

# ***CleverLoad***



***A different RF 'dummy' load***

# ***A Different Dummy Load***



## ***CleverLoad Key Features***

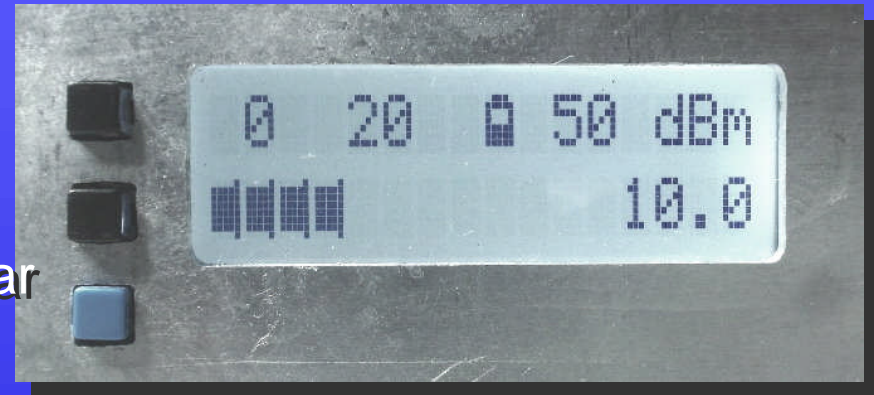
- Integrates a 50 ohm load and power meter
- Measures true RMS power from -10 dBm to +44 dBm
  - Range 100uW to 30W
- Displays dBm or Watts – user selectable
- Power measurement accuracy 0.25dB
- Frequency response <0.25 dB 2 MHz to 1,300 MHz
  - <0.5 dB down to 300 kHz
- Display readout shows bargraph and numeric values

# Display Readout Modes



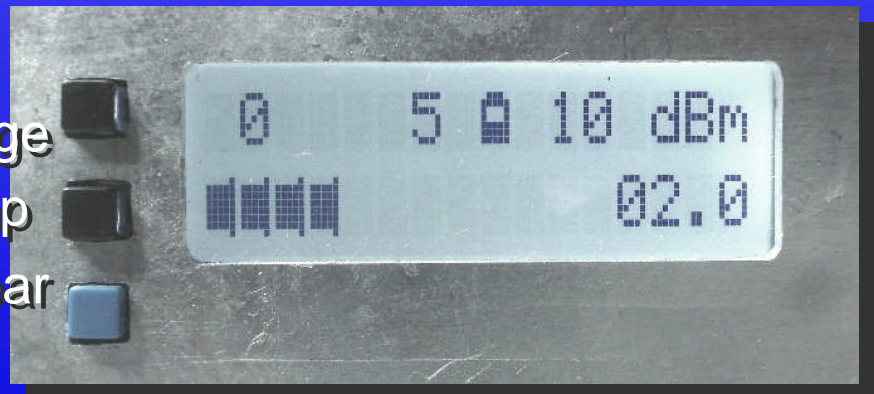
## Full Range

- 60 dB range -10to +50 dBm
- Bargraph increments 1dB / bar



## Auto Range

- Auto ranges over a 60dB range
- 12dB per range allows overlap
- Bargraph increments .2dB / bar

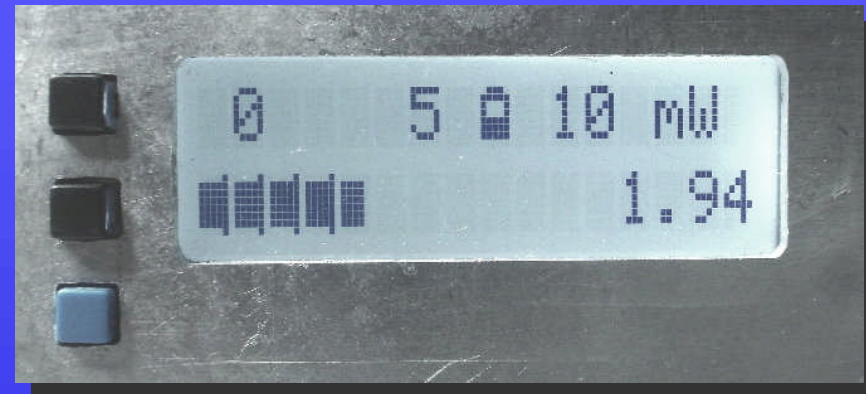


# Display Readout Modes



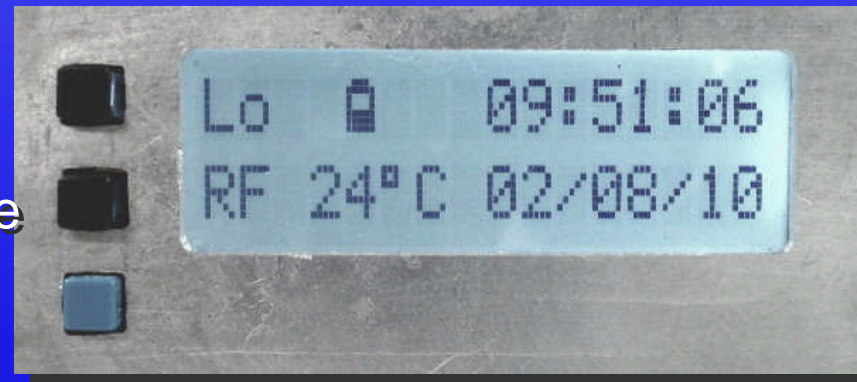
## Watts

- Bargraph always reads in dBm
- Press Sw2 momentarily to change numeric readout to Watts



## LoRf

- When Pin < -10 dBm unit displays LoRF screen
- Time, Date, & Temperature



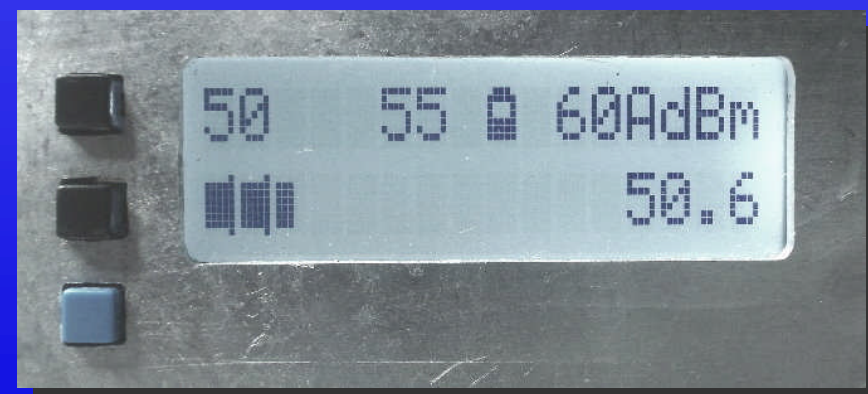
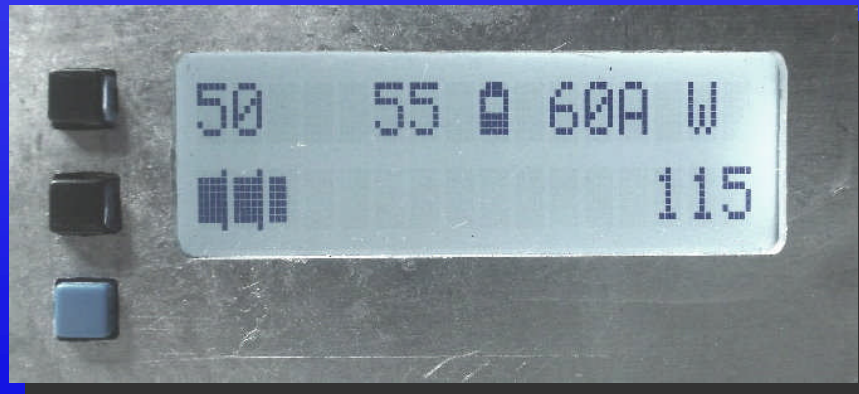
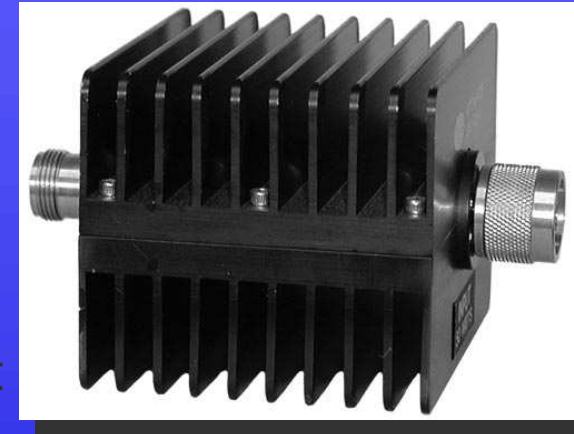


# Extend Pwr Measure Range



## External Attenuator

- Measure power up to 69.9 dBm
- 'A' preceding dBm or Watts indicates the meter is in attenuator mode
- Attenuator value set in utilities menu
  - Any value from 2.0 to 40.0 dB
- Displayed readings automatically adjust
  - Works in either full range or auto range

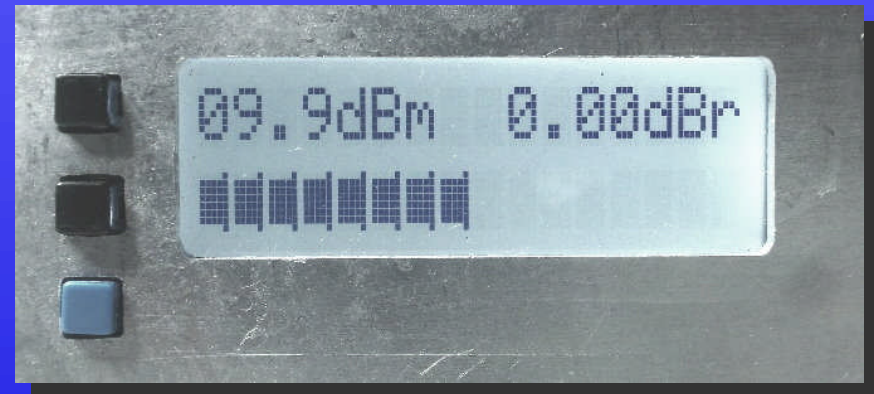


# Peaking Measurement Mode



## Relative Power Measurement

- +/- 3 dB range
- Displays power in to .1dBm resolution and simultaneously displays a bargraph and relative power to .01 dB resolution
- Bargraph resolution 0.075 dBm per bar
- Mode can auto range or remain fixed user selectable
- Mode offers a re-centering feature



# ***Additional Features***



## ***Soft off power switch***

- User selectable off timer 2min to 59min

## ***Flexible Power Seamlessly switches between***

- Internal battery
- USB cable
- External supply any voltage between 5 & 15V

## ***Battery Level Indicator Icon***

- Empty, Half, Full and external supply

## ***Sixteen display backlight levels***

## ***Remembers operating mode when re-powered***

- Housekeeping info saved external EEPROM

# ***Additional Features***



## ***Thermal Alarm***

- Over threshold display flashes alarm and shows temp.



## ***Low Current Consumption***

- Less than 30mA while measuring with backlight on

## ***Datalog capability***

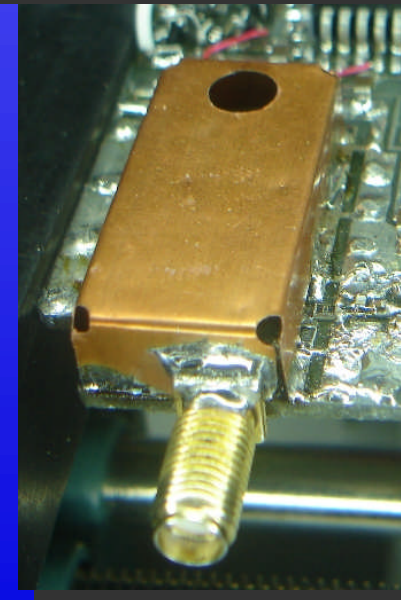
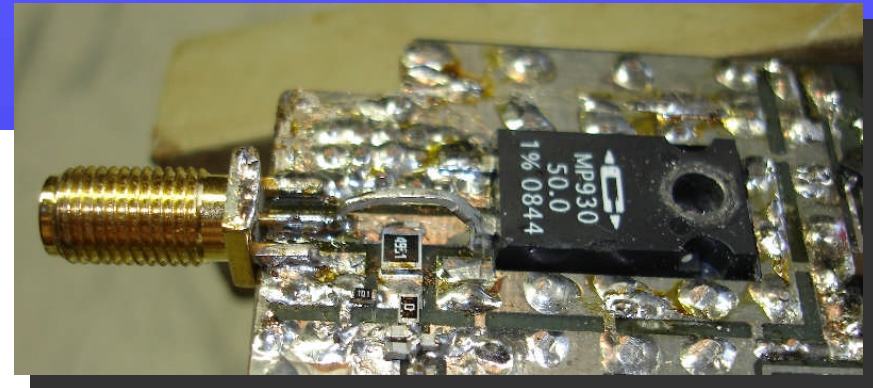
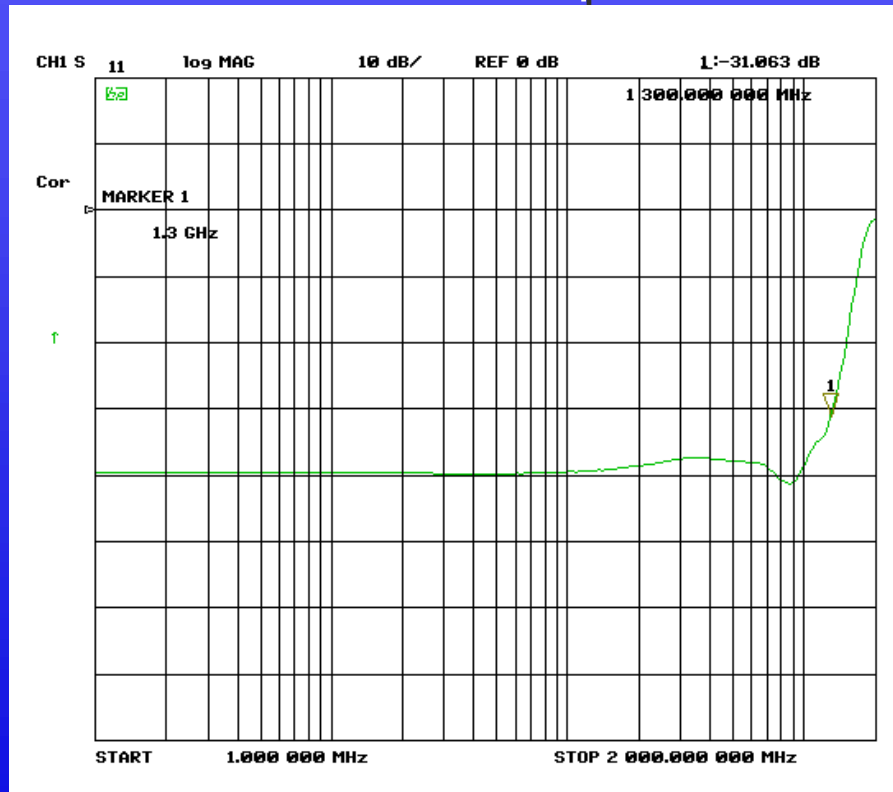
- Up to 2000 entries
- Timed interval user selectable
- Very low power datalog mode to conserve batteries



# Challenges

## Taming the load resistor for 1.3GHz operation

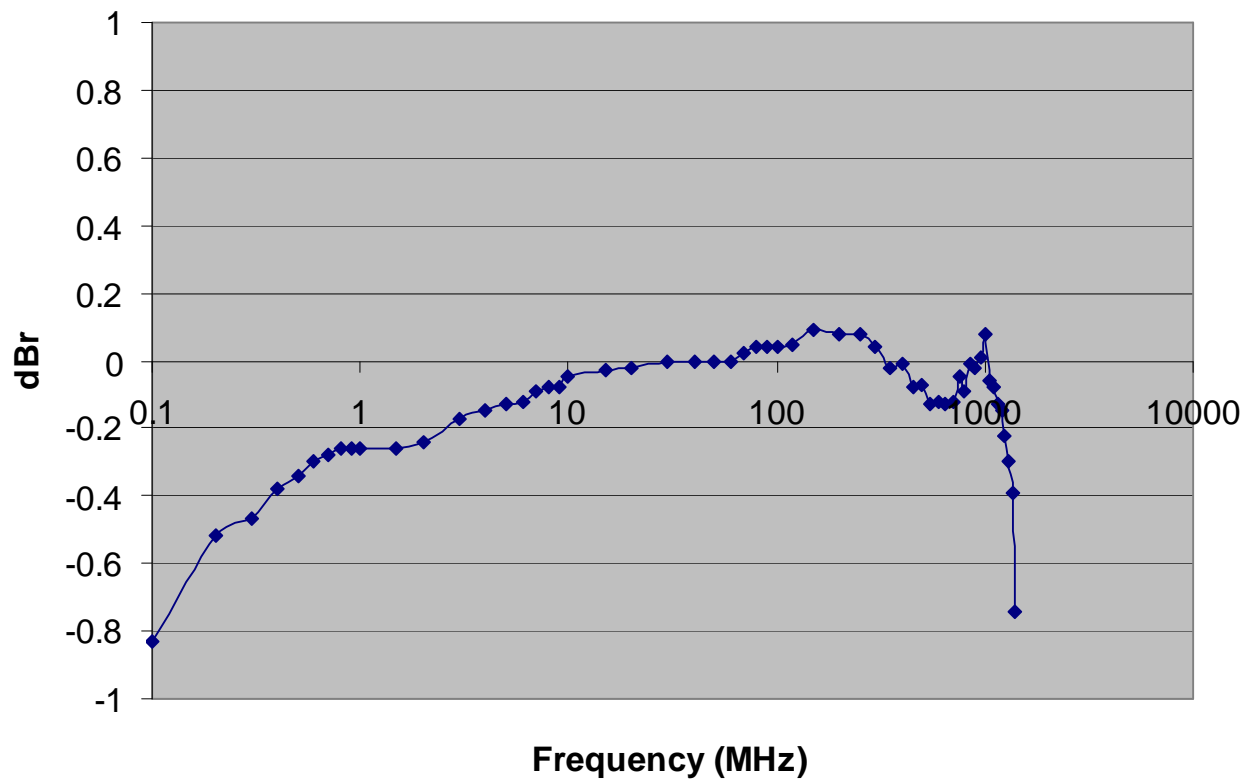
- >30dB return loss & about 40dB at lower frequencies



# Challenges

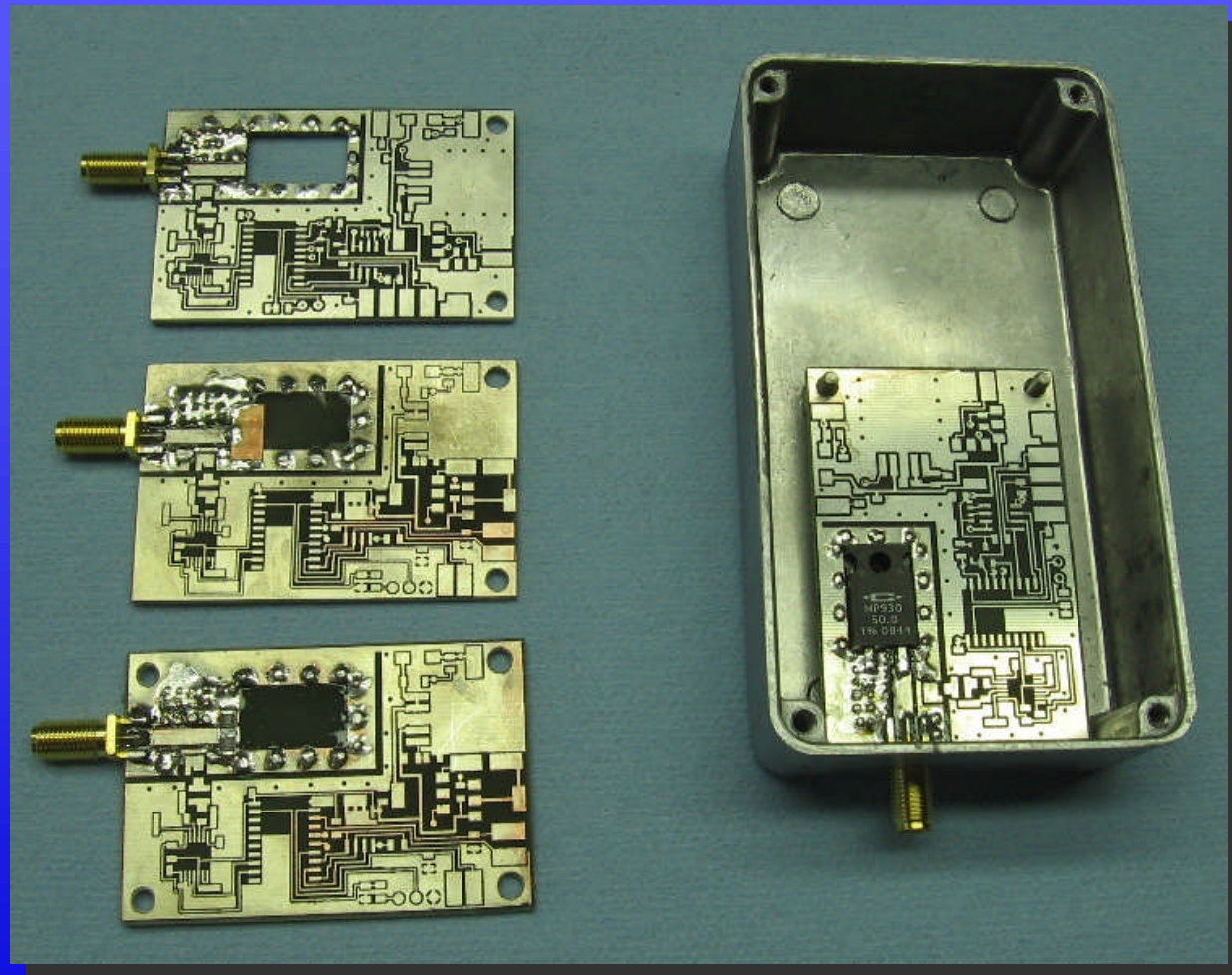


***Achieving flat frequency response to 1.3GHz through pickoff attenuator***



# Challenges

*First attempt  
at 50ohm  
Coplanar  
waveguide on  
FR4*



# Challenges



## ***dBm to Watts conversion over an 80dB range***

- $\text{Watts} = 10^{((\text{dBm}-30)/10)}$
- Not easy to do exponents with a PICAXE!

## ***Bargraph display***

## ***Auto ranging algorithm***

## ***Extending range to -10 dBm***