

James Cook University
Electrical and Computer Engineering
EE4306 RF Design Assignment Townsville

Aim

The aim of this assignment is to firstly provide some experience in the design and optimisation of RF circuits. This assignment is worth 20% of the total mark for the subject.

Requirements:

Design a wideband Wilkinson Hybrid to have a 2 to 1 operating frequency range, as specified for each student. To simplify the terminology, consider the operation of the Hybrid as a combiner, with the signals from two inputs (Input 1 and Input 2) being combined into the output.

For the whole frequency range specified, the reflection coefficient S_{11} of all the 3 ports should be better than -30 dB. For the whole frequency range specified, the isolation between the two input ports should be better than -30 dB.

A microwave RF substrate RO4003 made by Rogers is to be used for the PCB. In addition to the microstrip lines, only resistors and if needed capacitors are to be used on the PCB. The resistors and capacitors are to be made up with standard value surface mount components in a 1206 package. The RO4003 board has a thickness of the dielectric material of 0.8128 mm and has a relative dielectric constant of 3.38, with a loss tangent of 0.027. The board has a 1 oz copper cladding (0.035mm thick).

The design to be produced by each student should include a full PCB layout and its corresponding Gerber plot file. PCB mounting BNC connectors are to be used for the connectors to get the signals in and out of the board. These connectors can be in any suitable configuration, but they must be able to provide a good RF connection and be soldered directly to the board. The circuit is to occupy the smallest possible printed circuit board area.

Each student has to write a report providing full design, layout and optimisation details of the design. The circuit schematic design must be verified using computer simulation. The design report is to be submitted by 10am on Monday the 20th of October 2005 to the 3rd/4th Year slot in the wall in EL109. The Microwave Office and Gerber Plot files are to be Zipped and the Zip file should be submitted using Safe-assign in LearnJCU by the same deadline. The MWO files must have your name and student number as text in the Schematic file. **Safe-assign will detect plagiarism.**

Hint: It is recommended that the design is done initially using ideal transmission lines, resistors and capacitors as required. Once that circuit is optimised and meets the specification, then a microstrip version of that circuit is designed and optimised to again meet the specifications.

Each student is given a different filter to design, according to the following table:

Name		Operating Frequency Range
ARNEL	ROWAN WAYNE	200 to 400
BROMAGE	ANDREW WILLIAM	225 to 450
BUSOLI	DANIEL LEE	250 to 500
CARE	DAVID MATTHEW	275 to 550
CONDON	DEAN WILLIAM	300 to 600
DUBEY	BRAJBHUSHAN JAWAHERLAL	325 to 650
EASTON	CHRISTOPHER DAVID	350 to 700
FINCH	DAVID JOHN	375 to 750
HAIGH	RYAN JOSIRE	400 to 800
HARRIS	WADE MORGAN	450 to 900
KINGSBERRY	MATTHEW THOMAS	500 to 1000
LANIGAN	LIAM JAMES	550 to 1100
LIM	WAEI AAN	600 to 1200
MALLETT	CONLAN GEOFFREY	650 to 1300
MCCABE	THANE WILLIAM	700 to 1400
MCPHERSON	CRAIG ROBERT	750 to 1500
MILES	DANNY MICHAEL	800 to 1600
MURRAY	BRETT ROBERT	850 to 1700
RAINS	DAVID ANTHONY	900 to 1800
SANTAROSSA	MICHAEL JOHN	950 to 1900
SELLERS	BEN	1000 to 2000
SERES	RUSSELL EDWARD	1050 to 2100
SHARPE	LEE WILLIAM	1100 to 2200
SWEETLAND	WILLIAM ROBERT	1150 to 2300
WILKIE	SCOTT RICHARD	1200 to 2400
YIP	LI-WEN	1250 to 2500
ZAGAMI	CHRISTOPHER ALFIO	1300 to 2600

The marking scheme is on the next page and that page must be attached to your assignment, to permit the appropriate feedback.

C. J. Kikkert
3 August 2005

RF Assignment Marking Scheme

6 marks will be given for documentation outlining the operation of the circuit.

Your documentation should include all the circuit diagrams, and screen shots of the performance of the circuit.

7 marks will be given for the RF design i.e. the performance of the diplexer.

These marks will include the following performance indicators:

- 1 How well does the circuit work as a hybrid ?
- 2 How well does it meet or exceed the specifications ?
- 3 How costly is it to manufacture (Number of components, size etc) ?
- 4 Is the frequency range correct ?

5 marks will be given for the circuit layout.

Factors to be considered here are the overall size of the circuit, the real estate utilisation, the avoidance of unwanted coupling and the shielding provided by the ground-plane.

2 marks will be given for the Gerber plot files.

Minus 3 marks will given if the Documentation and Gerber Plot files are not clearly labelled with your name and student number.

Name:

	Max	Mark	Comment
Documentation	6		
RF design	7		
Layout	5		
Plot files	2		
Name in Docs	-3		
Total			