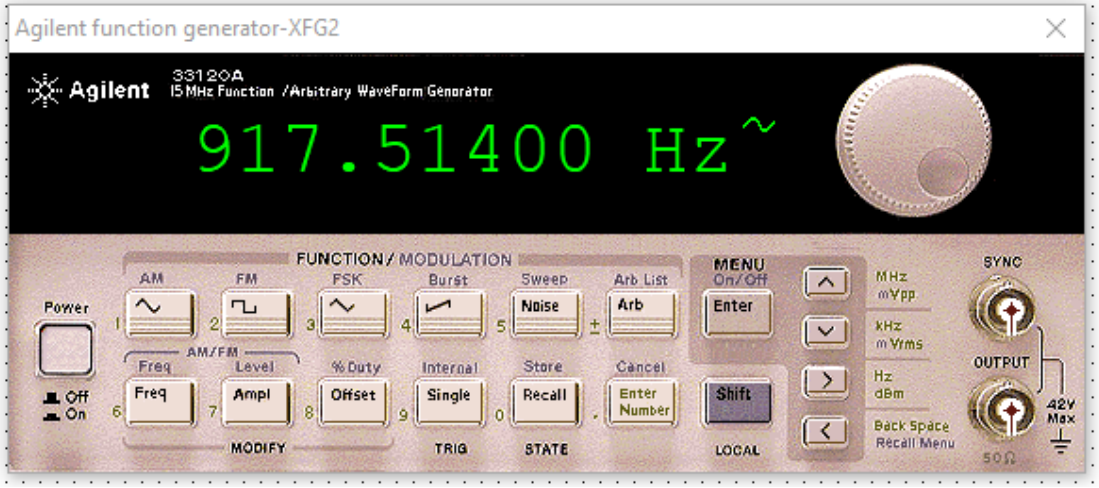
Table 5

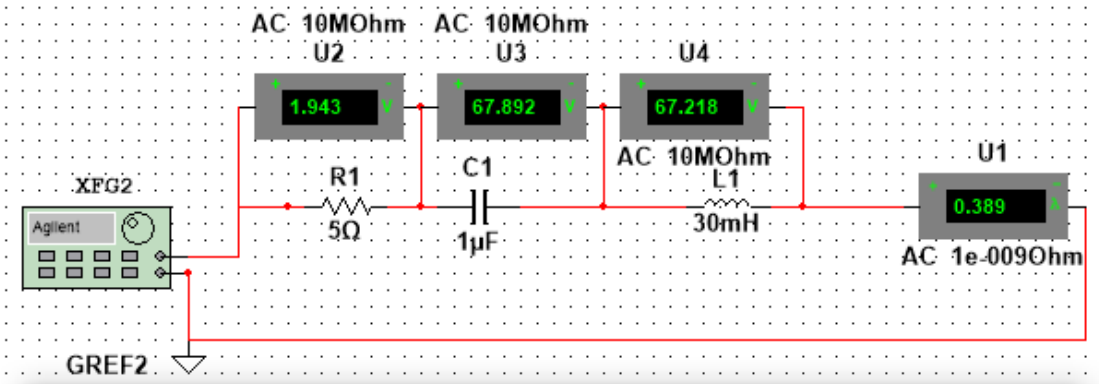
R=5-ohm, L=30mH, C= 1uF

f/Hz			f_1	890.989	f_0	904.252	f_2	917.514	
I_R/A			I_{R1}	0.243	I_{R0}	0.389	I_{R2}	0.346	
U_R/V			U_{R1}	1.216	U_{R0}	1.943	U_{R2}	1.731	
U_L/V			U_{L1}	41.243	U_{L0}	67.218	U_{L2}	60.752	
U_C/V			U_{C1}	42.858	U_{C0}	67.892	U_{C2}	59.647	




AC 10MOhm
U2
1.731
AC 10MOhm
U3
59.647
U4
60.752
AC 10MOhm
L1
30mH
U1
0.346
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
GREF2


Agilent function generator-XFG2
Agilent
33120A
15 MHz Function / Arbitrary WaveForm Generator
917.51400 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
AM/FM
Freq
Level
%Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
MODIFY
TRIG
STATE
Power
Off
On
MENU
On/Off
Enter
Shift
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω


AC 10MOhm
U2
1.943
AC 10MOhm
U3
67.892
U4
67.218
AC 10MOhm
L1
30mH
U1
0.389
AC 1e-009Ohm
XFG2
Agilent
R1
5Ω
C1
1µF
GREF2

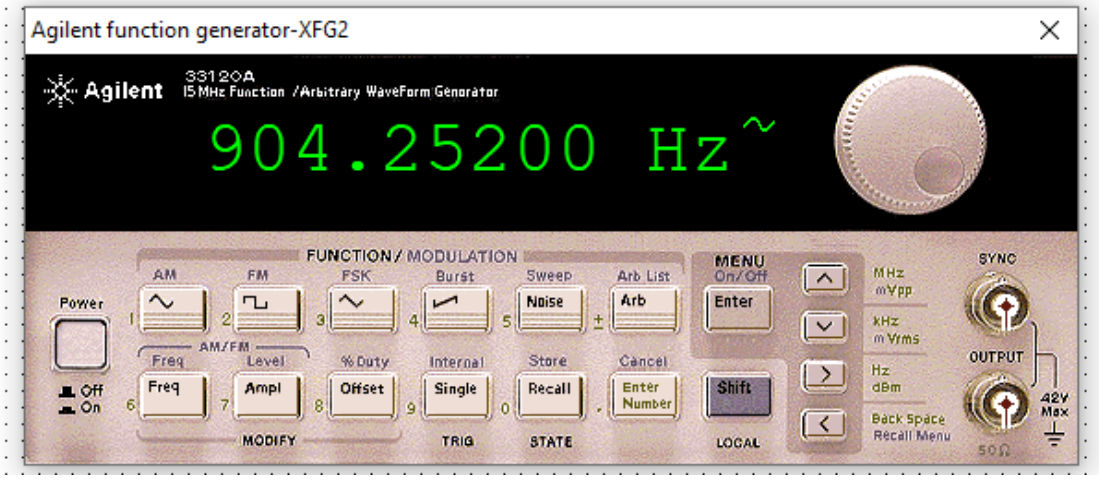
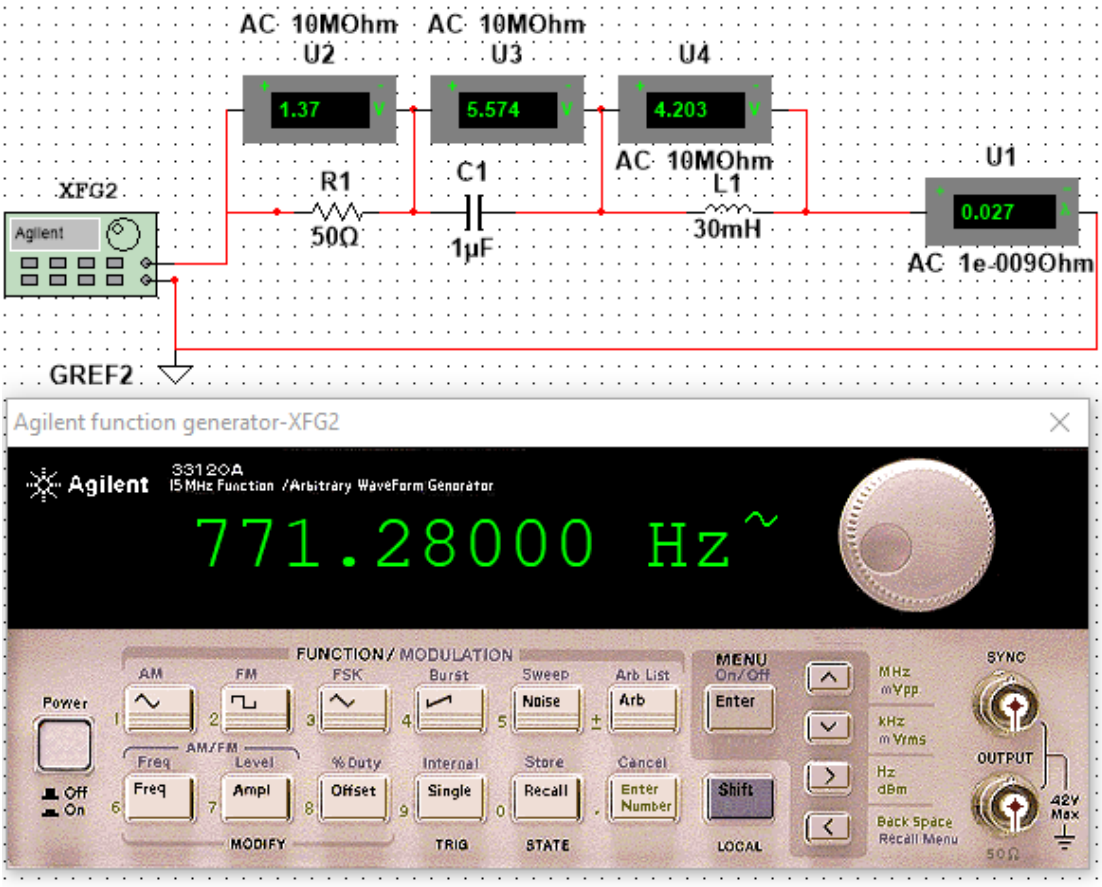
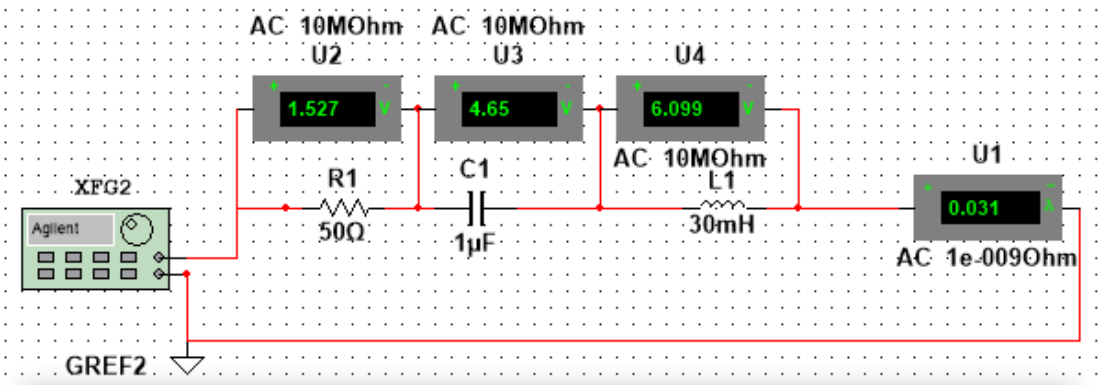

Agilent function generator-XFG2
Agilent
33120A
15 MHz Function / Arbitrary WaveForm Generator
904.25200 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
AM/FM
Freq
Level
%Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
MODIFY
TRIG
STATE
Power
Off
On
MENU
On/Off
Enter
Shift
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω

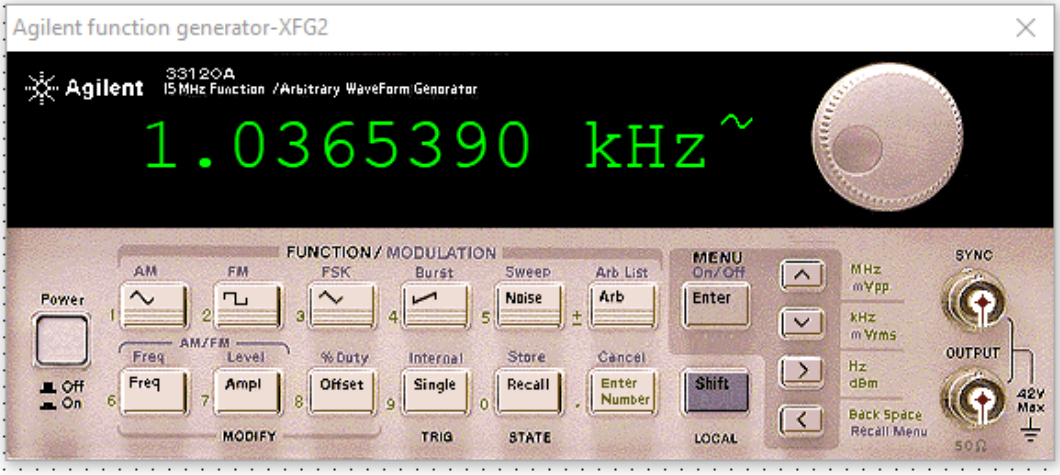
Table 6

R=50-ohm, L=30mH, C= 1uF

f/Hz			f_1	771.28	f_0	903.91	f_2	1036.53	
I_R/A			I_{R1}	0.027	I_{R0}	0.041	I_{R2}	0.031	
U_R/V			U_{R1}	1.37	U_{R0}	2.062	U_{R2}	1.527	
U_L/V			U_{L1}	4.203	U_{L0}	7.222	U_{L2}	6.099	
U_C/V			U_{C1}	5.574	U_{C0}	7.223	U_{C2}	4.65	




AC 10MOhm
U2
1.527
AC 10MOhm
U3
4.65
U4
6.099
AC 10MOhm
L1
30mH
U1
0.031
AC 1e-009Ohm
XFG2
Agilent
R1
50Ω
C1
1µF
GREF2


Agilent function generator-XFG2
Agilent
33120A
15 MHz Function /Arbitrary WaveForm Generator
1.0365390 kHz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
MENU
On/Off
Enter
Power
Off
On
AM/FM
Freq
Level
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
Ampl
MODIFY
TRIG
STATE
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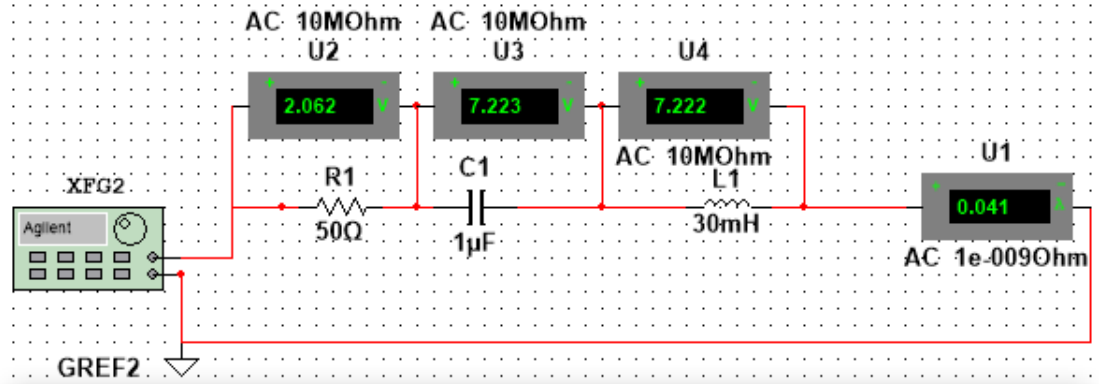
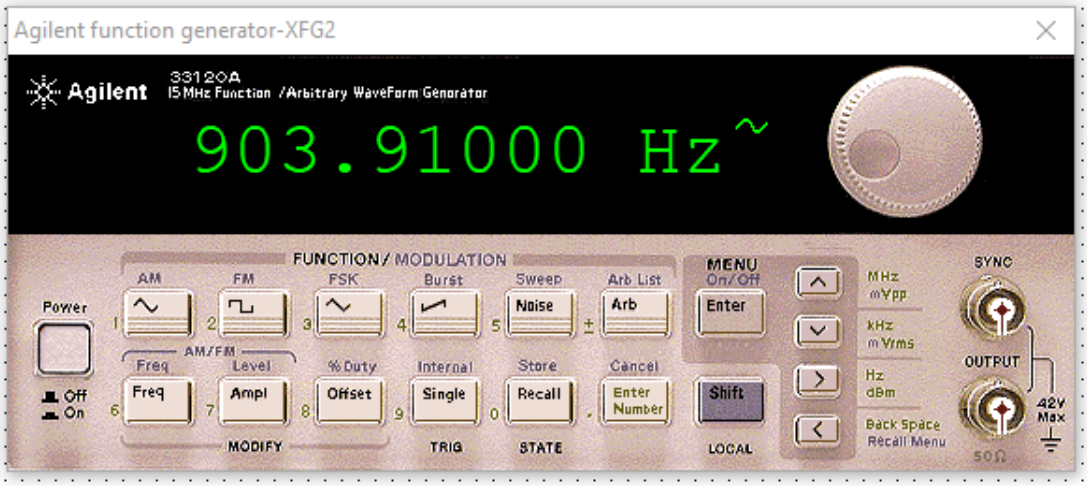
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω


AC 10MOhm
U2
2.062
AC 10MOhm
U3
7.223
U4
7.222
AC 10MOhm
L1
30mH
U1
0.041
AC 1e-009Ohm
XFG2
Agilent
R1
50Ω
C1
1µF
GREF2


Agilent function generator-XFG2
Agilent
33120A
15 MHz Function /Arbitrary WaveForm Generator
903.91000 Hz
FUNCTION / MODULATION
AM
FM
FSK
Burst
Sweep
Noise
Arb List
Arb
MENU
On/Off
Enter
Power
Off
On
AM/FM
Freq
Level
% Duty
Offset
Internal
Single
Store
Recall
Cancel
Enter Number
Ampl
MODIFY
TRIG
STATE
Shift
LOCAL
MHz
mVpp
kHz
mVrms
Hz
dBm
Back Space
Recall Menu
SYNC
OUTPUT
42V Max
50Ω