

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

*Would you believe
a quality transceiver
for only \$49⁹⁵?*



POWER MITE PM 1

- 40-80 meters. 15 meter converter available.
- Crystal control or transceive operation.*
- Slide-rule dial. Flywheel tuning.
- Power—12 volt lantern battery.
- Front panel band switching.
- Shaped audio—200-2500 Hz.
- Metered power amplifier stage.
- Silicon transistors. Integrated circuit.
- 2 KHz receiving band width.
- 2 watts input to final stage.
- 100 cycles drift. No warm-up.

Model PM 1 \$49.95

The basic circuit modules used in the PM 1 are available. Tuning dial and full instructions included. Designed for bread board mounting. Complete circuit boards need only to be inter-connected. Model MR 1 \$29.95

Convenience Kit for MR 1. Meter, antenna switch, knob, connector and panels. Model AC 1 \$7.95

Side-tone monitor. For normal keying or practice. Model AC 2 \$5.95
15 meter converter. Covers 21.0-21.45 MHz. For PM 1 or MR 1. Model AC 3 \$8.95

Low power SWR meter. 1/4-250 watts. Model AC 4 \$14.95

Low power antenna tuner. Matches random length, twin-lead or open wire antennas. Model AC 5 \$8.95

* Transceive on 40-80 meters. Crystal only on 15 meters.

FOR FURTHER INFORMATION, WRITE:



TEN-TEC
INCORPORATED
Dept. Q-11-9
SEVIERVILLE, TENNESSEE 37862

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

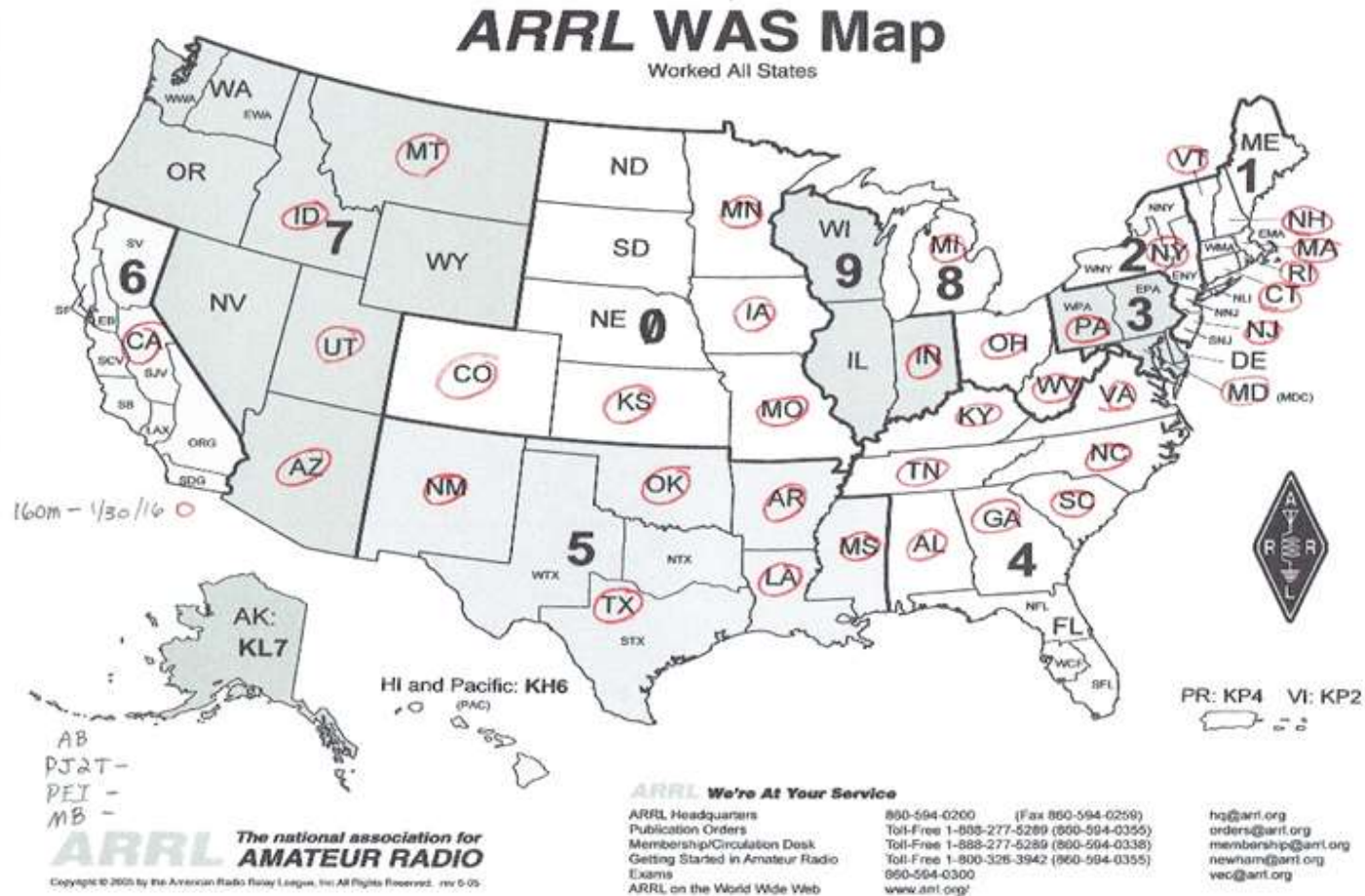


100 W signal is S9. Reduce power to 5 W.
What is the change in the S-meter reading?

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

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

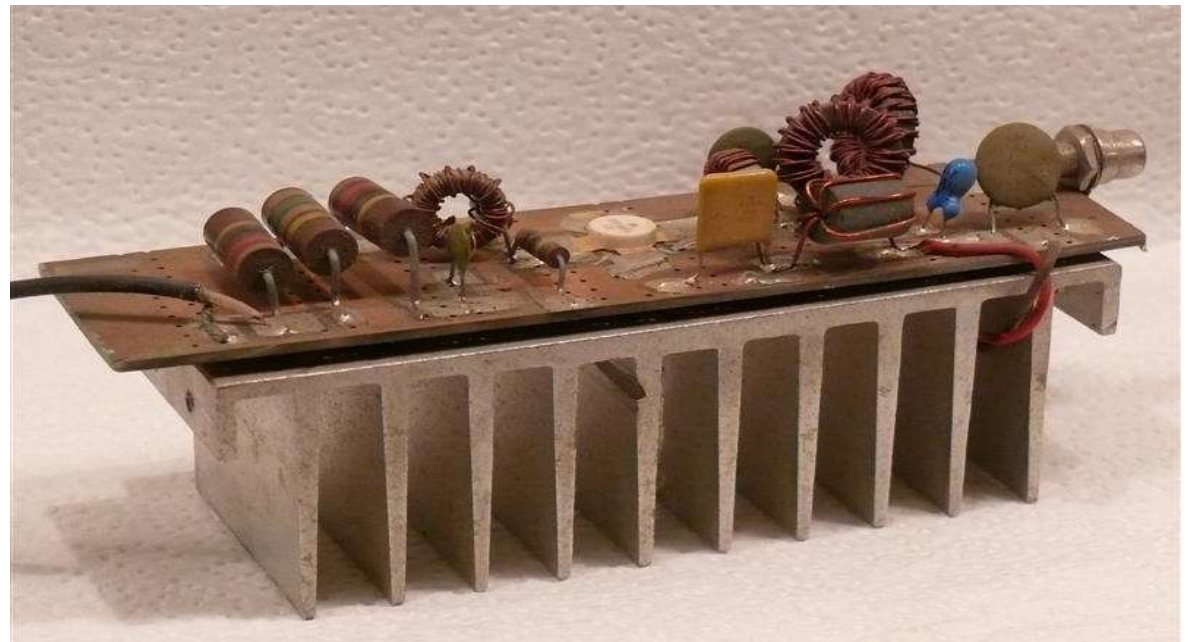
Effectiveness



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

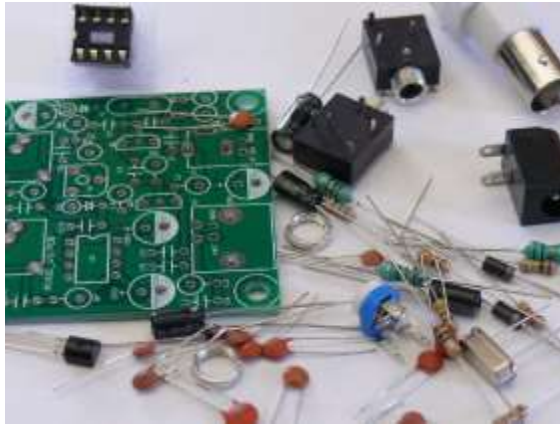
Operating Tips

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

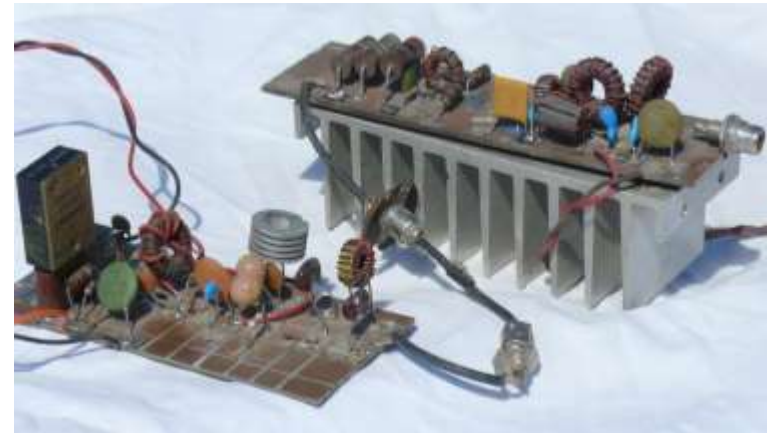


Small Wonder SW-20, 2W 20M Xcvr

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



Yaesu 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 μ W, 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