

# MICROWAVE LABORATORY

## Mod. MW-B-C/EV

### INTRODUCTION

The MICROWAVE LABORATORY is designed to study and test waveguide electronics and components used in the field of microwaves.

In detail, it is possible to analyse and carry out experiments in the principal aspects of microwaves and their application to communication systems:

- Active and passive components
- Waveguides and antennas for microwaves
- Audio/Video/Data communication systems and Measurements on microwaves



The laboratory consists of a main system and of two optional accessories:

- **Waveguides, Antennas and Microwave Audio/Video communication System Mod. MW-B-C/EV** enables to study and test lines, antennas and transmissions used in the field of microwaves and to carry out a complete microwave radio link for the transmission and reception of an Audio/Video signal.
- **Gunn Kit mod. MW-G/EV** is an optional system that uses a Gunn diode mounted on a cavity as RF source in microwaves.
- **Satellite Transponder Kit mod. MW-S/EV** is an optional system that simulates a satellite transponder; it consists of active and passive devices working on the same kind of Ku-band employed in commercial satellite communications.

In detail, it is possible to analyze and to experiment the following main aspects of microwaves and their applications in communication systems:

- Microwave generation
- Waveguide components
- Antennas for microwaves
- Microwave propagation
- Measurements on microwave systems

Besides its primary function, it also has high potentialities. In fact, if used with other equipment manufactured by Eletttronica Veneta, it enables to carry out modular systems of high performance and complexity, such as:

- a directional (one way) transmission channel for PCM-TDM Audio Data/PC signals, realized with 1 mod. MW-B-C/EV and 1 MCM32/EV: it simulates a PCM telephone microwave link;
- a directional (one way) transmission channel for PCM-TDM Audio/Data PC signals, realized with 1 mod. MW-B-C/EV and 2 mod. MCM32/EV: it simulates the operation of transmitting and receiving stations (physically separated) and the use of a microwave link between two PCM Central units;
- a bidirectional (two-way) transmission for PCM-TDM Audio/Data/PC signals, realized with 2 mod. MW-B-C/EV and 2 mod. MCM32/EV: it simulates the operation of transmitting and receiving stations (physically separated) and the use of a bidirectional microwave link between two PCM Central units.

	Microwave Lab - Available versions			
	Basic	with Gunn	with Satellite	Full
Microwave Trainer mod. MW-B-C/EV	✓	✓	✓	✓
Gunn Kit mod. MW-G/EV		✓		✓
Satellite Kit mod. MW-S/EV			✓	✓

# MICROWAVE WAVEGUIDES, ANTENNAS AND AUDIO/VIDEO COMMUNICATION SYSTEM - mod. MW-B-C/EV

## TRAINING PROGRAM:

- General microwave theory
- Overview of electronic devices and passive components of the laboratory
- Characteristics of:
  - microwave components
  - waveguide and flange
  - Horn antennas and parabolic reflector
  - reflection and polarization system
- Oscillator
- Frequency measurements
- Wavelength measurements in waveguide and free space
- Direct and reflected power measurements
- Power splitting and impedance mismatch measurement
- SWR and impedance measurement
- Impedance calculation with Smith's chart
- Impedance matching
- Directional and T-hybrid couplers
- Gain and radiation diagram of microwave antennas
- Antenna Gain measurement:
  - comparison method
  - method of the two antennas
- Link attenuation
- Passive repeaters (mirrors)
- Modulation and transmission of microwave signals
- Reception and demodulation of microwave signals
- Frequency conversion with local oscillator and mixer
- Audio/Video point-to-point communication system
- Audio/Video Satellite communication system: Analog satellite receiver required (not supplied)
- Audio/Data communication system and communication between PCs (with 1 or 2 optional modules mod. MCM32/EV - not included)
- Doppler Radar: more antennas are used and the relationship between the object speed and the doppler signal is complied with.

## TECHNICAL SPECIFICATION:

- Operating frequency:
  - 10750, 10777, 10804, 10831 MHz
  - X and Ku band,
  - 4 channels with PLL frequency generation
- TX/RX link frequencies: 10750 or 10777 MHz
- Silver-plated internal waveguide
- 2 waveguides – coaxial adapter
- 3 straight-line waveguide (WG)
- 1 WG frequency-meter:
  - Range: about 10500 to 11000 MHz
  - Calibration report: 21 points inside the frequency range with 25 MHz steps and 4 points on the 4 output frequencies (10750, 10777, 10804, 10831 MHz)
- 1 WG slotted line
- 1 WG variable attenuator of 30 dB
- 2 WG fixed attenuators of 3 dB and 6 dB
- 1 coax fixed attenuator:
  - 50  $\Omega$  impedance
  - SMA/SMA connectors
  - Range: DC to 3000 MHz
  - 20dB Attenuation
- 3 WG Loading terminations:
  - 2 matched terminations of 1 W
  - 1 short-circuit termination
- 1 WG tuner/impedance matching unit E-H
- 1 Coax detector:
  - 50  $\Omega$  input
  - SMA/BNC connectors
  - Range: 10 to 12400 MHz
  - Max input level: +20 dBm
  - Negative polarity
- 1 WG 4 ports T-magic
- 1 WG directional coupler:
  - 3 ports
  - 20dB coupling
- 3 WG horn antennas:
  - 2 with 20 dB gain
  - 1 with 15 dB gain
- 1 parabolic antenna:
  - 0.36 m Diameter
  - f/D = 0.5
  - Gain: 29.5 dB (theoretical)
- 2 reflector planes:
  - 1 with 180 X 180 mm
  - 1 with 300 X 300 mm
- 1 Polarization plane:
  - with 180 X 180 mm
- 2 conversion units:
  - Up converter: LO 8350 MHz, +15 Vdc power supply
  - Down converter: LO 8296 MHz, +15 Vdc power supply
- 6 (high and low) supports and connection cables
- 1 Rotary table with bearing scale
- Microphone



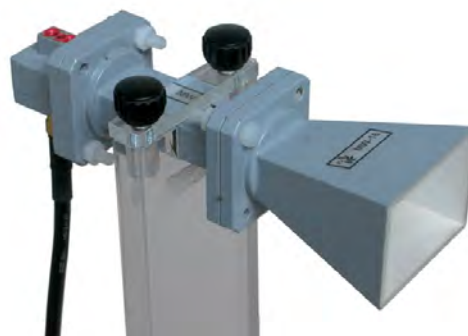
Wave guide components

- Transmitter unit including:
  - Regulated power supply protected from short-circuit
  - Audio generator
  - Video bar generator
  - Audio/video input
  - Audio modulator
  - Audio/video combiner
  - IF converter
- Receiver unit including:
  - Regulated power supply protected from short-circuit
  - IF demodulator
  - Audio demodulator
  - Audio/Video output
  - Loudspeaker with audio amplifier and volume control
  - LCD colour Video Monitor
- VSWR/LEVEL Measuring unit including:
  - Regulated power supply protected from short-circuit
  - Power and VSWR meter
  - Rechargeable battery with charge indicator
- 2 ALU tray for storing components

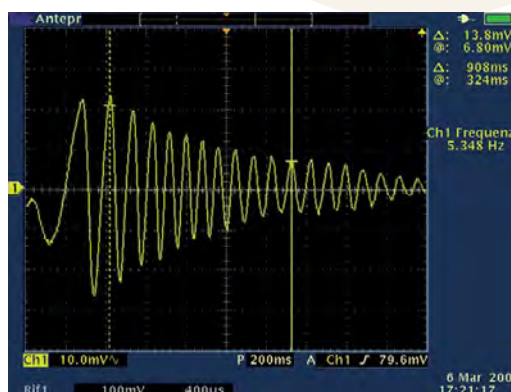
**Power supply:** 230 Vac 50 Hz single-phase - 90 VA  
(Other voltage and frequency under request)

**Dimensions:** 620 x 460 x 230 mm (each tray)

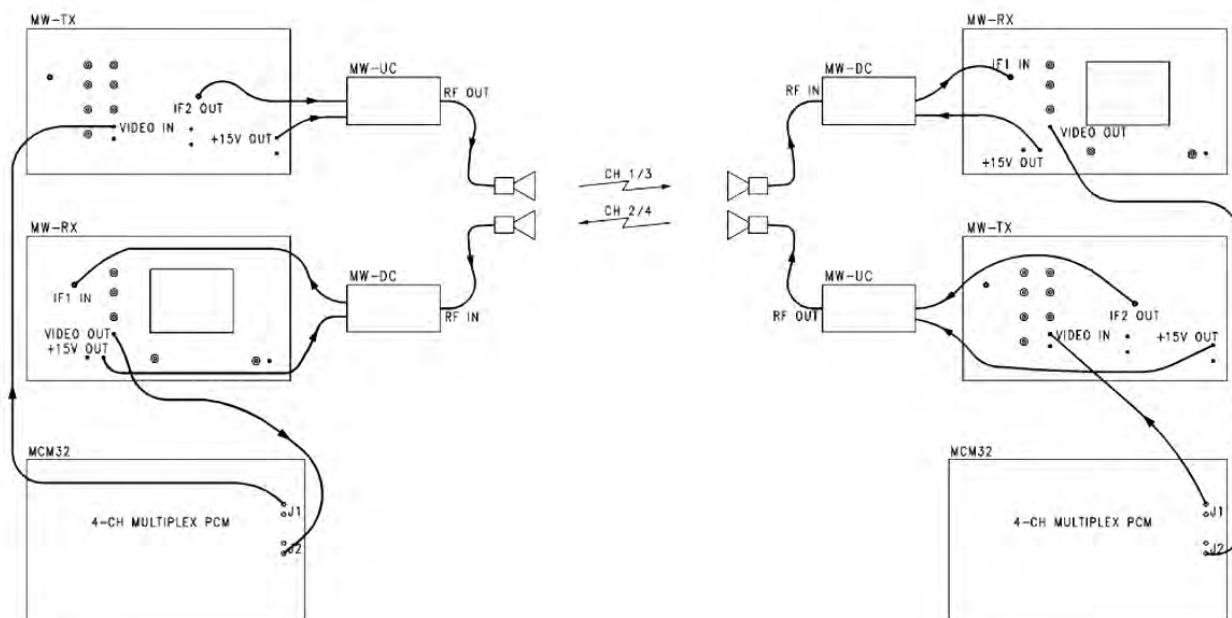
**Total weight:** 40 Kg



Matching unit + Antenna



Doppler signal



Example of bidirectional PCM - TDM Audio / Data / PC radio link

#### SUPPLIED WITH

**THEORETICAL-EXPERIMENTAL MANUAL**  
**PRACTICAL EXERCISES: MEASUREMENT AND**  
**PARAMETERS VARIATION**



## GUNN KIT (optional) mod. MW-G/EV

### TRAINING PROGRAM:

- Gunn Diode Oscillator
- Gunn Transceiver: Gunn Oscillator and Schottky diode (mixer)
- Radar Experiment and frequency relation between the signal Doppler – object speed

### TECHNICAL SPECIFICATION:

- 1 WG horn Antenna suitable for Gunn Diode Oscillator:
  - Frequency: 10525 MHz
  - Gain: 12dB
  - Ray Amplitude: 70° ( E plane) / 30° ( H plane)
- Gunn diode oscillator frequency: 10525 MHz (X band)
- Gunn oscillator power output: +7 dBm



Gunn Transceiver

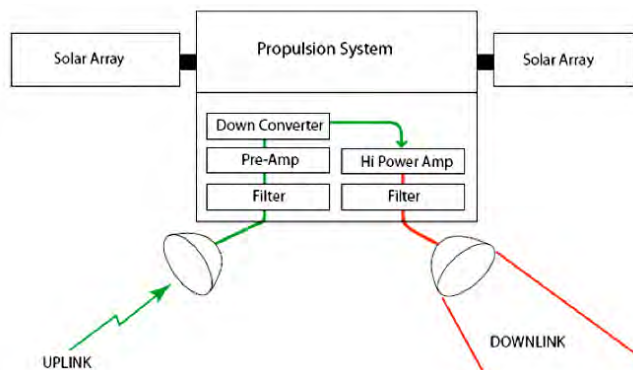
## SATELLITE TRANSPONDER KIT (optional) - mod. MW-S/EV

### TRAINING PROGRAM:

- Overview of electronic devices and antennas making up a satellite transponder
- Frequency conversion: up converter and down converter
- Audio/Video Satellite communication system with Satellite Ku band repeater simulation

### TECHNICAL SPECIFICATION:

- Up-Link unit including:
  - IF Ku-band converter (14GHz) with output amplifier
  - WG horn antenna, 10 dB
- Satellite Transponder unit including:
  - receiver parabolic antenna with waveguide - coaxial adapter
  - Ku-band converter (14GHz-to-10,75GHz)
  - transmitter parabolic antenna with waveguide-coaxial adapter



Block diagram of a Satellite Communication system