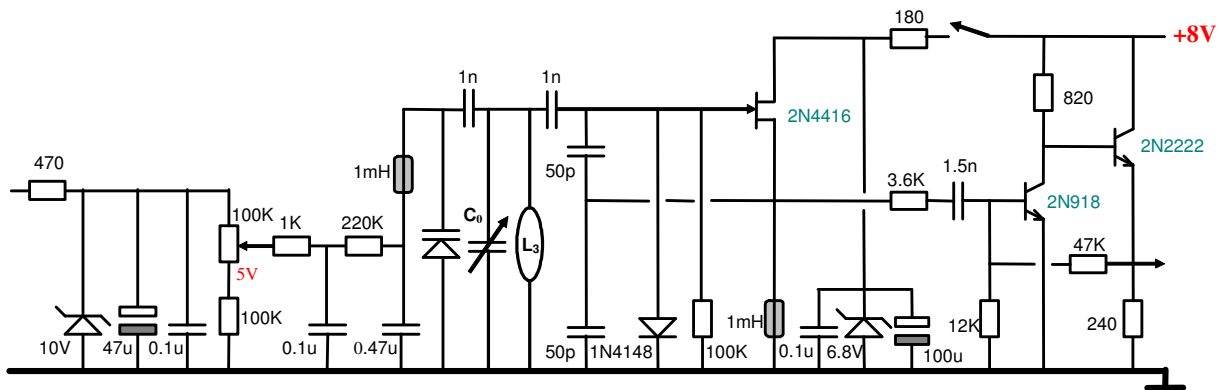


# **HF TUBE POWER AMPLIFIER**

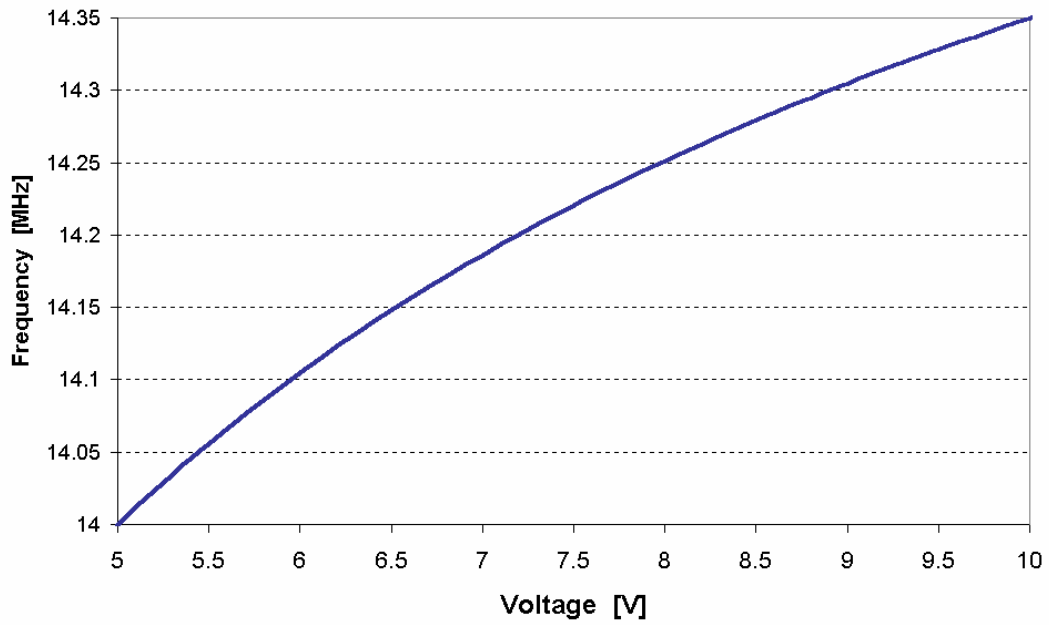
Prof. Yosef PINHASI

# Variable Frequency Oscillator V F O



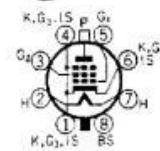
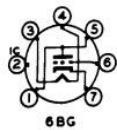
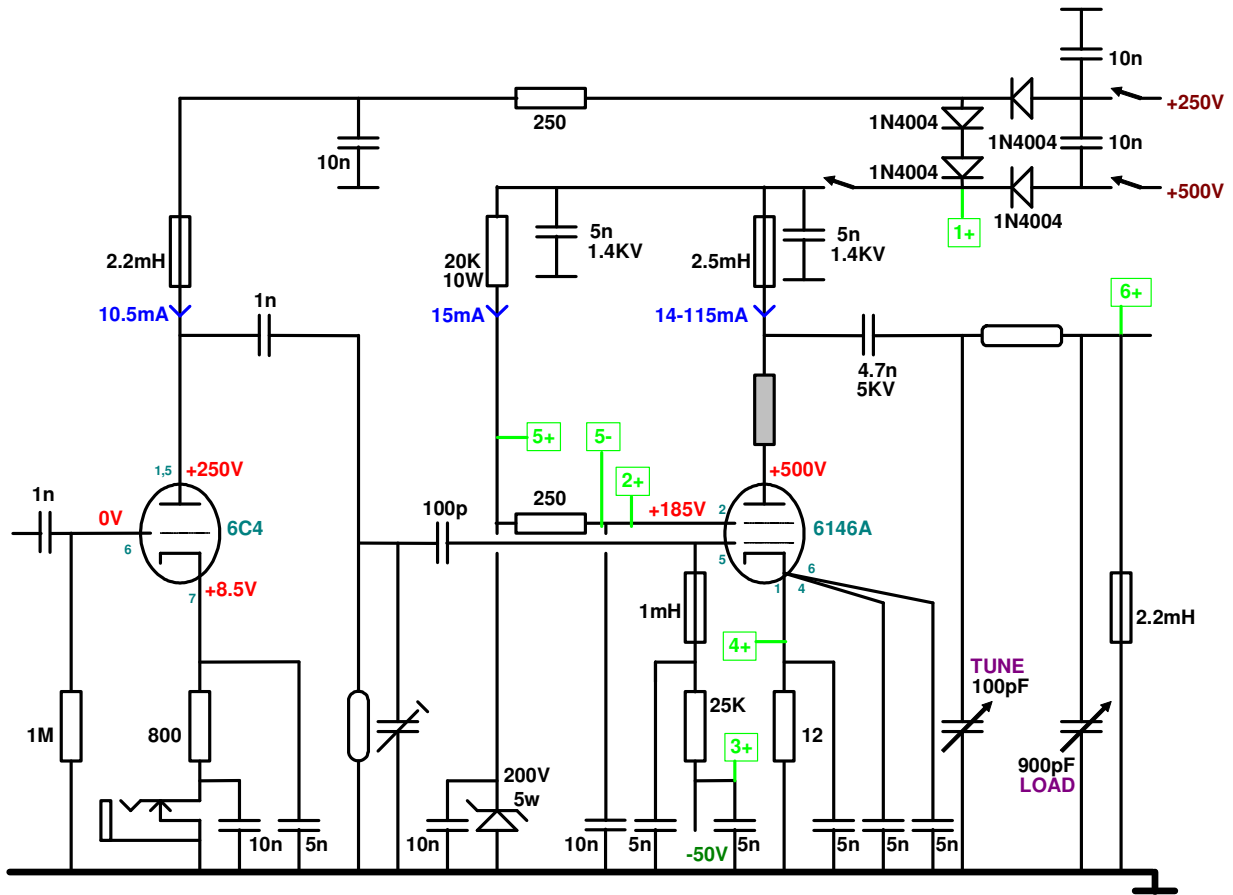
BAND	FREQUENCY	$L_3$	$C_0$
160m	1.8-2 MHz		
80m	3.5-4 MHz		
40m	7.0-7.3 MHz	16.784 $\mu$ H	0 pF
30m	10.1-10.15 MHz		
20m	14.0-14.35 MHz	4.286 $\mu$ H	0 pF
16m	18.068-18.168 MHz		
15m	21.0-21.450 MHz		
12m	24.89-21.99 MHz		
10m	28.0-29.7 MHz		
6m	50.0-50.2 MHz		

C1	50	pF			
C2	50	pF			
C3	1000	pF			
Ci	3	pF			
Co	12.5	pF			
L3	2.983	$\mu$ H	2.983	$\mu$ H	
fif	0	MHz			
V	C(V)				
[ V ]	[ pF ]				
3	8		K =	16.407663	
25	2		a =	0.6538312	
V	C(V)	f(V)			
[ V ]	[ pF ]	[ MHz ]			
5	5.7284663	14	V1/V2 =	0.5	
10	3.6409572	14.35	C1/C2 =	1.5733407	
Ctotal	37.6	pF	f1/f2 =	0.9756098	



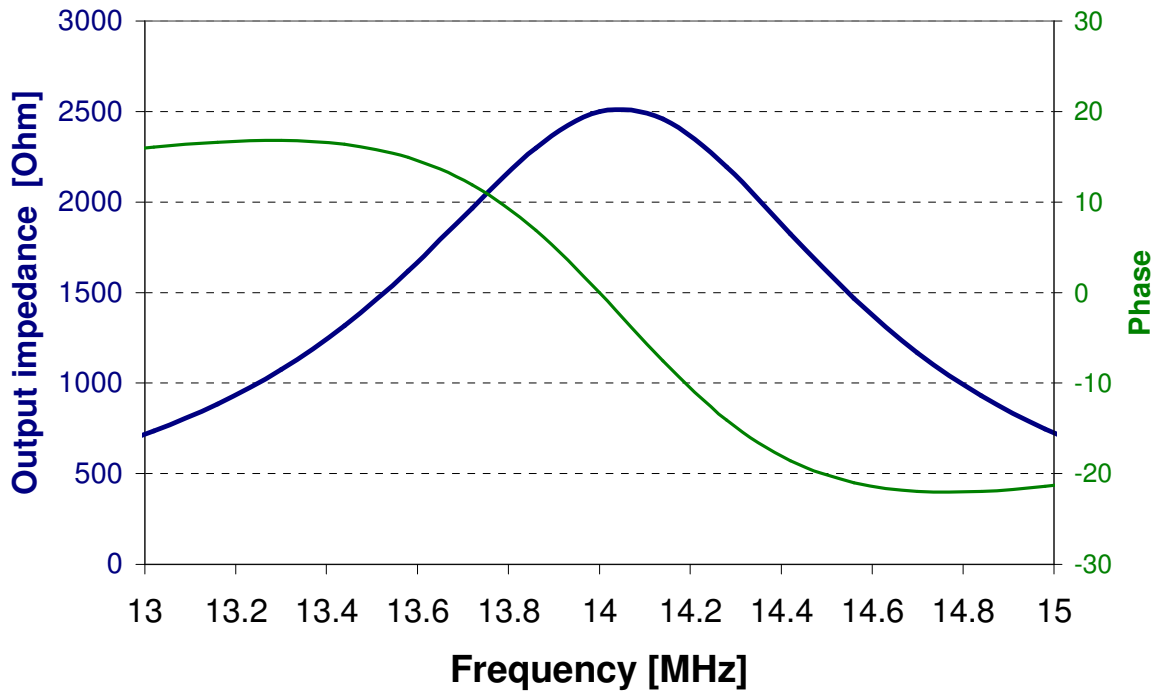
Vcc	8 V			
R1	12 K			
Rf	47 K			
Rc1	0.82 K			
2N918				
beta1	110			
Vbe1	0.6 V			
fT1	600 MHz			
Rc2	0 K			
Re2	0.24 K			
2N2222				
beta2	100			
Vbe2	0.6 V			
fT2	300 MHz			
Ve2	4.422935761 V	V	Vc1	5.022936 V
Ib1	0.031339059 mA			
Ic1	3.447296462 mA			
gm1	137.8918585 mS			
r_pi1	0.797726575 K			
C_pi1	36.57695148 pF			
Zin1	0.748001518 K			
Ib2	0.182464347 mA			
Ic2	18.24643466 mA			
Ie2	18.428899 mA			
gm2	729.8573863 mS			
r_pi2	0.137013068 K			
C_pi2	387.2013693 pF			
Zin2	24.37701307 K			
Av1	-109.3915828			
Gm2	-4.143247563 mS			
Gm	453.2364089 mS			
Av	-108.219024			
Zin	0.273171447 K			

# Driver and Power Amplifier



$V_{\text{peak}}=400\text{V}$  ;  $R_{\text{LOAD}}=50\Omega$

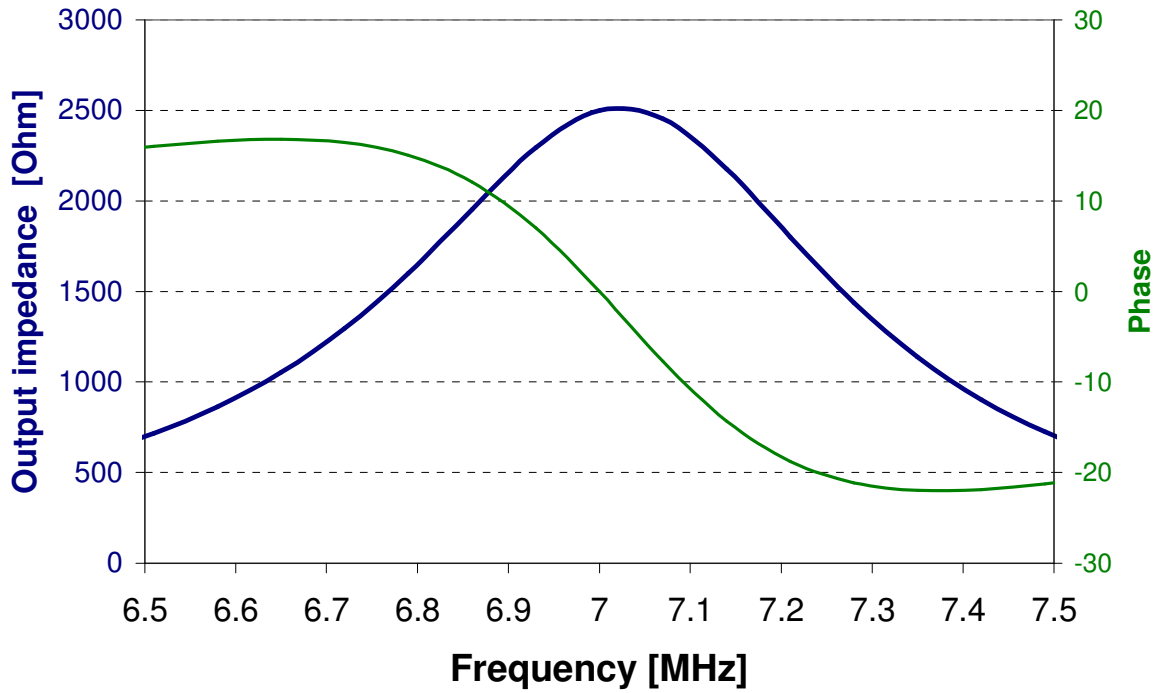
14MHz	POWER	$C_{\text{TUNE}}$	$C_{\text{LOAD}}$	L
2000 $\Omega$	40W	70pF	382pF	2.08 $\mu\text{H}$
2500 $\Omega$	32W	56pF	326pF	2.56 $\mu\text{H}$
3000 $\Omega$	27W	47pF	283pF	3.03 $\mu\text{H}$
3500 $\Omega$	23W	40pF	247pF	3.49 $\mu\text{H}$



Number of turns	N	7 Turns
Number of layers	M	1 Layers
Number of turns per layer	N / M	7 Turns
Wire diameter	2 r	1.2954 mm
Wire cross section area	$S = \pi r^2$	1.31794615 mm <sup>2</sup>
Core diameter	D	3.85 cm
Average radius	$a = \frac{1}{2} D + \frac{1}{2} c$	1.98977 cm
Lentgh	$b = N/M \cdot 2 r$	0.90678 cm
Thickness	$c = M \cdot 2 r$	0.12954 cm
Total wire lentgh	$l = 2 \pi a N$	0.87514655 m
Free space permeability	$\mu_0$	1.257E-06 H / m
Relative core permeability	$\mu_r$	1
Core permeability	$\mu = \mu_r \mu_0$	1.2566E-06 H / m
Resistivity	$\rho$	0.017 $\Omega$ mm <sup>2</sup> /m
General charecteristics		
=====		
Resistance	$R_l = \rho l / S$	0.01128839 $\Omega$
	$k_1 \pi \mu N^2 a$	1.2252E-06
	$k_2 \pi \ln(1 + \pi a/b)$	2.06606183
	$A \pi \frac{1}{\ln(8/\pi - \frac{1}{2})}$	2.3003754
	$B \pi 1.6$	1.6
	$C \pi 6/(3\pi^2 - 16)$	0.44089076
	$x \pi b/a$	0.45572101
Inductance	$L = k_1[k_2 + 1/(A+Bx+Cx^2)]$	2.9239E-06 H
	$L \approx 0.32a^2N^2/(6a+9b+10c)$	2.9016E-06 H

$V_{\text{peak}}=400\text{V}$  ;  $R_{\text{LOAD}}=50\Omega$

7MHz	POWER	$C_{\text{TUNE}}$	$C_{\text{LOAD}}$	L
2000 $\Omega$	40W	143pF	783pF	4.09 $\mu\text{H}$
2500 $\Omega$	32W	114pF	670pF	5.03 $\mu\text{H}$
3000 $\Omega$	27W	95pF	583pF	5.95 $\mu\text{H}$
3500 $\Omega$	23W	82pF	512pF	6.86 $\mu\text{H}$



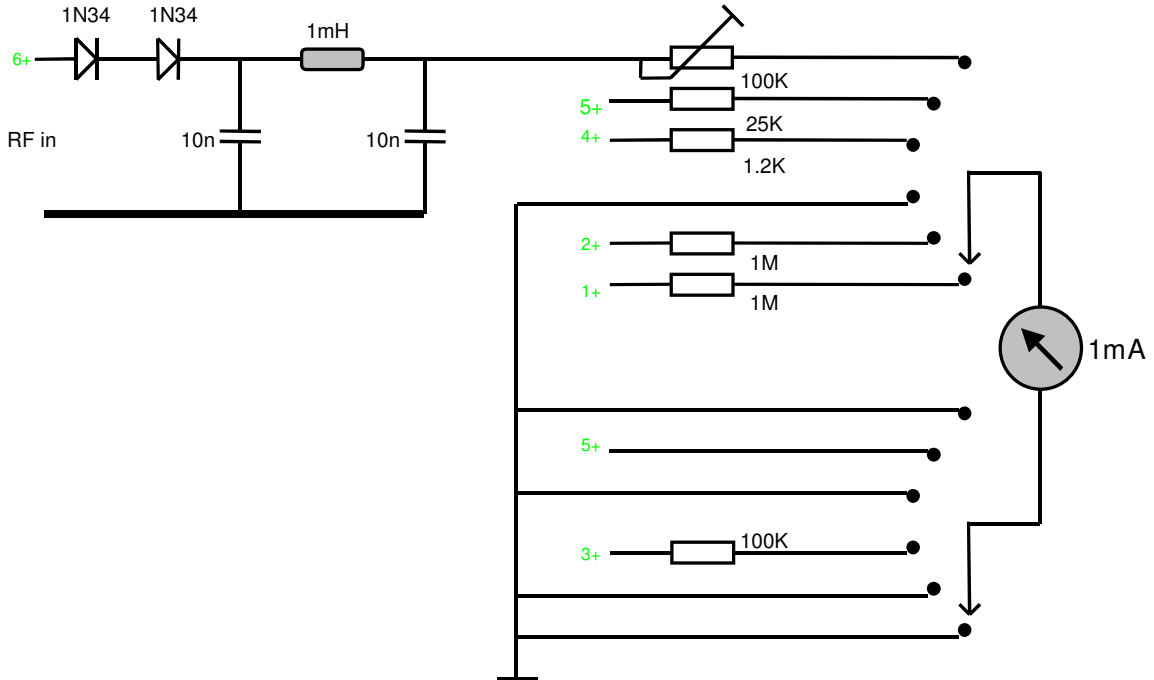


Number of turns	N	11 Turns
Number of layers	M	1 Layers
Number of turns per layer	N / M	11 Turns
Wire diameter	2 r	1.2954 mm
Wire cross section area	$S = \pi r^2$	1.31794615 mm <sup>2</sup>
Core diameter	D	3.85 cm
Average radius	$a = \frac{1}{2} D + \frac{1}{2} c$	1.98977 cm
Lentgh	$b = N/M \cdot 2 r$	1.42494 cm
Thickness	$c = M \cdot 2 r$	0.12954 cm
Total wire lentgh	$l = 2 \pi a N$	1.3752303 m
Free space permeability	$\mu_0$	1.257E-06 H / m
Relative core permeability	$\mu_r$	1
Core permeability	$\mu = \mu_r \mu_0$	1.2566E-06 H / m
Resistivity	$\rho$	0.017 $\Omega$ mm <sup>2</sup> /m
General charecteristics		
=====		
Resistance	$R_l = \rho l / S$	0.0177389 $\Omega$
	$k_1 \pi \mu N^2 a$	3.0255E-06
	$k_2 \pi \ln(1 + \pi a/b)$	1.68396715
	$A \pi \frac{1}{\ln(8/\pi - \frac{1}{2})}$	2.3003754
	$B \pi 1.6$	1.6
	$C \pi 6/(3\pi^2 - 16)$	0.44089076
	$x \pi b/a$	0.71613302
Inductance	$L = k_1[k_2 + 1/(A+Bx+Cx^2)]$	5.9187E-06 H
	$L \approx 0.32a^2N^2/(6a+9b+10c)$	5.8829E-06 H

Number of turns	N	15	Turns
Number of layers	M	1	Layers
Number of turns per layer	N / M	15	Turns
Wire diameter	2 r	1.2954	mm
Wire cross section area	S = $\pi r^2$	1.31794615	mm <sup>2</sup>
Core diameter	D	3.85	cm
Average radius	a = $\frac{1}{2} D + \frac{1}{2} c$	1.98977	cm
Lentgh	b = N/M 2 r	1.9431	cm
Thickness	c = M 2 r	0.12954	cm
Total wire lentgh	l = 2 $\pi$ a N	1.87531404	m
Free space permeability	$\mu_0$	1.257E-06	H / m
Relative core permeability	$\mu_r$	1	
Core permeability	$\mu = \mu_r \mu_0$	1.2566E-06	H / m
Resistivity	$\rho$	0.017	$\Omega \text{ mm}^2/\text{m}$
General charecteristics	=====		
Resistance	Rl = $\rho l / S$	0.02418941	$\Omega$
	k1 $\pi \mu N^2 a$	5.6259E-06	
	k2 $\pi \ln(1 + \pi a/b)$	1.43913546	
	A $\pi 1/\ln(8/\pi - \frac{1}{2})$	2.3003754	
	B $\pi 1.6$	1.6	
	C $\pi 6/(3\pi^2 - 16)$	0.44089076	
	x $\pi b/a$	0.97654503	
Inductance	L=k1[k2+1/(A+Bx+Cx <sup>2</sup> )]	9.41E-06	H
	L $\pi 0.32a^2N^2/(6a+9b+10c)$	9.2788E-06	H

Number of turns	Inductance	Resistance
5	1.67 $\mu$ H	8.06m $\Omega$
6	2.26 $\mu$ H	9.68 m $\Omega$
7	2.90 $\mu$ H	11.3 m $\Omega$
8	3.59 $\mu$ H	12.9 m $\Omega$
9	4.33 $\mu$ H	14.5 m $\Omega$
10	5.09 $\mu$ H	16.1 m $\Omega$
11	5.88 $\mu$ H	17.7 m $\Omega$
12	6.70 $\mu$ H	19.4 m $\Omega$
13	7.54 $\mu$ H	21.0 m $\Omega$
14	8.40 $\mu$ H	22.6 m $\Omega$
15	9.28 $\mu$ H	24.2 m $\Omega$

# Voltage, current and power meter



1. Plate voltage: 500V
2. Screen voltage: 180 - 200V
3. Grid voltage: -40 - -50V
4. Plate current: 0 - 100mA
5. Screen current: 0 - 10mA
6. RF Power: 0 - 100W

# Power supply

