What's in *Your* Workshop?

"When you can measure what you are speaking about, and express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind. It may be the beginning of knowledge but you have scarcely in your thoughts advanced to the state of science."
William Thomson, Lord Kelvin, 1824-1907

Uses

- General testing

    - Check voltage

    - Continuity

    - Monitor SWR

- Troubleshooting

    - What happened to my receiver?

    - Is my antenna ok?

    - What died in my transmitter?

- Debugging - new projects

    - Transmitter output clean?

    - Receiver alignment?

    - How good is my xtal filter?

The Basics – At home

- Voltmeter or DMM

- Signal source audio/RF

- LGB – R-S Audio Amp/speaker

- Computer/Internet access

- Test leads and adaptors

- DC power source

- SWR/Power Meter

- Scope

The Basics - In The Field

- Voltmeter or DMM

- LGB

- Test leads and adaptors

- SWR/Power Meter

- Antenna Analyzer?

Intermediate

- Antenna Analyzer

- VHF 'scope/ storage scope

- Spectrogram

- RF Voltmeter

- Component measurement

  - AADE L/C Meter

  - Peak Atlas/ M3

  - Smartweezers

  - RLC bridge

Advanced

- Vector/network analyzer

- Spectrum analyzer

- Computer controlled T/E

- True RMS audio voltmeter

- Microprocessor development system

Nice to Have

- K8IQY PVXO for quartz crystal measurements

- KD1JV Test Box

  - Sign gen, counter, dummy load, wattmeter, etc.

- Graphical antenna analyzer

  - AEA CIA, AntennaSmith

- Commercial RLC Bridge

- Tube Tester!

- Logic Analyzer

- Semiconductor Curve Tracer

- Time Domain Reflectometer

- White Noise Generator

- GPS Conditioned Freq. Reference

Where to Buy?

- Online auction sites

    - Caveat emptor

- E-mail lists, qrp-l and club reflectors

- http://www.eham.net/classifieds/

- Word of mouth

- Hamfests

- Garage sales

- Used T/E dealers

- Surplus from schools/businesses

- AADE, Kanga, OHR, Elecraft, etc.

Roll Your Own

- ARRL Radio Amateur Handbook

- RSGB Radio Communications Handbook

- Experimental Methods In RF Design

- Favorite web sites

    - W7ZOI

    - KD1JV

    - K8IQY

    - AmQRP

    - NORCAL

- QST/QEX

- QRP journals

- Simple Test Equipment for the QRPer. - G3MFJ/G4WIF

Calibration

- Important but can be difficult

- Compare to a "standard"

- Frequency

    - WWV, WWVB

    - GPS

    - Color burst

- Voltage

    - Fresh batteries

    - IC voltage references

- Hams usually rely on manufacturer

Oscilloscopes

- Recurrent vs Triggered Sweep

- Tube vs semiconductor

- Bandwidth

- Single or multiple trace

- Storage

- Digital vs Analog

- Need correct probe

    - Loading

    - Bandwidth

    - Attenuation

Oscilloscopes

Older Heathkit

Tektronix 545

Modern Heathkit

Tektronix 2215

Tenma 72 Series

Meters - Analog vs Digital

- Peak/Dip
  - Digital displays not optimum
- Accuracy and resolution
  - Analog displays less fine
- World going digital
  - Bar-graphs save the day

Voltmeters/DMMs

Simpson 260 VOM

RCA Voltohmyst VTVM

Fluke 77

Harbor Freight "Special"

Radio Shack $50

Antenna Analyzers

Autek Research RF Analyst

AEA CIA

AmQRP Micro908

MFJ 269
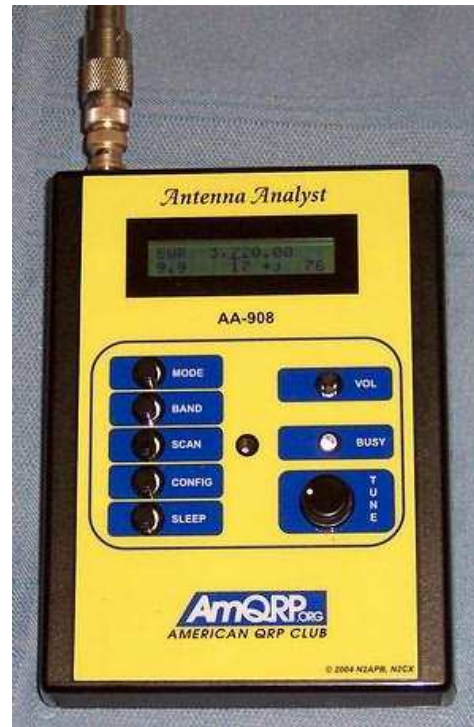
N2CX 2006
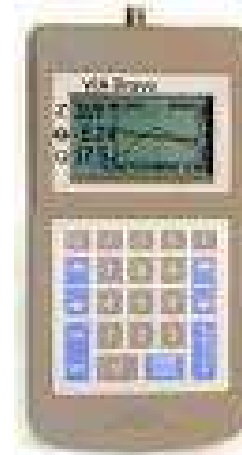
Timewave AntennaSmith

Component Analyzers

Peak Atlas

M3 Semiconductor Analyzer

LC Meters

AADE L/C Meter
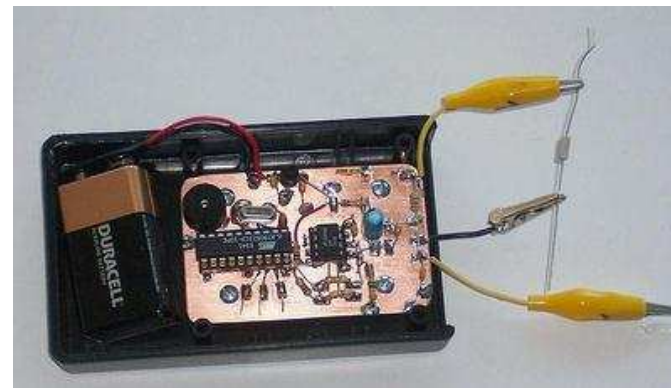
NJQRP "Elsie"

RF Probes
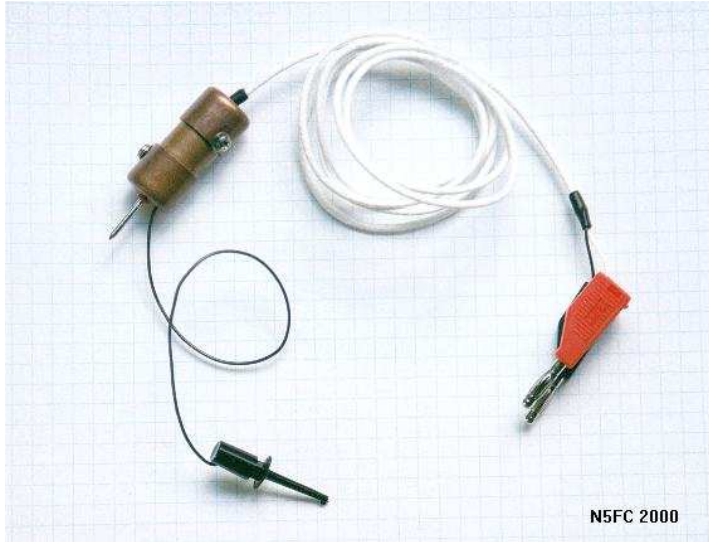
N5ESE RF Probe

NORTEX Accuprobe

SWR/Power Meters

NoGaWaTT (N5FC)   OHR WM-2

More SWR/Power Meters

KD1JV SWR/PWR METER

KA7EXM PIC-PM

Spectrum Analyzers

W7ZOI Spectrum Analyzer

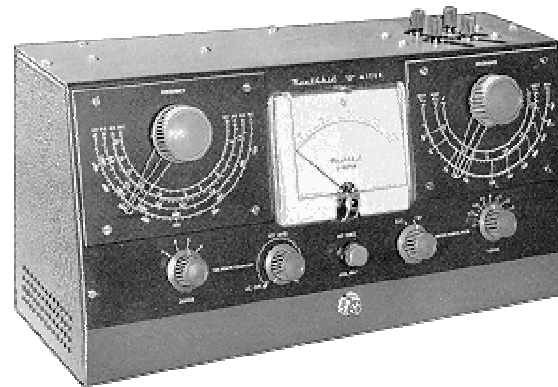HP-141T Spectrum Analyzer

Step Attenuators
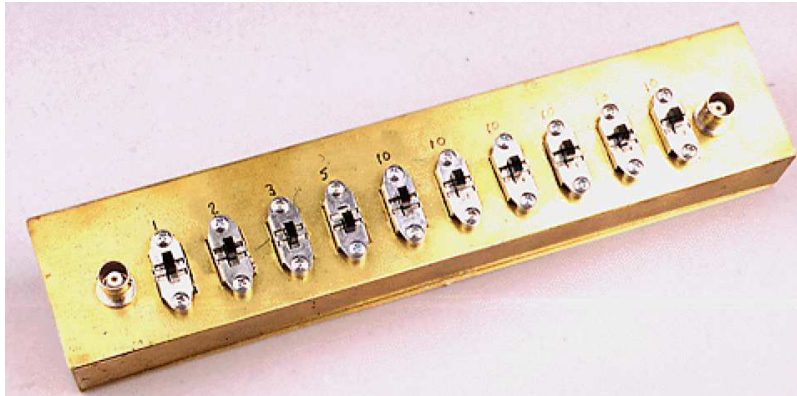
ARRL HB Attenuator
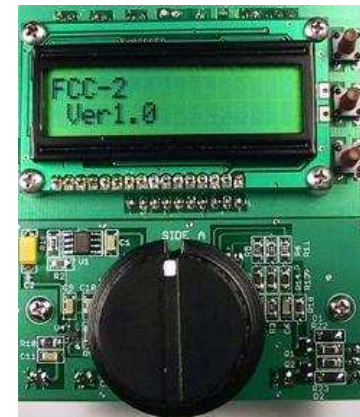

MFJ 762

Q Meters

Boonton 160

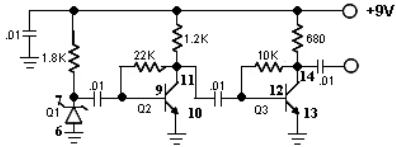Heath QM-1

Other Handy Modules

Elecraft XG2   Elecraft 2T-gen   Norcal FCC-1/FCC-2
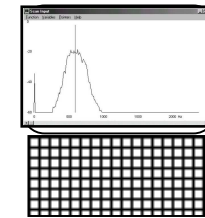
Using Spectrogram
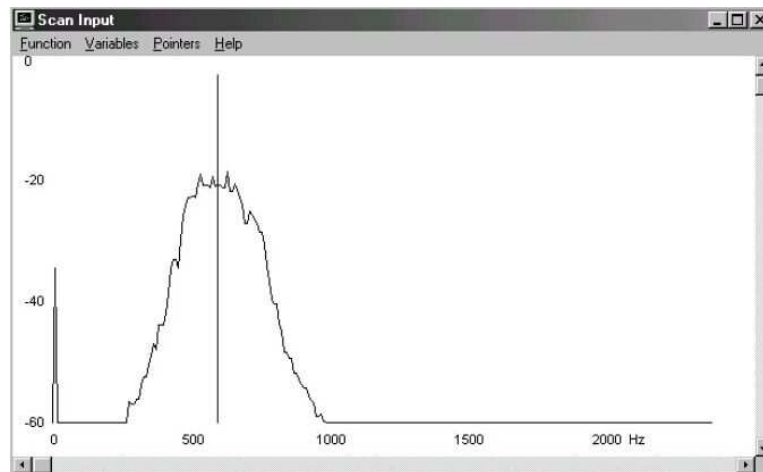# For Filter Alignment

RF Noise Gen

Elecraft K2

Home Computer

Spectrogram Uses Sound Card

RF

Audio

Filter Response Display

Coping With Loss

Of stuff that disappears from the Internet

- Print web pages to PDF and save locally
  - Free PDF converter
  - http://www.primopdf.com/

- Turn back the clock with a wayback machine
  - See things as they used to be!
  - http://www.archive.org/index.php

References

See hard-copy handout