

Physics

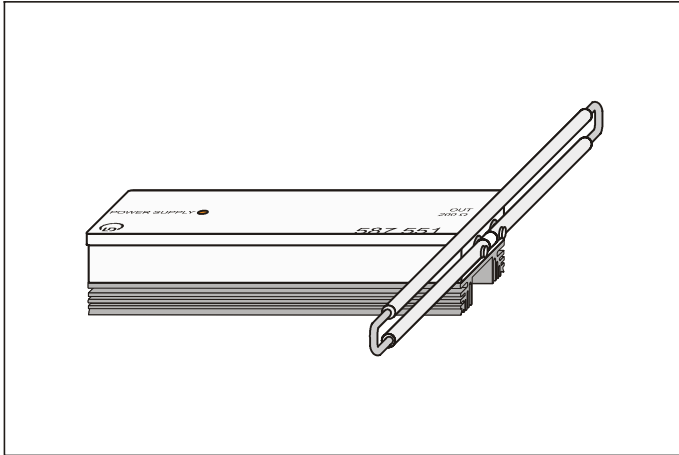
Chemistry · Biology

Technology



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Instruction sheet 587 551

UHF generator (587 551)

Electromagnetic compatibility

The UHF generator is classified as an educational device for studying electromagnetic phenomena. It is used to investigate the propagation of electromagnetic waves in space and on Lecher lines.

Experiment setups using the UHF generator may not always conform to the limit values of class A (group 2 of standard EN 55011). Such setups may cause interference in other devices in the experiment room of a school or educational institution; the proper function of devices situated outside of the experiment room is generally not affected. However, radio interference can occur up to a distance of several hundred meters, especially blocking remote controls.

The UHF generator may only be operated under the supervision of qualified personnel, e.g. a teacher, and may not be operated at all outside of the designated experiment room of a school or other institution. The UHF generator may not be connected to other communications systems or terminal devices.

Safety notes

It is the responsibility of the user to take all precautions to ensure that devices installed outside of the experiment room can continue to function properly.

- Do not operate the generator longer than is necessary to conduct the experiment.
- Set up the experiment horizontally (not vertically).
- Where necessary, also operate the UHF generator at reduced power for continuous wave experiments (Amplitude control input).

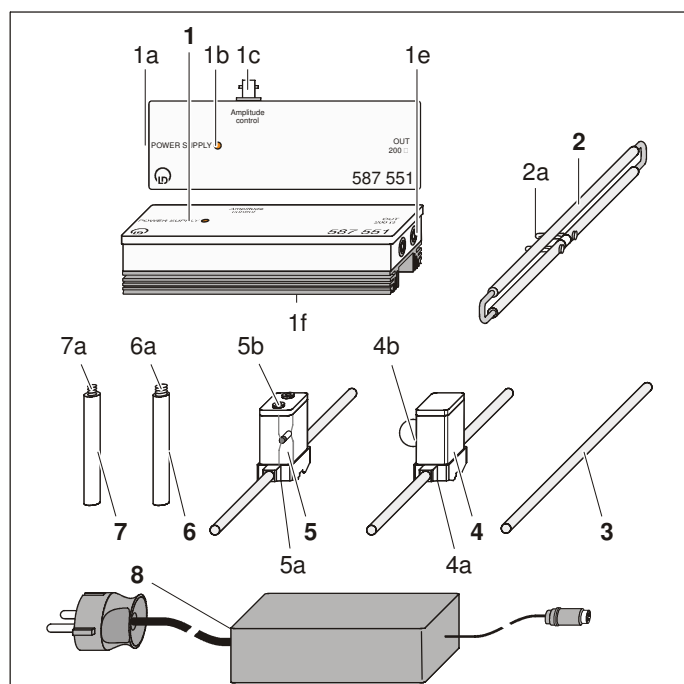
The UHF generator is ready for operation and emits high-frequency energy as soon as it is connected to the supply voltage.

- Deactivate the UHF generator immediately when the experiment is finished by disconnecting the table-top power supply.

The output amplifier of the UHF generator is proof against sustained short-circuit and no-load operation and can withstand mismatches up to a standing wave ratio of 20:1. In spite of this, always avoid sustained extreme mismatches.

- Never operate the UHF generator without terminating the antenna output with the loop dipole, the Lecher line or the 200 Ω terminator resistor.

1 Components



1 UHF generator

Power input (1a)
 Operation indicator (1b)
 Amplitude control input (1c)
 Antenna output (1e)
 Internal thread M6 (1f)

2 Loop dipole

4-mm plug (2a)

3 Antenna rod

4 Receiver dipole with lamp

Screw thread M4 (4a)
 Lamp 3.8 V (4b)

5 Receiver dipole with diode

Screw thread M4 (5a),
 4-mm sockets (5b)

6 Mounting rod for UHF generator

M10 thread (6a)

7 Mounting rod for receiver dipoles

Internal thread M4 (7a)

8 Table-top power supply

2 Scope of supply

1 UHF generator
 1 Loop dipole
 1 Antenna rod
 1 Receiver dipole with diode
 1 Receiver dipole with lamp
 1 Mounting rod for UHF generator
 1 Mounting rod for receiver dipole
 1 Table-top power supply

3 Description

The UHF generator is used to investigate the propagation of electromagnetic waves in free space (e.g. in the air), in dielectric media (e.g. in water) and on Lecher lines. It can be used in continuous wave mode, an amplitude control input can be used to reduce the power emitted.

The pluggable loop dipole functions as a transmitter antenna; the enclosed antenna rod acts as a director when placed in front of the receiver antenna, and as a reflector when placed behind it.

Two receiver antennas can be used. The receiver dipole with lamp indicates the field strength of the received signal as a function of the antenna distance and polarization in a qualitative manner through the change in lamp brightness. The receiver antenna with diode demodulates the high-frequency received signal and can be connected to a multimeter for quantitative display of the field strength or to an audio-frequency amplifier to generate an audio or video signal.

4 Technical data

4.1 UHF generator:

Operating data:

Frequency: 433.92 MHz (± 100 ppm)
 ISM band (industrial, scientific, medical) of UHF range

Wavelength: 69.14 cm

Operating voltages: from table-top power supply

Power consumption: 15 W

Operating modes:

CW: continuous wave

Amplitude control is possible

Output power (into $Z = 200 \Omega$):

CW: 3.0 W

with reduction to 0.3 W

Standing-wave resistance:

for Lecher line experiments max. 20 : 1

Connections:

Power input Mini-Mab 5
 Control input BNC socket
 Antenna output 4-mm safety sockets, high-frequency power output with symmetrical supply, for loop dipole, Lecher line or 200Ω terminator

General data:

Housing: 20.5 cm \times 8.5 cm \times 50 cm
 full metal enclosure with integrated heat sink

Weight: 400 g

4.2 Loop dipole:

Characteristic wave impedance: 200 Ω
 Connection: 4-mm plug pair for connecting to antenna output or open end of the Lecher line
 Dimensions: 14 cm × 7 mm dia.

4.3 Antenna rod:

Dimensions: 32 cm × 7 mm dia.

4.4 Receiver dipoles:

Lamp data: 3.8 V / 70 mA
 Lamp socket: E10
 Dimensions: 14 cm × 7 mm dia.

4.5 Mounting rods:

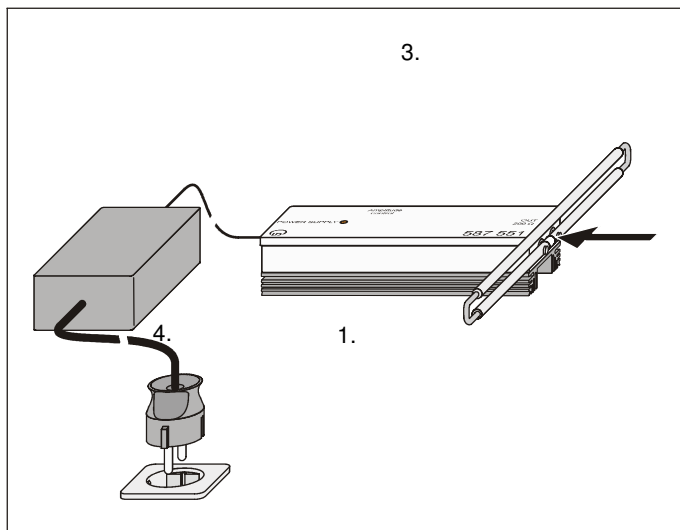
Mounting rod for UHF generator: 13 cm × 10 mm dia.
 Mounting rod for receiver dipole: 13.7 cm × 10 mm dia.

Note on the lengths of antenna rod, receiver dipoles and loop dipole:

The ideal elementary (or “Hertz”) dipole has an overall length of $\lambda/2$ and a diameter $D = 0$. For diameters $D > 0$, a contracting factor becomes apparent for the overall length and the bandwidth becomes greater. (Flatter antenna resonance curve).

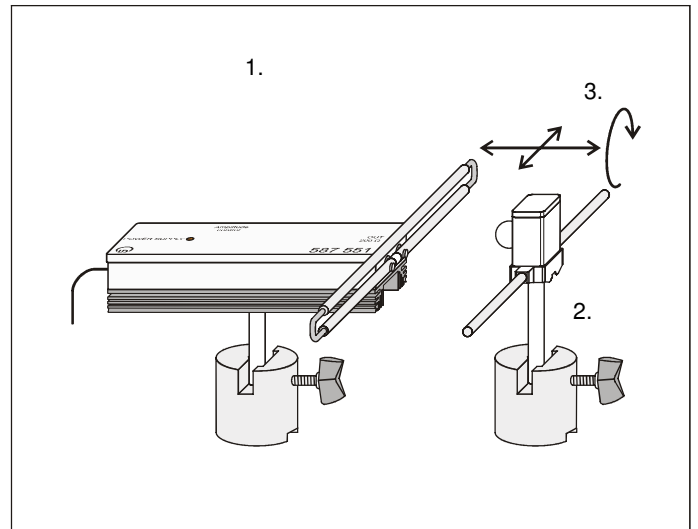
5 Operation

5.1 Putting the UHF generator into operation:



- Connect the loop dipole (2) or the Lecher line (from 587 56) to antenna output (1e).
- Connect the table-top power supply to power input (1a), plug the unit into a mains socket and switch it on.

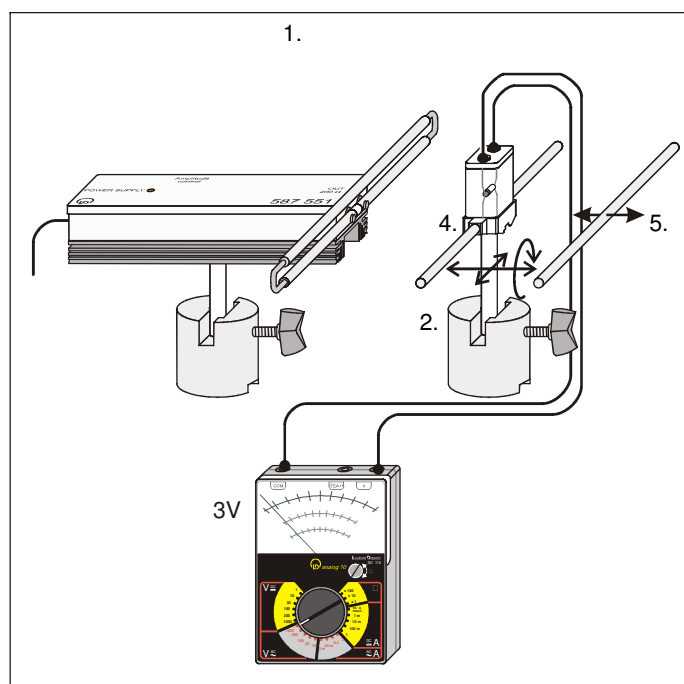
5.2 Using the receiver dipole with lamp:



Additionally recommended:

- 2 Saddle bases 300 11
- Operate the UHF generator using the loop dipole.
- Mount the receiver dipole with lamp using the mounting rod for receiver dipoles and align it parallel to the loop dipole so that the lamp lights up brightly.
- Vary the distance, move the receiver dipole around the loop dipole and lift it above the loop dipole, align the receiver dipole perpendicularly; observe the brightness of the lamp each time.

5.3 Using the receiver dipole with diode:



Additionally recommended:

1 Multimeter LD analog 10	531 110
2 Saddle bases	300 11

- Operate the UHF generator using the loop dipole.
- Mount the receiver dipole with diode using the mounting rod for receiver dipoles.
- Connect the multimeter (measuring range 3 V DC).
- Align the receiver dipole parallel to the loop dipole so that the deflection of the multimeter is approx. 2 V.
- Vary the distance, move the receiver dipole around the loop dipole and lift it above the loop dipole, align the receiver dipole perpendicularly; observe the deflection of the multimeter each time.
- Test the effect of the horizontally arranged antenna rod **(3)** on the received signal when placed in front of and behind the receiver dipole.