



## HÖGSKOLAN I GÄVLE

### Passive Microwave Devices 7.5 cr

*Passiva mikrovågskomponenter 7,5 hp*

Set by Faculty of Engineering and Sustainable Development

#### Version

Set at

Valid from

10/11/13

HT2014

<b>Level</b>	A1F
<b>Education level</b>	Second cycle
<b>Course identifier</b>	EEA302
<b>Credits</b>	7.5 cr
<b>Main field of study</b>	Electronics
<b>Subject group</b>	Electronics
<b>Disciplinary domain</b>	Technology 100.0 %

#### Learning outcomes

The course provides knowledge in general properties of passive microwave devices, the electromagnetic theory behind their operation. Emphasis is placed both on the electromagnetic aspects important for device design and on system aspects. Among the systems discussed are different microwave communication systems.

The course is suited both for microwave design engineers and those who encounter passive microwave components as sub-components in RF, microwave or optical systems. The course includes practical laboratory exercises involving the use of both computerized industry-standard design tools and standard RF measurement instrumentation.

After completion of the course the student shall be able to

1. apply electromagnetic theory to calculations regarding the different parameters and properties used to characterize common passive devices such as power dividers, directional couplers, antennas
2. make theoretical calculations of fundamental antenna elements such as dipoles and array antennas
3. have knowledge of some antenna systems and the demands of such on the antenna components
4. use commercially available program for antenna simulation
5. handle microwave equipment and make measurements.

<b>Course content</b>	<p>Introduction: Microwave communication systems and passive microwave devices  Power dividers and couplers. T junction, Wilkinson power divider, quadrature (90 ) hybrid, the 180 hybrid, other couplers  Filters using resonators. Quarter-wave resonators, capacitively coupled series and shunt resonators  Ferrimagnetic components. Ferrite isolators, ferrite phase shifters, ferrite circulators  Fundamental antenna parameters. Radiation mechanism, radiation patterns, beam widths, side-lobes, directivity gain, polarization, radiated power  Wire antennas. Small dipole, radiation patterns, input impedance, mutual coupling  Array antennas. N-element linear array, analysis, synthesis  Aperture antennas. Rectangular apertures, horn antennas, diffraction theory, radiation integrals  Patch antennas  Antennas for mobile communications</p>		
<b>Teaching</b>	<p>The education is performed as lectures, exercises, and laboratory work. The laboratory work is normally performed in groups of two students. Emphasis is put on the student's capability of accomplishing and reporting the work.  The lectures and exercises are not mandatory for the student. However, participation in laboratory work and assignment tasks is mandatory.  Laboratory exercises:  173E Network analyzer  183E Radiation pattern measurements of X-band antennas  184E Design, simulation and manufacturing of a patch antenna</p>		
<b>Prerequisites</b>	Elements of Microwave Engineering 7.5 cr or equivalent.		
<b>Examination</b>	Written examination and laboratory exercises.		
<b>Grade</b>	A, B, C, D, E, Fx, F		
<b>Other regulations</b>	Criteria for final grade will be given at the beginning of the course.		
<b>Sustainable environment</b>	A minor part of the course content deals with sustainable development.		
<b>Module</b>			
	0010 Written examination	6 cr	Grade: AF
	0020 Laboratory exercises	1.5 cr	Grade: UG