ECE320H1F: Fields and Waves
Laboratory 2: Standing Waves and Waveguides

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Show your calculations for all work, including theoretical diagrams and plots. **Include the full name, student number and PRA session for all group members on the laboratory report.**

4.2 [2] Measured width of the transmission line.
w = 3 mm

[2] Theoretical characteristic impedance.
s = 2
x = 0.5394
y = 0.9995
Ɛeff = 3.347029384 =3.35
t=7.75
Zo = 48.69 Ω

[2] Theoretical effective dielectric constant.
Ɛeff = 3.347029384 = 3.35

[2] Theoretical phase velocity.
Vp = 1.64 * 10^8 m/s

[2] Experimental VSWR.
Vmax = -38dB = 0.01258925411 V
Vmin = -71dB = 0.00028183829 V
VSWR = Vmax / Vmin = 44.66

[2] Comparison of experimental VSWR to theoretical value.
Experimental values are much less than theoretical (infinity), but it is expected as there are plenty of variables that affect precision during our experiments. Our experimental value is high enough that can be considered to have similar effects to the theoretical infinite value.

[2] Experimental wavelength.
λ : 16 cm

[2] Experimental effective dielectric constant.
vp = 160 * 10^6 m/s
Ɛeff = 3.515625

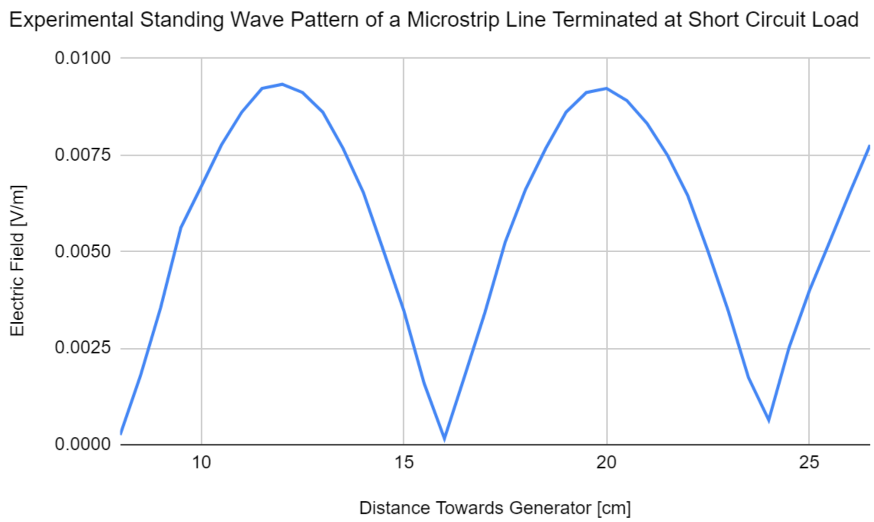
[2] Comparison of experimental wavelength and effective dielectric constant to theoretical values.

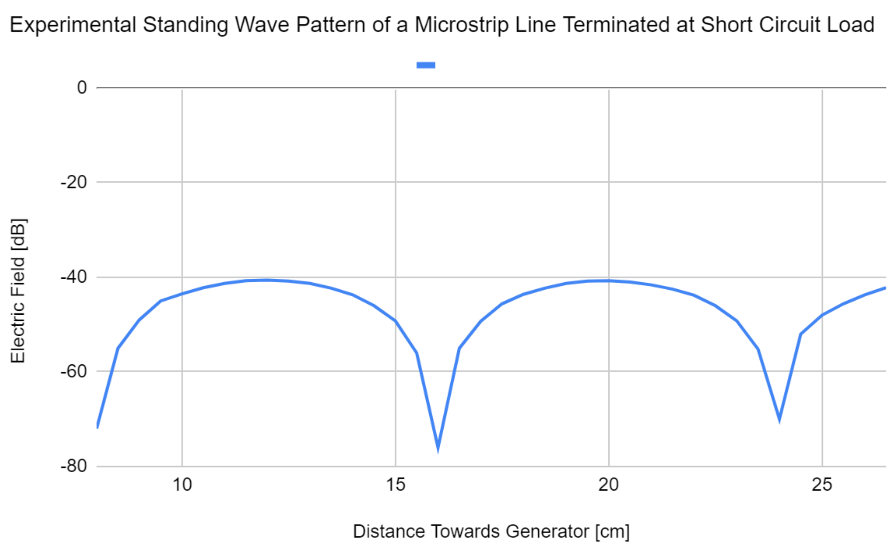
Theoretical wavelength: 0.164 m = 16.4 cm
Experimental wavelength: 16 cm

Theoretical Ɛeff = 3.347029384
Experimental Ɛeff= 3.515625

The experimental values are similar to the theoretical values, as expected.

[12] Plotting the experimental standing wave pattern.





4.3 [5] Impedance of the load found from experimental standing wave measurement data.

Vmax = -42dB @ 10 cm = 0.007943282347
Vmin = -50dB @ 6 cm = 0.00316227766

VSWR = 2.511886

λ = 4 x (10 - 6 cm) = 16 cm

Magnitude of the Reflection Coefficient = 0.430505502108
Phase of the Reflection Coefficient = 7.8539816339 rad = 90 degrees

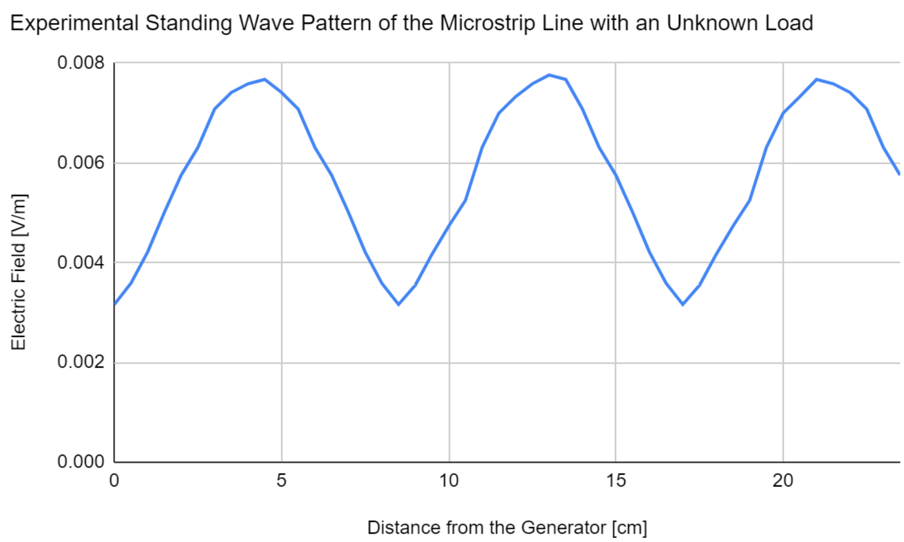
$\Gamma = 0.43 \angle 90.00^o$
$= 0.43(\cos 90.00^o + j \sin 90.00^o)$
$= 0.00 + 0.43j$

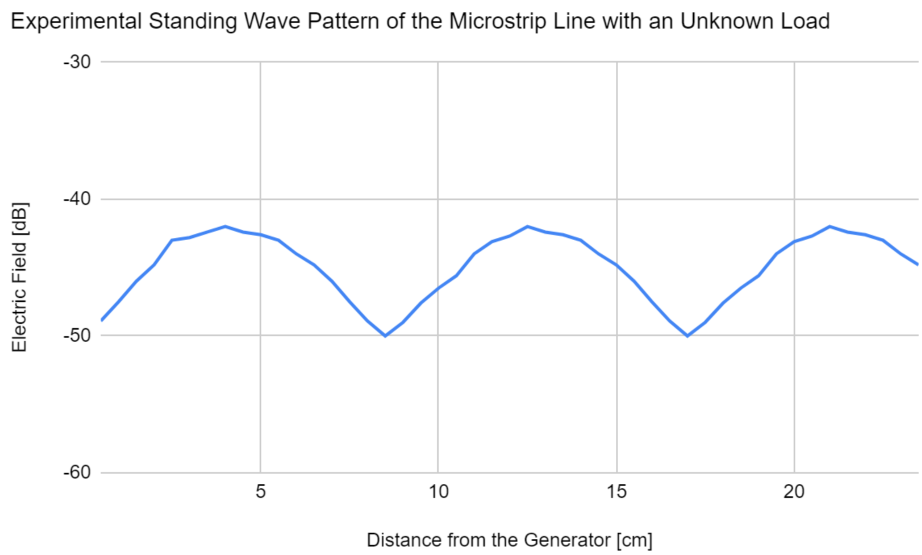
Impedance at the Load = *34.39530 +36.28998 i*

[5] Impedance of the load measured using the vector network analyzer (VNA).
Z = 23.168 - 4.24j (C is -37.4 pF)

[5] Comparison of results.
The theoretical value and the calculated value of the impedance at the load are close when compared at the Smith Chart. Measured value is slightly different from the calculated value to do the nature of the measurement equipment errors.

[15] Plotting the experimental standing wave pattern.





[10] Presentation and neatness.

[ ] Indicates the number of marks out of **70 total marks.**