School of Engineering & Information Technology

UNSW Canberra

ZEIT 3220 Engineering Electromagnetics

Lab #1: Report Guideline

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Session 1, 2021

Scope

This lab report should address the lab activity for Lab 1B and 1C. You should aim to provide a compelling story that showcases how you have gone about the indicated procedure:

1B (a) use the uVNA to measure S_{11} for cables # 2 and #3 when terminated in the 200 Ω load; save these results to a .csv file;

(b) calculate ε_r for cables #2 and #3

1C (a) select one of the supplied load impedances, and note its serial number;

(b) use the uVNA to measure the reflection coefficient of your load impedance; save these results to a .csv file for subsequent processing;

(c) from your measurements identify the reflection coefficient value at a frequency of 98 MHz, then calculate the corresponding load impedance;

(d) apply the stub matching procedure to find the lengths of the series and stub lines to match the 98 MHz load impedance to 50 Ω; use ADS to verify the performance of your stub matching solution;

(e) repeat Step 4 to find the solution for a quarter wave transformer match;

(f) write a Matlab script to calculate the input impedance Z_{in} as a function of frequency for both the stub and quarter wave transformer matching networks; how closely do they compare?

Note, that although lab 1B is not listed above, it is expected that the data from lab 1B is to be used to address lab 1C questions.

Content

Your report should be no longer than eight A4 pages (with reasonable page settings, e.g. 2cm margins, 12pt font)

Your report should showcase your understanding of the transmission line concepts as you address exercises 5–10 (listed at the end of Labs 1C and 1D)

Your report will be graded on its overall completeness, not length. **You need not to have the full 8 pages**

(SCOPE) 20% – How well does the report: (a) identify the key transmission line concepts; (b) discuss transmission line behavior; and (c) apply the understanding of transmission line theory to correctly design matching networks?

100 HD+
All objectives of the scope are met, and the work is free of errors with a very high level of technical competence.

90 HD
Somewhere in between the descriptions of HD+ and D. A few small omissions are allowed for HD.

80 D
All objectives of the scope are met, with some minor errors; displays a high level of technical competence.

70 Cr
Most objectives of the scope are addressed; fewer errors than in P+, but the fluency between topics is lacking.

60 P+
Basic requirements of the scope are covered; errors are mostly in the more nuanced topics.

50 P
Only basic requirements of the scope are covered; work contains a few errors and the technical competence is only at a routine level.

40 F+
Most of the basic requirements of the score are covered, but the technical errors are significant enough to deter from forming convincing descriptions of transmission lines

20 F
Only some of the basic requirements in the scope are covered; displays a low level of technical competence with many errors.

0 F-
Few of the basic requirements in the scope are achieved; a potentially misleading explanation of transmission lines.

(PRES) 20% – How well does the report demonstrate: (a) neatness and legibility; (b) structure and flow of narrative; (c) layout, labeling, captioning of diagrams, tables, graphs; (d) correct grammar, technical expression and spelling; (e) correct referencing.

100 HD+ (100)
The response will be clear and concise. Figures support arguments made in the text.Â Background is adequate to demonstrate understanding, and data are convincing to demonstrate conclusions.

90 HD
Somewhere in between the descriptions of HD+ and D. A few small omissions are allowed for HD.

80 D
The studentâ€™s submissions demonstrate strong understanding, but the arguments are not as clear as could be.Â Quality of figures and grammar is excellent.

70 Cr
Presentation of the arguments is confusing, requiring extra work on the part of the reader.Â Figure quality is average, and grammar is lacking.

60 P+
Somewhere in between the descriptions of Cr and P.

50 P
All the fundamentals of the answer are present, but the organization of the document makes it very hard to extract them.Â Figures are difficult to understand and/or incomplete.Â Grammar is understandable

40 F+
Major flaws in organization, grammar and figures.

20 F
A poorly written piece of work with little structure, poor figures, poor grammar.

0 F-
No attempt made.

(Q5) 10% – Observe the measured S_{11} values for the two new cables. Using the values at 40 MHz, 50 MHz and 60 MHz, estimate the value of ε_r. Compare your results for the three cables. Develop explanations for any differences you might see in the results.

100 HD+
All of HD plus the student will also have convincingly explained any discrepancies between the results and what was expected.

90 HD
The dielectric constant is determined from the data without error and a clear explanation of the results is presented.

80 D
Accurate calculations of the dielectric constant and a credible explanation of the results.

70 Cr
Accurate calculations of the dielectric constant but the explanation of the results is not convincing.

60 P+
Reasonably accurate calculations of the dielectric constant and the explanation of the results is marginal.

50 P
Calculations of the dielectric constant contain a few errors and the explanation of the results indicate gaps in understanding.

40 F+
Student will have made a good faith effort, but will have not have demonstrated significant understanding. There are significant flaws in the procedure the student has not recognized.

20 F
Student will have very little demonstrable results.

0 F-
No attempt made.

(Q6) 10% – Develop explanations as to why it might be advantageous to go through the process of estimating the value of ε_r. What is it that you are verifying?

100 HD+
All of HD plus the student will also have convincingly explained any discrepancies between the results and what was expected.

90 HD
The connection between estimating ε_r and what it means in terms of the electrical length is correctly outlined.

80 D
Demonstrates strong understanding of how ε_r values are related to the electrical length but the explanation is not clear.

70 Cr
A credible explanation of why it might be advantageous to evaluate the value of ε_r.

60 P+
The student's explanation will have indicated marginal understanding.

50 P
The student's submission will have presented an incomplete explanation.

40 F+
Student will have made a good faith effort, but will have not have demonstrated significant understanding. There are significant flaws in the procedure the student has not recognized.

20 F
Student will have very little demonstrable results.

0 F-
No attempt made.

(Q7) 10% – Determine the load impedance of the unknown load.

100 HD+
All of HD plus the student will also have convincingly explained any discrepancies between the results and what was expected.

90 HD
The link between load and input impedance is clear.

80 D
Demonstrates strong understanding of the relationship between load and input impedance but not as clear as it could be.

70 Cr
A credible understanding of the link between load and input impedance.

60 P+
Reasonably accurate calculation to evaluate the load impedance of the unknown load.

50 P
Some mistakes in the procedure are present.

40 F+
Student will have made a good faith effort, but will have not have demonstrated significant understanding. There are significant flaws in the procedure the student has not recognized.

20 F
Student will have very little demonstrable results.

0 F-
No attempt made.

(Q8) 10% – Determine the parameters for the shunt stub matching network. Verify its performance in ADS by simulating the proposed MN.

100 HD+
All of HD plus the student will also have convincingly explained any discrepancies between the results and what was expected.

90 HD
The shunt stub matching network is designed without error and the simulation results are accurate.

80 D
The shunt stub matching network is designed without error but the simulation results may not be completely accurate.

70 Cr
The shunt stub matching network is designed without error but the simulation results contain a few errors.

60 P+
Reasonably accurate evaluation of the parameters of the shunt stub matching network and the simulation results indicate significant errors.

50 P
The shunt stub matching network is designed with a few errors and the simulation results are not accurate.

40 F+
Student will have made a good faith effort, but will have not have demonstrated significant understanding. There are significant flaws in the procedure the student has not recognized.

20 F
Student will have very little demonstrable results.

0 F-
No attempt made.

(Q9) 10% – Determine the parameters for the quarter wave matching network. Verify its performance in ADS by simulating the proposed MN.

100 HD+
All of HD plus the student will also have convincingly explained any discrepancies between the results and what was expected.

90 HD
The quarter wave matching network is designed without error and the simulation results are accurate.

80 D
The quarter wave matching network is designed without error but the simulation results may not be completely accurate.

70 Cr
The quarter wave matching network is designed without error but the simulation results contain a few errors.

60 P+
Reasonably accurate evaluation of the parameters of the quarter wave matching network and the simulation results indicate significant errors.

50 P
The quarter wave matching network is designed with a few errors and the simulation results are not accurate.

40 F+
Student will have made a good faith effort, but will have not have demonstrated significant understanding. There are significant flaws in the procedure the student has not recognized.

20 F
Student will have very little demonstrable results.

0 F-
No attempt made.

(Q10) 10% – The frequency range where the magnitude of the reflection coefficient is such that the VSWR is less than 2 is often used to quantify impedance bandwidth. Observe your simulated frequency response results for the reflection coefficient at the input of the stub and quarter wave transformer matching networks. Which matching network achieves the wider impedance bandwidth? What are the 2:1 impedance bandwidths for each matching network? [*hint:* calculate $|\Gamma| = |S_{11}|$ for $VSWR = 2$.] Develop an explanation as to why a particular matching network provides the better frequency response.

100 HD+
All of HD plus the student will also have convincingly explained any discrepancies between the results and what was expected.

90 HD
The criteria by which matching networks are selected properly and interpreted correctly.

80 D
Student will have demonstrated strong understanding but the explanation will not be clear and concise.

70 Cr
Student will have presented an explanation that is not convincing.

60 P+
Student will have presented marginal explanation.

50 P
Student's submission will have demonstrated gaps in the understanding of the frequency response of matching networks.

40 F+
Student will have made a good faith effort, but will have not have demonstrated significant understanding. There are significant flaws in the procedure the student has not recognized.

20 F
Student will have very little demonstrable results.

0 F-
No attempt made.