



QRP, QRPp and QRPpp

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What is “QRP?”

- A Q-signal
 - “QRP” means to lower your power
 - “QRP?” means “Can you lower your power?”
- Technically speaking...
 - 5 watts or less on CW
 - 10 watts (PEP) or less on SSB
- QRPp – 1 watt or less
- QRPpp – 100 milliwatts or less



How can I operate QRP?

- Use a “QRP” radio
 - Commercially made or a kit
- Use your present radio and turn the power down
 - Most modern rigs will go to 5 watts or less
 - Some will go to 100 mW



Why operate QRP?

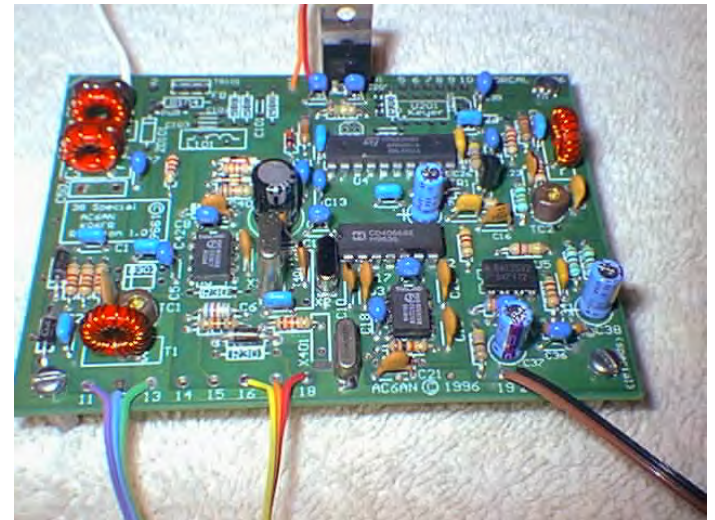


- To comply with Part 97 of the FCC rules
 - Open to vast interpretation
 - “Life is too short for QRP”
 - “Power is no substitute for skill”
 - “Use wits not watts”
- Signal strength allows it
- Safer for you, family & public (RF exposure)
- Minimizes possibility of TVI/RFI
- Simplicity of equipment (heat, power supplies, etc)
- Kit building & home brewing (incl “Manhattan”)
- Get out of the house / HOA’s / Portable operating
- Improve your skills (frequency, distance, time of day)
- It’s fun and challenging



QRP Fun Facts

- Pioneer 10 spacecraft used 8 watts to communicate 6.8 billion miles back to Earth before losing contact in 2003
- Most military comm radios are 10 watts or less
- Typical cell phone maximum output is 600 mW
- Bluetooth output is 1 mW





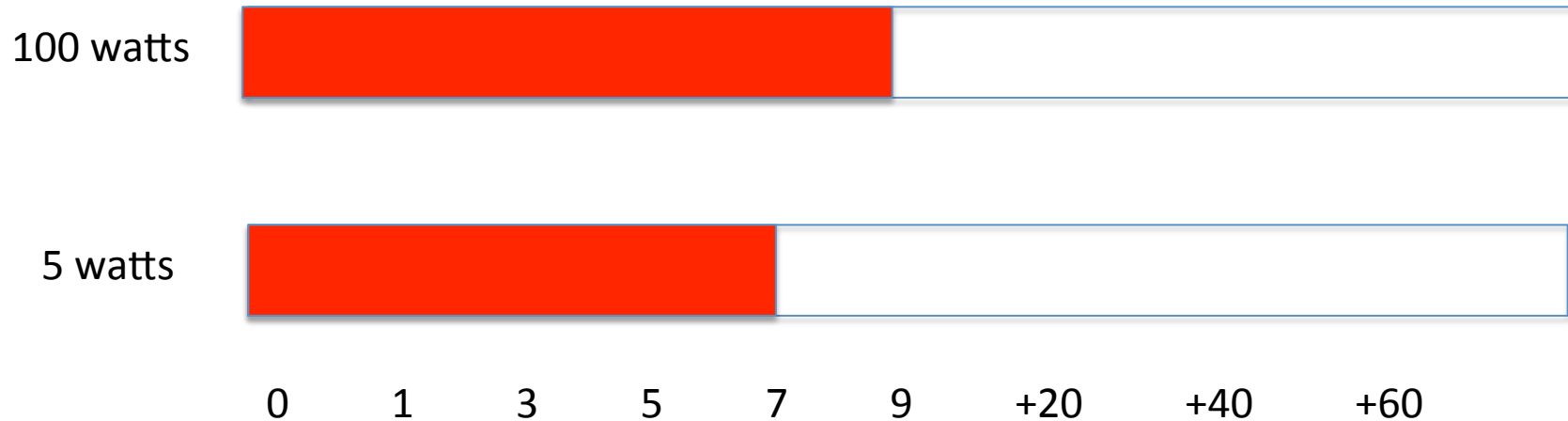
Mathematics of QRP

- Signal strength varies logarithmically with power
- Gain (db) = $10 * \log(P2/P1)$
- One S-Unit is 6 db
- Example:
 - Increase from 5 watts to 100 (20x)
 - 20x increase in power = 13 db gain
 - 13 db gain gives improvement of about TWO S-units!!





Signal strength



What does this mean to you?

Your 5 watt (or less) signal can be heard!!



Said another way...

S-Meter

Power

1 S Unit = 6dB

S9 + 20 dB

10,000 Watts

S9 + 10dB

1,000

S 9

100

S 8

25

S 7

6.25

S 6

1.6

S 5

391 Milliwatts

S 4

98

S 3

24

S 2

6

S 1

1.5



CW versus SSB

CW signal bandwidth = 100 Hz (nominal)

SSB bandwidth = 2000 Hz

Morse has much lower throughput...but...

Average power density (at 100 watts)

CW - 1 watt/Hz

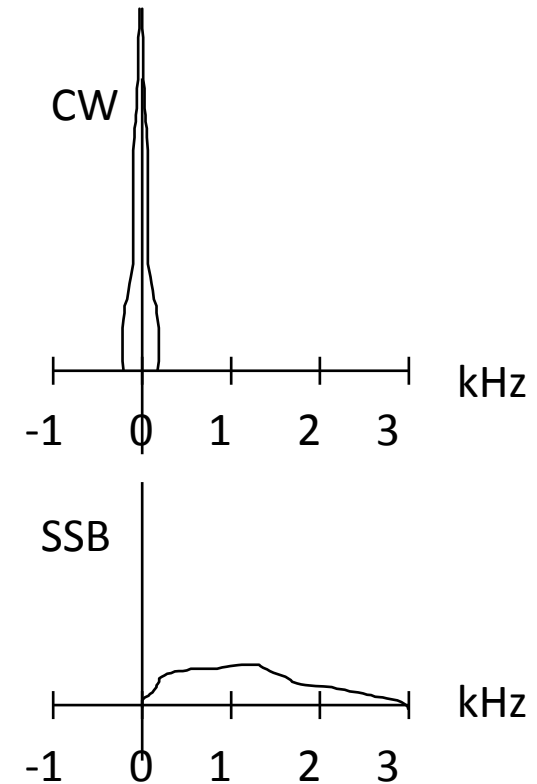
SSB - 0.05 watts/Hz

Which leads to...

Gain = $10 * \log (1.00/0.05) = 13 \text{ db!}$

5w CW is equivalent to 100w SSB!

Narrow digital modes enjoy similar advantages.



Output power = 100w



Implications

- Most (but not all) QRP contacts are either CW or a digital mode
- If you want to operate QRP, plan on (learning) CW or using a digital mode
- SSB is common, possible and many folks do it
- It is, however, more challenging





QRP advantages

- Size & weight increase with higher power. The reverse is also true.
- Simplify & minimize current draw
 - No lamps, use LED's instead
 - No digital display unless an LCD
 - Maximize transmitter efficiency
 - As few components as possible. Use IC's.
 - Need a sensitive receiver.
- Some QRP receivers out-perform "big rigs"



Size & weight vs. power

100 watt rig:

Icom 746/756	12 lbs
Tuner	6 lbs
Power supply	5-25 lbs (Switcher vs. Linear)
Total	23 – 43 lbs Trunk of car

QRP rig:

Yaesu 817/KX-3	2 lbs
Tuner	0-2 lbs
PS / battery	3 lbs
Total	5-7 lbs Backpack





Power requirements

To operate for a day (24 hours) 10% TX, 90% RX duty cycle:

- Compact HF rig (2A RX, 10A avg. TX)
 - $2.8 \text{ AH} * 24 = 67.2 \text{ AH}$ (car battery)
- QRP rig (150 mA RX, 1A avg. TX)
 - $235 \text{ mA} * 24 = 5.64 \text{ AH}$ (2-3 lb gel cell)



QRP Operating activities

- DX-ing (DXCC and WAS)
- Contesting – categories for QRP
- VHF/UHF – beams are your friend
- Parks & cars
- Vacations & picnics
- Mountaintops
- QRPp or QRPpp
- Miles Per Watt (MPW)





Antennas

- Most important part of any station
- QRP is not the place to skimp on antennas
- Try for a dipole, decent vertical or end-fed
- Buddi Pole or Super Antenna are OK
- Yes, your TH7-DX or SteppIR will work too!
- As low loss cable as you can
- Ladder line is better (less loss)
- Minimize connections, watt meters, etc.
- **Every (milli)watt counts**





Will I be heard???

- A simple test

- 100 watts vs. 5 watts = 13 db difference
- Switch in 10 db or 20 db attenuation
- Assuming everything else is equal....
 - If you can still hear the other station, there is a good chance he will hear you!
 - *May not work on very noisy bands*
- Use the Reverse Beacon Network !
 - <http://www.reversebeacon.net/>

Reverse Beacon Network



Firefox File Edit View History Bookmarks Tools Window Help

pughwj - Yahoo Mail DX = KC9IL spots - Rever...

www.reversebeacon.net/dxsd1/dxsd1.php?f=0&c=kc9il&t=dx

My Yahoo! Gmail Yahoo! Groups U-verse Portal Device List Facebook LinkedIn

REVERSE BEACON NETWORK

welcome main dx spots nodes downloads about contact us

show/hide my last filters

showing spots for DX call: KC9IL rows to show: 15

search spot by callsign

de	dx	freq	cq/dx	snr	speed	time
W4KKN	KC9IL	14052.0	CW CQ [LoTW]	5 dB	15 wpm	1901z 10 Aug
K4XD	KC9IL	14052.0	CW CQ [LoTW]	0 dB	15 wpm	1852z 10 Aug
VE2WU	KC9IL	14052.0	CW CQ [LoTW]	23 dB	16 wpm	1851z 10 Aug
NN3RP	KC9IL	14051.0	CW CQ [LoTW]	5 dB	15 wpm	1837z 10 Aug
AA4VV	KC9IL	14051.0	CW CQ [LoTW]	13 dB	15 wpm	1837z 10 Aug
K4XD	KC9IL	14051.0	CW CQ [LoTW]	10 dB	15 wpm	1837z 10 Aug
N2QT	KC9IL	14051.0	CW CQ [LoTW]	7 dB	15 wpm	1837z 10 Aug
W4KKN	KC9IL	14051.0	CW CQ [LoTW]	21 dB	15 wpm	1837z 10 Aug

100 mW

1 watt

10 watts



Rigs

- Commercial high power rigs (dial down)
- Commercial QRP kits
 - Complex or simple
 - All parts & enclosures
- Home brew kits from schematics
- DIY – your own design





Commercial QRP Rigs

Elecraft KX-3

Flex Radio 1500

TenTec 507 Patriot (SDR)

Yaesu FT-817, FT-301S

Ten-Tec Century 21, 22

Heath HW-7, 8, 9

Ten-Tec Argonaut 505, 509, 515, Argo 556

Ten-Tec Argonaut II

MFJ 92xx and 93xx series radios

Kenwood TS-130V

Icom 703, 731





Commercial QRP kits

NorCal 40A – 2 watt CW, 40 meters

Small Wonder Labs SW40+ 2 w, 40 meter CW

Wilderness Radio “Sierra” – all band CW

Oak Hills Research 100A – single band

Oak Hills Research OHR 500 – 5 band

Elecraft KX1 portable and K2 (intermediate size)





Home brew kits

- Tuna Tin 1 & 2 – 1 watt transmitter
- Herring Aid receiver
- Pixie transceiver
- NMOS “Ham Can” transceiver
- Rock Mite 500 mW transceiver
- Rainbow tuner





Mode Comparison

Typical S/N at 3 KHz:

- SSB +3 dB
- 300 baud packet +3dB
- RTTY -5.5 dB
- CW -10 dB
- PSK31 -11.5 dB
- JT-65A -26 dB
- JT-9 -27 dB



Mode Comparison versus SSB

- | <u>Mode</u> | <u>Typical Power – SSB Equivalent</u> |
|------------------------|---------------------------------------|
| - SSB +3 dB | 100 watts / 100 watts |
| - 300 baud packet +3dB | 50 / 50 |
| - RTTY -5.5 dB | 100 / 750 |
| - CW -10 dB | 100 / 2000 or 5 / 100 |
| - PSK31 -11.5 dB | 50 / 1500 |
| - JT-65A -26 dB | 25 / 20,000 or 5 / 4,000 |
| - JT-9 -27 dB | Slightly better than JT-65 |



Rules for Success

Listen, listen, listen!

Check worldwide beacon system for conditions

Look for strong stations (I like > S-9)

It is better to answer a CQ than calling CQ

Use the QRP calling frequencies

Use the best antenna you can

Use higher bands if open (20 is better than 40)

Upgrade for more frequencies & options

Try 30, 17 and 12 meters (Good for DX, less activity)



How far can I reach?

Digital & CW – anywhere in USA on 5 watts
DX and SSB – need reasonable conditions
40, 30, 20 and 17 meters are your friends

***** EXTREME QRPpp *****

World record on CW is 1.65 BILLION miles per watt

- 1,650 miles on 1 microwatt, 10 meters

I've done 213,757 MPW on CW

- 534 miles to Pennsylvania, 2.5 mW

- S-3 versus +10dB over S-9 @ 100 watts (-46dB)

- 40 meters, G5RV at 45 feet



QRP calling frequencies

	CW	SSB	NOVICE
160	1.810	1.910	
80	3.560	3.985	3.710
40	7.040	7.285	7.110
30	10.106		
20	14.060	14.285	
17	18.096	18.130	
15	21.060	21.385	21.110
12	24.906	24.950	
10	28.060	28.885	28.110
6	50.060	50.885	
2	144.060	144.285	



Clubs & Support Groups

NAQCC – North American QRP CW Club

SKCC – Straight Key Century Club

ARCI – QRP Amateur Radio Club Int'l

Flying Pigs QRP Club International

NorCal – Northern California QRP Club

HF Pack – (Pedestrian) portable operation

Adventure Radio Society

American QRP Club

FISTS





References

QRP club web sites (numerous)

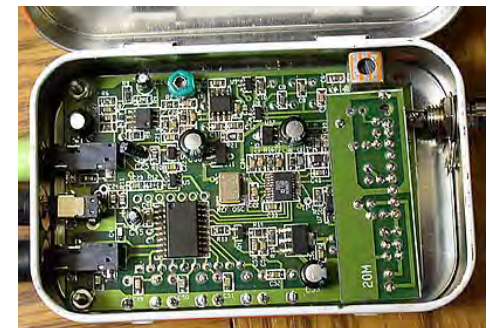
Newsletters (ARCI, NAQCC, SKCC)

Magazines (Homebrew, QRP Quarterly, SPRAT)

G-QRP Club – Great Britain

ARRL publications

“The History of QRP” and “The Joy of QRP”





NSRC QRP Campfire Night

Emily Oaks Park in Skokie

Tuesday September 8th, 7:00 – 9:00 PM

Not a contest, but we will recognize “winners”

Miles Per Watt (MPW)

SSB, CW, Digital modes

Commercial rigs vs. Kits/Home made

Come out and have fun!



***QRP..... “When you care
enough to send the very
least!”***

“72” and good DX OM!