



Experiment setup on a Doppler radar with track and trolley. The trolley is accelerated to typical laboratory speeds by means of a traction weight.

Topics

Chapter 1: Introduction

- Course operation
- Course content

Chapter 2: Doppler Effect

- Transmission links
- Situation in radars
- Block diagrams
- Spectral components at the mixer
- Applications

Chapter 3: CW-Doppler Radar

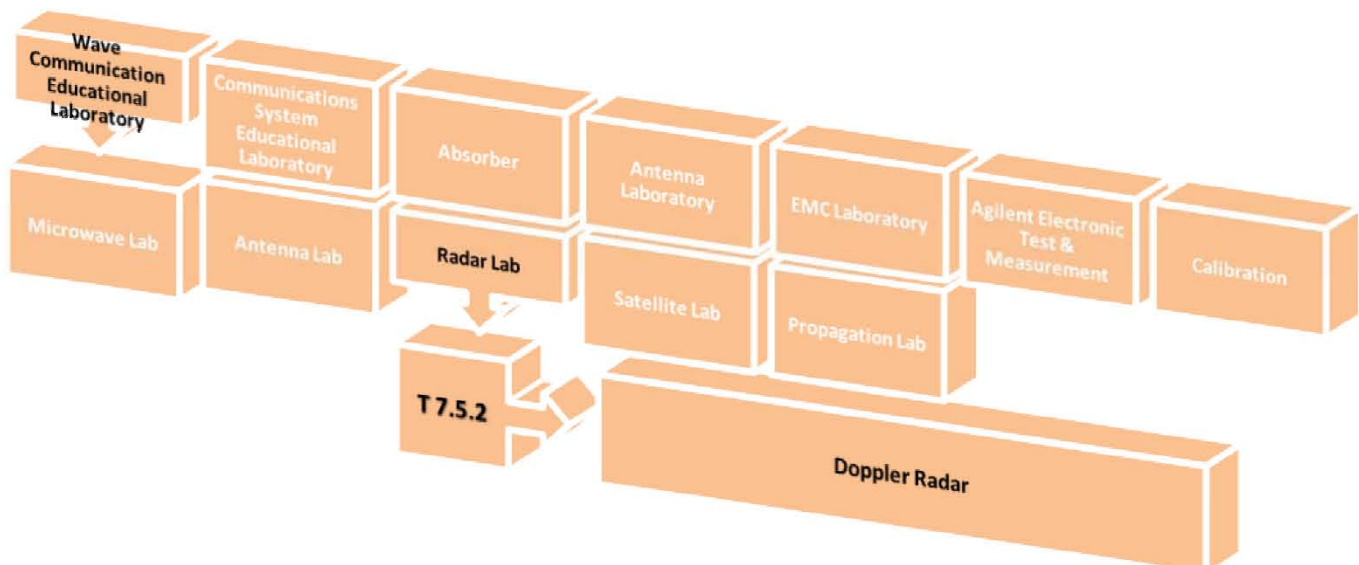
- Training system
- Properties of microwaves
- CASSY measurement technique
- Setting into operation

Chapter 4: Moving Targets

- Equations of motion
- Determining the acceleration
- Speed measurement
- Series of experiments: Direct measurements
- Series of experiments: FFT measurements
- Stealth in motion
- Multi-target detection
- Proximity detector with alarm triggering

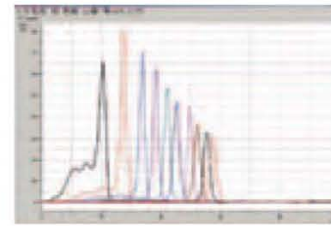
Chapter 5: Experiment with the MTI Simulator

- Characteristic curves of the MTI simulator
- Object vigilance



Speed measurement, detection of moving objects

The COM3LAB Course Radar Technology II operates with an X-band microwave source (Gunn oscillator). It investigates the fundamentals and applications of the Doppler effect by means of measurements in the time and frequency domain (FFT analysis of the Doppler spectrum in base band).

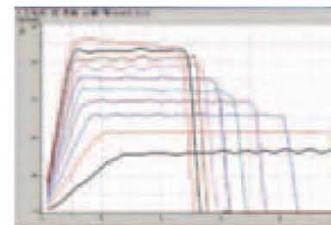


Doppler signal representation
FFT spectra for different vehicle speeds.

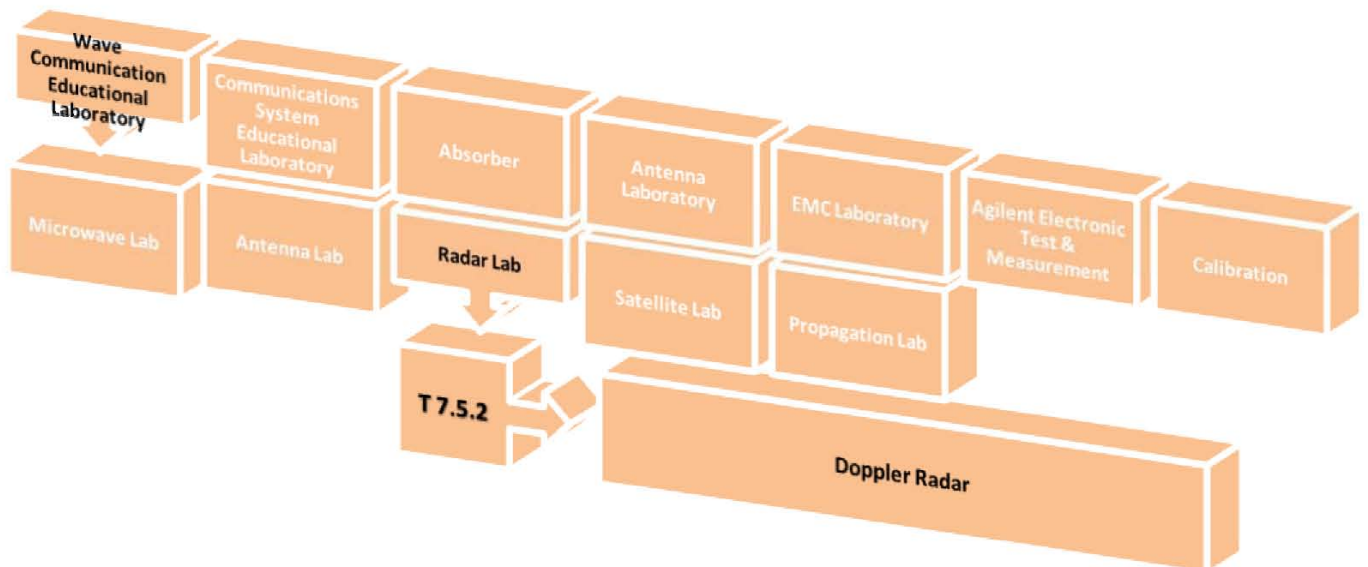
EQUIPMENT SET LIST

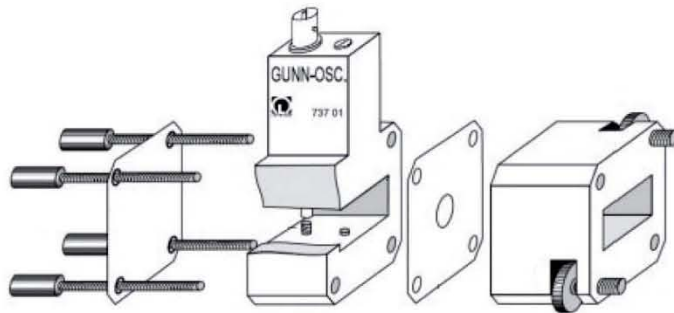
Doppler-Radar

QUANTITY	CAT. NO	DESCRIPTION
1	737 65	COM3LAB-Course: Radar Technology II
737 65 package content includes:		
1	737 01	Gunn Oscillator
1	737 21	Large Horn Antenna
1	737 610	Set of Passive Targets
1	737 615	Doppler Converter
1	737 630	MTI Simulator
2	562 791	Plug-in Power Supply 230 V AC,
2	648 07	Storage Tray
5	648 08	Partition
Accessories required:		
1	337 462	Combination Light Barrier
1	337 463	Holder for Combination Spoke Wheel
2	337 464	Combination Spoke Wheel
1	683 41	Holding magnet
1	337 110	Trolley
1	337 130	Track 1.5 m
1	524 010SUSB	CASSY-Starter USB
1	524 074	Timer S



The velocity-time diagram
The trolley speed is measured with the motion transducer. The horizontal curve traces correspond to the stationary velocities after the acceleration phase and before reaching the track end. In the stationary velocities range, a discrete Doppler spectrum with individual lines is obtained (shown above).





The microwave source

Schematic representation of the microwave source.

The Gunn oscillator acts as a transceiver.

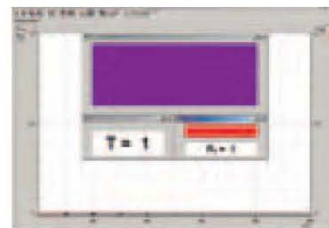
Doppler converter

Serves as a power supply for the Doppler module. The Doppler converter filters out the Doppler signal obtained by mixing the backscattered echo at the Doppler module.



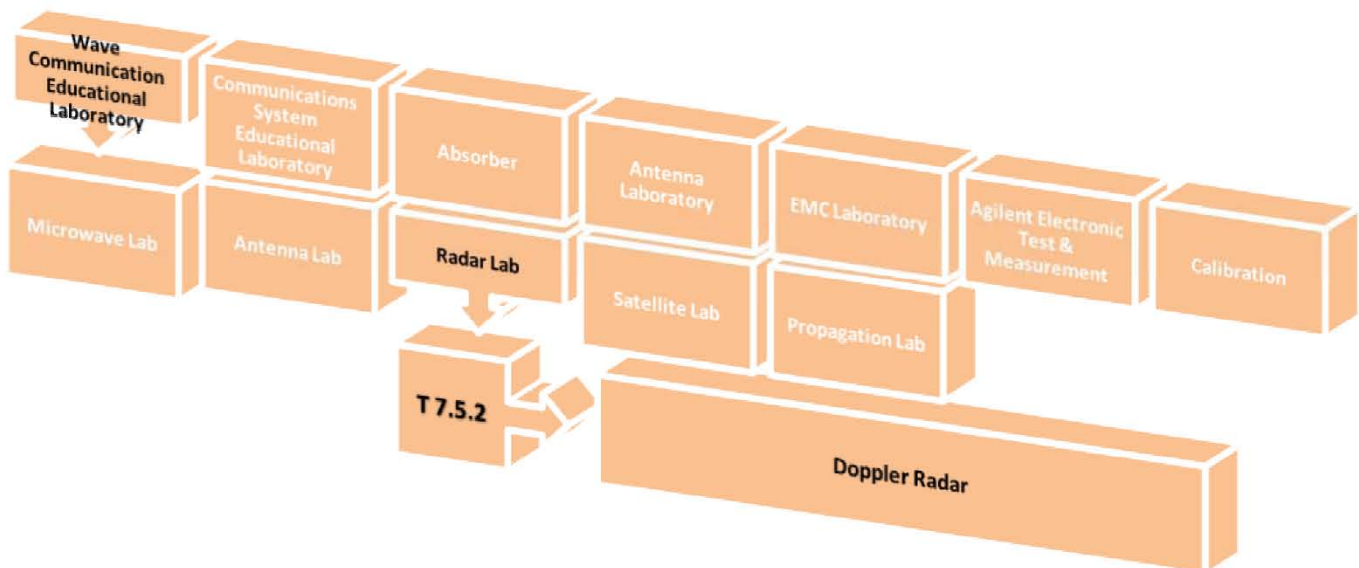
Applications of Doppler radars

Speed measurement in road traffic is one of the routine tasks of Doppler radars.



Proximity detector with alarm triggering

Target detector T is programmed as a threshold circuit. It compares the Doppler spectrum amplitude with the configured threshold. When the echo signals exceed the threshold (T=1), the relay circuit R is activated and the alarm is automatically triggered.



T 7.5.2

Doppler Radar

Equipment for 737 65
COM3LAB Course Radar Technology II



TECHNICAL DATA

Principle	Doppler radar module with self-mixing
Radar type	CW-Doppler
Operating frequency	Carrier frequency: 9.40 GHz
Range	2 m
Radar aerial	Horn
Transmitter	Power: +13 dBm
Doppler Converter	Doppler output: 0 Hz... 500 Hz (approx. 0..25 km/h)
MTI	Radar cross-section of Doppler target: 0.2 m ² Range of target frequency: 5 Hz ... 500 Hz Speed range: 8 cm/s ... 8 m/s
Display Mode/ Display Unit	Distance-time diagram FFT Spectrum Time-domain display Proximity detector
System platform	PC, Intel IV
Operating System	Windows XP or higher
Operating voltage	230V / 115 V 50 - 60 Hz
Documentation	Interactive multimedia training software with extensive glossary Languages: German/English/French/Spanish



Components of MTI Simulator.
The metallised membrane of the loudspeaker serves as a stationary Doppler target. The Doppler target is controlled through the control unit. With the MTI simulator, movements can be simulated and analysed for stationary targets.

