

ECE 431 Microwave Engineering The Cooper Union

Semester Project

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Vector Modulator Design Project

- The group will prepare and submit a report including detailed design information
 - Block diagram: including a written explanation of each block
 - RF / Microwave signal chain analyses: sufficient detail to evaluate each pertinent specification
 - Chart and/or discussion of each specification met / not met, and margins achieved – for all data states (16 states)
 - Discuss design trade-offs and/or other design decisions
 - Discuss size, weight, power consumption considerations
 - There are no limitations to the design, except only REAL parts (currently offered by manufacturers) must be used
 - Manufacturer part data sheets are to be included in a report appendix
- The group will present a short (approximately 30 minutes) oral report
 - Discuss the work and the results
 - Show significant elements
 - Each group member must speak individually about their contributions

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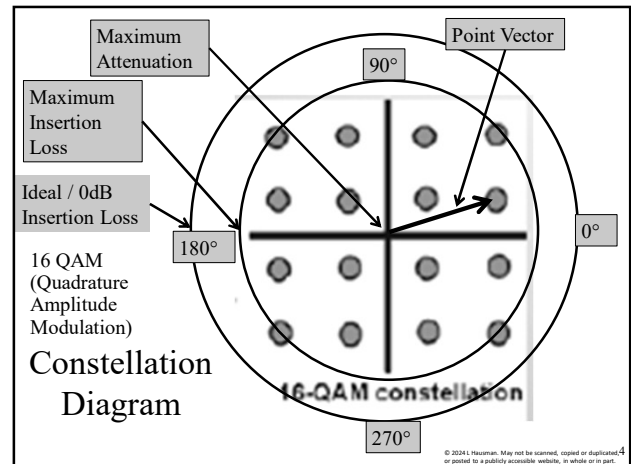
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Vector Modulator Design Project

- Grading
 - Written Report
 - Will be evaluated as a whole
 - Will receive a single grade for the group
 - Oral Presentation
 - Will be evaluated as a whole
 - Will also be evaluated on an individual contribution basis
 - Each group member must speak individually about their contributions and demonstrate individual “depth of knowledge”

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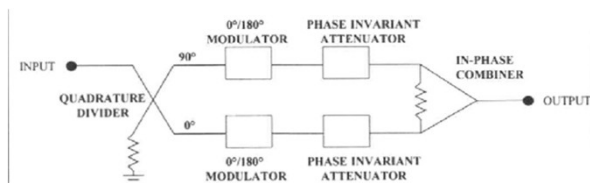
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Recommended Block Diagram



- 4-bit input – Take bits 4 at a time
 - 2 bits for 0/180 resolution
 - 2 bits for attenuation state resolution

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Vector Modulator Design Specification

- 16 QAM (Quadrature Amplitude Modulation)
- $F_c = 5.4$ GHz
- 900 Msps, min (mega symbols per second) double side-band (assume 1.8 GHz min BW)
- 8.5 dB max insertion loss
- $\pm 3.5^\circ$ phase accuracy vs. frequency
- 1.4:1 VSWR, max, 50 ohms input/output
- ± 0.70 dB amplitude variation vs. frequency
- Insertion Loss = Noise Figure (NO Amplifiers)
- Design for:
 - min DC power
 - min cost
 - min size
 - max RF power handling
 - maximum switching speed
- Use Rogers 4003, 20 mils thick
- Show all design information
- Include data sheets for all parts
- Write design report, including problem(s), methodology, results, explanation of devices, etc.
- Work together in a group (3 people per group, typ.)

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