A report on an Experiment of comparison between matched and mismatched loads

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Table 1: Group 1 Members

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Contents

Chapter 1

Introduction

1.1 Objectives

The objective of the practical is to understand the differences between a matched load and a mismatched load and different grades of mismatched loads. We will compare the results and we will recognise the different types of loads.

1.2 Equipment

1. Interface
2. Gunn oscillator
3. Waveguide slotted linewidth
4. 6dB fixed attenuator
5. Termination load
6. Short circuit
7. Horizontal variable attenuator

Chapter 2

Procedure

The experiment was carried out following the procedure as listed below

1. First of all, the first circuit ("Mismatched Load 1") that consists of a gunn oscillator, a horizontal variable attenuator, a slotted line and a short circuit was assembled.

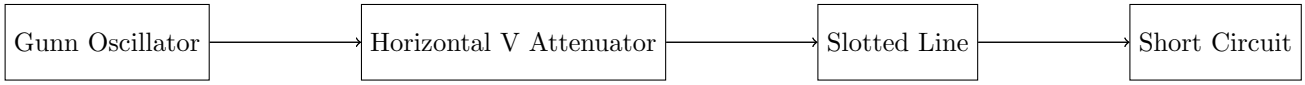


Figure 2.1: Microwave crcuit with mismatched load 1

2. The gunn oscilator element is connected to the gunn oscilatorpower supply connector. The power meter is connected to the power meter "RF Input" connector.
3. The micrometer of the horizontal variable attenuator is set to the 2mm position
4. The diode dector of the slotted line is set to the 0 mm position
5. After verifying that the circuit breaker is on, the unit is switched on.
6. The detector in the ssloted line is moved slowly until maximum power is reached.
7. The position of the micrometer is moved slowly until the maximum power signal detected is between 0.800mW and 0.850mW. With this attenuation, the diode detector is prevented from saturation.
8. With the diode detector mount in 0mm, the diode mount of the slottedline is increased slowly while recording the value of SWR meter display every millimeter until the 40 mm position
9. The unit is turned off
10. The reflected power is calculated with the equation included below

$$SWR = \frac{V_{max}}{V_{min}}$$

$$Power_{reflected} = \left(\frac{SWR - 1}{SWR + 1}\right)^2$$

. In real systems, the reflected power is the powersignal that goes back to the generator and it should be minimised in order to avoid the gneraator to be damaged.

11. Now the second circuit ("Mismatched Load 2") is assembled that consists a gunn oscillator, horizontal variable attenuator, 6dB fixed attenuator and short circuit as shown in the figure below.

Figure 2.2: Microwave crcuit with mismatched load 2

12. Steps 2 through 10 are repeated and reflected power is calculated.

13. Finally the third circuit ("Matched Load") is assembled that consists a gunn oscillator, horizontal variable attenuator, and termination load as shown in the figure below.

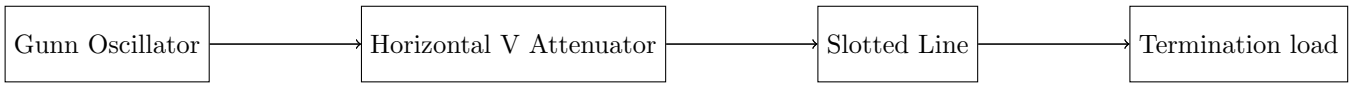


Figure 2.3: Microwave crcuit with matched load

14. Steps 2 through 10 are repeated and reflected power is calculated.

15. The results are compared and the load with the worst SWR is identified

16. Using a smith chart, the SWR and reflection coefficient of all loads are calculated.

$$coefficient_{reflection} = \frac{SWR - 1}{SWR + 1}$$

Chapter 3

Theory

Chapter 4

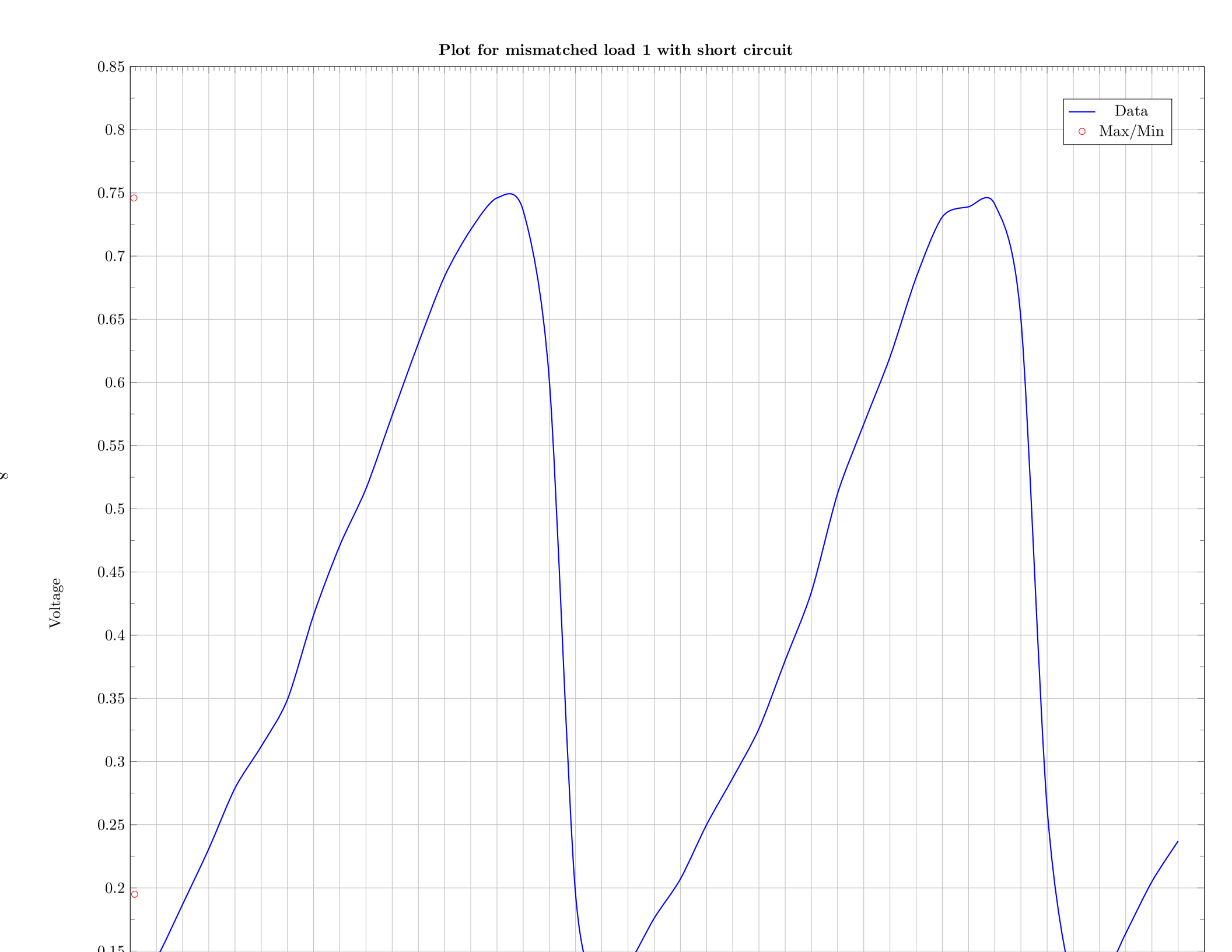
Results

4.1 Mismatched Load 1

Length(mm)	Column 2
0.00	0.113
0.01	0.144
0.02	0.187
0.03	0.231
0.04	0.279
0.05	0.312
0.06	0.349
0.07	0.416
0.08	0.471
0.09	0.516
0.10	0.574
0.11	0.631
0.12	0.684
0.13	0.721
0.14	0.746
0.15	0.736
0.16	0.601
0.17	0.195
0.18	0.119
0.19	0.139
0.20	0.176
0.21	0.207
0.22	0.250
0.23	0.287
0.24	0.326
0.25	0.380
0.26	0.434
0.27	0.512
0.28	0.567
0.29	0.620
0.30	0.683
0.31	0.731
0.32	0.739
0.33	0.741
0.34	0.650
0.35	0.263
0.36	0.122
0.37	0.123
0.38	0.164
0.39	0.205
0.40	0.237

Table 4.1: Mismatched Load 1

First Minimum value	
First Maximum value	
SWR value	
Power reflected	


Plot for mismatched load 1 with short circuit
Data
Max/Min
Voltage
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15

4.2 Mismathed load 2

Length(mm)	Column 2
0.00	0.757
0.01	0.770
0.02	0.786
0.03	0.797
0.04	0.794
0.05	0.784
0.06	0.760
0.07	0.737
0.08	0.703
0.09	0.642
0.10	0.611
0.11	0.568
0.12	0.552
0.13	0.559
0.14	0.578
0.15	0.608
0.16	0.655
0.17	0.693
0.18	0.730
0.19	0.769
0.20	0.780
0.21	0.796
0.22	0.799
0.23	0.791
0.24	0.771
0.25	0.738
0.26	0.701
0.27	0.668
0.28	0.619
0.29	0.572
0.30	0.550
0.31	0.548
0.32	0.564
0.33	0.595
0.34	0.639
0.35	0.671
0.36	0.708
0.37	0.742
0.38	0.770
0.39	0.784
0.40	0.794

Table 4.2: 6dB attenuator

First Minimum value	
First Maximum value	
SWR value	
Power reflected	


Plot for mismatched Load 2 with 6dB attenuation Load and short circuit
Data
Max/Min
Voltage
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15

4.3 Matched Load

Length(mm)	Column 2
0.00	0.752
0.01	0.750
0.02	0.742
0.03	0.735
0.04	0.721
0.05	0.692
0.06	0.674
0.07	0.647
0.08	0.629
0.09	0.610
0.10	0.598
0.11	0.598
0.12	0.613
0.13	0.614
0.14	0.634
0.15	0.655
0.16	0.673
0.17	0.698
0.18	0.724
0.19	0.743
0.20	0.751
0.21	0.742
0.22	0.730
0.23	0.715
0.24	0.685
0.25	0.666
0.26	0.640
0.27	0.625
0.28	0.606
0.29	0.601
0.30	0.601
0.31	0.607
0.32	0.623
0.33	0.642
0.34	0.668
0.35	0.697
0.36	0.718
0.37	0.734
0.38	0.744
0.39	0.744
0.40	0.738

Table 4.3: Termination load

First Minimum value	
First Maximum value	
SWR value	
Power reflected	


Plot for Matched load with termination load
Data
Max/Min
Voltage
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15

Chapter 5

Explanation and Conclusion