

# Why QRP?

*An Update on the Joys of Low-Power  
Ham Radio – 5 watts or less!*

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<http://www.njqrp.club>

<http://www.bosquearc.com>

**QRP**

*Ver 4.0 5/27/2024*

**Page 1**

# What is “QRP?”

A telegraphy Q-signal

“QRP” = To lower one’s power

“QRP?” = Can you lower your power?

Five watts RF output power (or less!)

Use a “QRP” rig, or

Reduce power on your radio

Only 5 watts?  
You must be  
kidding...

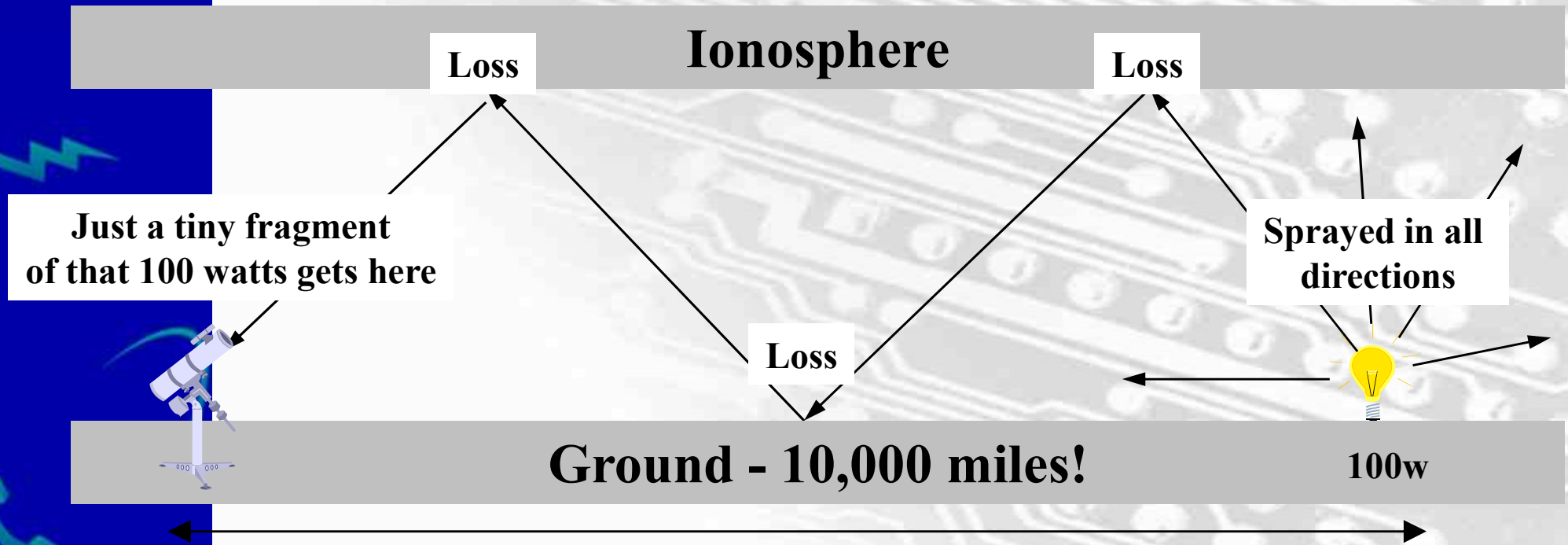
# Background

“CQ” Magazine article by N2GJ – February, 2020, page 26, ff.

“QRP From There to Here”

- My history with QRP
- The NJ QRP Club ([www.njqrp.org](http://www.njqrp.org))
- QRP rigs I've owned and used
- New Mexico QRP operations

# A Pretty Amazing Analogy

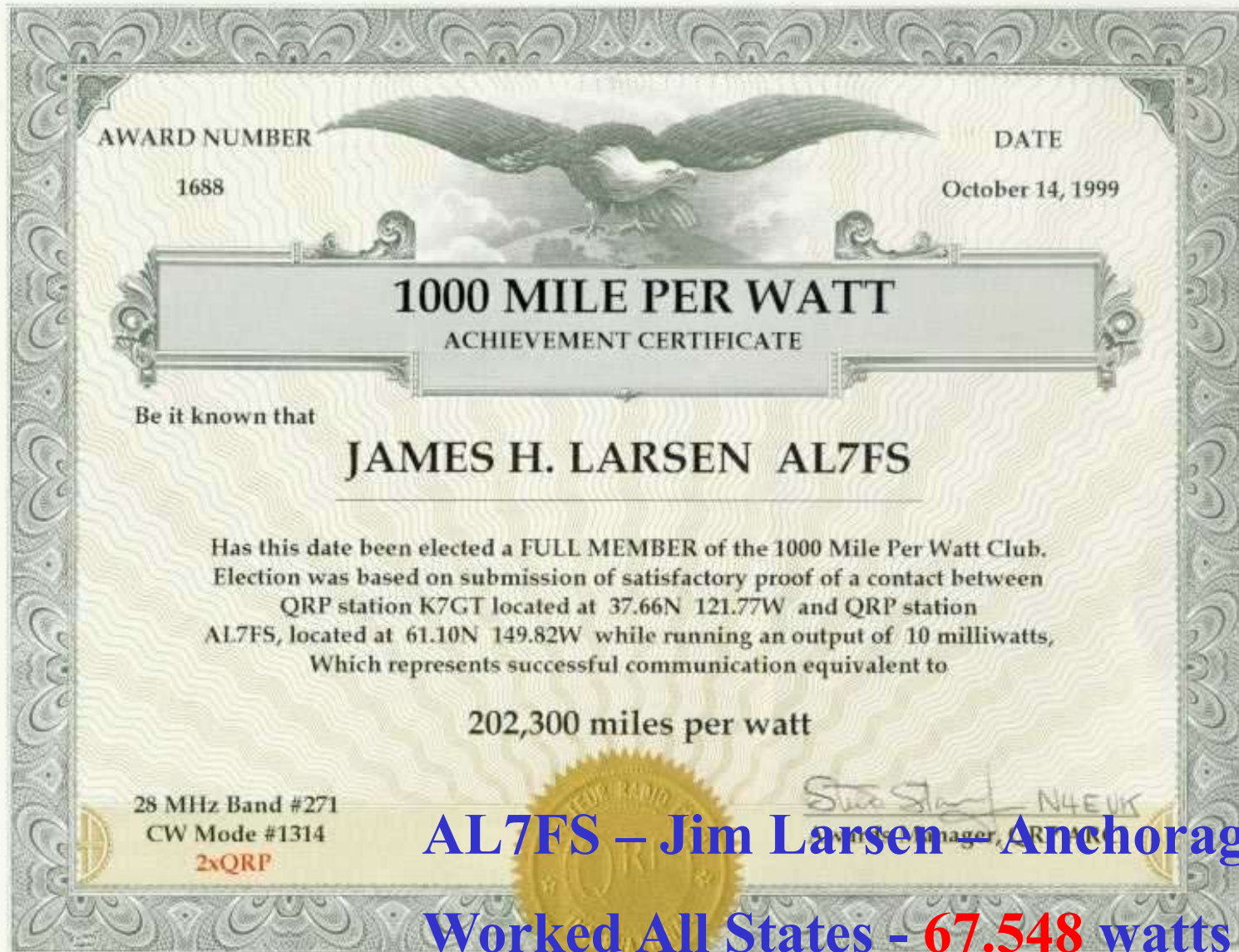


**Pretty amazing stuff, huh?**

**Now...replace the 100w light bulb with a 3 watt flashlight.**

**MAGIC!!! That's what it is!**

# Pretty Amazing Stuff



**AL7FS – Jim Larsen – Anchorage**

**Worked All States - 67.548 watts total**

**& in Year 2000 ~ 1.5M Miles per Watt**

**QRP**



# Part 97, FCC Rules

**“Run only the power necessary to maintain the desired communications.”**

**There is, of course, room for interpretation here...**

# Why QRP?

- Signal strength allows it
- Safer for you, your family, and the public
- Quality and simplicity of equipment
- Joys of homebrewing & kit-building
- Backpacking with lightweight gear
- Excellent way to improve skills
- It's fun!



# QRP Mathematics

Varies LOGARITHMICALLY with power

Gain (db) =  $10 * \log(P2/P1)$

ONE S-unit is 6 db

Example:

Increase from 5 to 100 watts (20x)

*20x* increase in power = *13 db gain*

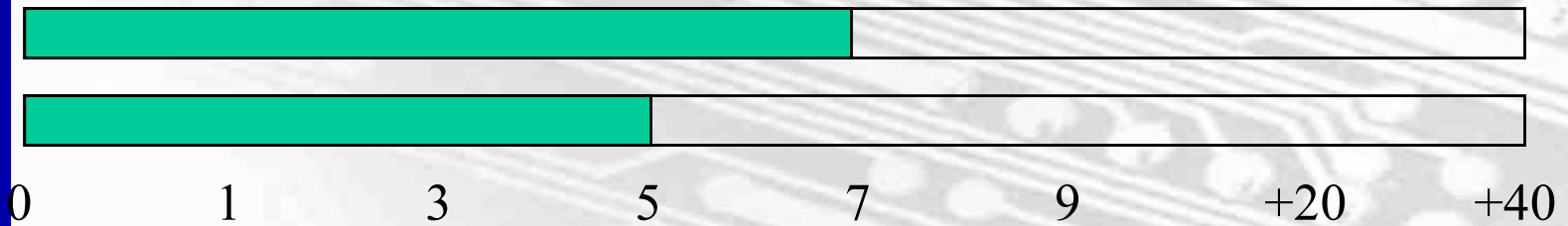
*13 db gain* gives gain of only *TWO S-units!!!*



# Signal Strength

100w

5w



**WHAT DOES THIS MEAN?**

**Your 5-watt signal *CAN* be heard.**

**QRP**

# Proof That It Works

**W3EAX Field Day, 1988**

**1200 QSOs with 3 radios & a pair of beams.**

**May, 1997 contest**

**31 countries with a mobile whip in 8 hours.**

**QRP Mobile, Yaesu FT-817 (<5 watts) on top of car!**

**Antarctica, Europe, VKs, ZLs, UA0s...**

**AA3MD**

**Over 125 countries confirmed in 24 mos. w/dipole.**

**N2RE Field Day, 2016**

**N2GJ with KX3 on battery power outscored 7 other stations' total using only an end-fed 40 meter long-wire!**

# Proof That It Works

## New Mexico QSO Party Activity

### NMQP Results

CALLSIGN	POWER	QSOs	SCORE	CLUB
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2023

N2GJ QRP NM **1** Amateur Radio Caravan Club

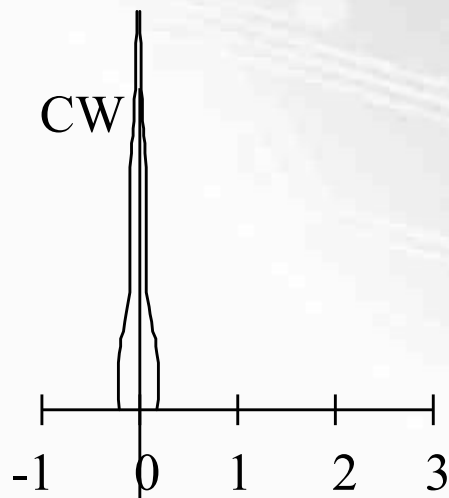
2022

N2GJ Low NM 17 12 **408** New Mexico Big River Contesters

2021

N2GJ QRP 47 21 **23,400** New Mexico Big River Contesters (Top Mobile/QRP score)

# CW vs. SSB



CW signal bandwidth = 100 Hz

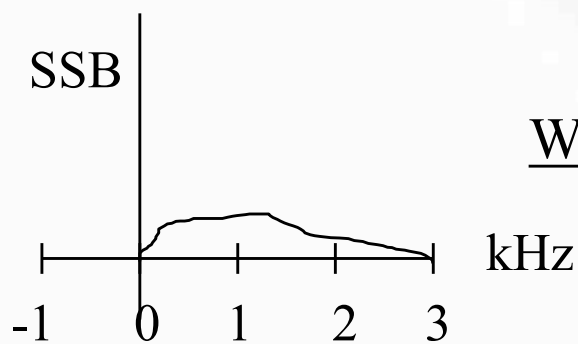
SSB bandwidth = 2000 Hz

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

Average power density

CW - 1 watt/Hz

SSB - 0.05 watts/Hz



Which leads to...

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

Output power = 100w

***5w CW is equivalent to 100w SSB!***

# What Does This Mean?

- **Most (but not all) QRP QSOs are CW QSOs**
- **Thus, if you plan to try QRP...**
  - Learn code, practice code, use code, dream code, etc.**
- **So, who does QRP SSB?**
  - Lots of people, but it's an even bigger challenge than CW QRP**

# QRP With 100w XCVRs

Most can be reduced to 5w from the front panel

Some require re-adjustment of internal controls

Some require physical modification, but you can also...

- 1) Use an RF-switched, 50-ohm, high-power attenuator
- 2) Play with ALC

nearly all 100w radios can drive amplifiers

certain voltage into the ALC jack reduces RF output

can often get down to the milliwatt range

# QRP “Optimization”

- 1) Size & weight increase with maximum output power
- 2) Minimize current draw
  - No lamps (except LEDs)
  - No digital display unless LCD
  - Maximize TX efficiency
- 3) Use few components & pack the board tightly
- 4) Use ICs if possible
- 5) Sensitive RX - If you can't hear 'em, you can't work 'em

# Size and Weight vs. Max. Power

Conventional 100w setup	ICOM 756 PRO III, etc.	~21 lb.
	* External Tuner	4 lbs.
	<u>Astron RS-20</u>	<u>25 lbs.</u>
	<b>TOTAL</b>	<b>50 lbs.</b>
	<b>TRANSPORT</b>	<b>Trunk of Car</b>
QRP setup	QRP rig	2 lbs.
	* Tuner	2 lbs.
	<u>Power supply/battery</u>	<u>3 lbs.</u>
	<b>TOTAL</b>	<b>7 lbs.</b>
	<b>TRANSPORT</b>	<b>Small Briefcase</b>

*\* Some QRP rigs have internal antenna tuner units*



# Power Requirements for a Day

To run for 24 hours - 10% transmit, 90% receive:

Conventional, compact HF rig (IC-706, Yaesu FT-890)

Receive - 2 amps...Xmit - 4 to 20 amps (avg. 10 amps)

**TOTAL CONSUMPTION - 67.2 A-H (a car battery)**

QRP-optimized rig

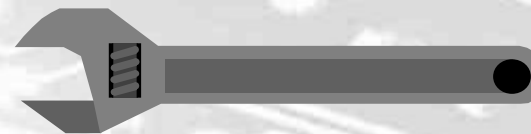
Receive - 100 milliamps...Xmit - 500 milliamps

**TOTAL CONSUMPTION - 3.36 A-H (a 3-lb. gel cell)**



# Kit building & Homebrewing

- Some hams are natural builders and experimenters
- Complete radios have been built from old TVs (Tubes are harder to kill than transistors)
- Thousands of schematics are available



# Kits

Hundreds of kits are currently available

Single- and multi-band transceivers

Antenna tuners (automatic ones, too!)

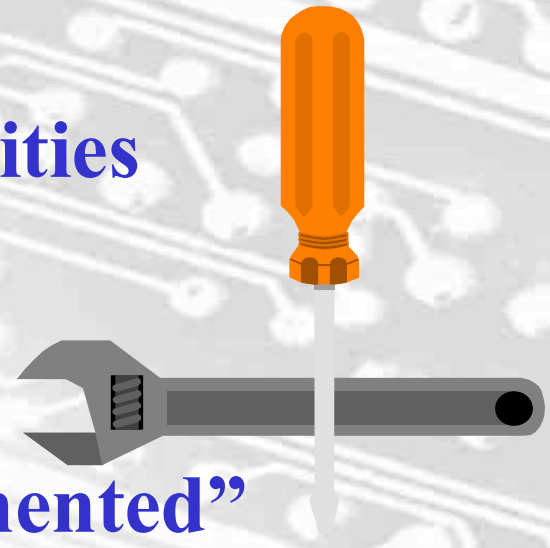
audio filters, electronic keyers

Made for a wide range of abilities

“U-scrounge-’em”

“Bag-o-parts and a board”

“Complete and fully documented”



# Antennas!!!

The most important part of ANY station

A radio hooked to a dummy load will hear almost nothing

Good coax

Good antenna tuner (with non-resonant antennas)

Well-built antennas

Beams work wonders, as do full-size loops

Dipoles, loops, and verticals work OK, too

*A poor antenna system hurts your receiver AND transmitter*



# Taking it to the Field

Mountaintop operation adds to a radio's performance!

SOTA = "Summits On The Air" is great fun!

Complete station:

- single-band rig

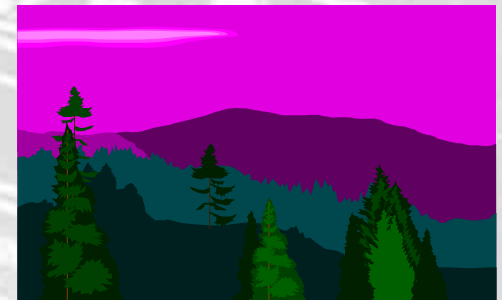
- dipole cut to proper length, with coax & rope

- straight key or iambic paddles w/electronic keyer

- Gel-cell (SLA/AGM) battery

- pen & paper for logging

- nice campsite with tall trees



# Taking to the Field, cont.

**“CQ” Magazine article “SOTA Adventures in New Mexico” – published in the April 2021 issue**

- **Definition of SOTA (Summits On The Air)**
- **Officially began in the UK in 2002**
- **Activators and Chasers**
- **Local “Heroes”: George Yoakum WB5USB, and Tim Keene K5DEZ**
- **And now we have POTA, too! Parks on the Air**
- **Began as NPOTA (National Parks on the Air) in 2016**
- **Hugely popular activity <https://parksontheair.com/>**

# More on SOTA & POTA

- **How to get started**
- **Pre- and Post activation reports**
- **Helpful URLs**
- **Equipment suggestions**
- **Opportunities for wonderful photographs of New Mexico vistas**
- **Ed Poccia KC2LM “NM Outback ops”**
- **Rob Summerhill KI5 “No Bad News!”**

# QRP DX-ing

**There are two rules for QRP DX-ing:**

- 1) Listen, listen, listen**
- 2) When in doubt, see rule #1**

**Put your signal where and when the others aren't  
Let others QRM each other, and pick your spot**

**Try to get in BEFORE the pileup starts! (see rule #1,  
above)**



# QRP Contesting

Great way to pick up QSOs, countries, states, continents

Good operators with good ears

Equipment & antennae are optimized

Lots of QRP-only contests

Sponsored by clubs – some contests just a few hours!

Many QRP categories in larger contests

My favorite non-contest - link: [FIELD DAY](#)

2024 ARRL Field Day is June 22-23

**You DO have a chance!**

# My Favorite Thing to Hear...

“HOW much power are you  
running? A watt?  
Really? No way.”

**“Way.”**

# VHF QRP? Yes!

5 watts into a 20-element Yagi can do VERY well

Much 1296, 2304, 3456, and higher equipment is homebrewed, and is already QRP

On 6 meters, 5w and a dipole is more than adequate

Sporadic-E season is upon us

Lots of people DO have beams

Use THEIR antennas to your advantage

# Even More Challenging

**QRPP - aka “Milli-watting”**

**Defined as less than 1 watt**

**Big antennas can make up for low power**

**Worked CN (Morocco) at 200 mW**

**AA2U has DXCC at under 100 mW**

**Even modest antennas work well, though**

**MD - FL on 30m - dipoles & 25 mW output**

**SSB/Digital**

**Wider bandwidth, lower power spectral densities!**

# Digital Modes & QRPp are perfect together!

WSJT = A smorgasbord of digital software (written by K1JT, 1993 Physics Nobel Prize winner, Dr. Joseph Taylor, AKA “just Joe!”)

Suite includes, among *many* others:

WSPR = Weak Signal Propagation Reporter

JT65 = keyboard to keyboard QSOs, used mostly on HF, mostly superseded by FT8/FT4

JT6M = optimized for meteor scatter

JT9 = experimental version

# Presentation Appendices

Slides 32 to the end highlight equipment, show photos of some QRP radios, discuss antennas, and offer additional resources.

All slides will be posted to the club website.

73,

Gerry with a G (N2GJ) [n2gj@arri.net](mailto:n2gj@arri.net)

(609) 937-2315

# Some Commercial QRP Rigs

Elecraft makes several new KH1- I've owned the KX1, KX2 & KX3, Baab W9YA has the KH1

ICOM IC-705/706 (160m, 2m and 70cm) – I've owned these!

lab599 Discovery TX-500 – Baab W9YA loves his!

Yaesu FT-817, FT-817ND, FT-818 – I've owned several!

XIEGU X6200 HF Transceiver – other models, too.

Ten-Tec made several very popular models

Oak Hills Research 100a (single-band)

MFJ 90xx (CW), 94xx (SSB) (single-band, *not* kits!)- I have 40m

NN1G Small Wonder Labs SW40, NE40-40 (single-band)

W6EMT (SK) Emtech (single-band)

Kanga UK/US

Wilderness Sierra, Cascade, SST, and NorCal 40A

# Other QRP Equipment

## Direct Conversion Radios

Heath HW-7, HW-8, Ten-Tec Century 21, 22

## Super heterodyne transceivers

Heath HW-9

Ten-Tec Eagle 599AT, Argonaut 505, 509, 515, 539,  
Argo 556, Argonaut II, 506 “Rebel”, 507 “Patriot”

A&A Engineering K9AY 20, 30, 40m

Yaesu FT-817/817ND, Kenwood TS-130V, ICOM 703



# Club Projects

**Northern California (NorCal) QRP Club**

**Sierra, Cascade, 40a, 40-9er, 38 Special**

**NJ QRP Club**

**Rainbow Tuner, SDR Cube system**

**St. Louis QRP Club**

**W6MMA, St. Louis Vertical**



# PHOTO GALLERY

- **Equipment**
- **Antennas**
- **Websites**
- **Clubs**
- **Field Sites**
- **Newsletters/Journals**

# Yaesu FT-818



QRP all-mode, 6 watts, 160-6m, 2m and  
70 cm bands

**QRP**

# Yaesu FT-817/818

## lab599 Discovery TX-500



# XIEGU X6200 HF Transceiver



+



# NEW!!! Elecraft KH1



# Elecraft KX1 (Discontinued, highly-prized!)



- *Up to 4 bands*
- *CW Transmit, multi-mode receive*
- *Internal AA batteries*
- *1-2 watts output*



**QRP**

# Elecraft KX2

- *80-10 meters*
- *10 watts output*
- *Internal AA batteries*
- *All mode*
- *Person-mobile operation with whip antenna*





# Elecraft KX3

- *160-6 meters*
- *15 watts output (w/external 12 vdc)*
- *Internal AA batteries*
- *All mode + optional Panadapter PX3*
- *KPA100 amplifier for base station use*
- *Best QRP Field Day rig ever!*



# ICOM IC-705

- *160 meters-70 centimeters, all-mode*
- *5 watts output (10 watts w/external 12 vdc)*
- *Supplied handi-talkie battery from ID-51A*
- *Touch-screen, bright, responsive, same size as the IC-7300 screen!*
- *No internal antenna tuner (yet?)*



# Ultimate3S QRSS/WSPR Kit

- *The Ultimate3S QRSS/WSPR Transmitter Kit transmits various QRSS, Hell, Opera, PI4 and WSPR slow-signal modes on any LF, MF, HF or VHF band (all amateur bands from 2200m to 2m or 222MHz).*
- *From QRP Labs - <http://www.qrp-labs.com/>*



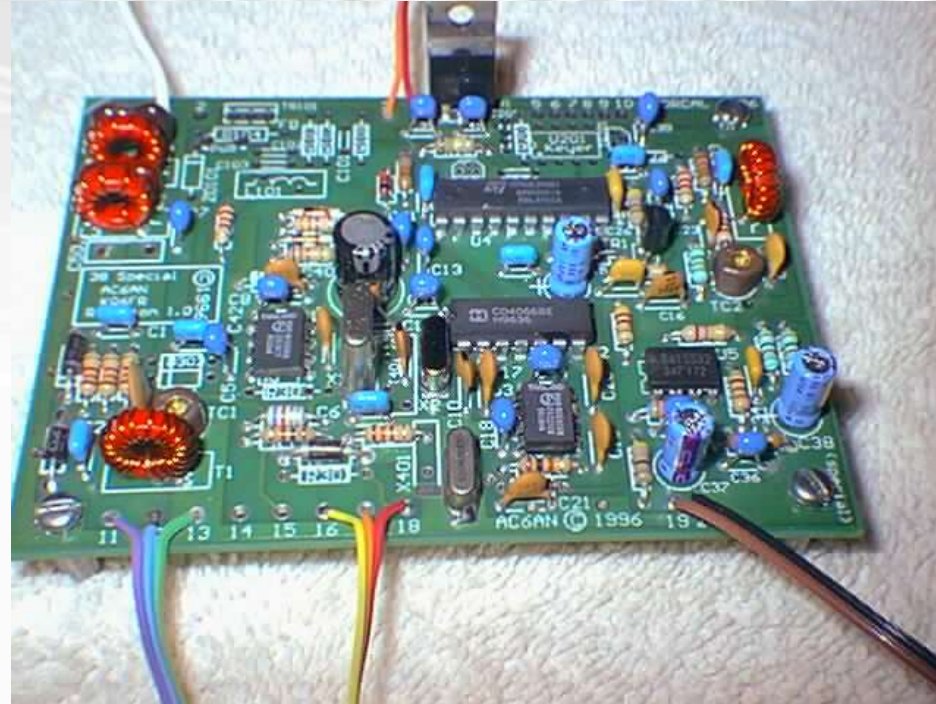
# The “Pixie”

Bruce Hopkins - KL7H built his for 3.920 and 3.933. Check-ins were successful with net control on both Motley and Snipers Nets



- Simple 250mW transceiver kit from HSC Electronics

# The NorCal “38 Special”



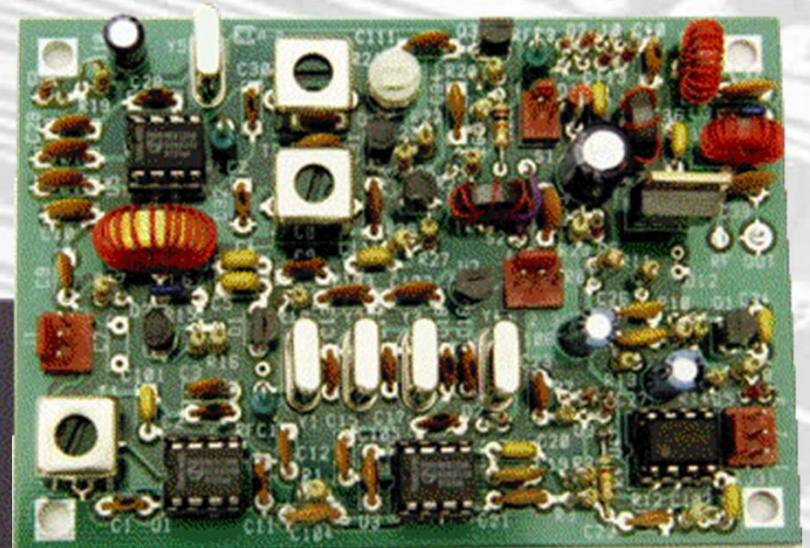
- 30m superhet CW kit from NorCal Club
- 2W output, wide VXO
- Very popular as instructional kit

# N2APB's "38 Special"



- Custom cabinetry in LMB enclosure

# Small Wonder Labs' "SW40+"



- 40m 2W CW transceiver
- Improved, simplified

# Small Wonder Labs' "White Mountain 20m SSB"



- 20m 2W QRP SSB transceiver
- Solid design
- Easy construction



# The “Sierra” by Wilderness Radio



- All band CW transceiver
- Superhet, VFO
- Dig display & key options
- Removable band modules
- Rivals quality of rigs 5x \$
- ARRL Handbook cover '96

# The NorCal 20

- 20m superhet CW
- great front end
- Norcal kit for 3rd world countries



# The NorCal 40A

©1996, Steve Hideg



©1996, Steve Hideg



- 40m 2W CW transceiver
- Grandfather deluxe

**QRP**

# OHR



- 4 band superhet CW rig

# Index Labs' "QRP Plus"



- Super stable QRP rig
- Great user interface

**QRP**

# Ten Tec Argonaut 515



©1995 Steve Hideo

- QRP for CW and SSB

# Ten Tec 507 “Patriot”



- QRP for CW and SSB
- Open-Source, Arduino-based
- <https://www.tentec.com/507-patriot-ssb-cw-grp/>

# Heathkit HW-8



- 4 band direct conversion CW QRP rig

**QRP**



# The “Tuna Tin 2”



- Simple Tx, less than 1W
- W1FB original design

# “Herring Aid” Receiver

Fully Built-Up Herring Aid 5 Board  
Circuit Update by Glen VK1FB  
Artwork by Doug KI6DS  
Board by Gary N2JGU  
Digital Image by Kodak DVC-323  
February 15, 1998 11:56 ET



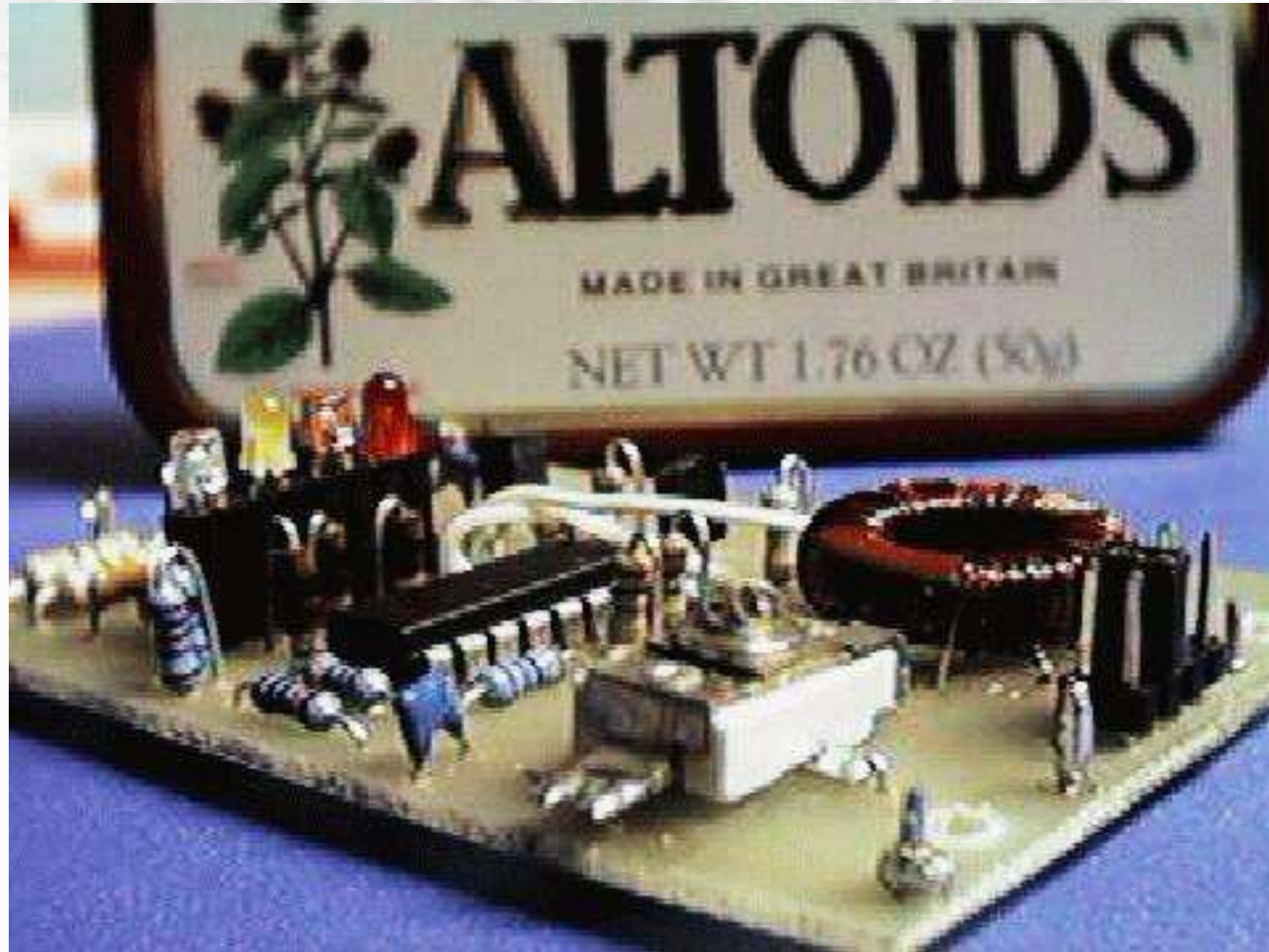
- Simple Rx project
- Mate to Tuna Tin 2 transmitter

# Portable Paddles



- N2APB enclosure for New Zealand ARC project

# N2CX “Rainbow Tuner”



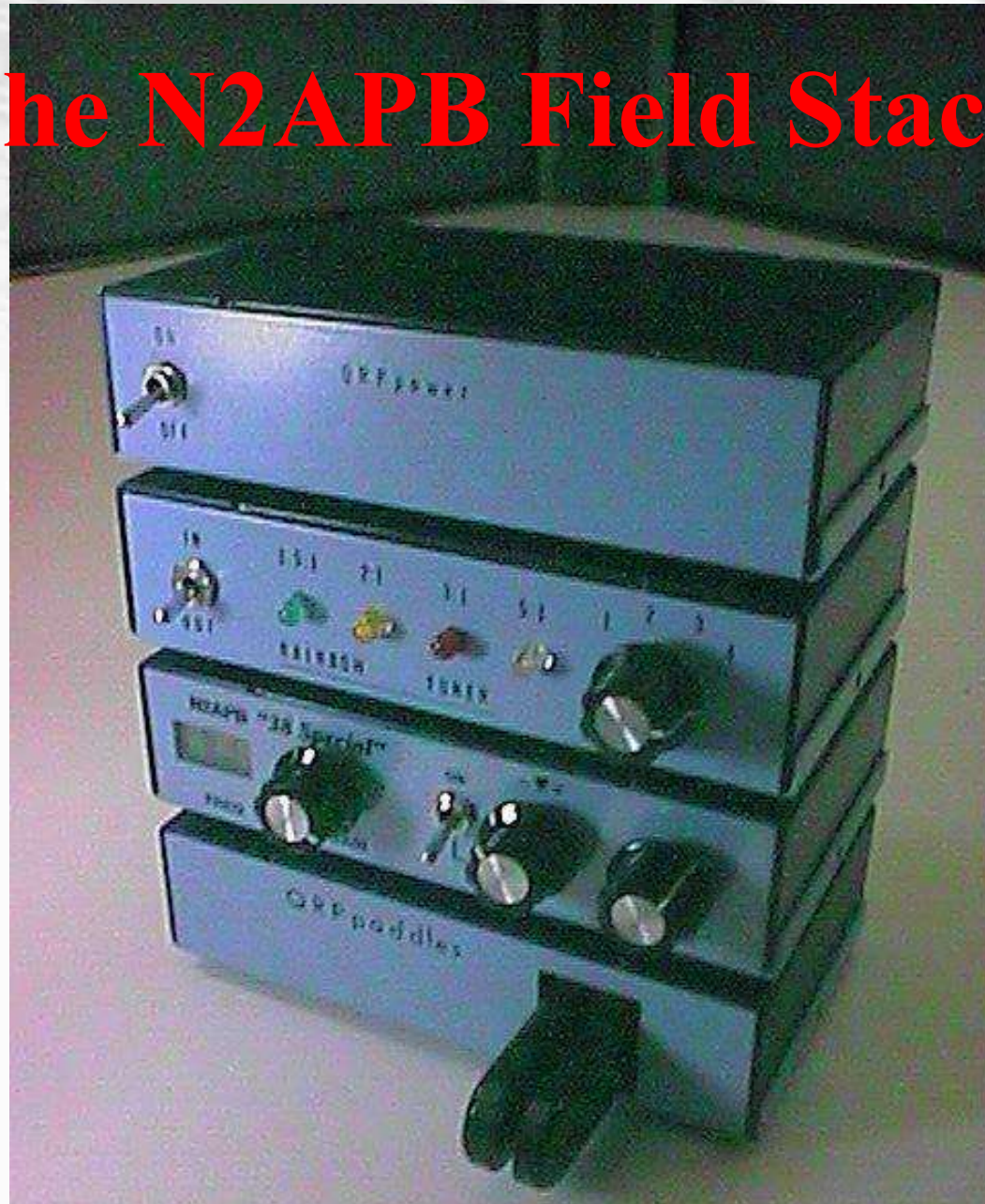
- Kitted by the NJ-QRP club
- Resistive (absorptive) SWR bridge w/LED indicators
- Built-in tuner suited for half-wave end-fed antennas

# N2APB's "Rainbow Tuner"



- Custom enclosure with panel mounted switch for tuner inductor settings

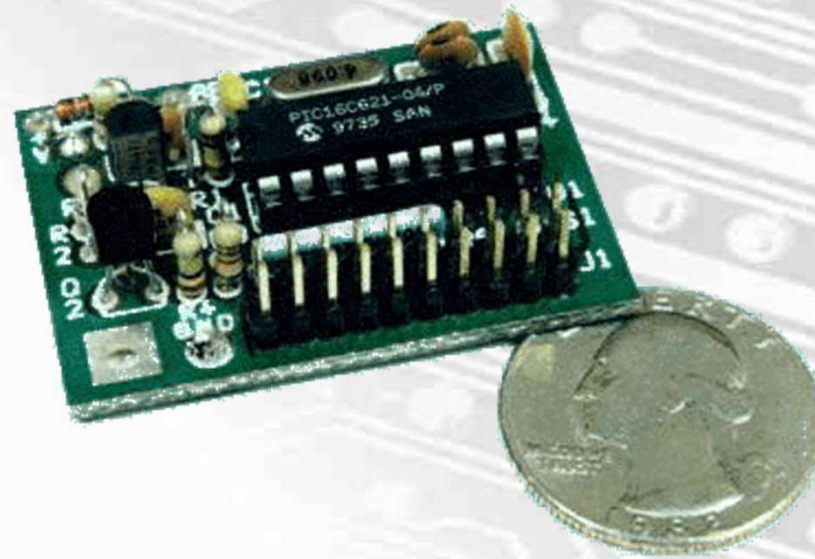
# The N2APB Field Stack



- Batteries
- Rainbow Tuner
- 38S Xcvr
- QRP paddles

This is what N2APB takes on biz trips (along with “Halfer” half-wave end-fed wire for 30m). Easily fits in small briefcase! Page 62

# A Simple and Inexpensive Morse Frequency Display



- Small Wonder Labs' "Freq Mite"
- PIC microcontroller as digital frequency meter

# Miniature QRP Paddles



- Original design by WK8G



# The NorCal Paddles



- First club project not being electronic-related
- Unfinished kit ... yields superior quality

# Mini-Keys from Whiterook

Pocket  
Micro-Key



MK-11

Pocket  
Mini-Key



MK-22

Iambic  
Mini-Paddle



MK-44

Single Lever  
Mini-Paddle



MK-33

All images © 1998 The Whiterook Products Company

- Great for portable use!

# My German Keyer Paddle



Bestellung BaMaTech <[bestellung@bamatech.de](mailto:bestellung@bamatech.de)>



# Portable Antennas

- **Gusher (by N2CX-SK)**  
**40m dipole, insulators, RG-174 feedline**
- **Halfer (by N2CX-SK)**  
**40m half wave end-fed w/ 1/4w counterpoise**
- **St. Louis Vertical**  
**Center loaded collapsible fishing pole w/radials**
- **Wolf River Coils Antenna**  
**<https://www.wolfrivercoils.com/>**

# The St. Louis Vertical: "SLV"



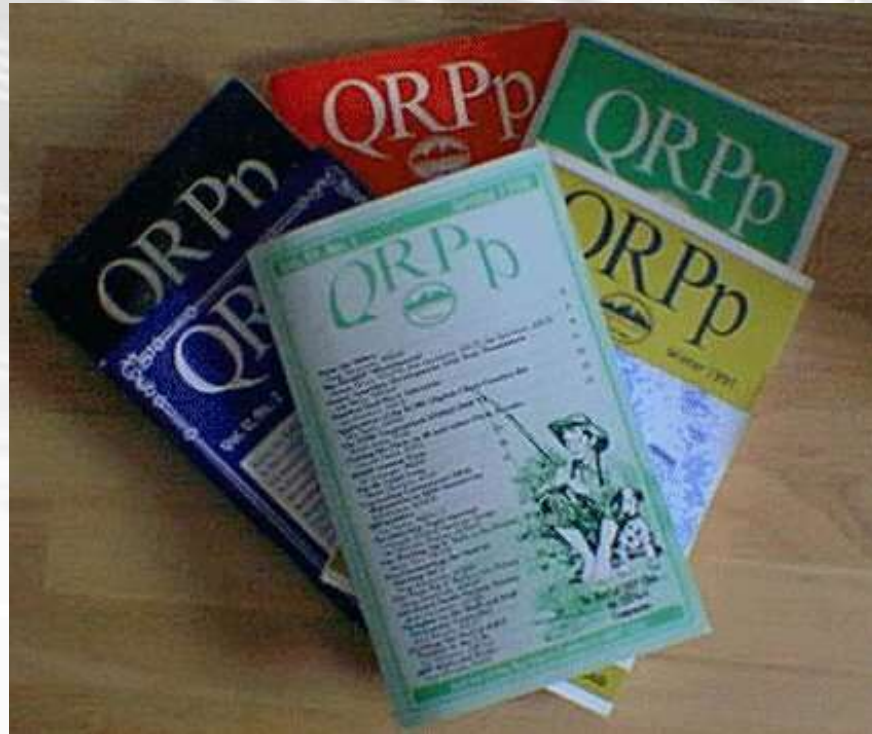
- Center-loaded multi-band half-wave vertical
- On a collapsible fishing rod w/rotor cable radials

# N2CX (SK) on QRP Field Day



- Using Argonaut, Rainbow Tuner & Half-wave end-fed

# QRP Publications



- The mainstay of QRP information
  - QRPPp from NorCal
  - QRP Quarterly from ARCI
  - SPRAT from G-QRP

# QRP Websites



QRP is FUN!

Low Power **BigResults**

Welcome to the QRP Amateur Radio Club International home page.

- QRP ARCI is superset of all QRP clubs
- <http://www.qrparci.org>

**QRP**



# New Jersey QRP Club



## Welcome!

Here's where the New Jersey QRP Club membership hangs out. You'll find our club projects, member list, activities, technical interests, and topics of general interest to the QRP community. Give us a browse and let us know

JULY

Vote on THIS club QSL design!

Field Day Results

<http://www.njqrp.club>

QRP

# Recap...again, “Why QRP?”

- You can throw a QRP station in your backpack but you don't need to be portable to enjoy QRP operation
- Conserves power and enables re-use of bandwidth
- Hone building and operating skills
- It's FUN!



# “Why QRP?”

- Safer for you, your family, and the public
- Less QRM to TVs, stereos, phones, etc.
- Because it’s a challenge, and it’s fun
- Working into Sweden on 100w is easy, at one watt, it becomes “really cool!”

“Why not?”



# QRP Clubs (1 of 2)

*New Jersey QRP Club (NJQRP)*

*Website at <http://www.njqrp.club>*

*Kits: SDR Cube stack*

*Activities: Free membership, “virtual” meetings using TeamViewer, club projects, radio field outings*

*Northern California QRP Club (NorCal)*

*Website at <http://www.norcalqrp.org>*

*Kits: Various*

*Activities: Free membership, regular social gatherings, club projects, radio field outings*



# QRP Clubs (2 of 2)

*QRP Amateur Radio Club International (QRP ARCI)*

*Website at <http://www.qrparci.org/>*

*Activities: Publish "QRP Quarterly" magazine, Four Days in May (FDIM) at Dayton Hamvention, contests, awards*

*G-QRP Club*

*Website at <http://www.gqrp.com/>*

*Kits: The GQRP "Limerick Sudden" 40m Transmitter Kit to match the Sudden Receiver, and matching antenna tuner unit*

*Activities: Publish "Sprat" magazine, annual convention*

# QRP References: Literature

- *“CQ” Magazine article, February 2020,*
- *“QRP From There to Here” by N2GJ, pp. 26 ff.*
- *“CQ” Magazine article, March 2021,*
- *“SOTA Adventures in New Mexico” by N2GJ, pp. 12 ff.*

# QRP References: Literature

- QRP Power, published by the ARRL
- QRP Classics, published by the ARRL
- W1FB's QRP Notebook, published by the ARRL
- The History of QRP, by Adrian Weiss, W0RSP, ISBN 0-9614139-1-3
- The Joy of QRP, by Adrian Weiss, W0RSP, ISBN 0-9614139-0-5

*... and many, many more!*

# Acknowledgements

- **George Heron N2APB**
- **Joe Everhart N2CX (SK)**
- **John DeGood NU3E**
- **James Larsen AL7FS**
- **George Yoakum WB5USB**
- **Tim Keene K5DEZ**
- **Bob Longoria N5JH**
- **ARRL [www.arrl.org](http://www.arrl.org)**



# Questions/Comments?

Please do not hesitate to contact me about any facet of amateur radio. If I don't know the answer to your questions myself, I probably know someone (or someone who knows someone) who does!

Gerry Jurrens N2GJ

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