Project 1:
Retrodirective Array Phase Modulator

ECE 6361: Microwave Design Lab

Objective

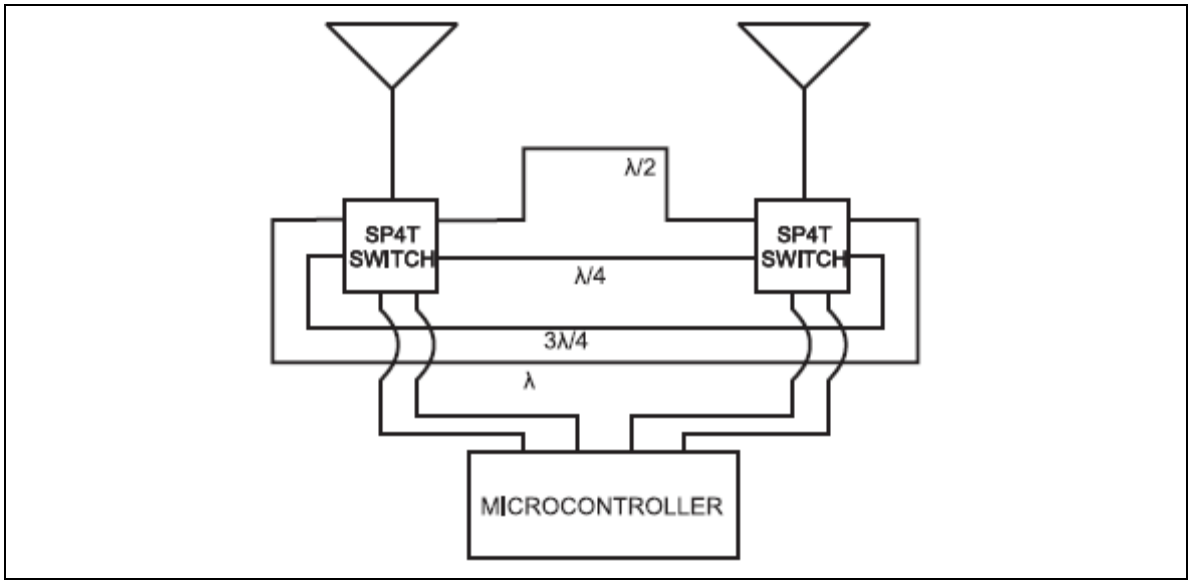
The student team will produce a device capable of generating a binary retrodirective array phase modulator (RAPM) in the 5.8 GHz ISM band capable of transmitting a random QPSK signal.

Design Specifications

Each student team is expected to design and build a binary RAPM signal board in the 5.8 GHz band using an array of 2 patch antennas on FR4. The key design targets are

- Operation within the 5.725 – 5.850 GHz ISM (unlicensed) band, capable of reflecting a random sequence 100 kbaud QPSK signal that will be measured at the IQ outputs of a direct downconversion backscatter receiver (provided). Example output when graphed on xy-inputs of an oscilloscope will look like this: http://www.movingpixel.com/DemodCSmall.jpg
- The two antenna elements must be detachable (board and antennas must be SMA connectorized) so that the s-parameters can be measured and analyzed in your final report.
- The board must be driven by a coil cell Lithium ion battery, but must also have a breakout for external power supply.

A high-level diagram of the backscatter QPSK modulator is shown below:



There is a list of supplies online for building this project. Ask the instructor for these components when ready to fabricate the circuit board. Connectors and basic surface-mount capacitors, resistors, and inductors are available from the lab manager. If a team would like to use additional components, please clear the component with the course instructor. Once cleared, the components may be purchased (likely out-of-pocket) by the team.

Students must design and fabricate this board using the in-house facilities of the ECE board layout laboratory.

Grading

Grading for the student teams is based on three parts:

1. **Written Report** – The base score of this project will be based on the written documentation of the group's project design and implementation. Key grading points for good design documentation:
    a. Technical Correctness
    b. Thorough Design Methodology
    c. Clear, *Concise* Writing
    d. Professional Content
    e. References

    Design documentation should strive for succinct repeatability. For this particular project, the students must compare their dual patch RAPM antenna efficiency to a single patch element tag using conventional BPSK.
2. **Compliance Test** – Each team must demonstrate to the course instructor that their final device complies with the project specifications. Various project score deductions will be assessed to a team depending on how far "out-of-spec" a final device performs. Compliance may only occur immediately after a scheduled lecture.
3. **Peer Evaluation Forms** – Download the peer evaluation forms from the course site and fill them out for each team member. Various project score adjustments may be assessed to a team depending on peer-assessment of individual team member effort. Form feedback is kept confidential.