13/6/57

# Overal Performance

Input dial 8, Recvr dial 10

Trimmer to mark, BFO 87

Attenuator 6DB, B+ 140V Bias. +6.0V

| Stage | R.F. | Mix | I.F. | I.F. |
|---|---|---|---|---|
| cathode | 3.2V | 1.1V | 2.7V | 3.0V |
| Color | clear | brown | blue | white |

6KC band

25Ω dummy antenna

Velocity potential 0.25 volt

100,000Ω load

2 Volts Output.

| Freq. KC | Input uv |
|---|---|
| 143 | 15 |
| 144 | 1.15 |
| 145 | 0.6 |
| 146 | 0.55 |
| 147 | 0.50 ← zero beat. |
| 148 | 0.55 |
| 149 | 0.6 |
| 150 | 0.7 |
| 151 | 2.0 |
| 152 | 45 |

No signal Beat Oscillator Output 1.8 volts

R.F. noise 0.38 volt (.13v above diode output)

1 25/32" from inside edge of bakelite plate to outside aluminum can

2/6/57

| Antenna | Rcvr. | Freq | Input for 2V out | |
|---|---|---|---|---|
| 3 | 0 | 143.5KC | 1.41 uv | 15 Ω dummy antenna |
| 14 | 20 | 154 | 1.25 uv | 24 DB |
| 33 | 45 | 171 | 1.20 | attenuator |
| 58 | 70 | 186.5 | 1.1 | 6KC band |
| 96 | 100 | 205KC | 1.0 | |

B+ = 140V  Bias = + 5.9V

Cathode to bias

~~RF~~ + 3.55V Mix +0.72V 1st +3.30V 2nd. +3.40V

+2.6V

When distance down to 31/32" the noise drops from 2,20μ when off resonance to 0.4μ when on resonance.

13/6/57

Note

All this noise was in the double diode clipper on first grid. When this removed the noise is negligible.

13/6/57

# Antenna Input Performance

Added 46 turns to bottom end antenna input coil making a total of 311 turns. Also rewound primary as 14 turns .032" wire over bottom end of input coil with edges of coils in same place. Now when input coil tuned thru resonance noise drops from 2.40 to 1.2 volt with attenuator at 6 DB. 25 Ω dummy antenna used. 1 11/16" between black bakelite plate and aluminum can. Less than 0.25 volts noise left when input grid is shorted.

When dist are 1 5/16", then output drops from 2.5V off resonance to 0.6V on resonance still too loose

Input Coil assembly performance

| Freq KC | Primary Open C | Q | 25 Ω dummy C | Q | C ratio |
|---|---|---|---|---|---|
| 145 | 445.5 | 100 | 465? | 8? | 1.045 |
| 180 | 281 | 125 | 302 | 6? | 1.075 |
| 220 | 187.5 | 139 | 204 | 5? | 1.080 |
| 290 | 106.5 | 151 | 118 | 5? | 1.108 |

(over)

When primary closed by 25 Ω dummy the inductance dropped about 8% and Q to less than 5%. However the coupling between input + secondary still too small.

15/5/57

# Overal Performance. RF. System

Input 15 Ω dummy  Output Mixer Grid return
2.0 volts output  1 megohm load.

| Ant. Dial | Set Dial | Freq. KC | Input µV |
|---|---|---|---|
| 91 | 100 | 199.5 | 1.65 |
| Gain 61.6DB | | 200.8 | 1.55 |
| Dip 0.5DB | | 203.0 | 1.65 |
| Peaks 5.0KC | | 205.8 | 1.55 |
| | | 206.8 | 1.65 |
| | | 166.0 | 2.3 |
| 31 | 45 | 167.0 | 1.9 |
| Gain 58.8DB | | 170.0 | 2.3 |
| Dip 1.6DB | | 173.8 | 1.9 |
| Peaks 6.8KC | | 174.8 | 2.3 |
| | | 139.3 | 3.1 |
| 1 | 0 | 140.3 | 2.3 |
| Gain 56.2DB | | 144.0 | 3.1 |
| Dip 2.6DB | | 147.3 | 2.3 |
| Peaks 7.0KC | | 148.2 | 3.1 |

Filament code
R.F. = clear
Mixer = brown
1st I.F. = blue
2nd I.F. = white

15/5/57

R.F. Performance, R.F. stage only

Input R.F. Grid. Output Mixer Grid return

2.0 Output volts                1 megohm load,

| Dial. | Freq | Input |
|---|---|---|
| 100 | 198.6 | 36 mv |
| Gain | 200.0 | 33 |
| 55.5X | 203.0 | 36. |
| | 205.8 | 33 |
| | 207.0 | 36 |
| 45 | 165.0 | 49 |
| Gain | 166.5 | 37.5 |
| | 170 | 49 |
| 41.8X | 173.5 | 37.5 |
| | 175.0 | 49 |
| 0 | 138.3 | 61 |
| Gain | 140.0 | 40 |
| 32.8X | 144.0 | 61 |
| | 147.7 | 40 |
| | 148.6 | 61 |

Put 160K Ω across secondary

Nov 2/6/57

25/5/57

Input Mixer Grid. 10,000 Ω load.
Input 0.10 volts constant. I/o Oscillator

π Network — This is Best

| Freq KC | Output Volts |
|---|---|
| 85 | .13 |
| 150 | .17 |
| 200 | .23 |
| 230 | .332 |
| 240 | .387 |
| 245 | .408 |
| 250 | .412 |
| 255 | .392 |
| 260 | .352 |
| 280 | .177 |
| 300 | .089 |
| 320 | .048 |

Gain 12.3DB

.27DB

| Dial | Osc Volts |
|---|---|
| 0 | .195 |
| 20 | .158 |
| 40 | .120 |
| 60 | .090 |
| 80 | .066 |
| 100 | .053 |

Transformer

| Freq KC | Output Volts. |
|---|---|
| 150 | .046 |
| 180 | .073 |
| 200 | .108 |
| 220 | .168 |
| 230 | .223 |
| 240 | .290 |
| 245 | .317 |
| 250 | .328 |
| 255 | .316 |
| 260 | .288 |
| 280 | .184 |
| 300 | .134 |
| 320 | .100 |
| 350 | .074 |
| 400 | .057 |

.32DB

Gain → 10.3DB

| Dial | Osc Volts |
|---|---|
| 0 | 1.50 |
| 20 | 1.43 |
| 40 | 1.34 |
| 60 | 1.25 |
| 80 | 1.19 |
| 100 | 1.15 |

30/9/56

Changed Pri. shunt to 330K Ω

New primary looks into

$\frac{1}{\frac{1}{.133}+\frac{1}{.6}} = \frac{1}{4.67} = 214 K\Omega$

This reflected back by ratio of $(4.2)^2 = 17.8$ gives

$\frac{214}{17.8} = 12 K\Omega$ into filter.

Resonance still at 250.0 KC.

There gives 1.05 volts.

Gain = 1.05/.077 = 13.6 times

3DB points 236 & 266 KC = 30KC.

$Q = \frac{250}{30} = 8.3$

5 pf goes from 250 to 231 KC.

$\left(\frac{x+5}{x}\right)^{1/2} = \frac{250}{231}$

$53200x + 266000 = 62500x$

$\quad - 53200x$

$= 9300x$

$x = \frac{266000}{9300} = 28.6$ pf circuit capacity.

30/9/56

Characteristics of #1 Tiger Output transformer

Pri. 286T .015" dia wire

Sec. 56T .034" dia litz (8 layers of 7 turns) about 6½ ft of litz

| Pri. only (sec. open) outside end high Freq. | Cap. | Q | Sec. only (Pri. open) Freq. | Cap. | Q |
|---|---|---|---|---|---|
| 55KC | 459 | 123 | 215KC | 445 | 18 |
| 80KC | 209 | 80 | 250KC | 212 | 5 |
| 110KC | 100 | ~~154~~ | 265KC | 123 | 2 |
| 120KC | 80 | 49 | | | |
| 160KC | | | | | |
| 170KC | 30.2 | 26 | | | |

Not able to go higher in frequency as primary resonates somewhere just above 250KC

$C_0$ = 459
400
3|59
20pf.

Two gaps each .020" one at each end of center core.

(over)

30/9/56

Primary reduced to 236 Turns,
Now Resonance 254KC.
3DB points at 246 + 263KC
3DB band 17KC,
77mv input gives 1,86v output,
Gain = $\frac{1.86}{.077}$ = 24,2 times.

added 5pf + 470KΩ across pri,
Resonance now, 231KC
77mv gives 1,18Volts,
Gain 1.18/.077 = 15.3 times.
3DB, 220 + 243KC = 23KC

Took off 5pf, Now 470KΩ only
Resonance 250.0KC
77mv gives. 1.20 volts,



3DB 237 + 263KC = 26KC,
Ratio now $\frac{236}{56}$ = 4,2:1 Pri should look into 180KΩ

20/5/57

## Mixer Output Transformer

Secondary of entire assembly

| Freq | C | Q |
|---|---|---|
| 240 kc, | 431 | 29 |
| 270 | 284 | 21 |
| 300 | 180 | 12 |
| 320 | 120 | 8 |
| 340 | 70 | 5 |

$$L(C_1+C_0)\omega_1^2 = L(C_2+C_0)\omega_2^2$$

$$C_1\omega_1^2 + C_0\omega_1^2 = C_2\omega_2^2 + C_0\omega_2^2$$

$$C_0(\omega_2^2-\omega_1^2) = C_1\omega_1^2 - C_2\omega_2^2$$

$$C_0 = \frac{C_1\omega_1^2 - C_2\omega_2^2}{\omega_2^2-\omega_1^2}$$

$\omega_2 = 4/3\,\omega_1$, so $\omega_2^2 = \frac{16}{9}\omega_1^2$

$$C_0 = \frac{C_1\omega_1^2 - C_2\frac{16}{9}\omega_1^2}{\frac{16}{9}\omega_1^2-\omega_1^2} = \frac{C_1-\frac{16}{9}C_2}{\frac{16}{9}-1}$$

$$C_0 = \frac{431-\frac{16}{9}120}{\frac{7}{9}} = (431-213)\frac{9}{7} = 280\text{pf}.$$ This is due to resonance of primary.

Same but primary removed,

| Freq | C | Q |
|---|---|---|
| 285 Kc | 450 | 183 |
| 350 | 291 | 140 |
| 450 | 170 | 96 |
| 570 | 99 | 64 |
| 900 | 29 | 24 |

$$C_0 = \frac{450-396}{3} = \frac{54}{3} = 17\text{pf}.$$

$$L_0 = \frac{1}{(6.28\cdot 285\cdot 10^3)^2\cdot 467\cdot 10^{-12}} = \frac{1}{1500} = 668\,\mu h$$

(over)

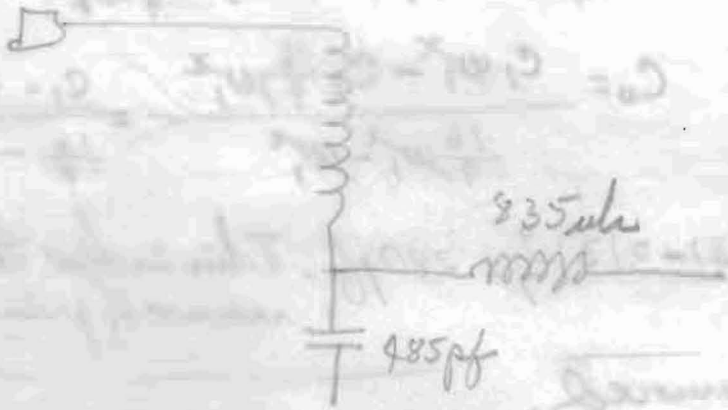
Same but excess wire core removed

| Freq | C | Q |
|---|---|---|
| 255 | 450 | 164 |
| 350 | 230 | 109 |
| 510 | 99 | 60 |
| 800 | 29.3 | 24 |

$C_0 = \frac{450 - 4 \cdot 99}{3} = \frac{54}{3} = 17 pf$

$L_0 = \frac{1}{(6.28 \cdot 255 \cdot 10^6)^2 \cdot 467 \cdot 10^{-12}} = \frac{1}{1200} = 835 \mu h$

485 pf for resonance at 250 KC



5/6/57

Mixer Voltages & Currents.

$E_B = +142$, $E_c = +6$, $R_p = 100K\Omega$ — $E_p$ & $E_{SG}$ & $E_G$ measured from cathode

| $R_K$ | $E_G$ | $R_{SG}$ | $E_{SG}$ | $I_{SG}$ | $E_p$ | $I_p$ | Oscillator |
|---|---|---|---|---|---|---|---|
| 15K | -1.3 | 290K | ~~44V~~ | .31ma | 118V | .17ma | oscillating |
| 10K | -1.6 | 170K | 52V | .50ma | 107V | .27ma | |
| 10K | -2.6 | 125K | 60V | .63ma | 108V | .25ma | |

use this condition (← 10K, -2.6 row)

a mixer is needed which will pass more plate current for a given $E_G$, $E_{SG}$ + $E_p$. Thus a lower screen voltage may be used and better ratio $I_p/I_{SG}$ for a given $E_G$

$E_G$ must be 2v or more so that positive peaks (+1.7v?) let thru by clipper will not allow grid to go to zero.

15/5/57

# Mixer Voltages. 1A7 Tube

220K Ω screen resistor — $E_{SG}$ = 55 V, $I_{SG}$ = .51 ma
15K Ω cathode resistor — $E_P$ = 159 v, $I_P$ = .13 ma
Bias +6 V — $E_K$ = +9.1 V, $I_K$ = .64 ma

220 K Ω screen resistor — $E_{SG}$ = 51 V, $I_{SG}$ = .53 ma
10 K Ω cathode resistor — $E_P$ = 159 V, $I_P$ = .29 ma
Bias +6 V (changed osc anode grid #6 terminal to ground. No difference) — $E_K$ = +7.8 V, $I_K$ = .81 ma

# Voltages on R.F tube 1LN5

15 K Ω cathode resistor — $E_P$ = 160 V, $I_P$ = } 0.72 ma total
Bias + 6 V — $E_{SG}$ = 160 V, $I_{SG}$ = }
$E_K$ = +10.2, $I_K$ = .72 ma

---

15K 100K
Ep 160 $E_{SG}$ 81
$I_P$ .04 ma $I_{SG}$ .79 ma
$E_K$ = 10.9 V

4 1/2

10 K 220K
Ep 160 $E_{SG}$ ~~58~~ 48 V
$I_P$ = ~~.15~~ ma $I_{SG}$ = ~~.52~~ ma .53
$E_K$ = + ~~6.7~~ V 7.0

Mixer oscillating Dial at (zero)

~~10 K = $R_K$ 100K = $R_{SG}$~~
~~Ep 160 V $E_{SG}$ 72 V~~
~~$E_K$ = 9.8 V ~~$E_{SP}$~~ .15 ma $I_{SG}$ .89 ma~~
~~osc~~

~~$R_K$ = 15 K, $R_{SG}$ = 220K~~
~~Ep = 160 V $E_{SG}$ = 57 V~~
~~$E_K$ = 8.4 V $I_P$ = .09 ma $I_{SG}$ = .50 ma~~

Oscillator 30K Grid 100 K plate.

| Dial | $E_P$ | $I_P$ | $I_G$ | $E_G$ |
|---|---|---|---|---|
| 0 | 43 V | ~~.84~~ .74 ~~ma~~ | ~~.078~~ ma | .115 | 7.7 |
| 45 | 43 V | ~~.65~~ .76 ~~.64~~ | ~~.077~~ | .102 | 7.0 |
| 100 | 46 V | ~~.5~~ .74 ~~.68~~ | ~~.055~~ | .073 | 5.2 |

20/5/57

# Oscillator Performance

$E_B$ = 162V  $E_F$ = 1.57V  1LN5 tube

Plate resistor 1.1 megohms, Grid resistor 0.23 megohm.

| Dial | $I_P$ | $E_P$ | $I_G$ | $E_G$ |
|---|---|---|---|---|
| 0 | 120μa | 30V | 35μa | 8.1V |
| 45 | 130μa | 19V | 40μa | 9.2V |
| 100 | 135μa | 14V | 41μa | 9.4V |

Superseding Radiotron 1A7-GT Data Sheet issued February, 1942

# RADIOTRON

## 1A7-GT

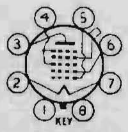
### PENTAGRID CONVERTER

1A7-GT

| | | | |
|---|---|---|---|
| Filament | Coated | | |
| Voltage | 1.4 | d-c volts | |
| Current | 0.05 | amp. | |
| Direct Interelectrode Capacitances O | | | ← |
| Grid #4 to Plate | | 0.5 μμF. | |
| Grid #4 to Grid #2 | | 0.4 μμF. | |
| Grid #4 to Grid #1 | | 0.2 μμF. | |
| Grid #1 to Grid #2 | | 0.9 μμF. | |
| Grid #4 to All Other Electrodes (R-F Input) | | 7.0 μμF. | |
| Grid #2 to All Other Electrodes Except Grid #1 (Osc. Output) | | 4.4 μμF. | |
| Grid #1 to All Other Electrodes Except Grid #2 (Osc. Input) | | 3.4 μμF. | |
| Plate to All Other Electrodes (Mixer Output) | | 10.0 μμF. | |
| Maximum Overall Length | | 3-5/16" | ← |
| Maximum Seated Height | | 2-3/4" | ← |
| Maximum Diameter | | 1-5/16" | |
| Bulb | | T-9 | |
| Cap | | Skirted Min. | |
| Base | | Intermediate Shell Octal 8-Pin. | |

Basing Designation GT-7Z

| | |
|---|---|
| Pin 1 - No Connection | Pin 5-Grid #1 |
| Pin 2-Filament + | Pin 6-Grid #2 |
| Pin 3-Plate | Pin 7-Fil. - |
| Pin 4-Grids #3 & #5 | Pin 8-No Con. |
| | Cap - Grid #4 |




Mounting Position Any

BOTTOM VIEW (GT-7Z) ←

Maximum Ratings are Design-Centre Values. ←

CONVERTER SERVICE

| | | | |
|---|---|---|---|
| Plate Voltage | 110 max. | volts | |
| Screen (Grids #3 & #5) Voltage | 60 max. | volts | ← |
| Screen Supply Voltage | 110 max. | volts | |
| Anode-Grid (Grid #2) Voltage | 110 max. | volts | |
| Total Zero-Signal Cathode Current. | 4 max. | mA. | |
| Typical Operation: | | | |
| Plate | 90 | volts | |
| Screen ** | 45 | volts | |
| Anode-Grid | 90 | volts | |
| Control-Grid (Grid #4) ▲ | 0 | volts | |
| Oscillator-Grid (Grid #1) Resistor | 200000 | ohms | |
| Plate Resistance | 0.8 | megohm | |
| Conversion Transconductance | 250 | μmhos | |
| Convers. Transcond. grid #4 bias of -3v. | 5 | approx. μmhos | |
| Plate Current | 0.6 | mA. | ← |
| Screen Current | 0.7 | mA. | ← |
| Anode-Grid Current | 1.2 | mA. | |
| Oscillator-Grid Current | 0.035 | mA. | |
| Total Cathode Current | 2.5 | mA. | ← |

NOTE: The transconductance of the oscillator portion (not oscillating) is 550 micromhos under the following conditions: plate volts, 90; screen volts, 45; cont.-grid volts, 0; anode-grid volts, 90; and oscillator-grid volts, 0.

O With close-fitting shield conn. to negative fil. terminal.

** Obtained preferably by using a properly by-passed 45000- to 75000-ohm voltage dropping resistor in series with the 90-volt supply. ←

▲ A resistance of at least 1.0 megohm should be in the grid return to negative filament pin.

← Indicates a Change.

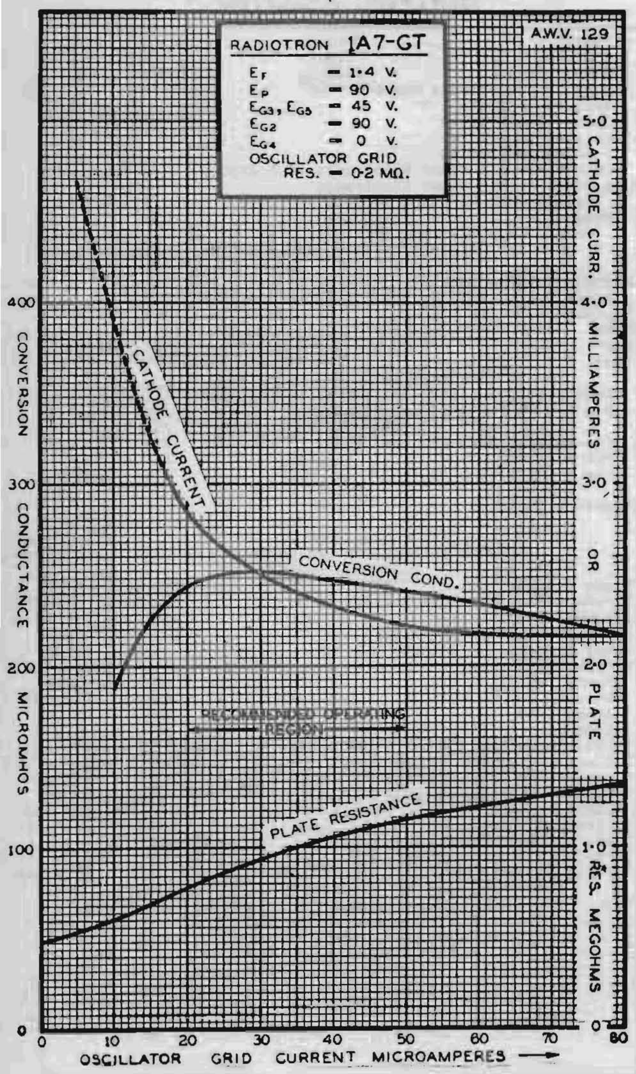

AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

DECEMBER, 1944 SYDNEY, AUSTRALIA

1A7-GT

# RADIOTRON
## 1A7-GT

### OPERATION CHARACTERISTIC



3/4" dia x 1" long
7 Pi coil with short core in center.

| Freq | Q | C |
|---|---|---|
| 50 | 145 | 226.0 |
| 100 | 141 | 52.3 |
| 136.5 | 112 | 27.0 |

$C_0 = \frac{226.0 - 4 \cdot 52.3}{3} = 5.6\text{pf}$

$L_0 = 43.9\text{mh}$.

Actual core is this one part way in one end.

1 June 57

Output R.F. coil for coupling between Mixer + 10,000 Ω pad. This coil same as one measured in 1954 on Maui. Made of 7/41 litz in 4 Pi with iron core. The two outside Pi wider than inside Pi. O.D. = 7/8"

| Freq | Cap. | Q |
|---|---|---|
| 60 KC | 450 pf. | 111 |
| 90 | 196 | 132 |
| 120 | 107 | 135 |
| 180 | 45.4 | 115 |
| 227 | 27 | 91 |

$C_0 = \frac{450 - 4 \cdot 107}{3} = \frac{450 - 428}{3} = \frac{22}{3}$

$= 7.3$ pf

$L_0 = \frac{1}{(6.28 \cdot .06 \cdot 10^6)^2 \cdot 457 \cdot 10^{-12}} = \frac{1}{64.9}$

$= 15.4$ mh.

D.C. resistance 39 Ω

This is rebuilt coil of Feb 3, 1954

Output coil performance 22/5/57

| In Air | | | Core Out | | | Core In | | |
|---|---|---|---|---|---|---|---|---|
| Freq | Q | C | Freq | Q | C | Freq | Q | C |
| 120KC | 103 | 450.0 | 120 | 104 | 426.0 | 90 | 115 | 427.5 |
| 240KC | 125 | 107.5 | 240 | 124 | 102.0 | 180 | 134 | 101.0 |
| 360KC | 102 | 46.5 | 360 | 100 | 43.6 | 240 | 119 | 54.0 |
| 459KC | 80 | 27.0 | 444 | 80 | 27.0 | 323 | 89 | 27.0 |

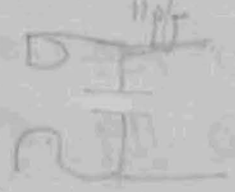
Obsolete on 1/6/57

This coil is center two Pr of coil of 1/6/57

$X_A = \frac{1}{6.28 \cdot 25 \cdot 10^6 \cdot 11 \cdot 10^{-12}} = \frac{10^6}{17.28} = 5800\,\Omega$

| | | | |
|---|---|---|---|
| 0 | 28.4 | 31.9 | 29.0 |
| 71.3 | 75.9 | 72.5 | 62.5 |
| 71.3 | 104.3 | 104.4 | 91.5 |

$10^6$



11 pf

$X_L = 2\pi f L$

$L = \frac{X_L}{2\pi f} = \frac{X_L}{6.28 \cdot 25 \cdot 10^6}$

10,000 Ω

$= \frac{10^{-6}}{1.57}$ ~~$= X_L$~~

$= \frac{X_L}{1.57} \times 10^{-6}$

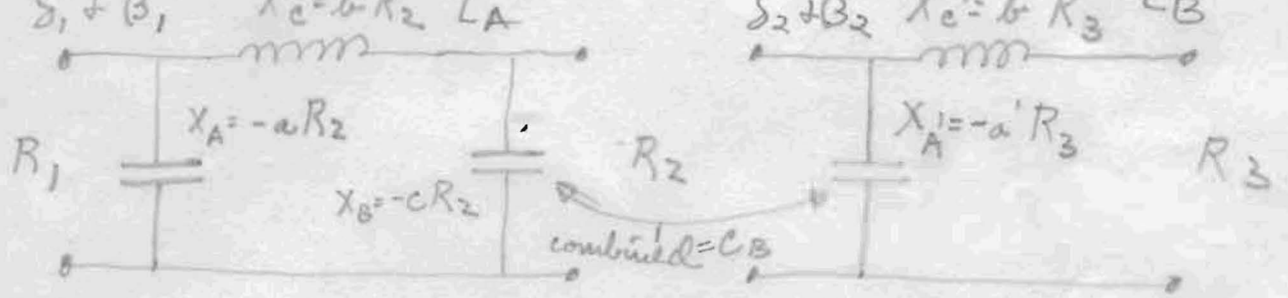
52.3
× 4
209.2
226.0
3 | 16.8
5.6

23
65.9
× 4
263.6
275.5
3 | 11.9
4.0 pf

22/5/57

Network between Mixer Plate + Filter

See Terman page 210-217 and figures 75-80




$R_1 = 10^6 \Omega$, $R_3 = 10^4 \Omega$   Frequency = 250 KC, $C_A$ = 11 pf, $X_A$ = 58000 $\Omega$

| | | | | |
|---|---|---|---|---|
| $R_2$ (by definition) | 10000 | 15000 | 20,000 | 30,000 |
| $R_2/R_3$ | 1 | 1.5 | 2.0 | 3.0 |
| $a'$ (from Fig 75, Locus for L section) | $\infty$ | 2.25 | 2.0 | 2.2 |
| $X_A'$, $X_A' = -a' R_3$ | $\infty$ | -22500 | -20000 | -22000 |
| $b'$ (from Fig 76, Locus for L section) | 0 | .7 | 1.0 | 1.45 |
| $X_c'$, $X_c' = b' R_3$ | 0 | 7000 | 10000 | 14500 |
| $\beta_2$ (from Fig 76, Locus for L section) | 0 | -35° | -45° | -55° |
| $\delta_2$ (from Fig 80, Locus for L section) | - | .8 | 1.0 | 1.4 |
| $R_1/R_2$ | 100 | 67 | 50 | 33 |
| $a$, $a = 58000/R_2$ | 5.8 | 3.9 | 2.9 | 1.93 |
| $\beta_1$ (from fig 75, $\beta > 90°$) | -144° | -147° | -152° | -157° |
| $\delta$ (from fig 79) | 19 | 18 | 19 | 20 |
| $b$ (from fig 76) | 6.0 | 4.3 | 3.2 | 2.7 |
| $X_c$, $X_c = b R_2$ | 60,000 | 64000 | 64000 | 66000 |
| $c$ (from Fig 77) | .71 | .56 | .44 | .34 |
| $X_B$, $X_B = -c R_2$ | -7100 | -8400 | -8800 | -10200 |
| $L_A$ | 38.2 mh | 40.8 | 40.8 | 42.1 |
| $L_B$ | 0 | 4.46 mh | 6.36 | 9.25 |
| $C_B$ | 74.3 pf | 104.3 | 104.3 | 91.5 |

1/6/57

Filter Design Continued.

| | | | | Use this one | |
|---|---|---|---|---|---|
| $R_2$ | 40,000 | 50,000 | 60,000 | 70,000 | 80,000 |
| $R_2/R_3$ | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 |
| $a'$ | 2.3 | 2.5 | 2.65 | 2.8 | 3.0 |
| $X_a'$ | -23000 | -25000 | -26500 | -28000 | -30000 |
| $b'$ | 1.75 | 2.0 | 2.2 | 2.4 | 2.6 |
| $X_e'$ | 17500 | 20000 | 22000 | 24000 | 26000 |
| $\beta_2$ | -60° | -65° | -69° | -70 | -72° |
| $\delta_2$ | 1.7 | 2.0 | 2.2 | 2.4 | 2.55 |
| $R_1/R_2$ | 25 | 20 | 16.7 | 14.3 | 12.5 |
| $a$ | 1.45 | 1.16 | .97 | .833 | .725 |
| $\beta_1$ | -160° | -162° | 163° | 163° | 163° |
| $\delta$ | 21 | 21 | 22 | 21 | 20 |
| $b$ | 1.7 | 1.4 | 1.2 | 1.05 | .92 |
| $X_c$ | 65,000 | 70,000 | 72,000 | 73,000 | 74,000 |
| $c$ | .295 | .26 | .235 | .22 | .21 |
| $X_B$ | -11,800 | -13000 | -14000 | -15400 | -16800 |
| $L_A$ | 43.4 | 44.5 | 45.9 | 46.5 | 47.1 |
| $L_B$ | 11.1 | 12.8 | 14.0 | 15.3 | 16.6 |
| $C_B$ | 82.0 | 74.7 | 69.6 | 64.3 | 59.3 |