ME1310

Antenna and Propagation (3D) Courseware
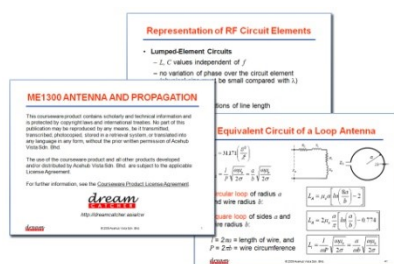
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~Complete Resources for Lecturers~

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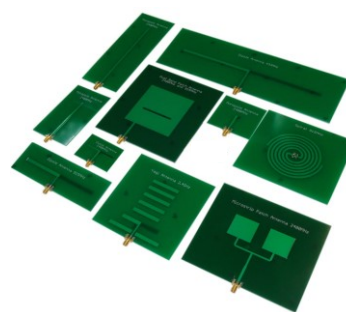Extending our solutions to meet your needs

Teaching slides	Training kit
• Editable Microsoft® PowerPoint® slides • Covers 45 hours of teaching	• Antenna transmitter and receiver modules • Radiation Pattern Plotting (RadPat 3D) software • Lab sheets & model answers • Problem-based assignments • Covers 24 hours of labs

Target university subject	Target year of study	Prerequisite(s)
Antenna and Propagation	3rd or final year undergraduate	Electromagnetic Theory

The ME1310 serves as a ready-to-teach package in the areas of antenna fundamentals, practical antenna design, and antenna measurement techniques. This is a lecturer resource consisting of teaching slides, training kits, lab sheets, and problem-based assignments.

Designed to impart knowledge in

➢ Antenna fundamentals
➢ Antenna parameters
➢ Antenna impedance matching techniques
➢ Practical antenna design

➢ Antenna measurement techniques
➢ Software tools usage
➢ Measurement instruments usage

Benefits of the ME1310 courseware

➢ The lab sheets are specially designed to enable students to perform **S_{11} plot**, **2D Radiation** Pattern plots **(Polar and Cartesian)**, **Orthogonal** plot and **3D Radiation** Pattern plot.
➢ The Windows-based antenna radiation pattern plotting software can perform fully automated antenna measurements for 2D radiation pattern and semi-automated for 3D with selectable resolution (1 to 30 degrees per step).
➢ There are more than 10 antennas in various designs such as monopole, dipole, spiral, microstrip patch, Yagi-Uda, dual-band antennas covering the frequencies of 433, 915 & 2400MHz.
➢ The rotating receiver module has a built-in RF detector, allowing you to perform antenna measurements with an existing RF signal generator.
➢ Examples of antenna design and measurement techniques are included in the teaching slides and lab sheets, enhancing the understanding of practical antenna design for industrial applications.

Teaching Slides

(PN: ME1310-100)

More than 500 editable Microsoft PowerPoint teaching slides, covering 45 hours of teaching for one full semester is provided. The slides cover the following topics:

- Introduction to Antennas
- Antenna Parameters
- Impedance Matching Techniques
- Antenna Measurements
- **3D Radiation Pattern Measurements**
- Wire Antenna Design
- Broadband Antenna Design

- Yagi-Uda Antenna Design
- Microstrip Patch Antenna Design
- Introduction to Wi-Fi, Bluetooth, and ZigBee
- WLAN Antennas
- Smart Antennas
- Antennas for Wireless Communications
- Introduction to Portable Device Antennas

Training Kit

(PN: ME1310-230)

The training kit consists of the transmitter module and the receiver module. The Radiation Pattern Plotting (RadPat) software is also included with the training kit.

2nd Axis Rotator (manual)

1st Axis Rotator
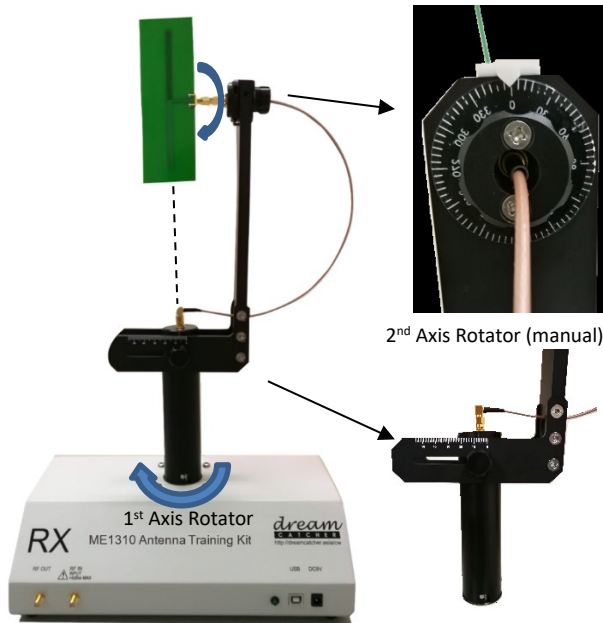
Transmitter Module

- Frequency range: 2 MHz to 4 GHz
- Maximum output power to antenna port: 3 mW
- Output impedance: 50 Ω

Note: This module requires an external signal source. Specifications above are based on the recommended instrument (Keysight N9912A FieldFox RF Analyzer). With a 6GHz VNA, it can do the measurements up to 6GHz.

Receiver Module

- Frequency range:
    50 MHz to 3 GHz (with built-in RF detector)
    2 MHz to 4 GHz (with N9912A FieldFox RF Analyzer)
- RF input level:
    −60 dBm to -5 dBm (with built-in RF detector)
    −125 dBm to 27 dBm (with N9912A FieldFox RF Analyzer)
- Input impedance: 50 Ω
- PC-based controlled 1st axis rotator (0 to 359 degrees) with variable step size of 1 to 30 degrees/step
- A 2nd axis manual rotator: the smallest step side of 5 degree

Radiation Pattern Plotting (RadPat 3D) software

The RadPat 4.0 software is a Windows-based (Windows® 7, 8 or 10) software that is included with the training kit. It enables you to perform radiation pattern plotting with just a click. (Download the Quick Start Guide for detail)
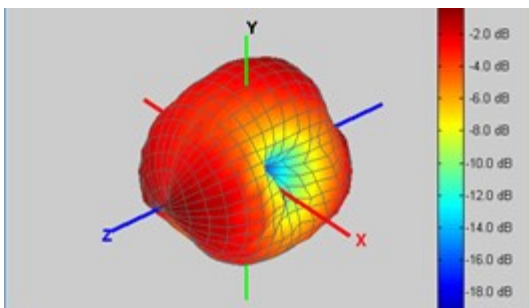

Sample 3D radiation pattern plot

RadPat 4.0 GUI with 3D measurements

Accessories

The following accessories are provided with the training kit.

Item	Quantity
Power adapter, 5 Vdc, 2 A	1
RF coaxial cable, 1 m	2
RF coaxial cable, 0.18 m	1
SMA(m)-to-SMA(m) adapter, straight	2
SMA(f)-to-SMA(m) adapter, right-angle	2
N(m)-to-SMA(f) adapter	2
Type A-to-Type B USB cable, 1.5 m	1
LAN cable, 1 m	1
Antenna set:	1
433 MHz: Dipole and monopole antennas	
915 MHz: Dipole, monopole, and spiral antennas	
2.4 GHz: Dipole, monopole, microstrip patch,	
and Yagi-Uda antennas	
915 MHz & 2.4 GHz dual-band antenna	

Adjustable-length
Dipole
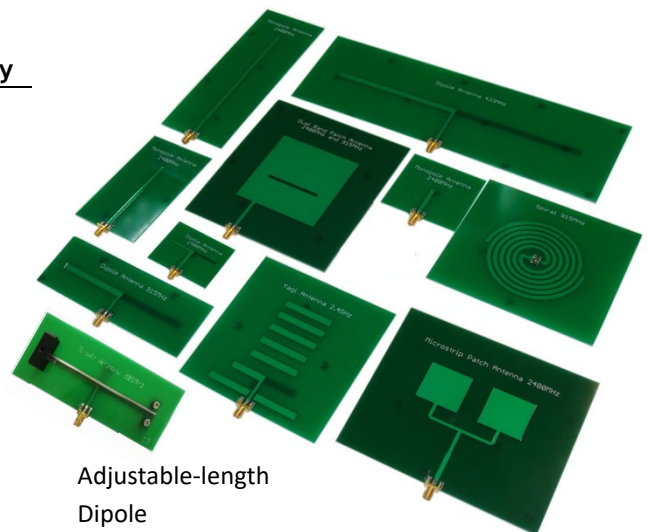
Lab sheets

The training kit includes 8 lab sheets in editable Microsoft Word format. Each lab requires 3 hours to complete. Model answers are provided with all lab sheets. The required training kit hardware and required instruments for the labs are listed below.

Lab Sheet	Hardware Kit	Required Item	
		Option 1 RF Signal Generator	Option 2 Vector Network Analyzer
Introduction to 2D & 3D Radiation Pattern Measurements	√	√	√
Antenna Impedance Measurement	√		√
Antenna Gain Measurement	√	√	√
Polarization Measurement	√	√	√
Antenna Efficiency Measurement (Dipole)	√	√	√
Antenna Beam Efficiency Measurement (Patch)	√	√	√
Antenna Calibration	√	√	√
Free space propagation	√	√	√

Problem-based assignments

The problem-based assignments below allow students to enhance their problem-solving skills.

- Microstrip Patch Antenna design
- Planar Inverted F Antenna design

Instruments

The recommended instrument from Keysight Technologies, to be purchased separately, is listed below.

| Instrument[1]	Model
RF Signal Generator	Minimum 3 GHz: N9310A RF Signal Generator[3], 9 KHz - 3 GHz
Vector Network Analyzer	Minimum 3 GHz: E5061B ENA Series Network Analyzer[4] [with option 235] or N9912A FieldFox RF Analyzer[5], 4 GHz [with option 104, 110, 303] Or, N9913A FieldFox Handheld Microwave Analyzer[4], 4 GHz [with option 210, 211]
Calibration Kit[4]	85033E Standard Mechanical Calibration Kit, DC to 9 GHz, 3.5 mm

[1] Refer to the Lab sheets section for the instrument selection. [2] The courseware is designed to work with these instruments. Other models with equivalent performance may be used with alterations to the RadPat's instrument command file. [3] These instruments are also the recommended models for ME1000 and ME1020. [4] These instruments are also the recommended models for ME1000, ME1020, ME1200 and ME1400.
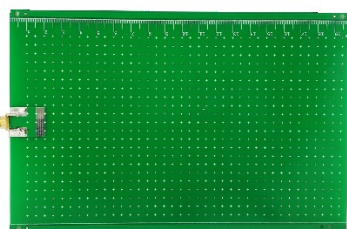
Add-on: Antenna Prototyping

(PN:ME1310-230)

Antenna Development Board, 120 x 200mm:

Conductive copper tape, 12mm x 33m :
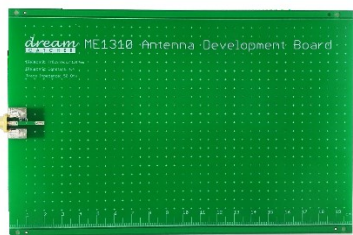
Top view	Bottom view

Training Kit Hardware Specifications

	Min		Max
Receiver Module			
RF Detector input power at 900 MHz	−60 dBm		0 dBm
RF Detector input power at 2.4 GHz	−60 dBm		−5 dBm
RF Detector Accuracy, dB			+/- 1.5
Antenna Rotator		**Typical**	
Input voltage	4.5 V	5 V	5.5 V
Input current	0.5 A	0.75 A	1.0 A
Step size (degree/step)	1	10	30
Angular coverage (degree)	0 deg		359 deg
General			
Warranty			1 year

EMC designed to	CISPR11:1990/EN55011:1991, Group 1. Class A
	IEC801-2:1984/EN50082-1:1992, 4kV CD, 8kV AD

Ordering Information

Description	Package	Product Number
Teaching Slides	1 user license	ME1310-100
Training Kit	1 set	ME1310-200
Training Kit upgrade for ME1300	1 set	ME1310-210
(3D Antenna Pole, RadPat 3D, Lab sheets, QSG)		
Antenna Prototyping Board		
(3 x PCBA's + 3 x conductive copper tape)	1 set	ME1310-230
Teaching Slides + Training Kit	1 user license + 1 set	ME1310-300
Instrument	where applicable	Purchase separately from Keysight or its distributor

Note: Pictures in this document are for illustration purposes only, and they may be different from the actual product.

Training courses related to subject matter are available on request. Visit dreamcatcher.asia for details.