ANTENNA MEASURING SYSTEM

Mod. ANT-M/EV

INTRODUCTION

With the ANTENNA MEASURING SYSTEM, learners can analyze and characterize single antennas and arrays, starting from the UHF band up until microwaves, through simple yet effective experiments:

- Impedance matching: RL and SWR
- Radiation: antenna gain, 2D/3D radiation diagrams and planes of polarization
- Antenna Arrays

The **ANTENNA MEASURING SYSTEM mod. ANT-M/EV** is a complete system composed of:

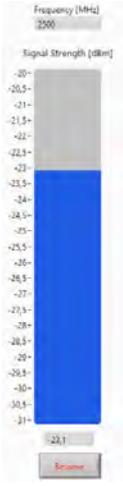
- 1 Transmitter, including:
  - PLL dual-band synthesized RF generator (1GHz and 10GHz)
  - Support for reference antenna
- 1 Receiver, including:
  - Synthesized PLL RF reception system
  - Motorized rotating support for D.U.T (Device Under Test)
  - Data acquisition system, that both acquires the RF signal and controls the motorized system
  - USB port to connect the system to a supervising PC
- Several types of antenna for 1 GHz and 10 GHz bands
- 1 Directional coupler to measure the Return Loss
- 1 supervision and control software, to configure and control the system. It enables to analyze the received data and represent them graphically on a PC screen

The following optional accessories are available:

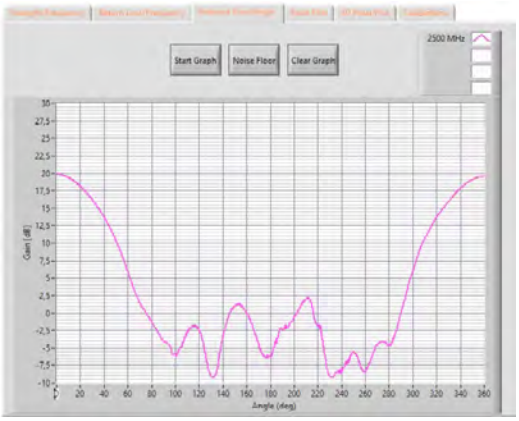
- **Phase Shifter 1 mod. ANT-S1/EV**: this module inserts a phase shift at the input of one of two equal antennas composing an array. It also enables to continuously regulate the phase, and to analyze the changes in the array polar diagram. For example, learners can observe how a phase variation in only one of the two antennas composing an array converts a Broadside Array into an Endfire Array.
- **Phase Shifter 2 mod. ANT-S2/EV**: this module has the same features of mod. ANT-S1/EV, except it is controlled by a microprocessor and its phase is calibrated.
- **Directional Coupler 1 mod. ANT-C1/EV**: this module measures the Return Loss in the 2200-2600 MHz band.
- **Directional Coupler 2 mod. ANT-C2/EV**: this module measures the Return Loss in the 10-11 GHz band.

TRAINING PROGRAM:

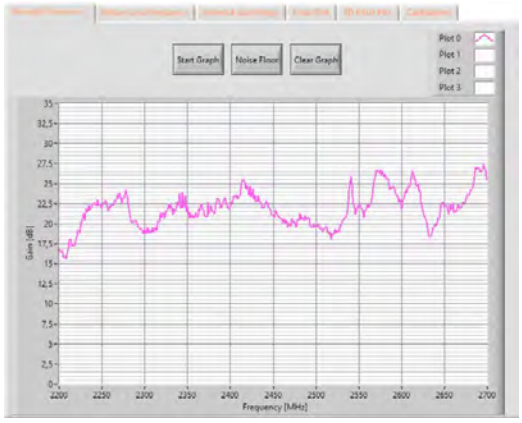
- Analysis and operation of antennas
- Characteristics of antennas:
  - Antenna gain
  - Directivity and beamwidth
  - Polar radiation diagram
  - EM wave polarization: Linear (H/V) and Circular (RHCP, LHCP)
  - Impedance matching
  - Antenna arrays: use of combiners
- Units of measurement:
  - dB, dBm, RL, VSWR
- Measurements in 1 GHz and 10 GHz band:
  - Received Signal Strength Indicator (RSSI)
  - Noise Floor analysis
  - Received signal level vs Frequency
  - Antenna gain vs Frequency
  - Antenna gain vs Angle
  - 2D and 3D polar diagram
- Assembly and mechanical installation of single antennas and arrays
- Alignment of transmitting and receiving antennas
- Measurement of the antenna gain by comparison, using path attenuation
- Software setup:
  - Transmitter and Receiver calibration with distance setting
  - Reference antennas calibration
  - Directional coupler calibration
- Antennas:
  - Single antennas: directional and omnidirectional
  - Linear arrays using omnidirectional antennas: Broadside and Endfire Array
  - Planar array using directional antennas: Array composed of 4 antennas
    Antenna arrays:
  - Effect of a phase shift inserted in the feed of one antenna in the array (Phased Array)
  - Effect of the distance between antennas in the array



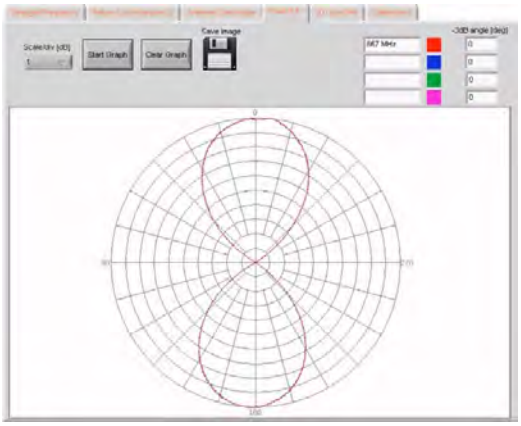
RSSI bargraph



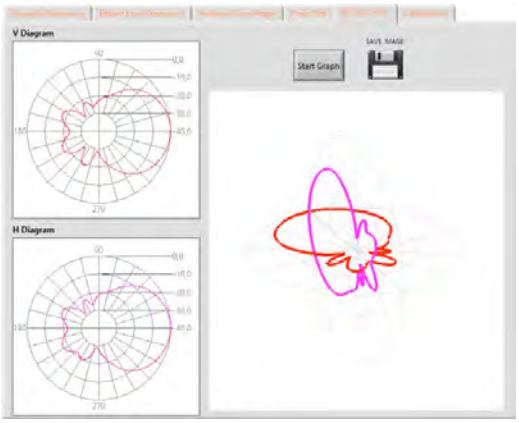
Gain vs Angle - cartesian graph



Gain vs Frequency - cartesian graph



Gain vs Angle – polar graph



Vertical & Horizontal plane **3D pattern**

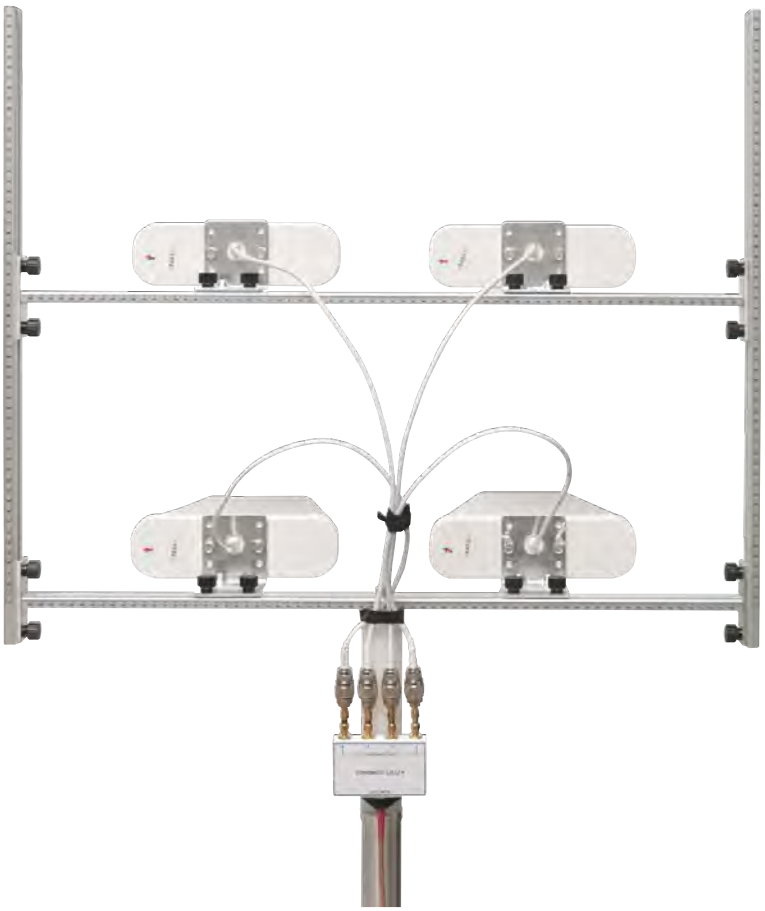
TECHNICAL SPECIFICATIONS:

- Transmitter:
  - Low Band RF Generator: +7dBm RF level, 850-2700 MHz band, 1MHz step
  - High Band RF Generator: 0dBm RF level, 10-11 GHz band, 1MHz step
  - Synthesized Reference oscillator with PLL control and thermo-stabilized frequency reference
  - Vertical support for reference antenna: non-rotating, adjustable height from 1.08 to 1.55m
  - Proprietary port to connect the receiver
  - Proprietary port to connect the directional coupler
  - Safety feature: the RF generator is only active during the necessary time required to perform measurements. A LED lights up to alert the user.
  - Dimensions: 310x310x1100 mm
- Receiver:
  - Low Band and High Band RF receiver, 1MHz step, 300kHz BW, 65dB range
  - Synthesized tuner with PLL control, frequency conversion and high-selectivity IF S.A.W. filters
  - Data acquisition system resolution: 10bit
  - USB port for PC
  - Support for reference antenna or D.U.T.: 360° rotation with motorized control, 0.2° resolution, 1.1m height
  - Proprietary port to connect the transmitter: provides electrical power and control of the system
  - Acoustic protection: intermittent sound signalling the ongoing rotation of the support
  - Mechanic protection: every antenna or array is fixed at a minimum height of 1.1m from the table where they are placed
  - Electrical plug to connect the system to the mains
  - Dimensions: 310x310x1100 mm
- Directional coupler 1GHz/2GHz:
  - measures the reflected component of the signal, caused by the D.U.T. mismatch to the standard 50 Ohm impedance
  - Active RF Detector
  - Bands: 850-1000 MHz and 1700-2200 MHz
  - Directivity: >17dB
  - RF output to connect the D.U.T.
  - RF input to connect the coupler to the RF generator output
  - Cable to connect the transmitter, in order to send data and provide power to the module
- Directional antennas:
  - 2 Yagi, 8 elements
  - 1 Patch Panel
  - 4 Log Periodic
  - 2 Horn 10dB
  - 1 Horn 15dB
  - 2 Helical (RHCP)
  - 1 Helical (LHCP)
- Omnidirectional antennas:
  - 2 Monopole ¼ λ (1 helical)
  - 2 Ground Plane
- Parabolic reflector:
  - Diameter: 360mm
  - f/D: 5
- 2 Waveguide-to-coax adaptors:
  - Waveguide: WR75
  - Flange: UBR120
  - Coaxial connector: SMA
- Shield for monopole antennas:
  - 300x300mm
- Combiners:
  - 2 input ports and 1 output port
  - 4 input ports and 1 output port
- Phase Shifter:
  - 5 SMA-SMA elements
- Characteristic impedance of all the components (generators, receivers, directional coupler, antennas and combiners): 50 Ohm
- Available measurements:
  - Received signal total strength
  - D.U.T. Return Loss
  - Cartesian graph: received signal strength trend depending on frequency
  - Cartesian graph: antenna gain trend depending on frequency
  - Polar diagram/graph: response of the antenna depending on the angle, with a preset frequency
  - Polar 3D diagram/graph: response of the antenna depending on the planes of polarization H/V, with a preset frequency
- Distance between transmitter and receiver:
  - 2 - 5m
- Assembly of complex antennas:
  - Directional Broadside Array using omnidirectional antennas
  - Directional Endfire Array using omnidirectional antennas
  - Linear Array using two directional antennas
  - Planar Array using four directional antennas
  - Antenna for microwaves composed of a feeder and a parabolic reflector
- Examples of possible experiments:
  - Analysis of the characteristics of an antenna in both planes of polarization H/V
  - Noise floor measurement with source localization and frequency measurement
  - Influence on measurements and analysis of interferences caused by other electric appliances located near the system (cellphones, GSM base stations, Wi-Fi networks or television transmitters)
  - Measurement errors caused by the presence of an operator near the system: importance of the absence of obstacles near the receiver and of the lab layout
  - Effect of the presence/absence of a ground floor with a monopole antenna
  - Influence of the distance between feeder and parabolic reflector on the gain of a microwave antenna
  - Variations in the radiation diagram of an array inserting a phase shift in one antenna at a time, and modifying the distance between them
  - Effects on the received signal amplitude using transmitting and receiving antennas with same/different linear/circular polarizations
  - It is also possible to use the system to analyze antennas realized or purchased separately by the customer

- Supervision and Control software, to be installed in **one PC (not included)**:
  - Measurement angle: 360° (0.2° resolution)
  - Frequency range and measurement gain: adjustable by the user
  - The user can set the software to calibrate the system according to the types of antenna and directional coupler being used
  - Up to 4 diagrams for each graph (linear or polar)
  - Possibility to save measurement images in jpg format
  - Possibility to save configuration and calibration data in txt format
- Units of measurement:
  - dB: relative and selectable among 1, 2, 3, 5, 6 or 10dB
  - dBm: absolute, with selectable range to adapt the measurement to the graph
  - VSWR: relative, with selectable range for values >0 to adapt the measurement to the graph
- Supplied accessories:
  - USB cable (5m) to connect the receiver to a PC
  - Multipolar cable (5m) to connect the transmitter to the receiver
  - Coaxial cables
  - Coaxial adaptors: BNC, SMA, N
  - Supports for antennas: fixed and adjustable, with possibility to modify the plane of polarization
  - Every necessary component for the operation of the system is included

Power supply: 100/240 Vac 50/60 Hz single-phase - 30 VA (Other voltage and frequency under request)

Weight: 30 kg



4 antenna array - Rear view