Lab Exercise #3 due February 16, 2023

Ref: Hayt p 382-386.. Terminate a 'lossless' TL at *z=0* with Z_{LD}, which may represent an antenna. The input impedance as a function of position along the length of the TL is given

$$Z_{in}(l) = Z_o \frac{Z_L + j Z_o \tan \beta l}{Z_o + j Z_L \tan \beta l}$$

Figure 1 is a plot illustrating the input impedance versus position along the length of a Zo=50 Ω TL with a resistance termination (Z_L=75 Ω)

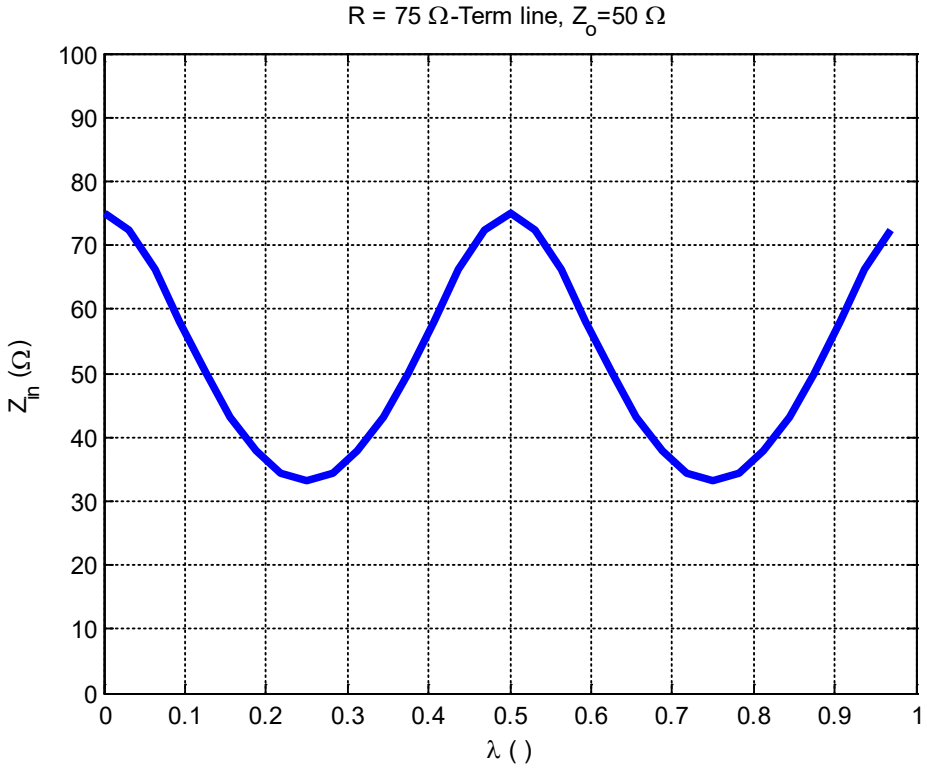

Fig. 1. Input impedance of a lossless line with a resistance termination.

Recall

$$\overline{\Gamma} = \frac{V^-}{V^+} = \frac{\overline{Z}_L - Z_o}{\overline{Z}_L + Z_o}$$

The Return Loss (S_{11}) is a measured (complex) quantity used to characterize an antenna impedance match and its ability to transmit power

$$RL_{dB} = -10 \log_{10}\left(\Gamma^2\right)$$

Continued on back

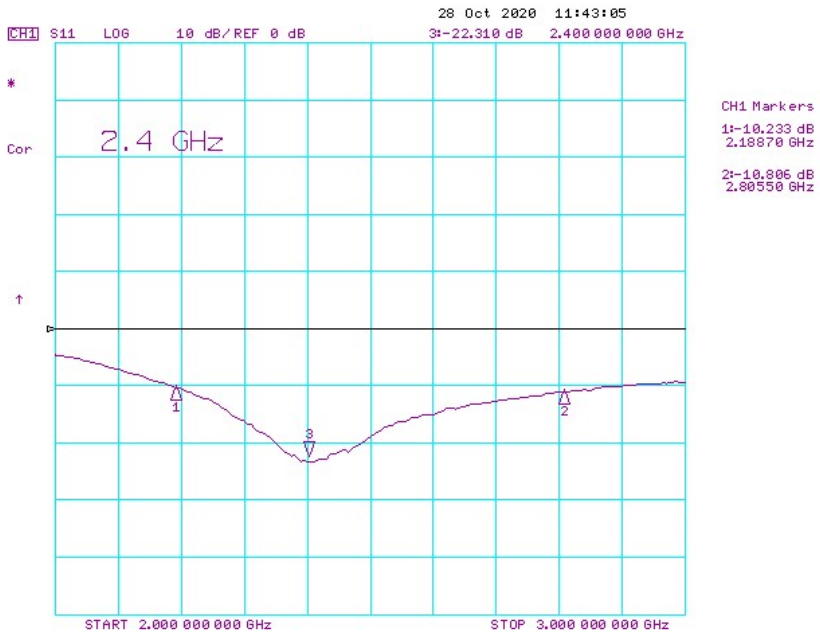

Fig. 2. Return Loss plot of prototype Quarter-Wave monopole antenna designed for Wi-Fi operation.

Procedure:

1. Reconstruct Figure 1 using Matlab or Python
2. Reconstruct Figure 2 using Matlab or Python. Download the measured data file from the Canvas page. The header section and first few lines are shown in Figure 3
3. Calculate $\Gamma, VSWR$ at the center frequency shown (*f=2.4 GHz*)

```
CITIFILE A.01.00
#NA VERSION HP8720ES.07.74: Oct 30, 2002
NAME DATA
VAR FREQ MAG 201
DATA S[1,1] RI
SEG_LIST_BEGIN
SEG 2000000000 3000000000 201
SEG_LIST_END
BEGIN
5.88409E-1,-8.42285E-3
5.81268E-1,-1.19628E-2
5.76080E-1,-1.85241E-2
5.66436E-1,-2.20336E-2
5.60150E-1,-2.48718E-2
5.55267E-1,-2.92968E-2
5.50720E-1,-3.48815E-2
```

Fig. 3. Screen-capture of header section and first few lines of measured data for QWMP