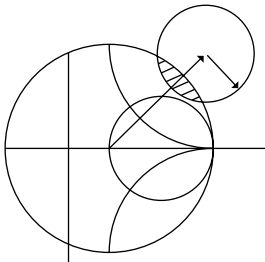

Answers to Selected Problems

1.2 **(a)** $\eta = 236\ \Omega$, **(b)** $v_p = 1.88 \times 10^8$ m/sec, **(c)** $\lambda = 0.0784$ m, **(d)** $\Delta\phi = 229.5°$
1.8 **(b)** $t \simeq 0.017$ mm
1.9 **(a)** $S_i = 46.0$ W/m^2, $S_r = 0.595$ W/m^2, **(b)** $S_{\text{in}} = 45.6$ W/m^2

2.1 **(a)** $f = 600$ MHz, **(b)** $v_p = 2.08 \times 10^8$ m/sec, **(c)** $\lambda = 0.346$ m, **(d)** $\varepsilon_r = 2.08$, **(e)** $I(z) = 1.8e^{-j\beta z}$, **(f)** $v(t, z) = 0.135\cos(\omega t - \beta z)$
2.3 $\alpha = 0.38$ dB/m
2.8 $Z_{\text{in}} = 203. - j5.2\ \Omega$
2.9 $Z_{\text{in}} = 19.0 - j20.6\ \Omega$, $\Gamma_L = 0.62\angle 83°$
2.11 $\ell = 2.147$ cm, $\ell = 3.324$ cm
2.12 $Z_0 = 66.7\ \Omega$ or $150.0\ \Omega$
2.16 $P_L = 0.681$ W
2.18 $P_{\text{inc}} = 0.250$ W, $P_{\text{ref}} = 0.010$ W, $P_{\text{trans}} = 0.240$ W
2.20 **(d)** $Z_{\text{in}} = 24.5 + j20.3\ \Omega$, **(e)** $\ell_{\min} = 0.325\lambda$, **(f)** $\ell_{\max} = 0.075\lambda$
2.23 $Z_L = 99 - j46\ \Omega$
2.29 $P_s = 0.600$ W, $P_{\text{loss}} = 0.0631$ W, $P_L = 0.1706$ W

3.5 loss $= 0.45$dB, $\Delta\phi = 2331°$
3.6 $\ell \simeq 10.3$ cm
3.9 $f_c = 5.06$ GHz
3.13 $f_c\,(\text{TE}_{11}) = 17.94$ GHz, $f_c\,(\text{TE}_{01}) = 37.35$ GHz
3.15 $k_c a = 3.12$
3.19 $W = 0.217$ mm, $\lambda_g = 4.045$ cm
3.20 $W = 0.457$ mm, $\lambda_g = 4.525$ cm
3.21 $\ell = 2.0754$ cm, $Z_{\text{in}} = 0.27 - j12.82\ \Omega$
3.27 $v_p = 2.37 \times 10^8$ m/sec, $v_g = 1.83 \times 10^8$ m/sec

4.4 $V_1^+ = 10\angle 90°$, $V_1^- = 0$, $Z_{\text{in}}^{(2)} = 50\angle 90°$
4.14 **(d)** IL $= 10.5$ dB, delay $= 45°$, **(e)** $\Gamma = 0.018\angle 90°$
4.18 IL $= 8.0$ dB, delay $= 90°$
4.20 $P_L = 1.0$ W
4.24 $V_L = 1\angle -90°$
4.30 $\Delta = 0.082$ cm

5.1 **(a)** $C = 0.0568$ pF, $L = 9.44$ nH or $L = 7.10$ nH, $C = 0.298$ pF
5.3 $d = 0.2276\lambda$, $\ell = 0.3776\lambda$ or $d = 0.4059\lambda$, $\ell = 0.1224\lambda$
5.6 $d = 0.174\lambda$, $\ell = 0.353\lambda$ or $d = 0.481\lambda$, $\ell = 0.147\lambda$

5.9 $\ell_1 = 0.086\lambda$, $\ell_2 = 0.198\lambda$ or $\ell_1 = 0.375\lambda$, $\ell_2 = 0.375\lambda$
5.14 error = 4%
5.17 $Z_1 = 1.1067Z_0$, $Z_2 = 1.3554Z_0$
5.21 $Z_1 = 1.095Z_0$, $Z_2 = 1.363Z_0$
5.24 RL < 6.4 dB

6.1 $f_0 = 800$ MHz, $Q_0 = 100$, $Q_L = 50$
6.5 $Q_0 = 138$
6.9 $f_{101} = 9.965$ GHz, $Q_{101} = 6349$
6.14 $a = 2.107$ cm, $d = 2.479$ cm, $Q_0 = 1692$
6.18 $f_0 = 7.11$ GHz
6.21 **(c)** $f_0 = 93.8$ GHz, $Q_c = 92,500$

7.3 RL = 20 dB, $C = 15$ dB, $D = 30$ dB, L = 0.5 dB
7.8 change = 1.2 dB
7.13 $s = 5.28$ mm, $r_0 = 3.77$ mm
7.19 $s = 0.20$ mm, $w = 0.6$ mm
7.22 $s = 1.15$ mm, $w = 1.92$ mm, $\ell = 6.32$ mm
7.32 $V_1^- = V_3^- = V_4^- = 0$, $V_2^- = V_5^- = -j0.707$

8.6 $R = 2.66$, $C = 0.685$, $L = 1.822$
8.7 $N = 5$
8.8 $L_1 = L_5 = 1.143$ nH, $C_2 = C_4 = 0.928$ pF, $L_3 = 0.877$ nH
8.10 attenuation = 11 dB
8.16 $\beta\ell_1 = \beta\ell_5 = 29.3°$, $\beta\ell_2 = \beta\ell_4 = 29.4°$, $\beta\ell_3 = 43.7°$
8.18 attenuation = 30 dB
8.19 bandwidth about 1.9:1
8.23 $N = 3$

9.1 (b) $\mu = 6.55\mu_0$, $\kappa = 4.95\mu_0$
9.4 $H_a = 500$ Oe
9.6 $L = 1.403$ cm
9.8 229 Oe < H_0 < 950 Oe
9.12 **(a)** $H_0 = 2204$ Oe, **(b)** $H_0 = 2857$ Oe
9.15 $L = 23.5$ mm
9.17 $L = 44.5$ cm
9.18 $L = 9.2$ cm

10.1 $F = 7.0$ dB
10.4 $F_{\text{cas}} = 4.3$ dB
10.7 **(a)** $F = 6$ dB, **(b)** $F = 1.76$ dB, **(c)** $F = 3$ dB
10.14 ratio = 6 dB
10.15 $\text{OIP}_3 = 20.8$ dBm (coherent)
10.17 LDR = 74.5 dB
10.18 LDR = 86.7 dB, SFDR = 57.8 dB

11.2 ON: IL = 0.42 dB, OFF: IL = 11.4 dB
11.3 ON: IL = 0.044 dB, OFF: IL= 18.6 dB
11.7 $R_i = 12.2\ \Omega$, $C_{gs} = 0.84$ pF, $R_{ds} = 213\ \Omega$, $C_{ds} = 0.51$ pF, $g_m = 54$ mS

12.1 **(b)** $G_A = 0.5$, $G_T = 0.444$, $G = 0.457$
12.4 $C_L = 4.00\angle 96°$, $R_L = 3.60$, $K = 0.275$
12.6 A and C are unconditionally stable
12.9 $G_T = 10.5$ dB

12.13 $-2.9\text{ dB} < G_T - G_{TU} < 4.3\text{ dB}$
12.15 $G_T = 19.4\text{ dB}$
12.21 $N_{\text{opt}} = 8.4$

13.3 $Q_{\text{min}} = 14$
13.8 $L = 2.5\text{ nH}$ results in $\mu = -0.931$
13.9 **(a)** $\mathscr{L} = -181\text{ dBc/Hz}$, **(b)** $\mathscr{L} = -153\text{ dBc/Hz}$
13.12 $\mathscr{L} = -121\text{ dBc/Hz}$
13.17 $f_{\text{IM}} = 1974\text{ MHz or }1626\text{ MHz}$

14.2 $D = 5.7\text{ dB}$
14.4 $D = 33.6\text{ dB}$
14.6 $\eta_{\text{rad}} = 65\%$
14.8 $G/T = 9.7\text{ dB/K}$
14.11 $R = 15.2\text{ km}$
14.13 $R = 1.9 \times 10^9\text{ m (for SNR} = 0\text{ dB)}$
14.17 80–1600 Hz
14.23 $|E| = 990\text{ V/m}$