Antenna Systems Demonstrator ASD512

Description

Operational antennas are built in a great range of shapes and sizes, depending on the function and operating frequency. At low frequencies the equipment could be too large to be manageable and at high frequencies too small to analyse. These factors are an essential consideration in the design of an antenna systems demonstrator.

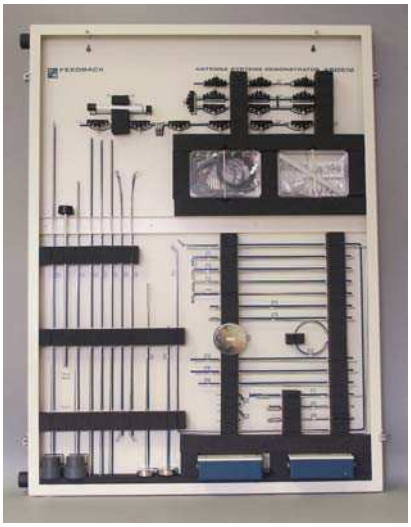
The ASD512 is a fully operational Antenna Systems Demonstrator working at a frequency of 167.2MHz, giving a half-wave element of approx. 90cm - an ideal size for classroom demonstration. Many types of antenna can be constructed from a few component parts making the ASD512 an extremely versatile demonstrator of antenna principles and practice. Considerable use is made of illuminated hand-held detector displays, which show the relative magnitude of voltage and current fields around the antenna and the field strength of the radiated signal at a distance from the antenna.

Practical demonstrations described in the associated manuals illustrate the principles involved, thus introducing students of various levels to the basic concepts, leading on to an understanding of most types of antennas in common use.

Features

- Fully operational antennas
- Vivid displays of antenna characteristics
- Convenient size for classroom
- Versatile and easy to assemble
- Complex concepts made easy
- Reconciles theory and practice

Radio Communications



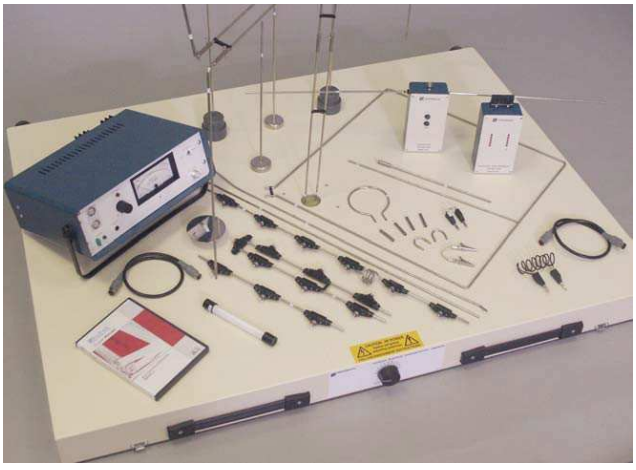
The world would be a very different place without radio communications. There would be no broadcasting, no television and all long distance telephone calls would have to go by cable. Man's leap into space would have been impossible and the world's airways would be very few and very dangerous without reliable radio.

The apparatus of a radio link starts with a transmitter and ends with a receiver, but neither is complete without an antenna. A transmitter does not generate high-frequency electrical oscillations; these must be fed into an antenna to generate a radio wave. Similarly, a radio receiver requires an antenna to convert an arriving radio wave into an electrical oscillation. The reliability of the communication link (or 'circuit' as it is sometimes called) often depends more on the antennas used than on transmitter power or receiver sensitivity.

Antennas are available in many shapes and sizes and considerations such as space and cost can affect specification as much as technical characteristics.

It is fortunate that antenna systems can be specified, installed, tested and maintained without a detailed knowledge of their theoretical design, since the theory is complicated and highly mathematical. The ASD512 offers a practical, non-mathematical understanding of how antennas work, allowing a range of simple design, installation, adjustment and maintenance exercises to be carried out to ensure that performance characteristics are met in practice.

Equipment



The Antenna Systems Demonstrator ASD512 is a self-contained set of equipment that promotes student participation. It is ideal for classroom demonstrations and does not require any special screening facilities. This demonstrator includes all the items to build and clearly demonstrates the majority of antennas described in the associated manuals. The half-wave element size of 90cm makes the ASD512 very easy to use and the low output power of the RF Generator ensures safety. The unique method of indicating V/I and the field strength with the hand-held detectors also helps the student to appreciate and understand complex concepts easily.

Ease of use of the equipment is further facilitated by a storage tray, which also serves as an inventory control for the various items (except the RF Generator) described below. This storage tray can be clipped on the ground plane for compact carrying purposes or can be fixed to a wall for easy access to the component parts.

1. R F Generator Unit

This unit incorporates the RF generator and power unit inside a metal case. The RF output is continuously variable from zero to 5 watts maximum, readable on the front panel meter when switched to the 'forward power' condition. When set to 'reverse power', the meter reads the power reflected by the antenna system. This facilitates the tuning of the antennas. The transmitter is short-circuit proof and will function with any impendence mismatch without excessive heat dissipation.

2. Antenna Ground Plane

The ground plane consists of an anodised aluminium box structure. Incorporated at the centre of the plane is a pair of sockets into which the constructed antenna arrays are plugged. RF power is conveyed to the antenna from the drive unit via a co-axial cable. The particular antenna array selected is then tuned by means of the 'balun' tuner contained within the ground plane.

3. Antenna

The many types of antenna described in the demonstration manuals can be constructed from a few basic components. These primarily consist of various specially made lengths of nickel-plated brass tubing, together with a selection of clips for connecting them. Some antennas have a series of connected lamps at intervals along their length to indicate the current standing wave in the elements.

4. Detectors

Two hand-held detectors are supplied with the ASD512. One is a current and voltage field probe, giving a linear LED display; the other is a radiation detector to indicate field strength. Both detectors are powered by rechargeable batteries that are recharged from the generator unit. The voltage and the current detectors are designed to explore the distribution of voltage and the current along the length of the antenna elements. Voltage is indicated by the illuminated height of the 'V' column of lamps, which increases as the electric field increases. The current indication likewise illuminates the 'I' column as the magnetic field increases. The fields used in these measurements are those immediately surrounding the antenna elements. The radiation detector is intended for exploring the radiation field at various distances from the antenna. The radiation is detected by a receiving dipole and the corresponding field strength is indicated by the detector lamp. The unit can be switched on and off by pushbuttons, but if it receives no radiation for two minutes it will switch itself off automatically. Conversely, strong radiation will automatically energise the unit.

Curriculum /Demonstrations

Two manuals are provided as part of the ASD512. One is in textbook form for use by the instructor in preparing the lesson, and the other is a short-form guide to conducting the demonstrations. The teaching level is aimed at those who will be involved in selecting, installing, commissioning and maintaining antennas. Consequently, the treatment of the subject is non-mathematical and non-quantitative.

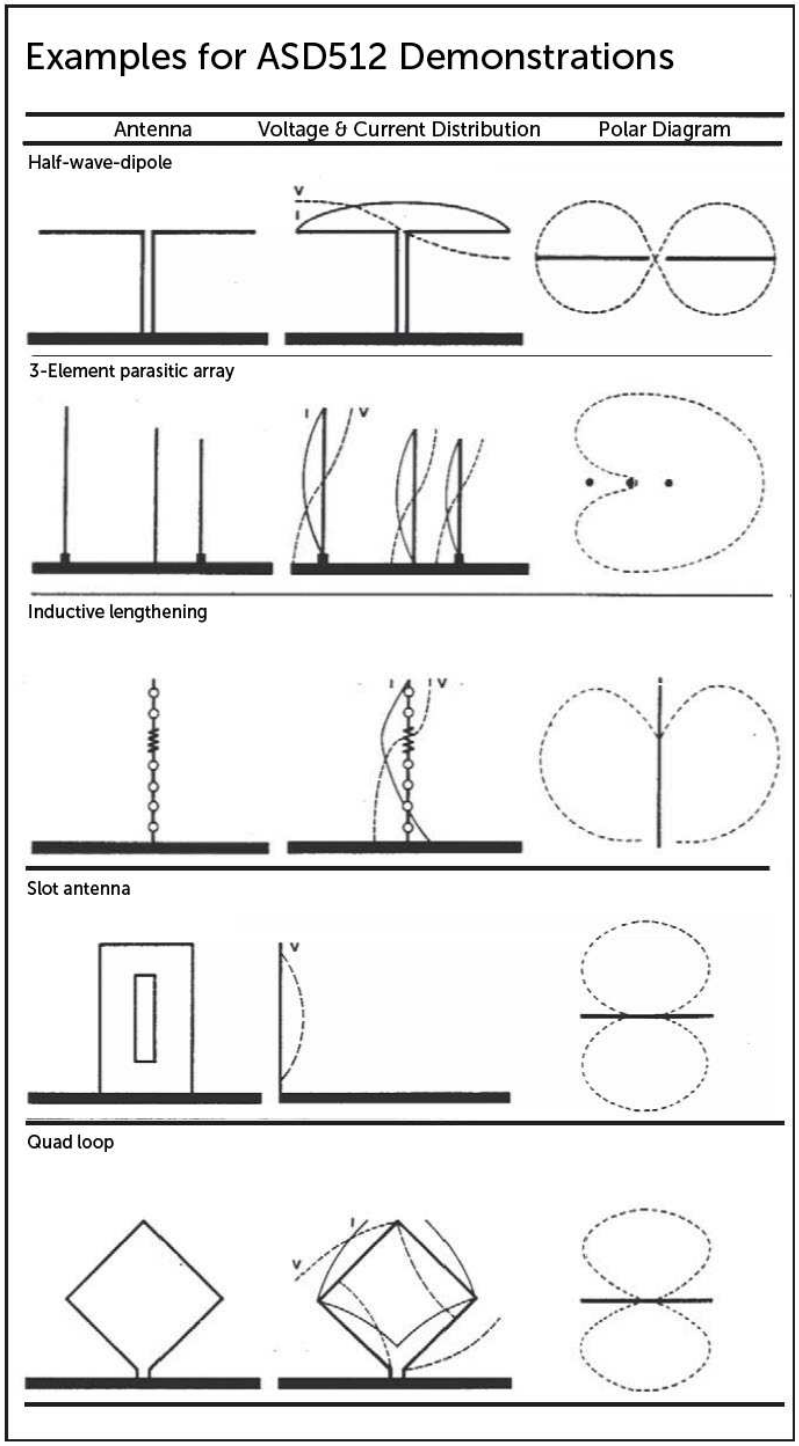
The demonstrations described are:

1 Basic theory of radiation, radiating & non-radiating systems
2 Feeders
3 Radiation resistance, drive point impedance and ground resistance
4 Physical and electrical length
5 Directional antennas and radiation patterns
6 Parasitic arrays and antenna gain
7 Antenna with folded elements
8 Slot radiators
9 Three dimensional polar diagrams
10 Loop antennas

Application notes are also provided in the manual describing some of the specialised antennas that cannot be directly demonstrated using the antenna components supplied with the ASD512. These application notes provide the necessary information to enable the customer to construct their own antennas for use with the transmitter, ground plane and detectors of the ASD512.

The antennas described are:

1 Log-periodic antennas
2 Rhombic antennas
3 Batwing antennas
4 Cylinder slot antenna
5 Reflector type antenna



Transmitter

The equipment emits an unmodulated carrier at field strength not exceeding 0.5 Volt/metre at 30 metres.

Frequency	*167.2 MHz ±50 kHz	
Power	0 - 5 Watts output	
Termination	Approximately 50Ω unbalanced	
Ambient temperature	0° to +50°C	
Metering	Forward Power	0 - 10 Watts
	Reverse Power	0 - 10 Watts
Front Panel Controls	Mains	Off - On
	Output Power	0 - full power continuous
	Power meter	Forward - Reverse
Detector charge	Two outputs charging at 60 mA for 5 V	
Modulation Input	The transmitter can be amplitude modulated if required by miniature jack (600Ω -15 dBm = 100%).	

*The operating frequency of the ASD512 is 167.2MHz and it is necessary in the UK for the establishment using the equipment to hold a 'Testing & Development License' available at low cost from the department of Trade and Industry, Radio communications Division. For overseas countries it is possible for the equipment to be returned within a range of ±10 MHz. This enables the equipment to be adjusted to local radio transmissions laws if necessary.

Ground plane

Size	1150 mm, 840 mm, Aluminium
Matching Assembly	Unbalanced 50Ω to balance any impedance
Control	Antenna matching, set for each antenna
Antenna sockets	Two 4 mm blind sockets
Antenna construction	Antennas are constructed from: 23 nickel-plated brass rods in various shapes, 3 rods containing a lamp every 12 cm, 1 flat sheet of aluminium containing a slot.

Voltage and current

Display	Linear LED
Power supply	5 volts from internal battery, recharged from transmitter
Charge usage	approximately three hours use after one charge
Charge time	approximately seven hours from empty

Radiation detector

Half-wave dipole with amplifier

Indication device	2.5 V 0.2 A MES lamp
Power supply	5 V from internal battery; recharged from transmitter
Controls	Pushbuttons for On/Off Unit will switch itself off approximately 2 minutes after receiving the last transmission.
Charge usage	approximately two hours after one charge
Charge time	approximately seven hours from empty

Dimensions & weight

	Storage Tray	RF Generator
Width	1160 mm (45.7 in)	330 mm (13 in)
Depth	855 mm (33 in)	226 mm (8.9 in)
Height	127 mm (5 in)	118 mm (4.6 in)
Weight	18.2 kg (40 lb)	2.7 kg (5 lb)

Tender Specification

Antenna Systems Demonstrator enabling construction and demonstration of many types of operating antennas. To give qualitative assessment of voltage and current distribution in the constructed antenna and field strength around the antennas by use of hand-held detectors. To include manual of practical demonstrations and assignments covering antenna principles & practice. Application notes on some specialised antennas.

Ordering Information

Antenna Systems Demonstrator	ASD512

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