QRP

Presented to the

Ozaukee Amateur Radio Club

W9JI April 13, 2016

QRP or QRO?

- QRO
  - Increase power.
- QRP
  - Decrease power
- Common usage
  - Less than 5 watts output power CW
  - Less than 10 watts PEP on SSB
  - QRPp – less than 1 watt output

Early CW Transmitter

Radio on display at the Vintage Radio & Communication Museum of Connecticut
http://www.vrcmct.org/

Looking for a “Bigger” Signal

Exciter / Amplifier combination could generate 500 hundred watts by the late 1940’s.

Collins 310B Exciter, 75A-1 Receiver, 30K-1 Amplifier

Original price in 1948 ~ $1800 New car in 1948 - $1200

Median wage - $3100

100 Watts Becomes “Standard”

In the early 1950’s 100+ watt radios become available and affordable.

QRP Radios – A New Niche

- Manufacturers introduce “QRP” rigs
  - Ten-Tec Powermite-1 (1969)
    - 40, 20M, 15M option
    - 2 W in, 600 mW out
  - Heathkit HW-7 (1972)
    - 40, 20 & 15M, 2 Watts
  - Yaesu & Kenwood
    - Several models, mostly for Asian markets

Heathkit HW-7

- First offered in 1972, about $70
- Transmitter
  - Break-in operation, VFO or Xtal control
  - 2w nominal output
- Receiver
  - 40673 Mosfet detector
  - Microphonics and Hum
  - “AM” pickup

Kit Building Takes Off

- 1990's see new interest in kit building
- Many companies offer quality QRP rigs
  - Ten-Tec, MFJ, Small Wonder, NorCal, etc.
- Elecraft sets a new standard

Elecraft K1

- Kit radio with performance rivaling a full sized radio
- Single conversion superhet
  - Dynamic blocking range 107dB, IMD 87dB
- Xtal filter, selectable bandwidth
- PIC microprocessor control
- Power output - .5 to 7 watts
- Built in keyer
- Optional built in tuner

Modes

- CW is most common QRP mode
  - Simple equipment
  - Good performance with weak signals
- SSB & AM suffer from poor S/N ratios
- Digital modes are very popular
  - PSK31 works very well with weak signals
- Weak signal analysis software will become more prominent in the future

Relative Signal Strength

Power (Watts)	dB	S Units
2	3.0	.5
5	7.0	1
10	10.0	2
100	20.0	3
1000	30.0	5

1 S Unit = 6 dB

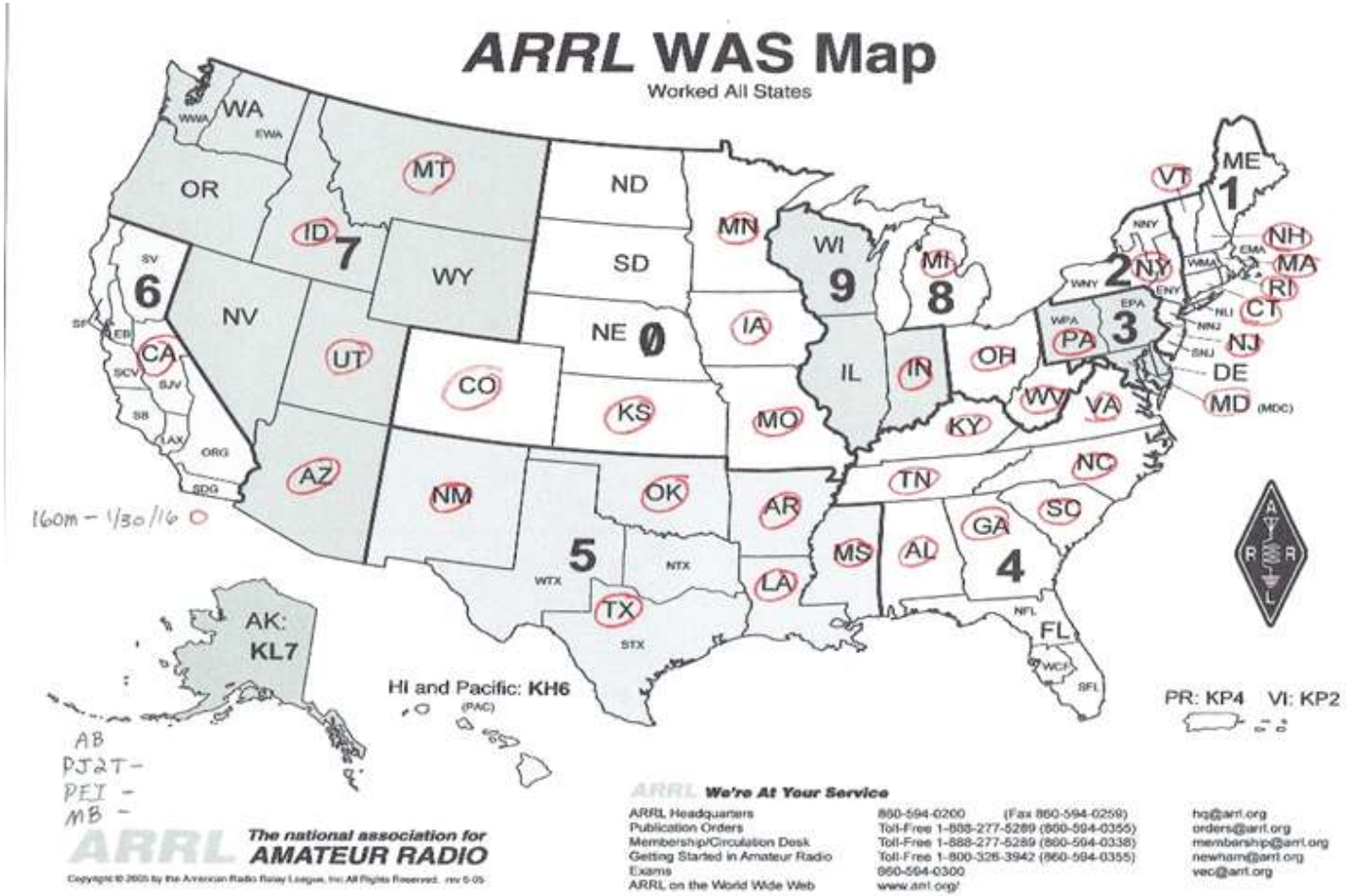
Reference power = 1 watt

100 W signal is S9. Reduce power to 5 W. What is the change in the S-meter reading?

$$10\ log_{10}(100/5) = 13\ dB$$

$$\frac{13\ dB}{6\frac{dB}{s\ unit}} = 2.2\ \text{S units}$$

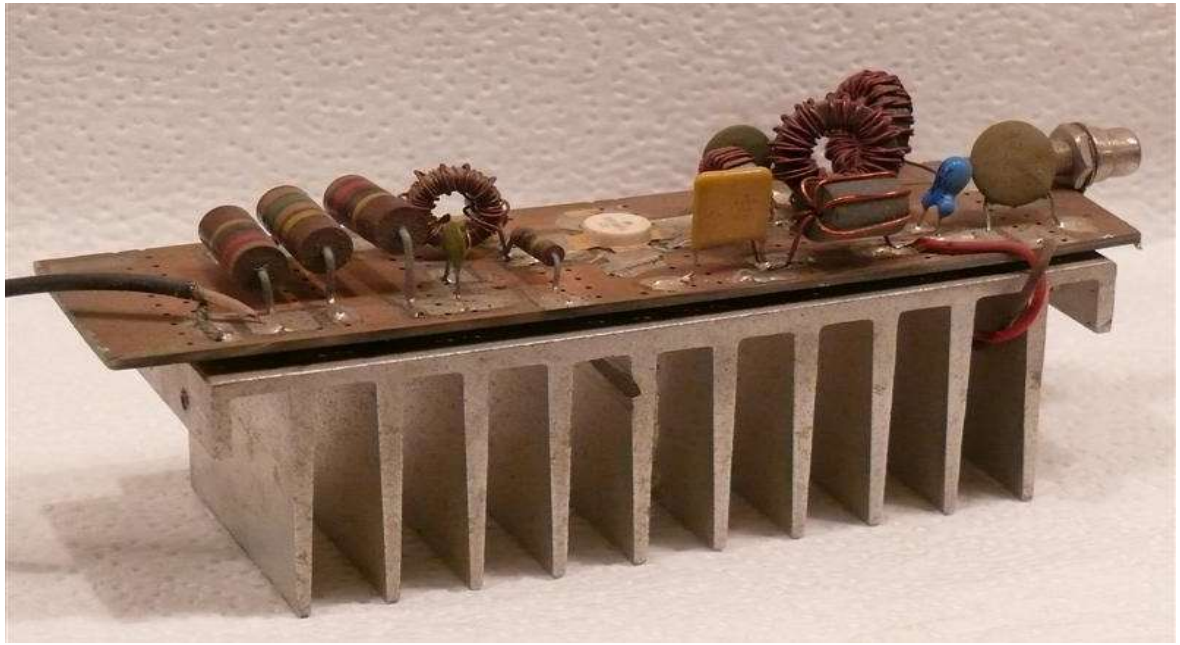
Effectiveness



January 2016 160 Meter Contest results using FT-817 @ 5 watts

Need More Power?

- Solid State Amplifier
  - Easy to build
  - Parts readily available
  - Operate from battery



40 Meter Amp

2w input, 20 Watts output

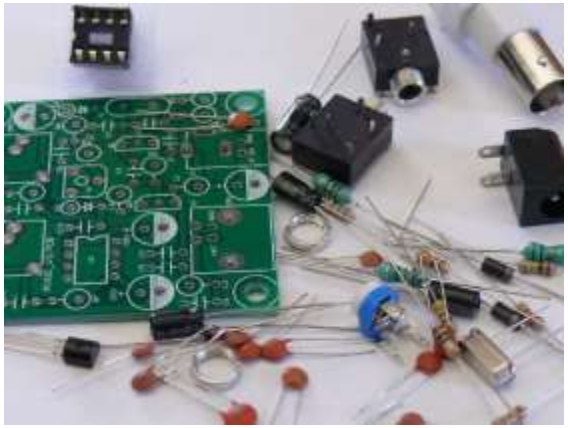
Designed & built by WB9JIC

Operating Tips

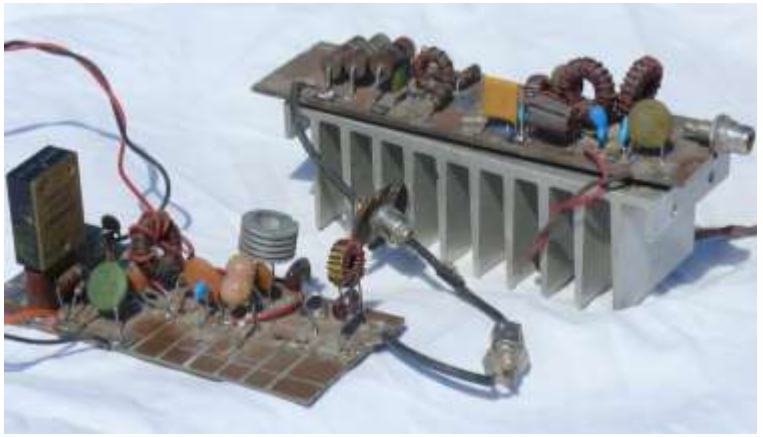
- Call strong stations
- It’s easier to answer a CQ
- Use the best antenna available
- Select the best band noise / propagation combination

Small Wonder SW-20, 2W 20M Xcvr

Lots of Options



The Pixie – 40 M xtal controlled direct conversion transceiver. About 1 watt output on 7.123 MHz.



Homebrew xmtr, 2 W on 40M with amplifier

Yeasu FT-817

Final Thoughts

- Pioneer 10 operated for more than 30 years. The last transmission was on Jan 22, 2003. The spacecraft sent an 8 watt signal 7.6 billion miles
- Ham radio long distance power record set in 1970- 1,650 miles, 1 µW, 1.6 billion miles / watt
- Military field communications are typically about 10 watts
- FCC Rule 97.67b – Amateur stations shall use the minimum amount of transmitter power necessary…

Pioneer 10 Satellite

Photo: NASA