·CTU·
CONTEST UNIVERSITY

Contest University
ARRL National Convention
February 10, 2022
Double Tree by HIlton
Orlando, Florida at Sea World

CTU

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by Hilton Orlando at Sea World

Orlando, Florida

ARRL National Convention

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Welcome!

On behalf of the CTU Board of Directors, K1DG, N9JA, K1AR and the Professors of this Contest University we are pleased you are here and we extend a warm welcome to you!

This is a celebration of the ARRL National Convention – Contest University. Many CTU's have been held in Dayton, several in South America (Brazil), even more in Europe (England, Germany, Finland and Italy), one in Australia, one in Russia, mini CTUs in Chicago, Connecticut, and now one here in Orlando, Florida.

CTU presentations are available here at the ARRL National Convention celebration today. This CTU is the product of many hours of hard work by your Professors and Teri, K8MNJ. Please remember to thank them.

Icom America has led the way by sponsoring CTU from the start in 2007. Contest University all over the world would not be possible without the support of Ray Novak, N9JA and Icom. DX Engineering, CQ Magazine, and ARRL all have contributed their help and guidance in making this CTU possible. Please support these vendors who have given back to our RadioSporting hobby.

Contest University is a platform for sharing ideas and learning new ways to enjoy Amateur Radio Contesting. We hope you will enjoy and share what you learn here today.

Remember to:
Always – Share, Learn, Enjoy and Encourage!

Very 73!

Tim Duffy K3LR
CTU Chairman
Orlando, Florida
February 2022

Table of Contents

Index of Advertisers

Contest Calendar

November 2021 – December 2022

This calendar covers the major contests, but there are plenty of others throughout the year.
Visit **www.arrl.org/contest-calendar** and **contestcalendar.com** for more contest dates and details.

Nov 2021

6-8	ARRL NOVEMBER SWEEPSTAKES — CW
20-22	ARRL NOVEMBER SWEEPSTAKES — PHONE

Dec 2021

3-5	ARRL 160 METER CONTEST
11-12	ARRL 10 METER CONTEST
12	ARRL & RSGB 160-METER TRANSATLANTIC CENTENARY QSO PARTY
19	ARRL ROOKIE ROUNDUP — CW

Jan 2022

8-9	ARRL RTTY ROUNDUP
15-16	NORTH AMERICAN QSO PARTY — CW
22-23	NORTH AMERICAN QSO PARTY — SSB

Feb 2022

5-6	NORTH AMERICAN SPRINT — CW
12-13	CQ WORLD WIDE WPX — RTTY
14-18	SCHOOL CLUB ROUNDUP
19-20	ARRL INTERNATIONAL DX — CW
26-27	NORTH AMERICAN QSO PARTY — RTTY

Mar 2022

5-6	ARRL INTERNATIONAL DX — SSB
12-13	NORTH AMERICAN SPRINT — RTTY
26-27	CQ WORLD WIDE WPX — SSB

Apr 2022

10	ARRL ROOKIE ROUNDUP — PHONE

May 2022

28-29	CQ WORLD WIDE WPX — CW

Jun 2022

25-26	ARRL FIELD DAY

Jul 2022

9-10	IARU HF WORLD CHAMPIONSHIP
16-17	NORTH AMERICAN QSO PARTY — RTTY

Aug 2022

6-7	NORTH AMERICAN QSO PARTY — CW
20-21	NORTH AMERICAN QSO PARTY — SSB
21	ROOKIE ROUNDUP — RTTY

Sep 2022

24-25	CQ WORLD WIDE DX CONTEST — RTTY

Oct 2022

17-21	SCHOOL CLUB ROUNDUP
29-30	CQ WORLD WIDE DX CONTEST — SSB

Nov 2022

5-7	ARRL NOVEMBER SWEEPSTAKES — CW
19-21	ARRL NOVEMBER SWEEPSTAKES — PHONE
26-27	CQ WORLD WIDE DX CONTEST — CW

Dec 2022

2-4	ARRL 160 METER CONTEST
10-11	ARRL 10 METER CONTEST
18	ARRL ROOKIE ROUNDUP — CW
TBD	ARRL & RSGB TRANSATLANTIC CENTENARY MARATHON

"Contesting" to Save Lives

Presented to
Contest University
Orlando Hamcation

Fred Kleber
K 9 V V / N P 2 X
Section Manager
ARRL USVI Section

•1

How Can Contesting Save Lives?

- **Contesting saves lives, really???**
- **Many skills learned in contesting are directly applicable to emcomm traffic handling**
- **Not only efficient traffic handling, but many other aspects are applicable**
- **Contesting teaches you a mindset, logic and skills that are extremely valuable in emcomm**

•2

In The Beginning

- **Amateur service has deep roots in emergency communications**
- **§97.1 Basis and purpose.**
  The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:
  (a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

•3

ARRL Section Appointments

- **Sections structure to support emcomm:**
  - Section Emergency Coordinator
  - State Government Liaison
  - Local Government Liaison
  - Net Manager
  - Section Traffic Manager
  - Official Emergency Station
  - Official Relay Station

•4

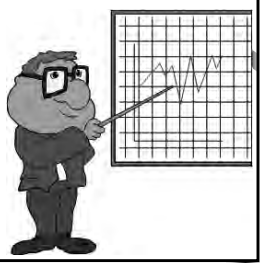
ARES & ICS

- Incident command system (ICS) – Universal command & control protocol
- ICS is scalable & flexible for any event
- ICS is like CTU materials for emcomm
- Core ICS classes - ICS-100, 200, 700 & 800
- Advanced table-top exercises with “injects”
- Exercises, drills are emcomm “contests”
- After action reviews, aka “hot washes”

•5

Tenants of First Response

- Above all, do not become a victim yourself
- Family first, always. No exceptions.
- Hams primary emcomm role is that of communicators. May do other things if able.
- Can’t help others unless you’re properly trained, qualified to help, and prepared at home
- Do not undertake anything you feel uncomfortable doing
- Be conscientious of liability!



•6

Other First Response Tips

- Know and understand the environment and personalities
- Ham radio is one spoke in the emcomm wheel
- Don't be offended if your opinion isn't taken. Don't try and drive the bus!
- Be humble. Your license doesn't qualify you to be a super-hero.
- Look / act professional. Your mother is not dressing you.

•7

Parallels – Emcomm & Contests

- The "meat" of contests is really just passing information quickly & accurately
- ARRL CD party, a prehistoric NAQP
- Sweepstakes may be closest to emcomm (Number, power, year licensed & section)
- Field day incorporates portable and hardware aspects of emcomm
- Simulated Emergency Tests (SETs) conducted by ARRL very realistic
- Partner agencies conduct their version of SETs. Use as opportunity to show value

•8

Your Fellow "Contesters"

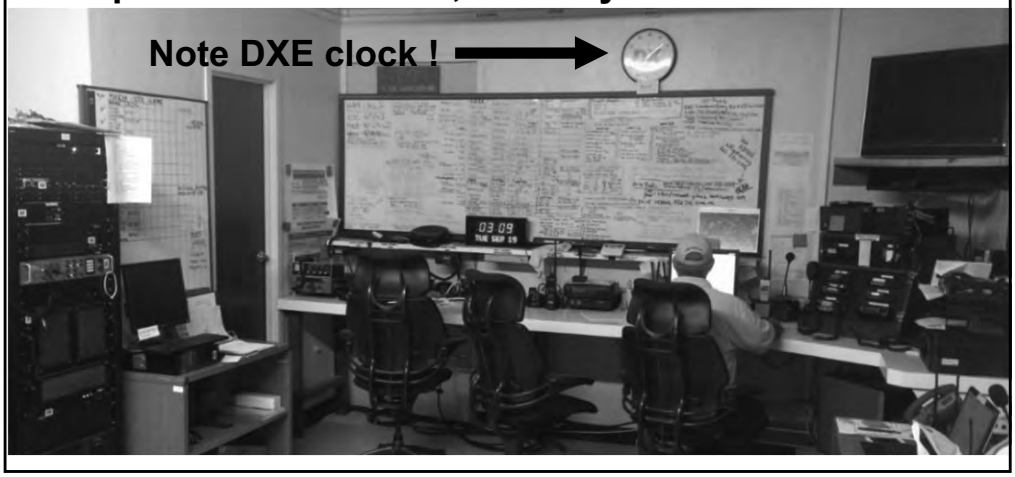
- Amateur Radio Emergency Service (ARES) serves:
  - DoD – Army, Navy, Air Force, Marines, USCG
  - Federal – FEMA, NHC, NOAA, TSA, NPS, USFW
  - Territorial – EMA, Police, Fire, EMS, Rescue, NG
  - NGOs - Red Cross, Salvation Army, VOAD
  - The community!
- Lots of funny calls; "Blackhawk 47", WGY-952, etc.
- Tactical calls come & go as incident unfolds

American Red Cross

•9

Your Shack

- Your 'shack' will be a little different
- Yes those are white boards > power outages
- Operation is WEEKS, not only 48-hours



•10

Nuts & Bolts

- Make sure your station is functioning properly:
  - Check power output, SWR, modulation, grounds
- Conduct periodic comms checks. Monthly minimum
- Have dedicated backup power for communications
- Consider taking down antennas and re-installing when danger has passed
- Have backup antennas, feedlines, radios available
- Have a good tool kit & spare fuses, connectors, etc.
- Have hardcopy manuals for ALL equipment

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Parallels – Emcomm & Contests

- Emergency Mgt Agency = ARRL / CQ WW
- ICS-213 Message form = QSO "points"
- ICS-205 Freq List = Band Plan
- Emcomm contact list = Call history
- Ships, helos & vehicles = Rovers
- Community comfort = Bonus points
- Lives saved = Multipliers
- Message accuracy = UBN report
- WebEOC = Packet

•12

Packet Cluster = WebEOC

- There is no “single op”; everyone is assisted
- WebEOC is like your local packet cluster
- Like the GAB or SKED window @K3LR M/M

Tracking #	Mission Name	Originator	Assigned To	Priority	Time Due	Status
TR-5700832	PRIORITY MEDICAL EVAC - MYRA KEETING	EOC	Pending Assignment	Immediate (4 hrs.)	09/10/2017 23:52:00	New Request
TR-1851276	Test Ticket - Ignore/Delete	EOC	Pending Assignment	Extended (over 96 hrs.)	10/10/2017 19:46:00	New Request
RR-0423785	Fireworks Supression Request (MEDEVAC Impacted)- vicinity Gift Hill (St. John)	EOC	Pending Assignment	Immediate (4 hrs.)	09/11/2017 00:29:00	New Request

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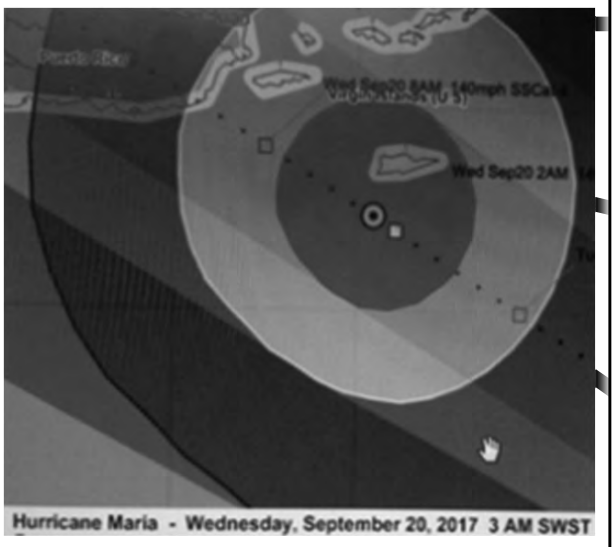
Uh Oh, Here Comes Maria

- Category 5 Irma hit USVI a mere 13-days earlier!



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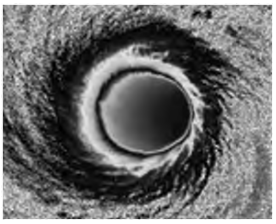

Maria Quick Stats

- Tenth strongest Atlantic hurricane at 914 mb!
- Maximum sustained winds 185 MPH for 8-10 hrs
- Maximum surface wind gusts of 200+ MPH!
- Ocean surge levels 12 feet above normal tides
- Twin eyewalls!
- Bark stripped from tree trunks!
- Four deaths in the USVI from two cat 5 ‘canes

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Apocalyptic Devastation

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Welcome to Gilligan's Island

Wireless

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The "Bands"

- Landlines / cell phones / social media
- Governmental – Trunked, conventional, ALE
- Private – Trunked, conventional,
- Amateur
  - HF – 60 Meters & ham nets
  - VHF – Local repeater system(s)
  - Digital – Winlink, VARA, Ghz Mesh
- Satellite phones – Know access codes!!
- VSAT Satellite Terminals
- Communications interoperability is traditionally the weak link in many response efforts

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60 Meters

- The band nobody uses – these guys do!
- Good band for NVIS propagation
- Conducted first responder nets twice daily

USS Kearsarge, USS Oak Hill, USS Wasp

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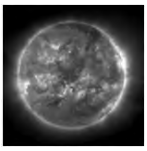
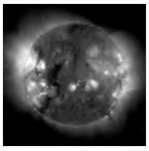
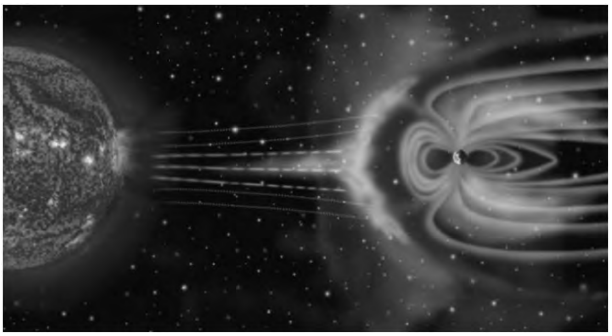


Solar Effects HF Emcomm Too



- Most HF emcomm is NVIS skywave
- Severe solar event can render HF useless. Even NVIS! Happened in Maria!
- Have backup plan in case this happens



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Emcomm "Contest" Planning

- Charge all portables and satellite phones.
- Have a supply of extra batteries & cache units
- Make skeds with critical locations & agencies
- Set goals, keep history. Next / last 24 / 48 hrs
- Keep ICS-214 activity log of check-ins / outs
- Record historical activity for AAR recall
- Handy non-routine emcomm frequencies
  - Airport ground & tower, Marine VHF, local businesses (query FCC database), hotels, resorts,
- Have a weather radio on-hand

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2 Meters

- Air-to-ground comms on 2m ham repeater!
- Surprised military helos didn't have UNICOM
- Who says Baofeng HTs aren't useful?

•22

Landing Zone Management

- No air-traffic control on STJ led to congestion!!
- Uncontrolled med-evac, military and private flights
- Prioritization of med-evac flights
- Hams deputized as helo pad air traffic control
- Critical is quick off / on loading of people / cargo
- Know LZ hand signals!! Eye protection too!

•23

Puerto Rico Banner Tow Project

- Airborne cross band repeaters relay ground messages from survivors
- Abandoned Project >

  No banner tow planes in KP4, Expensive to fly plane from FL, too late for impact
- Ready for next time

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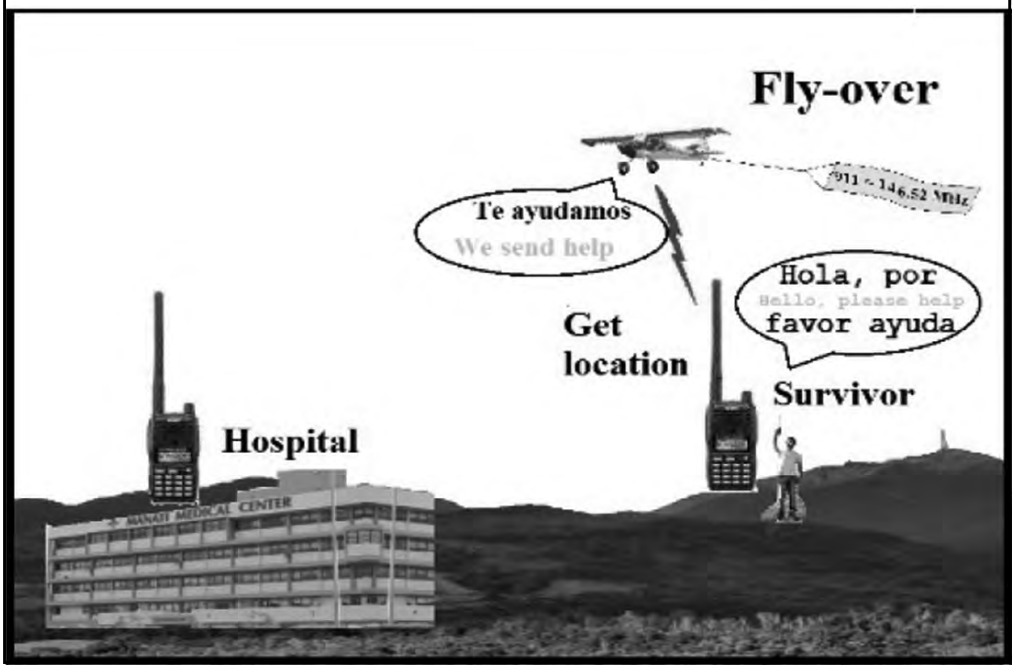
Call For Help



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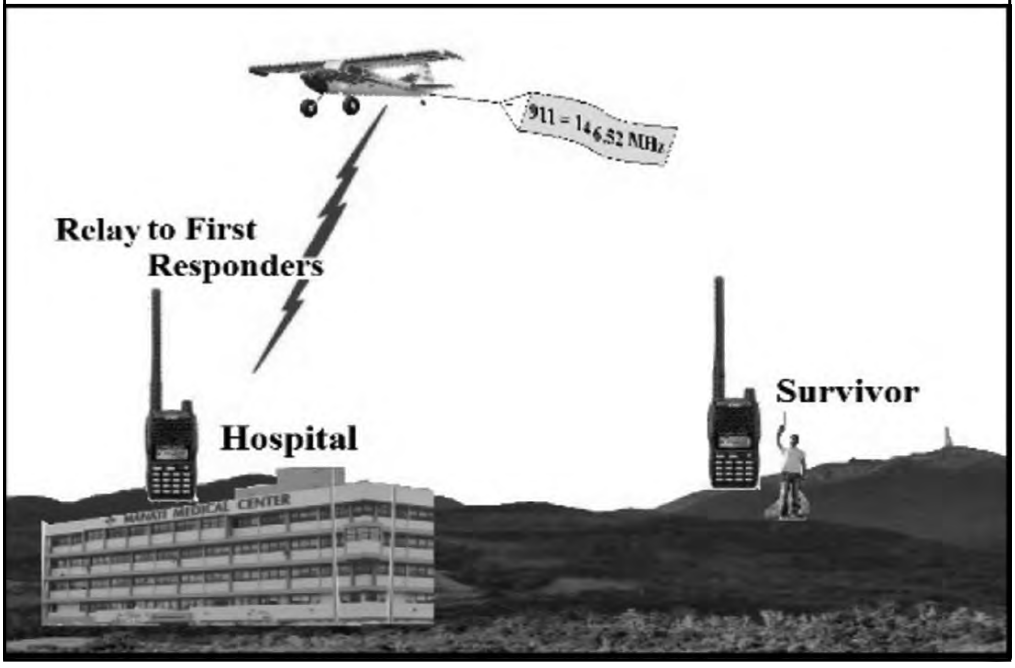
Relay to First Responders



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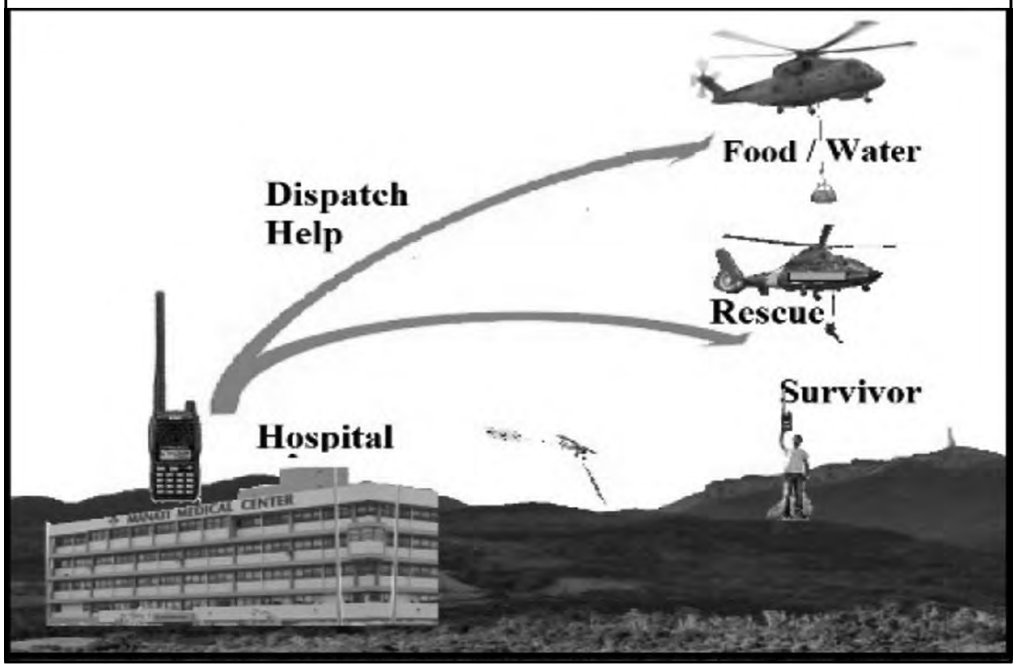
Receipt of Aid



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Contesters Make Good Traffic Handlers

- **EVERY "log" has to be a golden log (error free) – People's lives may depend on it!**
- **Life and limb & other critical traffic - slo' like turtle 'mon!**
- **Resist the adrenalin rush to pass everything quickly**
- **Immediately confirm received critical traffic – SLOWLY. Confirm multiple times if needed!**
- **Question / confirm anything that does not make 100% sense. You may not get a second chance to do so**
- **Pay special attention to dates, times, quantities, directions, names**

•28

Getting It Right & Acknowledged

"We have a 24-year old female DKA priority med evac""

"Copy 24-year old female priority med evac"

"Please confirm D-K-A, delta-kilo-alpha"

"Yes, diabetic keto acetosis"

"*Please confirm D--K--A, delta-kilo-alpha"*

"Yes, D-K-A"

"Please confirm "D", delta, "K", kilo, "A", alpha"

"Roger, delta-kilo-alpha"

"Roger, confirming 24-year old female priority DKA med evac"

Took three exchanges to get it 100% correct

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Traffic Handling Hints

- **Stay calm! Creates confidence in your abilities. Influences other "contesters"**
- **Patience! – Other ops have varying levels of experience (E.g. security guard & helo traffic)**
- **Know which station(s) to expect when, and on what frequency**
- **Try to anticipate needs of distant party & ask about their needs beforehand. Comforts them.**
- **Endurance – Long contests prepare you for long EOC shifts**
- **Stay organized! Don't let EOC comms room look like your office at home!**
- **Do not burn yourself out! Can be long haul!**

•30

"And Now The Weather…"

- Hams relay meteorological data to NHC. (Wind speed, direction, pressure, precipitation, etc.)
- HF, packet and VoIP nets used in handling traffic
- Especially beneficial in small island nations
- Embedded within NHC facility in Miami
- Serving NHC for more than 40-years!
- While not directly related to life saving, the reports passed by WX4NHC have certainly saved lives

•31

Saving Lives

- Gratifying cornerstone of our "hobby"
- No better feeling than knowing you saved a life doing something you enjoy doing
- Those lives saved will go on to marry, have kids, and be there for their loved ones
- Be humble. Not super-heroes. This is what we train and practice for. This is what hams do.
- FCC recognizes this public service value through the free license grants & spectrum we enjoy

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Directly Applicable Skills

In Summary

- ✓ Comms knowledge
- ✓ Contest preparation
- ✓ Traffic handling skills
- ✓ On-air procedures
- ✓ Technical competence
- ✓ Training & more training!
- ✓ Contesting save s lives!!

•33

It All Begins With People…

•34

Thank You for Attending!

Questions?

Thank You!

Fred Kleber, K9VV / NP2X

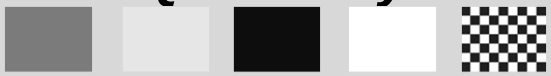
Section Manager, USVI / k9vv@arrl.org

No QRM when /mm!

•35

CTU Presents

Mobile QSO Party Contesting



George Wagner K5KG and Chris Blake NX4N

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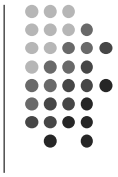
1

Today's Mobile Route



- Overview
- Your 1st Single Op Mobile Contest
- Safety Considerations
- Station Planning and Building
- Station Testing and Post-Test Optimization
- Operating Strategies and Plans
- Bring a Bud: Multi-Single Mobile
- 'Loco' Motion: Multi-Two and Multi-Multi Mobiles

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Start your Engines

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2

QSO Party Activity and the State QSO Party Challenge (SQP)

- QSO Parties have been popular for the past 20 years
- SQP Challenge announced Jan 2020
  - Point system with five achievement levels
  - **A key catalyst** for increased QSO Party participation
- In 2020, log submissions up 10-70+%
  - 1.3+M reported QSOs (est. 2M total) across 46 QP's
  - >2100 operators reported QSO Party scores on 3830
  - Participation from **36+** DXCC entities

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SQP Challenge grew QP popularity

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3

Why do Mobiles complement QSO Parties?

- Two thirds of states have 40+ counties
  - Hard to activate all without mobiles or expeditions
- QSO Party (QP) rules allow:
  - Working mobiles once per county (per band/mode)
- Frequent mobile county changes mean:
  - A transient, abundant supply of new QSOs and mults
  - Creates a **frenzy** of QP Ops tracking mobiles
- Mobile rates *skyrocket* with each county change
  - Rates high 15-30 minutes; smart routing keeps it high

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Mobiles create brief windows to work counties; pileups ensue!

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4

A 2021 Claimed QSO Comparison

CQ WPX CW – Leaders		FQP – CW Mobile Leaders	
Classic **SOHP – 24 hours**		**SO&M/S LP – 20hours**	
CALL	**TOTAL QSO's**	**CALL**	**TOTAL QSO's**
P49Y	**2732**	**AD4EB/m**	**3431**
KQ2M/1	**2518**	**N4CW/m**	**2734**
RZ9A	**2247**	**W4AN/m**	**2436**
VE3EJ	**2265**	**K1XX/m**	**2377**
Avg. QSO Rate = 102		***Avg. QSO Rate = 137***	

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FQP Mobile QSO Rates 34% higher

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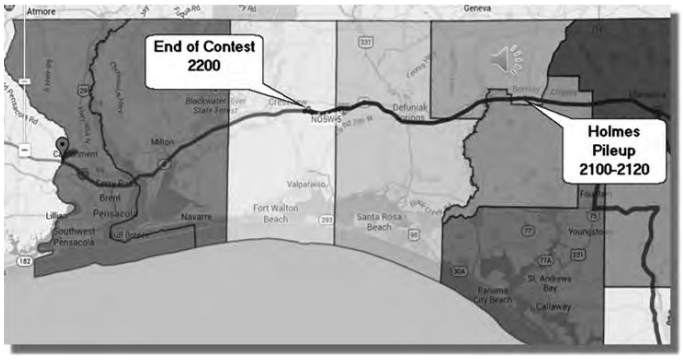
5

In real life here is how it sounds

(Slide courtesy Chuck NO5W)

- Recording by Bob W0BH
- Wichita KS
- Listening to NO5W/HOL in Florida QSO Party 2014



At the end of the 20 minute period an additional 60 Qs were in the log

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Mobile QP Pileups are HUGE!

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6

Nice results on SSB too

Some top QSO Party SSB Low Power Mobiles – Claimed Scores

Year	QP	CALL	SSB QSO's
2020	KS	K0O/m	1168
2015	FL	K4FCG/m	1144
2021	7QP	WY7AA/m	702
2016	TX	W0BH/m	626 (Mixed Mode- 744cw)

CTU CONTEST UNIVERSITY *SSB Mobiles–amazingly successful* ICOM

7

Not just About Rates- Road Rally Surprises

- True tales from road warriors:
  - *Parked on county line over dead skunk* (N4BP/K4PG)
  - *Flying refrigerator box vs. antennas* (N4KM/K0LUZ)
  - *We Won! Deer vs. M/2 big white van* (AD4ES et. Al.)
  - *We Lost! Antennas vs. low obstacle* (K1XX/W1MD)
  - *Near miss – 4ft iguana* (team K4OJ)
  - *Spooky sighting – 10' headless gator* (team K4OJ)

CTU CONTEST UNIVERSITY *Every Mobile outing is an Adventure* ICOM

8

So…Ready to Hit The Road?





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It's easy to join the Party

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9

First-Timers: Keep it simple

- Focus on two 'big bands'; antennas on roof
- Power station from car battery
- Rough parts estimate (all new):

BYO Station	NA
Small sinewave inverter (for laptop p.s.)	$30
20m & 40m Hamstick antennas	$40
Two three-magnet antenna mounts (3/8"-24)**	$90
20ft 8awg wire with two 40A fuses w/ clamps/lugs	$70
10ft – 1" wide braid & hose clamp	$20
	$250

*** Strap Mag Mounts to Luggage Rack for Safety*

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Go Mobile for $250 & 40 hours

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10

Mobile Safety Considerations

- Fixed & mobile stations shared safety risks:
  - Electrical shock & overheating
  - Falls and lightning
- Additional mobile safety concerns:
  - Distracted drivers
  - Accidents & airbags turn equipment into projectiles
  - Vehicle failure
  - Flying antennas/mounts
  - RFI to vehicle & RF exposure to occupants
  - Carbon Monoxide

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You are the Chief Safety Officer
(Next Slide: K5KG)

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Getting Started – Station Planning & Building

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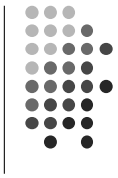
Mobile Installation Basics



- Helpful link for mobile topics – K0BG.com
- Vehicle's 12V battery should power a 100w transceiver
- Run 8awg cable from battery to passenger compartment
  - 30amp fused 8awg conductor from battery 'Plus' battery terminal
  - 8awg fused conductor from chassis ground, NOT from 'Neg' battery terminal
  - Use professional installer
- Best location for antenna is center roof
- Hamsticks are simple and work very well
- Bond antenna ground to vehicle chassis for best performance
- Strap equipment so it does not become a missile in an accident
- Disable auto-shut-off of engine at stop lights
- Avoid inverters – they are inherently noisy!

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See References/Links slide

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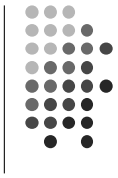
Mobile QSO Party Basics



- Planning the operation
  - Route planning & driver navigation
  - Single op with a driver – a good approach
  - Multi op – share driving and operating
  - Single op without a driver – most difficult - a last resort
- Choice of logging software – N1MM+, CQ-X, N3FJP, more
- Packet cluster from iPhone Hot Spot
- APRS to broadcast your location/county (optional)
- Laptop from vehicle's 110 vac outlet (if available)
- Full size keyboard & external monitor if possible
- Mono band antenna for each band on a switch
- Trailer mounted, multi-band antenna is an option
- Maximize mults – CW & SSB – VFOs A&B, 14.153

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Adapt to your Preferences

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Home-brew Station Platform

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Convenience for the Operator

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Ergonomics, Ingress/Egress, Handy food & drinks

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16

Lets the county sheriff know your intentions!

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Signage helps avoid a Pullover

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17

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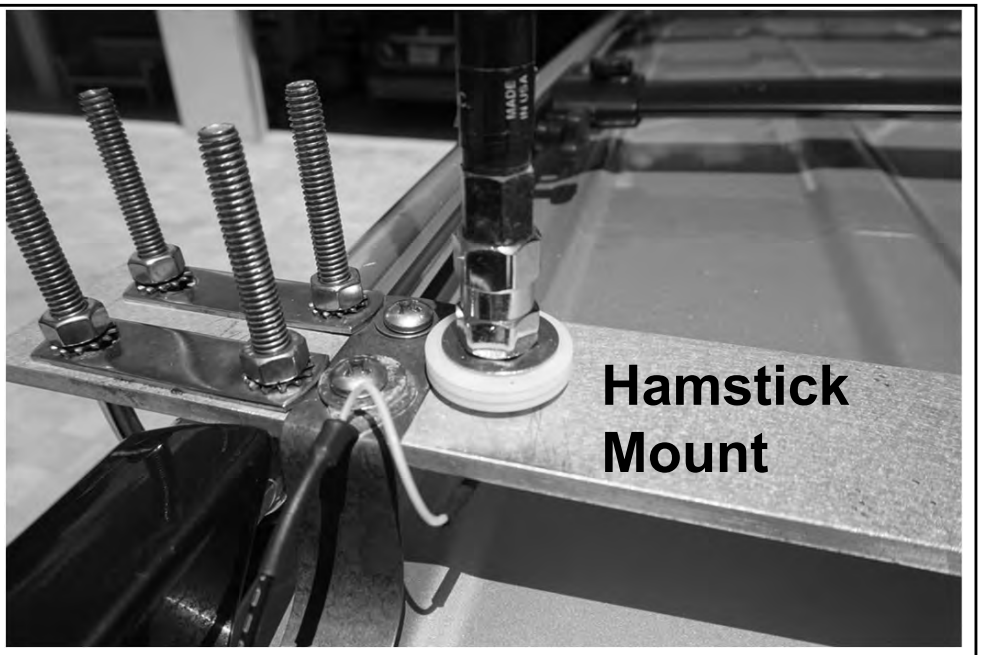
18


Hamstick
Mount
CTU
CONTEST
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19


40M
Copper strap
for bonding
CTU
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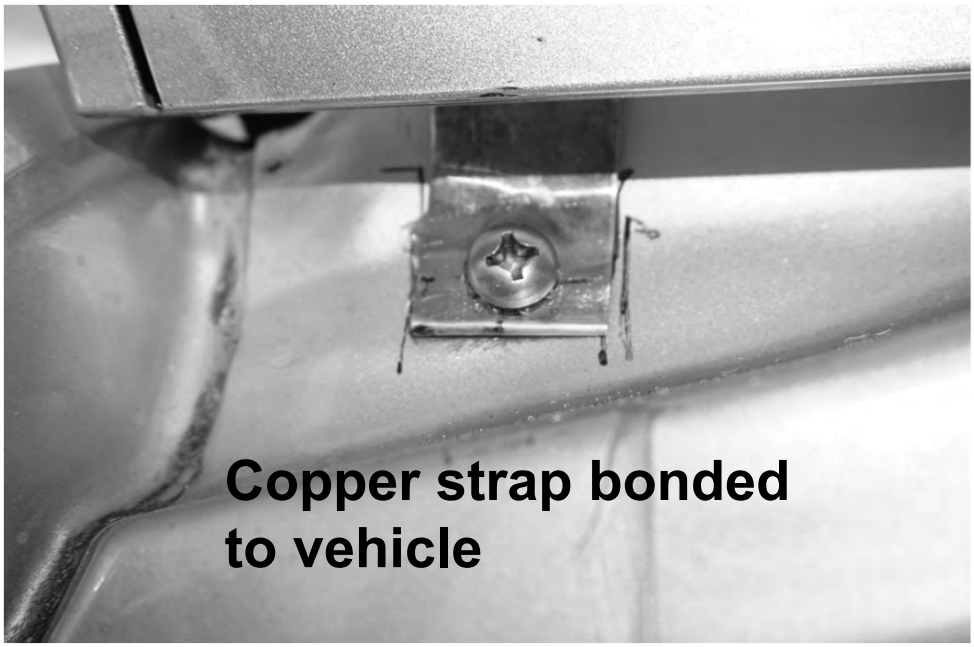
20



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Next Slide: NX4N

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21

Station Testing as you Build: Verify & Validate the Build Quality

- Basic functionality tests first:
  - mechanical, electrical and software
- Next: Integration tests
  - (ex.- Ambient noise using AC mains>start engine>gen pwr)
- Fix the 'Reliability Busters':
  - Computers (crashes, 2-way RFI noise)
  - Station RFI to vehicle
  - Vehicle & power plant RFI to station
- Highway road testing- operating reliability/ergonomics
  - Escort observation vehicle
  - Driveway testing only is *not* sufficient

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Minimize roadside stops for fixes

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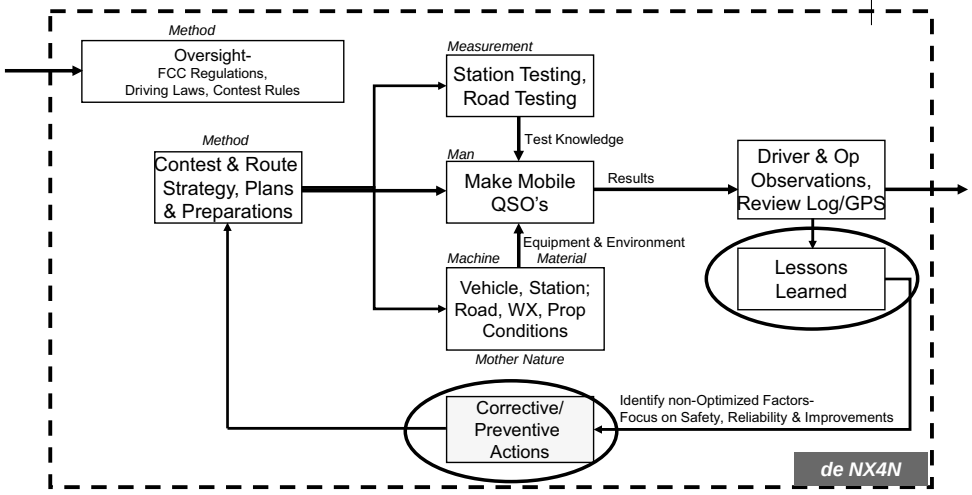
Post-Testing Optimization cycle of the Mobile Contesting 'System'



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Optimization is a continuous process

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23

Quiz- Which problems to fix first?

1. **a) Transmitting on 40m lights up car dashboard**
   b) 20m SWR is 2.5

2. **a) 20m Rx ambient noise is S6**
   b) PC blue screen when transmitting on 40m

3. **a) 20m Rx ambient noise is S5**
   b) 15m Rx ambient noise is S4 (preamp on)

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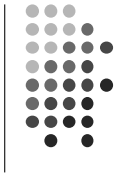
24

Quiz- Which problems to fix first?



SAFETY:

1. ➡ a) Transmitting on 40m lights up car dashboard
   b) 20m SWR is 2.5

2. a) 20m Rx ambient noise is S6
   b) PC blue screen when transmitting on 40m

3. a) 20m Rx ambient noise is S5
   b) 15m Rx ambient noise is S4 (preamp on)

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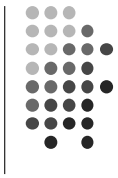
25

Quiz- Which problems to fix first?



SAFETY:

1. ➡ a) Transmitting on 40m lights up car dashboard
   b) 20m SWR is 2.5

RELIABILITY:

2. a) 20m Rx ambient noise is S6
   ➡ b) PC blue screen when transmitting on 40m

3. a) 20m Rx ambient noise is S5
   b) 15m Rx ambient noise is S4 (preamp on)

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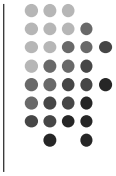
26

Quiz- Which problems to fix first?



SAFETY:

1. **a) Transmitting on 40m lights up car dashboard**
   b) 20m SWR is 2.5

RELIABILITY:

2. **a) 20m Rx ambient noise is S6**
   b) PC blue screen when transmitting on 40m

IMPROVEMENTS:

3. **a) 20m Rx ambient noise is S5**
   b) 15m Rx ambient noise is S4 (preamp on)

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Priorities (in order): Safety, Reliability, Improvements

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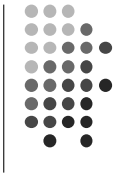
Operating Strategies & Plans



- You're the 'rare DX':
  - Run, Run, Run (Mobile S&P = Search & *Bounce*)
  - Plan band changes for rates and mults
- For counties <30min, stay on best band
- For counties >30min, change bands as needed
  - 20m/40m split (80m/15m/10m if open)
- If mixed mode:
  - Saturday – focus on passing CW mults to SSB
  - Sunday – focus on CW to maximize rate

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Rate is King

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Route Planning Tips

(Slide courtesy Chuck NO5W)

- Along the route:
  - What counties will be crossed?
  - How far apart are county lines?
  - What are the lat/long of county line crossings?
- Optimize time in each county
- Track total time of the route
  - Allowing for gas/nature/feeding stops
  - Assuming a given driving speed
  - Plan extra counties at the end if you're ahead of schedule
- Post your routes online
  - APRS – helps ops track you real time

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Optimal Time in County = 15-20min

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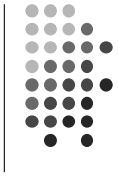
Bring a Bud: Multi-Single Mobile

Share operating and driving

30

‘Loco’ Motion: Multi-Two and Multi-Multi Mobile



- Big challenges and big fun
  - Expect lots of obstacles, failures and learning
  - Loads of fun for Ops on the other end
- Keys to success:
  - Reliability – keeping 2+ mobile stations running smoothly
  - Taming RFI – Equal parts tiger, mule and elephant
  - Ergonomics – a lot of bodies & gear in a sardine can

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Count on the Unexpected & Adapt

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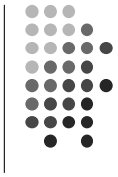
M/2 & M/M = More Complexity



- With each station addition, reliability grows more demanding and important
  - Roadside stops to fix <u>one</u> station = QSO hits to <u>all</u> stations
  - Ops ‘own’ their station - monitor/triage real time
  - Fix minor problems at planned stops
  - Driver also designated station engineer
    - Fix problems with minimum pullover time
  - Identical backup spares for *everything*
  - Fresh batteries in all accessories
  - Bring a complete tool/solder/crimp/spare parts kit
  - Handy limited tool set, with ferrite chokes, for ops

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Replacement is better than Repair to minimize down time

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Planning/Building M/2 & M/M – Recommendations

- Safety is critical, but reliability a close 2nd
- Use 110vac generator (clean sinewave)
  - Add AC EMI filtering
  - Dedicated DC power supply for each station
- Cable management – routing, color coding helpful
- Use small, light, 'clean' radios (robust Rx + clean Tx)
  - Band Pass filters & stubs
  - Roofing & AF filters, NR, NB, attenuator all useful tools
- Noise = $\underbrace{N_{site}+N_{gen}+N_{dc}+N_{car}+N_{ant}}_{\text{Ambient Noise}}+\underbrace{N_{RFI1}+N_{RFI2}}_{\text{Inter-station QRM}}\ldots$

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Goal: Reliable, Low Noise stations

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M/2 and M/M Antennas - Design Robustness

- Tips for success:
  - Drill hard mounts near center of roof
    - OR solder 1" braid (6-8" max) from feed point to roof
  - Use stainless springs on all antennas for safety & reliability
  - Avoid capacitive hats to reduce antenna movement
  - Wrap antenna whips in tape/heat shrink
  - Use shunt matching coil on all antennas per K0BG.com
    - Higher ambient and RFI noise levels without them
  - Coil coax with ferrite chokes at antenna feed points
  - Car bonding (engine, doors, tailpipe, etc.) lowers losses
  - Weatherproof cable grips for coax/cable ingress/egress

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Key: Short connection from antenna ground to roof directly underneath

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M/2 and M/M Antennas - Robust Road Test Method

- **The 'SWR Stability Test' (SST) –**
  - Performed by NX4N during **road testing** since 2014
  - Using *analog* meter on SWR analyzer, observe SWR max variations. Test each antenna in presence of the others.
  - Wild swings in SWR, usually found on the low band antennas, indicate need for:
    - Fixing intermittent intra-antenna, coax or mount connections
    - Better RF antenna grounding to roof
    - Better coax feedline isolation (chokes at feedpoint)
    - More or different spacing between antennas

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The SWR Stability Test is a key tool for evaluating Multi-Station Antennas

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Example: K4OJ/m M/M & M/2 Station Descriptions

- 2014=M/4; 2015=M/3; 2016-2021=M/2
  - No mobile outing in 2020
- Chevy Suburban and Toyota Sequoia SUV's
- Honda EU2000i, & external tank (E0 premium gas)
  - AC EMI Filters; power surge strips all rows
- Elecraft K3 (20m & 40/10m) & KX3/KPA500 (15m)
  - RFI – stubs and band pass filters for each band
  - Dozens of ferrite chokes everywhere
- Laptops; WinKey USB only (no rig ctrl, networking)

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3 Stations are Optimum bang/buck

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M/2 2021 Station Build Results

- Ambient antenna Rx noise levels (300Hz BW):
  - Measured at quiet site using generator power
  - 40m=S2; 20m=S2, 15m=S1/S3**; 10m S1/S3**
    **Preamp on
  - Noise blanker further reduced noise ~1 S unit
- Interstation RFI Rx levels:

TX 100W Band	RX Band	Added RFI Level
40m	20m	1-2 S unit
40m	15m	1-2 S unit
20m	40/15	none
15m	40/20	none
40/20/15	10m	untested

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Result of many hours working noise & RFI abatement

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What Works & What's Weird

- *What Works: 100W and mobile antennas*
  - JA worked on 15m at 14:30 EDT
  - Worked VK beaming *long path* on 20m
  - EU/OC/SA worked on three or four bands
  - Driving over/near saltwater = one S unit improvement!
- *What's Weird:*
  - Door Magic –
    - 3-station triplexer testing: 15m RFI from 20m went from S1 to S9 each time the passenger door was closed.
  - Two to Tango –
    - 4-station testing: 10m RFI =S3 from 20m & 40m, but when both stations transmit, RFI jumped to S9+10

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Surprises in every road trip

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Photos: K4OJ Multi-Multi Mobile

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Team K4OJ Multi-Multi Mobile

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Team K4OJ Multi-Multi Mobile

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Helpful Links & References

- http://k0bg.com/
  - Super duper everything-mobile website
- http://www.arrl.org/mobile-stations
  - Terrific quick references
- http://www.arrl.org/rf-exposure
- https://www.w8ji.com/mobile_and_loaded_antenna.htm
- http://audiosystemsgroup.com/RFI-Ham.pdf
  - (K9YC RFI article)
- http://stateqsoparty.com/
- ARRL Handbook
- ARRL Antenna Book

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Hope You'll join the Mobile Party

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Teams AD4ES, K4OJ, NO5W
Post-dinner and Tall Road Tales

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Mobile QSO Party Contesting

QUESTIONS and (hopefully) ANSWERS

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Mobile QSO Party Contesting

APPENDIX-
Additional Slides

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Mobile Category Selection

- Single op (no driver)* – For 'Swiss Army Knife' types
- Single op (w/ driver) – radio hogs
- M/S – buddies who like sharing all the tasks
  - Must trust each others' driving and navigation abilities
- M/2** – group of friends who multi-op regularly
- M/M** – Team players who adapt on the fly

*Operate while stopped for safety

**Dedicated driver for safety

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Rules vary – read the fine print

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Additional Selections

- Mode: CW/Phone/Dig/Mixed
  - Mixed mode requires antennas with wider bandwidth
- Power:
  - *Low Power is usually the ideal balance*
  - High Power – ac/dc power, antenna and RFI concerns
  - QRP – A few brave souls have done it!
- Bands – QSO parties vary widely

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Wide choice of options

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Your 1st Mobile Contest Outing

- Setting Expectations:
  - SOLP CW or SSB – best bang for the buck
  - Invest minimal amount of time & money
    - 'Try before you buy' into mobile contesting…
- Create your *own* goals for the competition
  - Have fun! Take your partner, a friend, your dog
  - Enjoy the competition and road trip
  - Observe, experience and learn –
    - What are the "Do-Agains" vs. "Do-Differentlies"?

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Hmmm…Will you get hooked?

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Safety examples – the Good, the Bad & the Ugly

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Safety First!

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Mobile Station Maintenance

- Keep an equipment/setup log
  - photos, notes, measurements, etc.
- Inspect antennas and power connections
  - Signs of mechanical and electrical problems
  - Repair or replace deficiencies
  - Keep a maintenance log
- Maintenance includes your vehicle
  - Make sure it's ready for a 500-1000 mile trip
  - Roadside assistance is additional option

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Check Before Each QP: Safety and Reliability

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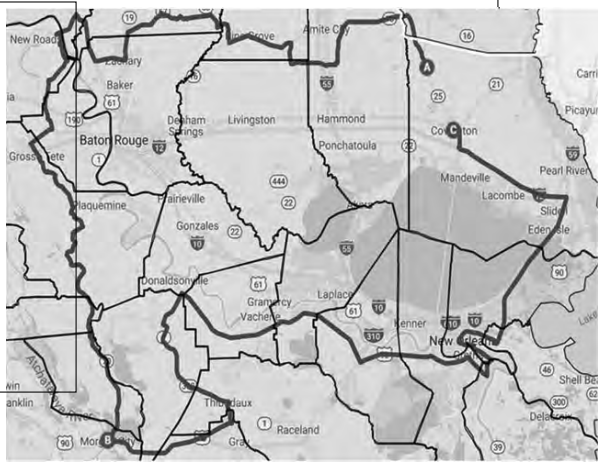
What's a Mobile Route Look Like?

(Slide courtesy Chuck NO5W)

St Tammany	Lafourche
Washington	Assumption
Tangipahoa	Ascension
Livingston	St James
St Helena	St John
East Feliciana	St Charles
East Baton Rouge	Jefferson
East Feliciana	Plaquemines
West Feliciana	Orleans
Pointe Coupe	Plaquemines
West Baton Rouge	Orleans
Iberville	Jefferson
Iberia	Orleans
St Martin	St Bernard
St Mary	Orleans
Assumption	St Tammany
Terrebonne	

25 unique parishes
400 miles



NO5W LA QP Route

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Why you need to know distance/time to next county

(Slide courtesy Chuck NO5W)

- A pileup is raging and you see you're only one mile from the next county and the driver is going 70mph
- You've been calling CQ for three minutes with no callers and have already tried 15m and SSB
- Someone you work asks you how long until you're in the next county.
- You're operating solo (w/o driver) and looking for a stopping point in each county. You need to know how much longer you will be able to look.

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Knowing duration helps you adapt

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Making the trip more enjoyable

- Driver & operator ergonomics
  - Including ingress and egress
  - Easy access to food, drink, trash bag
  - Operator night lights that won't bother driver
  - Cable routing and control (no rat's nests)
- Post-Contest route evaluation
  - What county durations were too long?
  - What route will you *never* take again?
- Saturday night 'reward'
  - Share a meal and exchange stories with other teams

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State QSO Party Challenge – More Tips for QP Participants

(Slide courtesy Anthony K8ZT)

- Always submit your log to sponsors, even if you only make a few QSO (they love to see the activity)
- Don't forget to enter your scores at 3830
- State QSO Parties are not just for US stations- VEs and DX stations are always appreciated
- Consider a trip to operate mobile in a near-by state

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Final Lap:
Mobile Mountains not yet climbed

- All Categories: remote operators
- Single Op mobile –
  - SO2R and 2BSIQ
- M/S mobile –
  - SSB High Power entry
- M/2 and M/M mobile –
  - CW HP
  - SSB LP or HP
  - QRP
  - Multi-Multi Mixed Mode

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To the best of our knowledge

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55

CTU Presents

SSB Audio Contest Processing:

Being HEARD and UNDERSTOOD!

Luis V. (Lu) Romero – W4LT
CTU Orlando 2022

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Welcome to the Better Audio Crusade!

Beware of Doctor Decibel's Rettysnich

If you ever utter the words **PLEASE COPY!**

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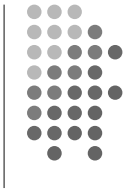
Presentation Overview



- Human Voice Basics
- The Human Voice as a Communications instrument
- ALC – Friend or Foe?
- Audio Dynamic Range: Friend or Foe?
- EQ, Compression, Noise Gating: What are they?
- A word about Adaptive Pre-Correction and CESSB
- Examples
- Conclusions
- Questions and Comments

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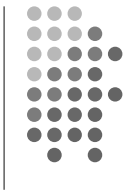
Composition of the Voice



- Consonants, Vowels and “Fundamentals” (male voice):
- Fundamentals: 85-250Hz – Lowest energy and power content – rich harmonic content - multiple redundant frequencies up the spectrum
- Vowels: 350-2kHz – Maximum energy and power – low harmonic content - contain most of the “information” of the communication in human communication
- Consonants: 1-2.5kHz – Medium energy and power – rich harmonic content - critical and essential for *INTELIGIBILITY*

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- Source: A Mathematical Theory of Communication – C.E. Shannon – 1948

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Composition of the Voice

- Vowels carry the power of the voice and consonants provide intelligibility. By tailoring the message spectrum over a closely defined and limited frequency range, intelligibility can be managed for minimum loss of fidelity

Spectrum Band provided	Intelligibility
250Hz and below	Very poor >10%
500-1000Hz	About 12 to 20%
2kHz to 4kHz	Together about 67%

The less channel “noise”, the less “ambiguity” to discern Intelligibility of content

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- Source: AVInfo.com

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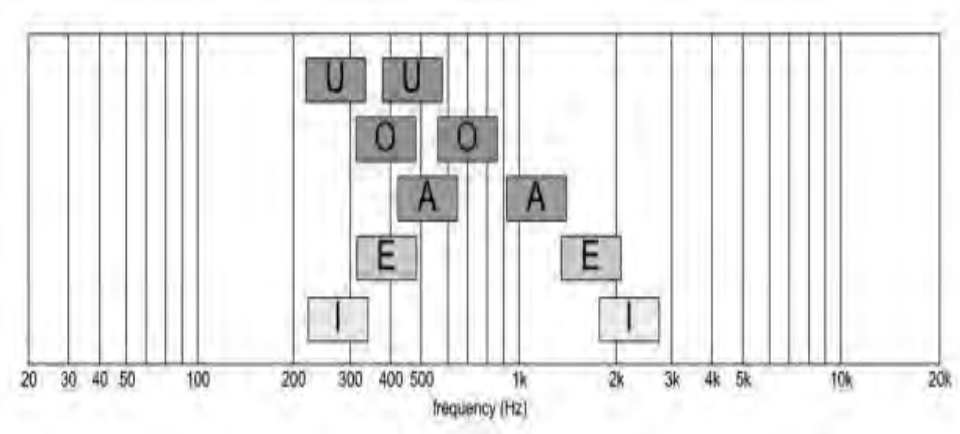
Composition of the Voice

- Vowel “power spectrum”



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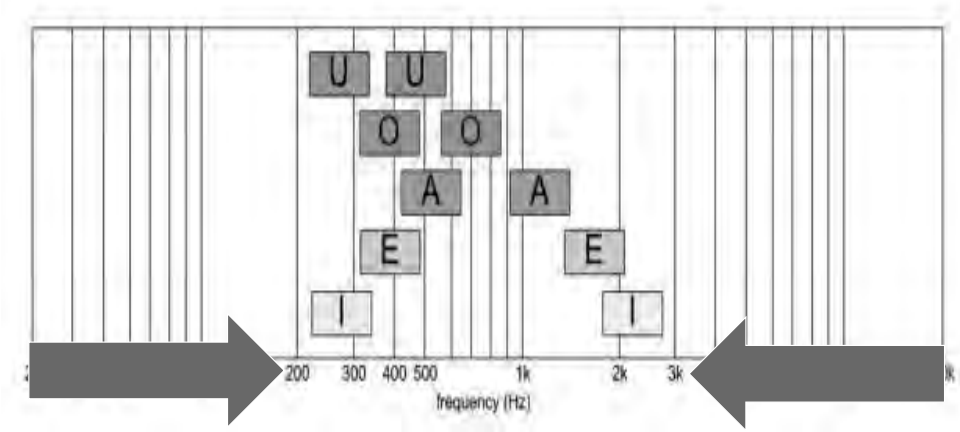
Composition of the Voice

- Vowel “power spectrum”



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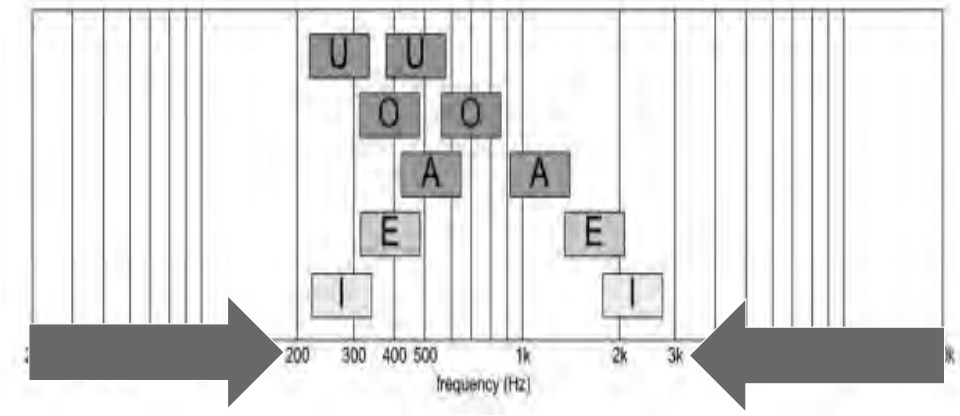
Composition of the Voice

- Vowel “power spectrum”



Where have I seen this before?

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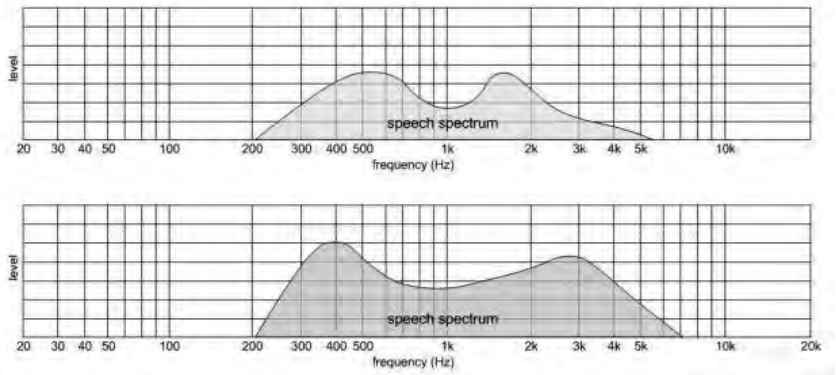
Composition of the Voice

- Male and Female differences



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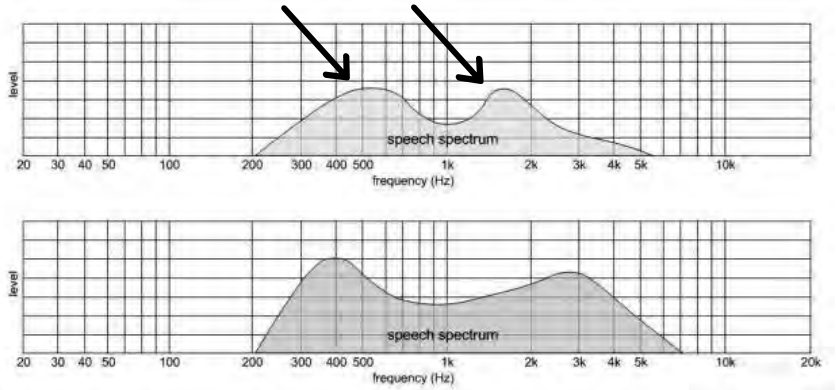
Composition of the Voice

- Male and Female differences



- Female voices have a definite advantage in speech communication…

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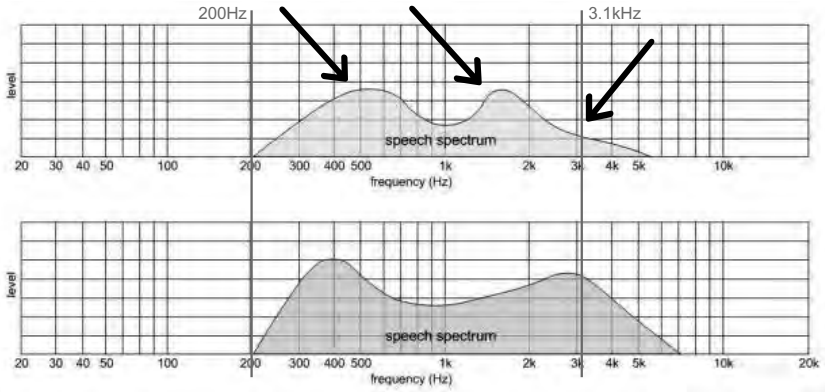
Composition of the Voice

- Male and Female differences



- Flatter power spectrum and most harmonic content falls within traditional SSB filter bandwidth!

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Composition of the Voice

- Frequency and its effect on intelligibility:

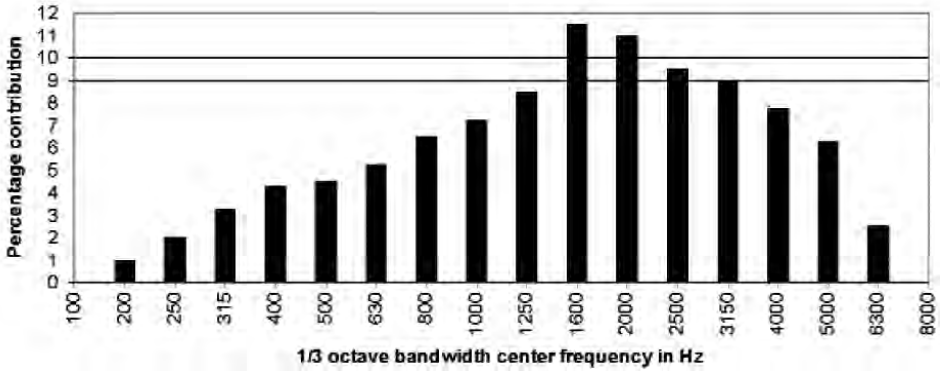

Chart courtesy Martin Ehrenfreid, G8JNJ
"Improving the Intelligibility of SSB Transmission"
RadCom, Feb 2009

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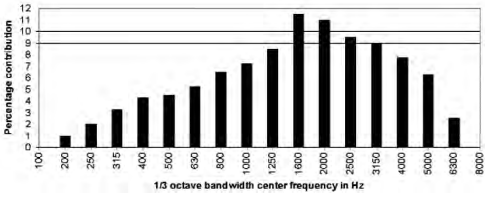
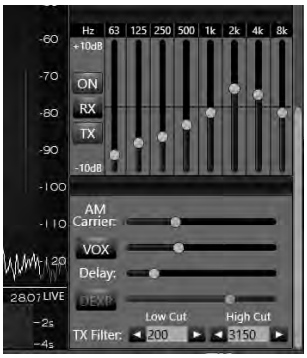
Composition of the Voice

- Frequency and its effect on intelligibility:





- Look Familiar?

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Core Idea Takeaway:

- The “POWER” of a given voice does not equate to the intelligibility of the voice as a communication transmitter. The idea is that just because a person has a “booming” voice does not mean that they are easy to understand.
- The key to intelligibility is tailoring the content spectrum to channel conditions.

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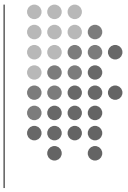
Defining Communication



- The ability to move “data” between a sender and a receiver with a minimum of ambiguity.
- Ambiguity defines the communication channel’s efficiency. The more ambiguity, the less efficient the channel
- “Quality” of a communication channel is only defined by the relative amount of ambiguity that affects the efficiency of the information transfer rate

* Source: A Mathematical Theory of Communication – C.E. Shannon - 1948

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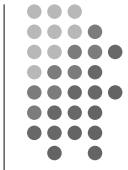
Defining a “Voice Channel”



- The BANDWIDTH available to transfer the intelligence (message) of a given communication
- Bandwidth is always “expensive” and always “limited” to a greater or lesser extent (“TANSTAAFL”)
- Bandwidth ALWAYS includes noise: Higher SNR = Less Ambiguity and Better Communication efficiency (And is ALWAYS limited to an extent – managed by the modulation method)
- Defines the “slice” of frequencies that are available to transfer the intelligence of a given communication (message)

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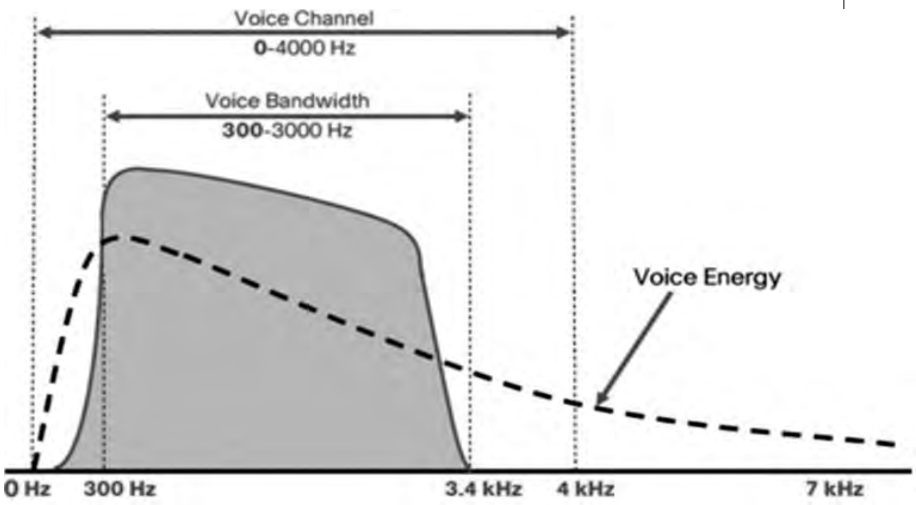
Defining a "Voice Channel"



* Source: Bell System Telephone Channel Schematic

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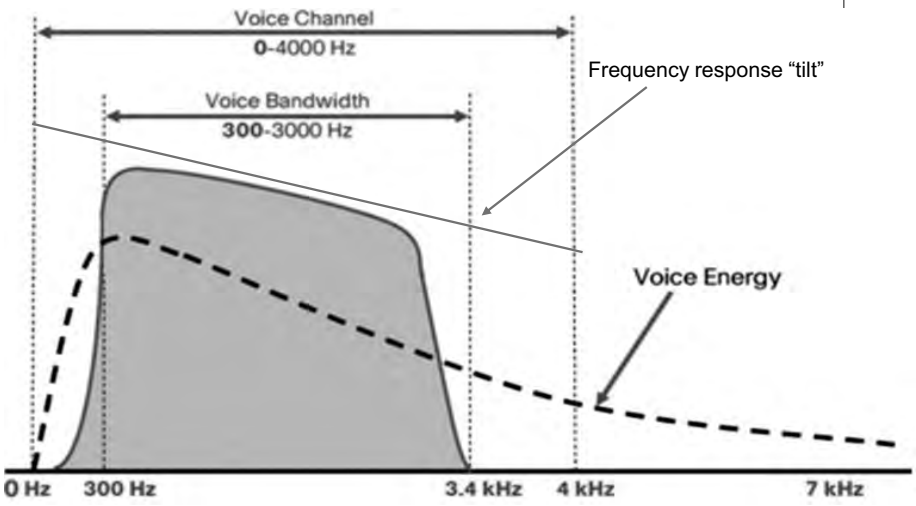
Defining a "Voice Channel"



* Source: Bell System Telephone Channel Schematic

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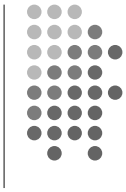
Core Idea Takeaway:



- The idea is to concentrate RF power WITHIN the available bandwidth. “Fill the channel” without overflowing it. “Flatten” the power spectrum and “lift” key intelligibility spectrum thereby reducing audio dynamic range* and increase depth of modulation.**

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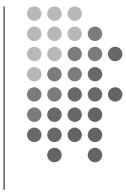
Core Idea Takeaway:



- The idea is to concentrate RF power WITHIN the available bandwidth. “Fill the channel” without overflowing it. “Flatten” the power spectrum and “lift” key intelligibility spectrum thereby reducing audio dynamic range* and increase depth of modulation.**

*Audio Dynamic Range = Ratio of “peaks to valleys”; not to be confused with Receiver Dynamic Range

**Depth of Modulation = The “density” of the audio waveform in relation to Peak Power vs Average Power

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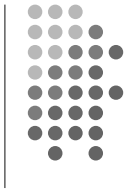
Dynamic Range/Noise Floor



- Audio Dynamic Range: The ratio of the softest sound to the loudest sound in an audio sample (Just as in RF)
- Noise Floor: The level of background noise in a signal, or the level of noise introduced by the system, below which the signal that's being captured cannot be isolated from the noise. (A.K.A. "MDS" in RF, same idea)

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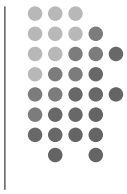
Dynamic Range/Noise Floor



- The Dynamic Range of a signal is limited by the noise floor of the medium it is being transmitted through. As the Noise Floor increases, softer sounds are "masked" by the Noise Floor. (Added Ambiguity)
- In competitive audio processing, "Wide" Dynamic Range" is not your friend. We want "Narrow" Dynamic Range audio – we are transmitting into a very noisy medium.

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Core Idea Takeaway

- Communication Audio Goals: Minimize Audio Dynamic Range by using compression and limiting. The noisier the medium you are trying to move data through, the more “wide” Audio Dynamic Range is your enemy.
- Equalize to concentrate “audio power” specifically in the frequency bands that have high intelligibility content potential
- IMPORTANT: Maximum Discernable Human Hearing Dynamic Range (in minimum noise floor situations – The “MDS” of your Ears!):

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120dB

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Before We Continue…

- … Dispelling some “Religion”:

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Important Religious Disclaimer

- The following comment is “controversial” in Amateur Radio applications. It is based on personal experience with many different amplifier/exciter combinations both in Amateur Radio and Broadcast environments

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Important Religious Disclaimer

- The following comment is “controversial” in Amateur Radio applications. It is based on personal experience with many different amplifier/exciter combinations both in Amateur Radio and Broadcast environments
- I.E.: This is my opinion… You may disagree… But IMHO, those who agree will always sound cleaner on the air than those who disagree! ☺

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Automatic Level Control (ALC)

- A process designed to reduce peak overdrive
- IT IS ***NOT*** designed to process audio and increase modulation depth – it’s designed to avoid amplifier power supply induced clipping by REDUCING RF output!
- Attack and decay time constants WAY TOO SLOW to affect peak management (even “fast dynamic ALC”)
- Different from radio to radio, but similar in principle
- Overdriving ALC increases IMD and makes audio hard to copy, widens your signal and makes you a bad neighbor
- DO NOT use it to manage audio – EVER!

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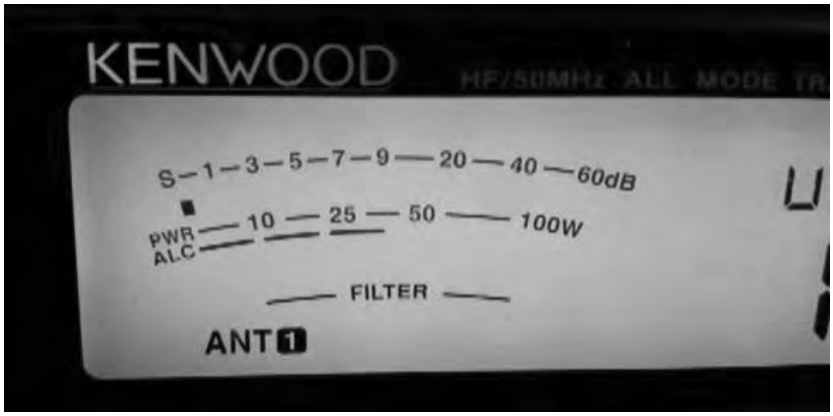
Automatic Level Control (ALC)

- ALC should ALWAYS look like this:



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Core Idea Takeaway

If you remember ONE THING from today, remember this slide:

- ALC was designed as a way to avoid "running out of power supply current" in a transmitter. It's NOT a way to control modulation depth or density. It is imperative that you stay within the ALC curve to avoid distortion and "splatter". I recommend not feeding ALC voltage to a Linear Amp – ALC is simply not fast enough to react acurately and each manufacturer implements it slightly differently! If the exciter is linear, the amp should be too. If it isn't, adjust the exciter THEN the amp. Pay particular attention to grid current in GG Tube Amps. Adding exciter ALC current feedback to the amp adds yet another variable out of your control.

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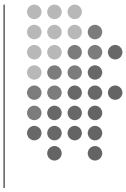
Core Idea Takeaway



If you remember ONE THING from today, remember this slide:

- ALC was designed as a way to avoid "running out of power supply current" in a transmitter. It's NOT a way to control modulation depth or density. It is imperative that you stay within the ALC curve to avoid distortion and "splatter". I recommend not feeding ALC voltage to a Linear Amp – ALC is simply not fast enough to react acurately and each manufacturer implements it slightly differently! If the exciter is linear, the amp should be too. If it isn't, adjust the exciter THEN the amp. Pay particular attention to grid current in GG Tube Amps. Adding exciter ALC current feedback to the amp adds yet another variable out of your control.
- Be a good neighbor… Stop the Splatter Madness! Don't turn your mic gain up to 11, that only works for Spinal Tap.

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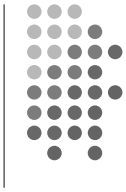
Making The Magic Happen



- It starts with a good articulate microphone
- It continues with good microphone technique
- It is reinforced with good environmental acoustics
- It is accentuated by good AF and RF grounding
- It is managed by attention to audio detail (especially in DVK recordings) and accuracy in TX level setting
- It is both SCIENCE and ART
- It requires "giving a damn" and taking pride in your signal

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Choosing a Microphone

- More expensive isn't always better
- Dynamic vs Condenser (Bias, Level differences and impedance differences)
- Articulation (low inter phoneme distortion)
- Different frequencies arrive at the diaphragm at different times and with different power
- How reflective is your environment (Omni vs Cardioid)
- Frequency response curves to fit your voice

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Choosing a Microphone

- I like headsets. I wear them all the time, not just for contesting. Been wearing them professionally for 42 years…
- Mic always at the right distance and right location from your mouth.
- Careful with close talking Electret elements and some Dynamic elements (Proximity Bass Boost effect)
- Tight cardioid patterns help with room noise
- Since it moves with you, one less thing to worry about!

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Choosing a Microphone

- Audio Technica BPSH-1 ($200.00)
- Broadcast Sports Announcer hypercardioid dynamic capsule
- Rich, but clean, bottom end (for that “manly” sound)
- If you are a baritone, this one’s for you!
- Removable Cord!

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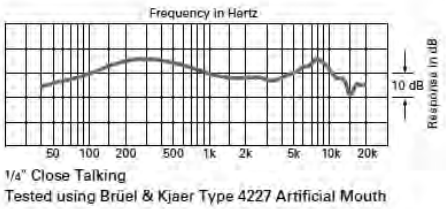
Choosing a Microphone

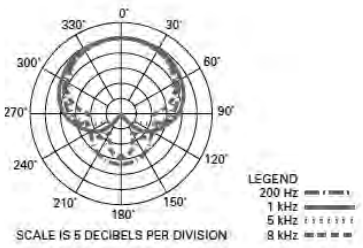
- Audio Technica BPSH-1 ($200.00)

microphone
frequency response: 40–20,000 Hz



¼" Close Talking
Tested using Brüel & Kjaer Type 4227 Artificial Mouth

microphone
polar pattern



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Choosing a Microphone

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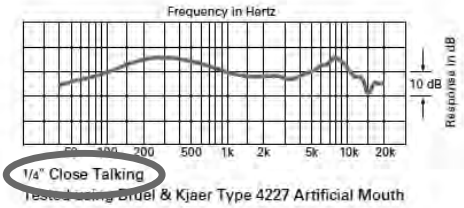
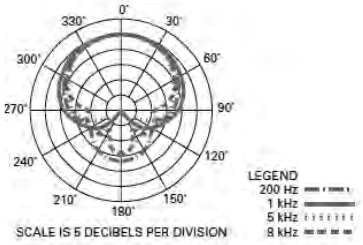


microphone
polar pattern



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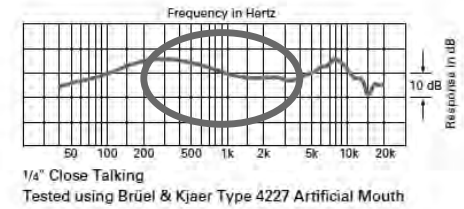

microphone
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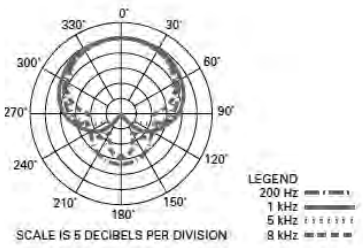

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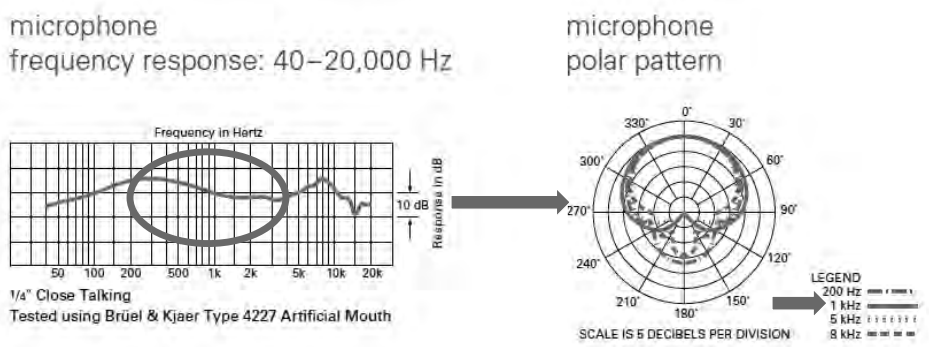

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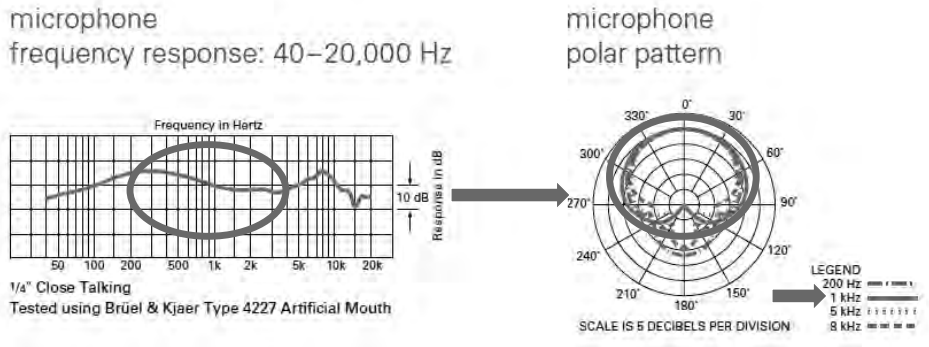

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Choosing a Microphone

- Yamaha CM500 ($60.00)
  - Ruler Flat Electret Condenser element (lots of boomy proximity effect – not for close talking!)
  - Lightweight and reasonably rugged
  - Works with just about any rig with a multiband equalizer (more than just bass and treble)
  - Flex Radio EQ and CESSB Processing seems to LOVE this mic!
  - Also known as the Koss SB40/45

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Choosing a Microphone

- Audio Technica Pro8HEx ($80.00)
- Like you are not wearing a mic.
- No headphones, I use CCA Musician Monitor earbuds
- Superior articulation

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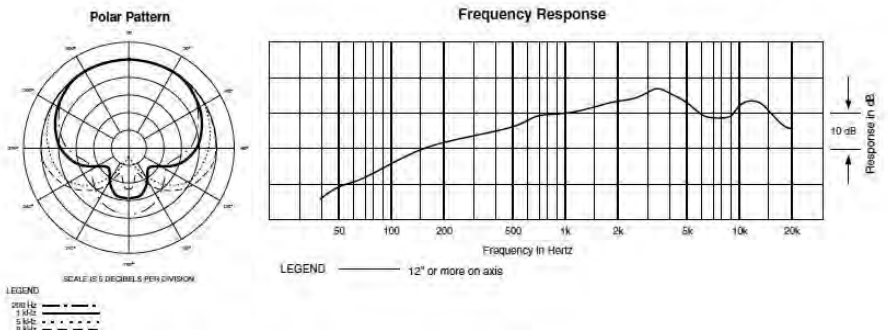
Choosing a Microphone

- Audio Technica Pro8HEx ($80.00)



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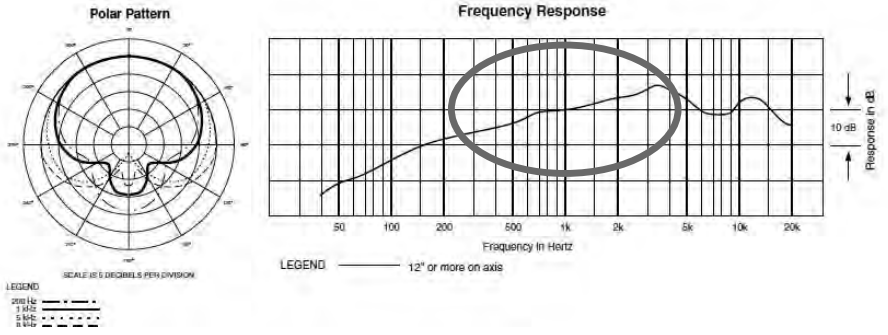

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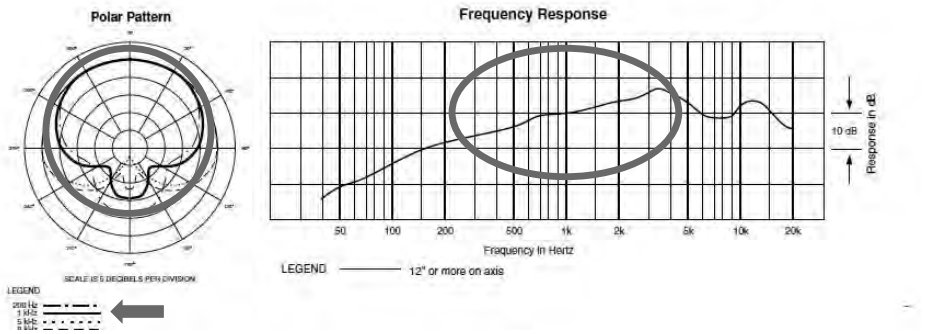

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Choosing a Microphone

- What works for me may not work for you
- You can spend literally hundreds and still not beat a $10 WalMart headset
- With today's transceivers and their high resolution equalizers, you can make most any crappy mic sound pretty good.
- Experiment to find something that fits your needs and voice.

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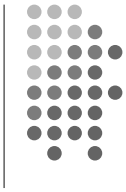
Mic Technique and Acoustics



- Always talk ACROSS the mic, not directly into it (less pops)
- Try not to close talk Electrets (and some Dynamic) capsules (Peak clipping and Proximity effect)
- 2-4 inches from your mouth for best results, depending on room ambiance… Closer in Multi Multi. Lower mic level to compensate

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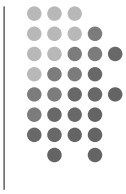
Mic Technique and Acoustics



- Avoid being close to hard walls. Cover with felt or curtains or acoustic foam ($$$)
- Same goes for ceilings and floors – Carpets!
- Desks in corners of hard walled rooms are challenging (comb filter effects); you sit in the focus of a corner reflector
- The quieter the room, the better! The more soft, non-reflecting surfaces, the better.

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Using The Tools at Hand

- My Voice (I hate it!) flat, before any processing

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Using The Tools at Hand

- Apply Gating (if your radio supports it)
  - Maximizes SNR by managing extraneous noise pickup by the microphone:
  - Removes noise by “muting” the audio pickup
  - Reduces “wasted bandwidth”
  - Smoothly manages transition from silence to full power
  - Is different for each environment
  - As close to the microphone as possible

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Using The Tools at Hand

- Apply Gating (if your radio supports it)
  - Maximizes SNR by managing extraneous noise pickup by the microphone:

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Using The Tools at Hand

- Apply Equalization
  - Maximizing SNR by managing frequency response:
  - Remove frequency bands that are “redundant”
  - Accentuate frequency bands that are “high value”
  - Rearrange the power ratio between vowels, consonants and formants for maximum INTELIGIBILITY
  - Is different for each voice and each microphone combo
  - Immediately after Gating but before other processing

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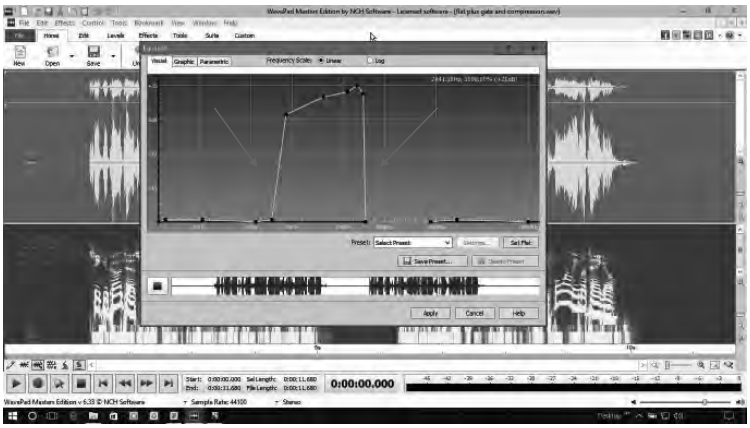
Using The Tools at Hand

- Apply Equalization
  - Maximizing SNR by managing frequency response



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Using The Tools at Hand

- Apply Compression to maximize Dynamic Range
  - Decrease the instantaneous difference between peaks and valleys
  - Increase “modulation density”
  - Take advantage of every watt of power for information transfer
  - Is different for each voice and each microphone combo
  - Always placed directly AFTER Equalization

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Using The Tools at Hand

- Apply Compression
  - Maximizing SNR by managing Dynamic Range

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Using The Tools at Hand

- Apply Limiting (a.k.a. “Clipping”) if available
  - Maximizing SNR by further managing dynamic range
  - Ensures that maximum levels are enforced (protect PA)
  - Increase “modulation density” by clipping overshoot
  - Creates “distortion” (makes sine waves into square waves), so don’t overdo it
  - Creates harmonics as it clips off waveforms, so use restraint and common sense in its application
  - Is always placed directly AFTER compression; Keeping in mind that a little goes a long way… Use in moderation!

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Using The Tools at Hand

- Apply Limiting (a.k.a. Clipping)
  - Set a brick wall for overshoots to avoid overmodulation splatter

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What Are We Trying to Do?

- Transfer intelligence (message) within 3kHz
  - Maximize INTELIGIBILITY within our bandwidth constraints
  - Use as much available power as possible for information transfer
  - Reduce frequencies that inefficiently transfer information
  - Accentuate frequencies that transfer information
  - Use all available means to increase SNR across all formants and vocal spectra (see Slide #10 chart!)

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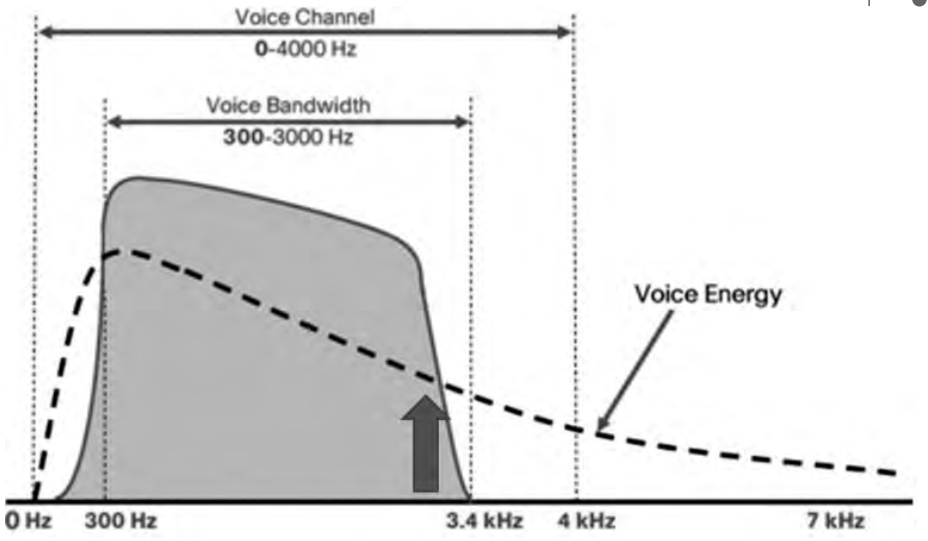
The Secret Sauce



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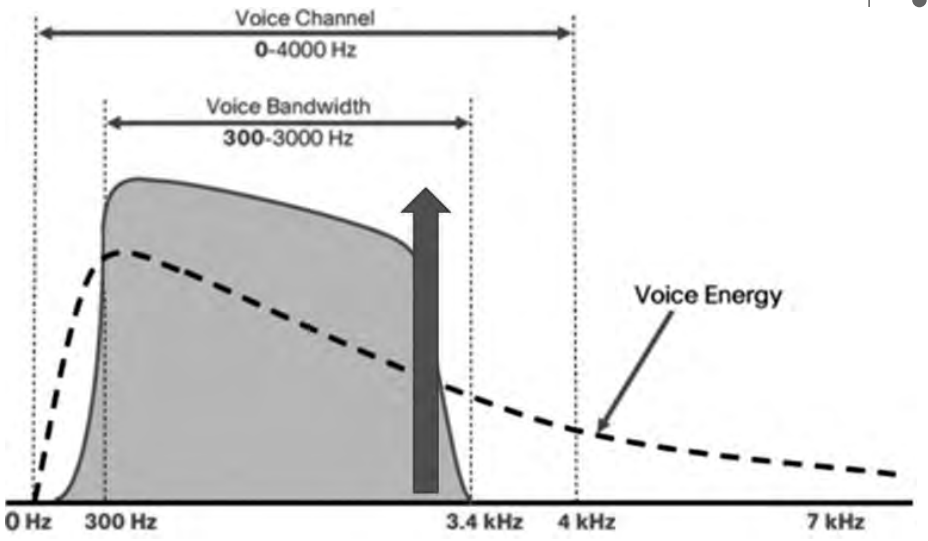

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Through the Transmitter

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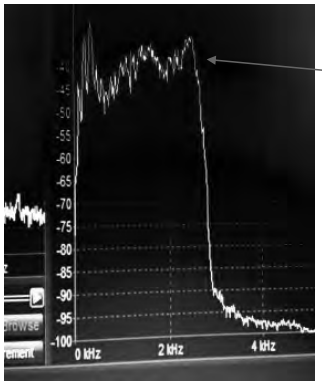
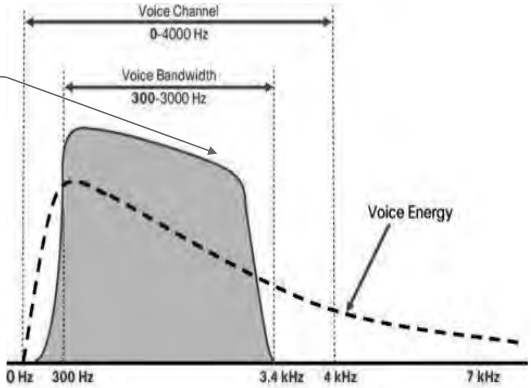
What Are We Trying To Do?

- Will it win any Dynamic Range or Timbre Awards?





Probably not – But it will get the information through!

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What's The Point of All This?

- The idea is to be HEARD and UNDERSTOOD!
  - We only have 3kHz to do it in
  - We are transmitting into a very noisy medium (SSB contesting creates really high noise floors!)
  - We must adapt as EVERY VOICE IS DIFFERENT!
  - A SSB Contest is not a place for ESSB or Wide Dynamic Range audio!
  - All Things In Moderation – Knobs to 11 are only good for Spinal Tap, not hams!

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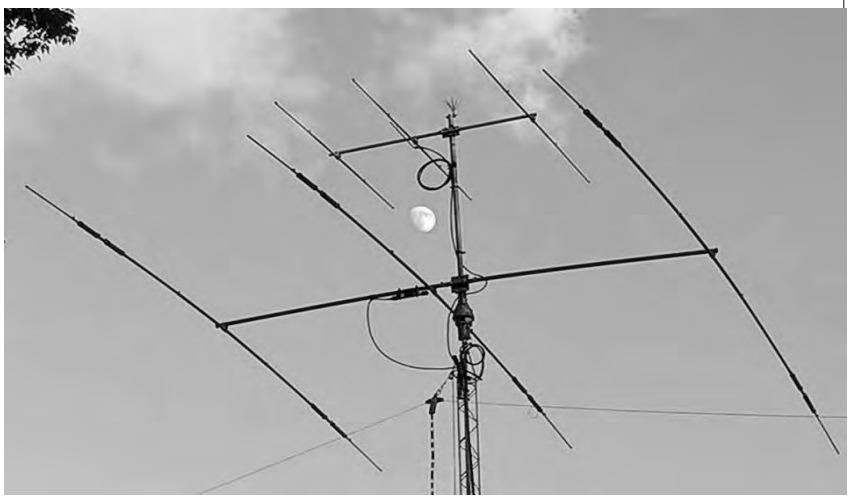
What's The Point of All This?



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Addendum: New Technologies

- A few words and simple sentences about:
  - Controlled Envelope Single Sideband – “CESSB”
  - Adaptive Pre-Distortion – “Pure Signal”
    - These are new (to Hams) technologies made possible by Software Defined Transceivers and DSP processes
    - More accurate, more effective, cleaner ways to manage audio dynamic range
    - They make for good neighbor relations, maximizing band useability and reducing the noise floor

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Pure Signal

- Concept has been around since the 1960’s: “Datatek” Pre-Distorter for UHF TX’s
- Idea is: Dynamically screw up the waveform at the input so it “comes out right” at the output by sampling the TX output and correcting at the input before modulation.
- Easier now with DSP and SDR than with capacitors and resistors.
- First seen on the ADAT200, now marketed by ANAN and “OpenHDSDR” (Hermes, et al.)

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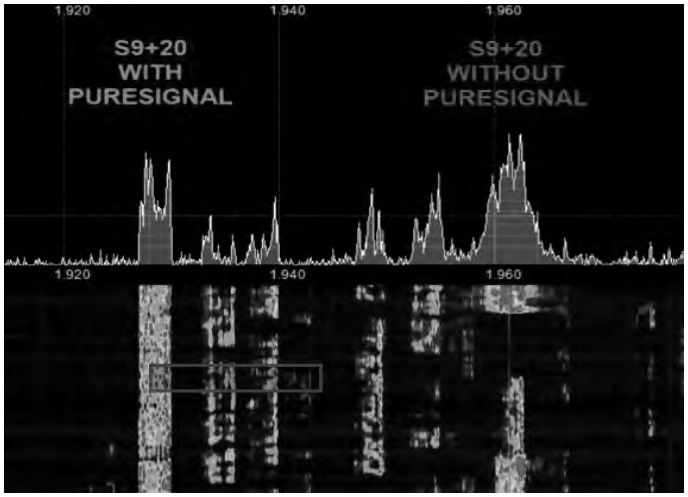
Pure Signal – Less “Splatter”



Courtesy VK5HW

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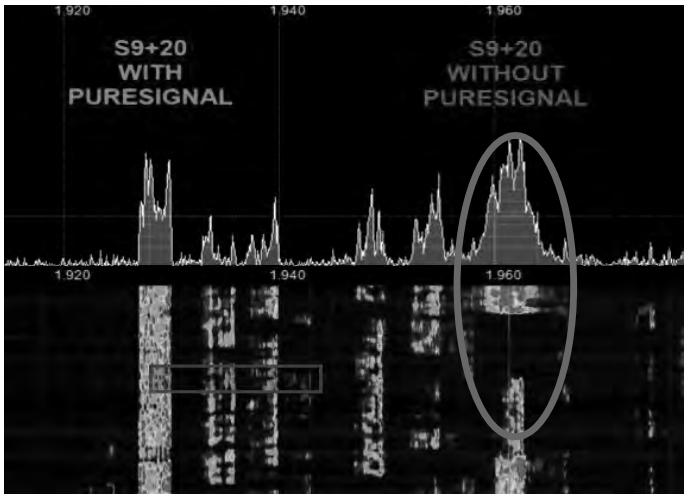
Pure Signal – Less “Splatter”



Courtesy VK5HW

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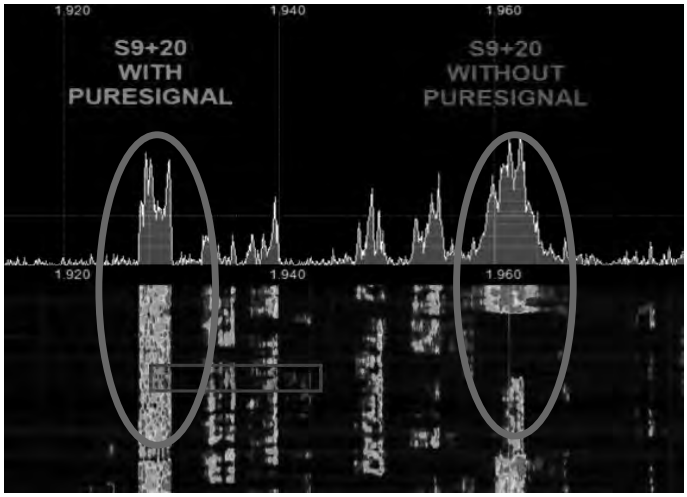
Pure Signal – Less "Splatter"



Courtesy VK5HW

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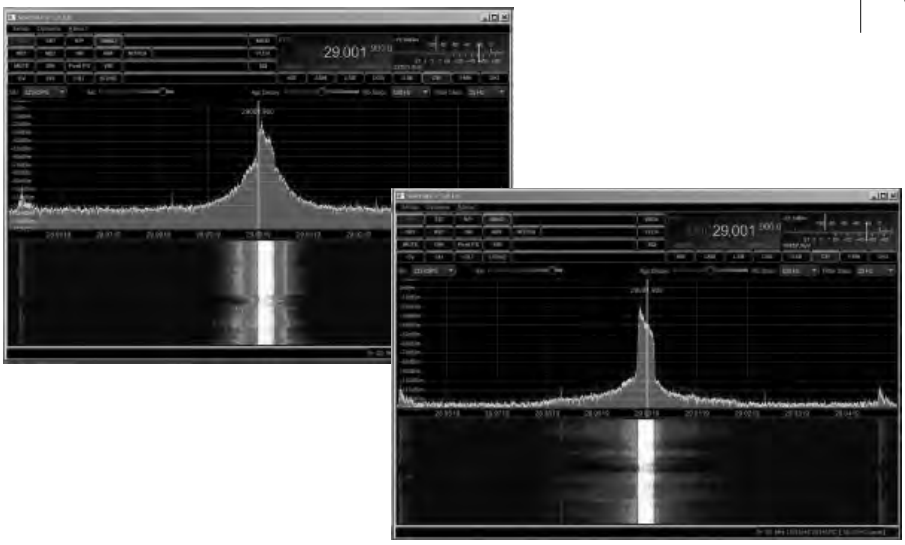
Pure Signal – Reduced IMD



Courtesy NR0V

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Controlled Envelope SSB

- Developed by W9GR, implemented by Flex Radio in the 6000 series
- I was skeptical – “just another processor”… Then I played with it for a while... WOW!
- Really a “different” way to generate SSB; clean, tight and intelligible with minimum distortion products – close to Pure Signal in a single ended process.
- Maximizes dynamic range with superior peak control – really makes the meters dance: Without noticeable distortion!

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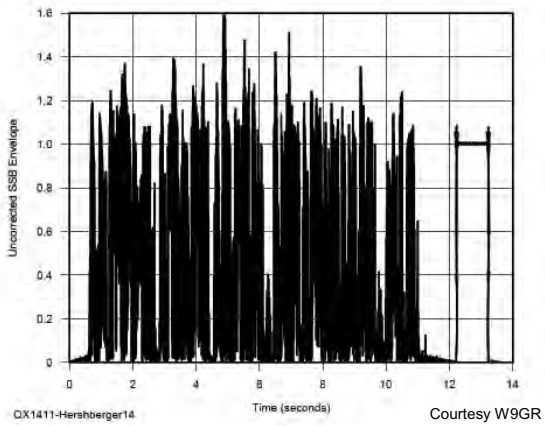
Advantages of CESSB



Conventional SSB with ALC: 59% Overshoot

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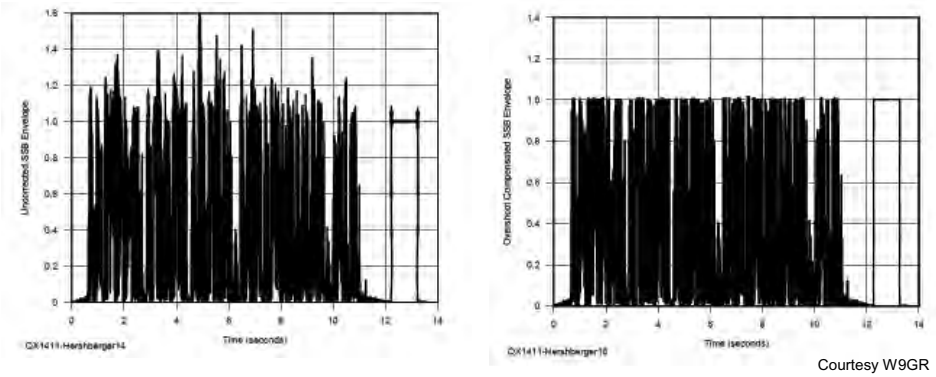
Advantages of CESSB



Courtesy W9GR

In Comparison, CESSB = 1.6% Overshoot

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CESSB Maximizes RF Power

- Average power increase of about 80% (2.56dB) – WITHOUT added distortion !

Without CESSB

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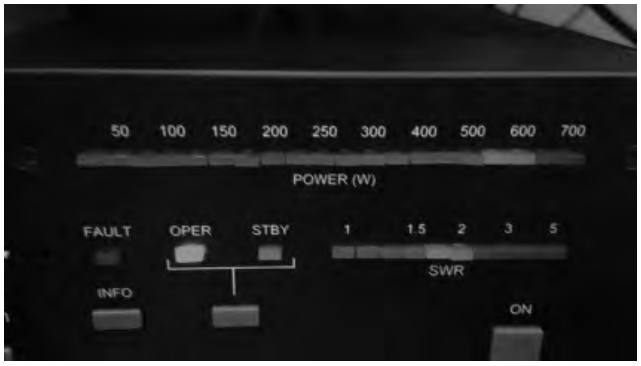
CESSB Maximizes RF Power

- Average power increase of about 80% (2.56dB) – WITHOUT added distortion !



With CESSB

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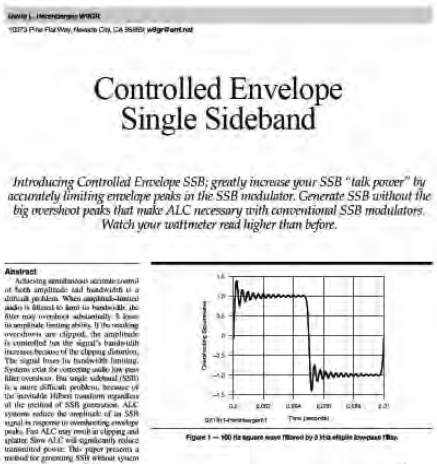
The Magic is in the Math!

- Deep dive by Dave W9GR… Hold your breath!



Controlled Envelope Single Sideband

Introducing Controlled Envelope SSB; greatly increase your SSB "talk power" by accurately limiting envelope peaks in the SSB modulator. Generate SSB without the big overshoot peaks that make ALC necessary with conventional SSB modulators. Watch your wattmeter read higher than before.

Abstract

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But if you own a Flex 6XXX…

- … Here is all you need to know about this:

18.4.2 Operating the Speech Processor

The speech processor implements the W9GR Controlled Envelope Single Sideband (CESSB) peak limiting algorithm in SSB, AM and FM modes. The processor may be on or off and has three different settings when enabled. In the NOR or normal setting, the processor provides minimal additional gain and simply prevents audio peaks from clipping or producing power in excess of the set level. In the DX setting, some compression is provided to the audio to increase the overall sideband envelope which results in a stronger signal that may be more readily heard at a distance. The DX+ setting adds even more compression increasing your talk power or "punch" without incurring significant audio distortion. DX+ is most effective if you increase the low-cut TX filter to between 200-400 Hz in order to concentrate your talk power in the audio frequency range that has the greatest intelligibility.

The recommended setting is to leave the speech processor enabled and in the NORmal or DX position.

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In Closing…

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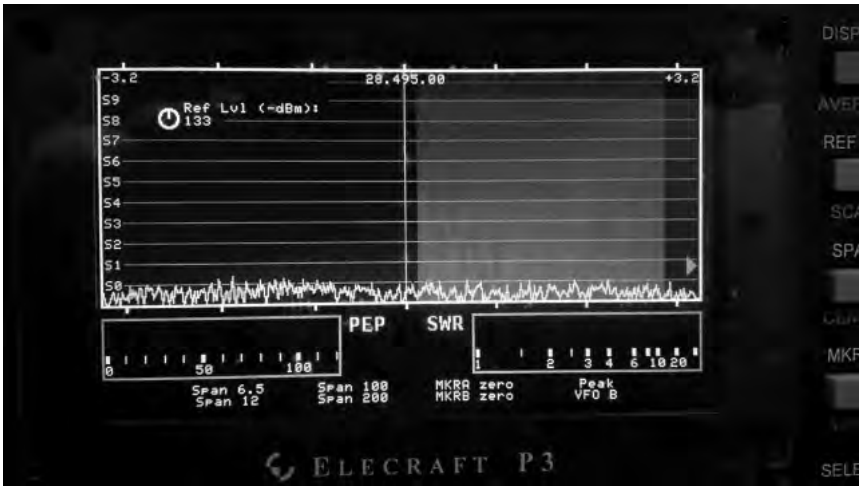
Don’t Be This Guy!



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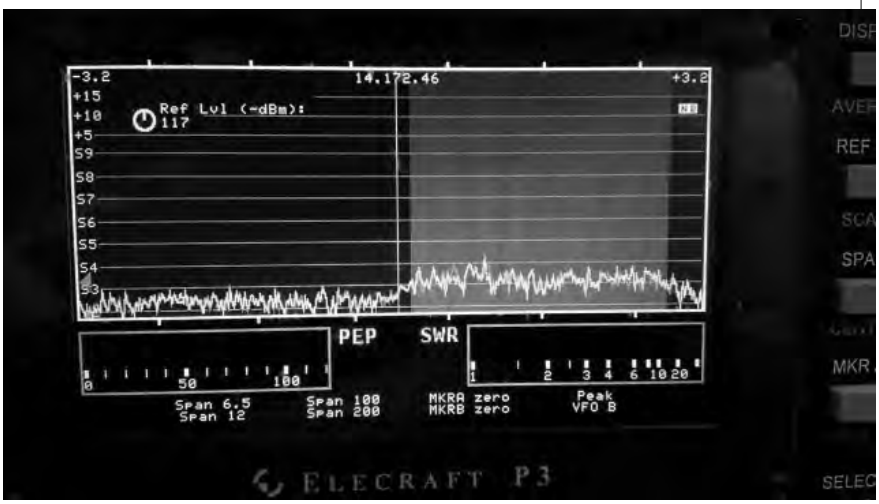
Be This Guy!



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Thanks for your attention!

Questions?
Comments?

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SSB Audio Contest Processing:
Being HEARD and UNDERSTOOD!

Email: lromero56@tampabay.rr.com / Hamshack Hotline # 12383

Luis V. (Lu) Romero – W4LT
CTU Orlando 2022

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References and Bibliography:

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C.E. Shannon
Bell System Technical Journal, 1948

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Martin Ehrenfreid, G8JNJ
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www.long-lines.net

"Controlled Envelope Single Sideband"
David Hershberger, W9GR
QEX Nov-Dec 2014

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Youth – The Future of Amateur Radio

Max Fountain – KJ4EUT

1

Youth – The Future of Amateur Radio

HOW I GOT STARTED

2

How I got started

- My Father, Pete – WD4IXD
- Licensed in 1977
- Hallicrafters HT-37 Transmitter w/ Drake 2B Receiver
- 40m Dipole

3

How I got started

- Licensed in 2008
- Contesting and DXing
- Alinco Dual Band Radio for 2m and 440
- 2m - Ringo Ranger on a 15ft pushup pole
- 440 - 4 Element beam

4

How I got started

- Invited to K4T DXpedition to the Dry Tortugas 2010
- 100% Green Operation powered by wind
- 3 Stations running 24/7 80-6m

5

How I got started

- 9k QSOs between SSB, CW, and Satellite operations
- Largest satellite DXpedition ever at the time

6

Youth – The Future of Amateur Radio

LOOKING BACK

7

Looking Back

- QST Articles of old remind us of the “once was”
- *“It got to the point that the highlight of each day was the radio contact between YN4KLB and W5AUT. This usually brought news of our families and a few words of hope…Through W5AUT we were able to get medical supplies for our expectant mother, insulin for a diabetic, and a sick woman was able to get out by private plane.”* – QST Magazine June 1980

AUGUST 1983 COVER OF QST FT. OWEN GARRIOTT W5LFL. IMAGE: QST - ARRL

8

Looking Back

- *Amateur radio needs new blood and too many youngsters never even heard of ham radio… What we need is lots more teenagers raising the roof at hamfests and … shuttling around all the bands.* - CQ Magazine August 1948.
- *Amateur radio is growing older, more mature. It has long been more that just a hobby for the youngsters: it has now gotten well beyond their reach (in terms of cost and complexity).* - QST Magazine May 1938.

HAM OPERATOR IN 1921. IMAGE: CA BRIGGS/LOC

9

Looking Back

- 1970 average youth (0-17) population was 34%.
  - Using this to apply to the # of HAMs, this equals approx. 97k
- 1980 average youth (0-17) population was 28%
  - Approx. 121k
- 1990 average youth (0-17) population was 25.7%
  - Approx. 127k

Year	US Pop Millions	% Increase per year	All Hams Thousands	% Increase per year	% US Pop
1970	203		285		0.140
1980	225	1.08	433	5.19	0.192
1990	249	1.07	494	1.41	0.198
2000	279	1.20	677	3.70	0.243
2010	308	1.04	682	0.07	0.221
2015	320	0.78	725	1.26	0.227
2019	327	0.55	755	1.03	0.231

DATA FROM WWW.AH0A.ORG/FCCLICENSES.HTML

10

Youth – The Future of Amateur Radio

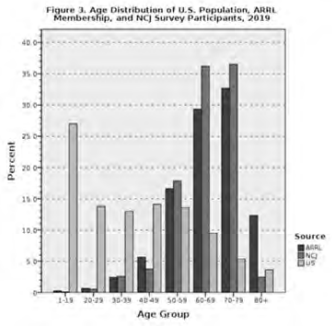
THE PRESENT

11

The Present

- From Howard Michel, WB2ITX, former ARRL CEO in his Second Century editorial in QST May 2019:

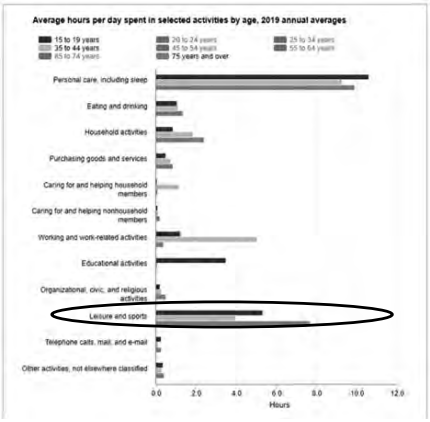
- Average ARRL Member is 68 years old. 54% are Extra Class, 31% General Class.
- Average Nonmember is 52 years old. 75% are Technician Class, 18% General, 7% Extra.

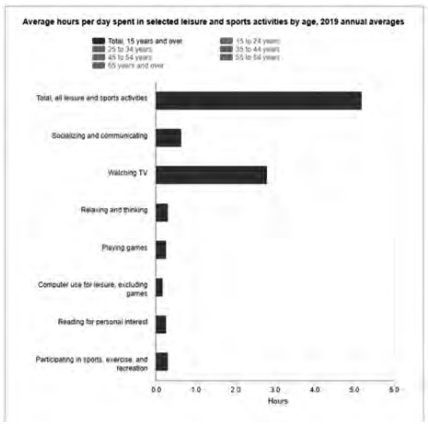


SOURCE: N8RMA's 2019 State of the Hobby Survey

12

The Present



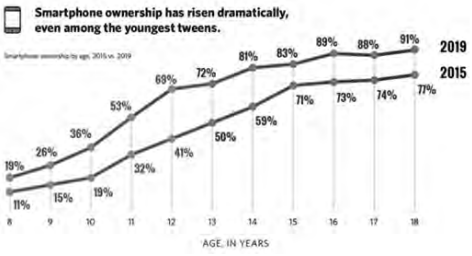


SOURCE: U.S. Bureau of Labor Statistics

13

The Present

- Based on the survey conducted every four years, “screen time” increase heavily led by Smartphone ownership vs 2015
- 53% of Tweens screen media activity dedicated to TV/Videos, Teens – 39%
- Youth are utilizing smartphones as their main form of entertainment



SOURCE: Common Sense Census: Media Use by Tweens and Teens 2019

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Youth – The Future of Amateur Radio

WHAT CAN WE DO?

15

What can we do?

- Get involved with already existing youth programs
  - YOTA (Youth on the Air) – Held its first US camp and holds contest events
  - YACHT (Young Amateurs Communications Ham Team) – Formed in 2007, one of the longest-running youth organizations. Have a team of 50 adult mentors - Echolink net on #954283 and on the W8PIF-R repeater #481872
  - Radio Club of America – Carole Perry moderated the Youth Forum for 32 years at the Dayton Hamvention – Taught “Introduction to Amateur Radio” for 30 years in a New York Middle School

PHOTO SOURCE: YOTA Camp Cincinnati 2021 Americas

16

What can we do?

- Be an Elmer
  - Youth family member or friend's son/daughter – show them how cool amateur radio can be!
  - Show and have the youth participate in the many facets of Amateur Radio. From contesting, DXing on HF, Digital QSOs on FT8/FT4/PSK31, SOTA (Summits on the Air) and like programs, or ragchewing on a repeater
  - Don't just tell or show them how it's done, let them experience it for themselves
  - Lend a spare radio, help them get a shack started

PHOTO SOURCE: YOTA 5 January 2019 Kids Day Publication

17

What can we do?

- Join your local Amateur Radio Club
  - Many clubs are already involved in the community with youth outreach programs
  - Club organized Field Day – a great way to meet and engage with youth of your community
  - ARRL has a online listing of ARRL Affiliated Clubs to help find the right club which suits you

PHOTO SOURCE: Florida Contest Group Logo

18

Youth – The Future of Amateur Radio

THE FUTURE

19

The Future

- STEM (Science, Technology, Engineering, and Mathematics) programs in schools are keeping Amateur Radio with the youth of today
- Opportunities for scholarship programs such as the ARRL Foundation are allowing youth more opportunities with HAM Radio
- Careers involving technology and engineering are more prevalent today
- The key to the future of amateur radio is you – our current HAMs

PHOTO SOURCE: The Daily Gazette - "Kids get to ham it up a bit" - Jan 5th 2009

20

The Future

- *Amateur radio needs new blood and too many youngsters never even heard of ham radio… What we need is lots more teenagers raising the roof at hamfests and … shuttling around all the bands.* - CQ Magazine August 1948.

- *Amateur radio is growing older, more mature. It has long been more that just a hobby for the youngsters: it has now gotten well beyond their reach (in terms of cost and complexity).* - QST Magazine May 1938.

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Youth – The Future of Amateur Radio

QUESTIONS?

22

CTU Presents

WRTC2022
World Radiosport Team Championship
Bologna Italy July 2023

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1

WRTC2022 Bologna Italy July 2023

WRTC 2022 World Radiosport Team Championship Italia

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2

What is WRTC ?

During Contests, every operator has **different conditions** compared with all other competitors: location, antenna's, propagation and personal skills some of the many variables.

It's almost impossible to know who is really the best operator, because you never know how his results will be influenced not only by his skills, but overall operating conditions.

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Have a level playing field

- All competitors must have the same location, antennas, and power levels to see how the personal skills can make the difference in finding the best operators in the world.
- By providing a completely Level Playing Field allowing operators to compete on equal terms, is exactly what WRTC has been doing since 1990.

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What WRTC Will Do

- WRTC will bring 65 teams of operators together after a hard assessment of their qualifications.
- They will compete against each other during IARU HF Championship with the same weapons. This is the only way to know the operators' skills.
- World Radio Team Championship is a world-wide, 4-year event.
- It is a Contest within a Contest.

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WRTC2022 - How It Will Be

- 65 stations in the field, each with a site and all facilities, enough distant from each other but in the same geographic location.
- It's a big committment for some 300 volunteers to install the stations and ensure their safekeeping before, during and teardown after the competition.
- You can easily compare this 4-year event to the Olympics, as it has been called the "Radio Olympics" by concentrating a large number of competitors and referees in the same location.

- Photo courtesy of EY8MM

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WRTC is not only a competition

- WRTC is not only a competition: it is really one of the best occasions to meet each other. It is a meeting point.
- There is no other occasion to have all top contesters together passing some days over a glass of wine.
- Everybody will be able to enjoy some excursions around Italy, enjoying the the culture, scenery and good food and wine.

Photo courtesy of EY8MM

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WRTC the History

▶ 1990 USA Washington	-	John Dorr K1AR Doug Grant K1DG
▶ 1996 USA California	-	Jeff Steinman KR0Y(N5TJ) Dan Street K1TO
▶ 2000 Slovenia	-	Jeff Steinman N5TJ Dan Street K1TO
▶ 2002 Finland	-	Jeff Steinman N5TJ Dan Street K1TO
▶ 2006 Brasil	-	John Sluymer VE3EJ James Roberts VE7ZO
▶ 2010 Russia	-	Vladimir Aksionov RW1AC Alexey Mikhailov RA1AIP
▶ 2014 USA New England	-	Daniel Craig, N6MJ Chris Hurlbut, KL9A
▶ 2018 Germany	-	Gediminas Lucinskas, LY9A Mindaugas Jukna, LY4L

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Where and when will WRTC take place ?

In July 2023 - posponed due to Covid19 - it will be in Italy, near the city of Bologna.

The Organizing Committee has its headquarters in Guglielmo Marconi's house in Sasso Marconi (very close to Bologna) which is now the Headquarters of Fondazione Guglielmo Marconi (IY4FGM). The Organizing Committee is cooperating with ARI (the biggest Italian Amateur Radio Association) and other Associations.

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What will be WRTC 2022 ?

Participants to WRTC will be hosted from the Thursday before the contest for six days. This allows all competitors to setup and check their contest stations in the field.

Before and after the contest there will be time for excursions around Emilia Romagna.

One of these will be the visit to Guglielmo Marconi's house, the headquarters of the WRTC2022 Committee.

It is a unique opportuity for amateur radio operators to visit Marconi's home and possibily operate the IY4FGM station.

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Who will be there ?

This means that in Bologna in 2023 we will have more than 180 hams, competitors and referees with many guests.

We expect to have over 1000 people from more than 40 different countries.

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Where is Bologna in Italy?

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Marconi's Home - Villa Griffone

- Birthplace of wireless
- Main residence of the Marconi family from the mid-1800s
- Guglielmo Marconi set up his first workshop and performed his first radio-telegraphy experiments
- WRTC headquarters is located here

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Bologna - Where every day is special

- HISTORY – Experience medieval Bologna's downtown area
- FOOD – Enjoy wine, parmigiano reggiano, pasta, ham, balsamic vinegar…
- RADIO – Visit Marconi's house and radio museum
- FAST AUTOS – Tour Lamborghini, Ferrari, Maserati and Ducati factories and museums

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WRTC2022 POSPONED TO 2023

- The covid situation did not allow to carry out on-site inspections and to involve the necessary volunteers for the initiative.
- Many potential and existing sponsors have found themselves in dire financial straits All national and international events were not held, not allowing the correct and natural advertising of the WRTC 2022 event and the related fundraising
- The pandemic situation is still uncertain with continuous waves, relative difficulties in mobility, both in Italy and abroad.
- It is extremely difficult to have a health and economic situation that allows the WRTC to be carried out in 2022 without affecting the sociality of the event
- After careful analysis and various comparisons with the Sanctioning Committee, at the beginning of 2021 the Board of Directors has decided to move the WRTC from 2022 to 2023 with the specification that the brand remains WRTC 2022.
- All rules and qualification standings will remain the same.

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The Station Setup

At the beginning of 2021 Krassy K1LZ made an important donation of all antennas to WRTC2022

The LZ Antenna special edition LZA 7-3 7 elements:

2el for 20 meters,

2el for 15 meters

3el for 10 meters,

balun and drop with a single cable at 50 ohm.

14 MHz - 11.96dBi, F / B 15.74dB
21 MHz -12.29dBi, F / B 15.36 dB
28 MHz - 13.1 dBi, F / B 17.87 dB

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Testing WRTC's antennas

First 30 antennas arrived in Bologna

The LZA 7.3 tested in Sicily by IT9EQO

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The sites

The great plane near Bologna Ferrara and Modena.

65 stations in field day style

The Adriatic coast of E.Romagna.

65 stations located in hotels.

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The WRTC's station

- A team made up of two operators (a Team leader who has chosen his team-mate)
- Identical 100w stations located in similar sites to eliminate locational advantage.
- All operations will be refereed by impartial hams.
- Operation in Multi-2 without external assistance (PCL or limited SDR)
- Five sponsored teams, six youth teams and some wild card teams

Photos courtesy of EY8MM

I4VEC
Verdi

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The Station Setup

- **ANTENNAS**
  - **Triband yagis -2L 20/15m, 3L 10m - donated by Krassy K1LZ**
  - **Inverted V Dipole 40 meters**
  - **Inverted V Dipole 80 meters**
- **COAX & CABLES – Italian manufacturer Messi & Paoloni will supply cables and connectors**
- **MASTS – Testing a new light tower**
- **ROTORS – Searching for donor solution for rotors**
- **Mechanical needs, like masts for the system will be provided by Momobeam.**
- **As of October 2021**

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WRTC2022 for Youth

- **6 youth team leader will be selected for WRTC2022**
- Applicants born after July 14, 1997 with the highest Qualification Score worldwide
- The Youth Team Leaders must select another youth operator as his or her Team Mate from anywhere in the world.
- **Please consider a donation for youth station sites.**

- **5 Wild Card teams are reserved for the WRTC2022** Organizing Committee to acknowledge exceptional efforts within the pool of applicants that did not otherwise qualify.
- **Two donor slots are still available** (Oct 21) see rules on www.wrtc2022.it

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The qualification process

- Qualification criteria as been published at the end of 2018.
- 24 events that have been included in the qualifiers for WRTC2022 from ARRL CW 2019 to WWDX CW 2020
- We have processed over 110,000 entries. Over 29,600 YL and OM entered the rankings.
- The USA made the best performance for both the total score achieved and the number of operators.
- Thanks to all contest managers for their invaluable help in providing us with the rankings of individual events.
- During 2020, many were unable to participate in the usual multi-operator contests or were unable to reach their contest stations away from home.

K - United States

Total Points: 2873930
Operators: 7365
Total Entries: 25617

Country rank	Operator	Qualification Points (with claimed)	Counted contest entries	Area rank	Area	Class
1	K9RRN	11900	12	1	NA9	Eligible Team Leader
2	K7RL	11629	12	1	NA7	Eligible Team Leader
3	W9RE	11607	12	1	NA4	Eligible Team Leader
4	NN3W	11249	12	1	NA3	Eligible Team Leader
5	KD4D	11105	12	2	NA3	Eligible Team Leader
6	K5GN	11095	12	1	NA6	Eligible Team Leader
7	AA3B	11064	12	3	NA3	Eligible Team Mate
8	K4AB	10832	12	1	NA5	Eligible Team Leader
9	N9NB	10620	12	4	NA3	Eligible Team Mate
10	KU8CW	10561	12	2	NA7	Eligible Team Mate
11	KR5HVO	10454	12	2	NA5	Eligible Team Mate
12	WA1Z	10446	12	1	NA1	Eligible Team Leader
13	K5ZD	10369	12	2	NA1	Eligible Team Leader
14	K3PA	10351	12	1	NA10	Eligible Team Leader

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WRTC2022 world team leaders

Operator	WRTC Area	Country	Area rank	Country rank	Tot WRTC points	Tot entries
EA8RM	AF1	EA8	1	1	11343	12
9G5SA	AF2	9G	1	1	4212	6
ZR2A	AF3	ZS	1	1	11400	12
RBCT	AS1	UA9	1	3	10422	12
RM9I	AS2	UA9	1	1	11567	12
4X6FR	AS3	4X	1	1	11100	12
BA1RB	AS4	BY	1	1	10980	12
VR2XAN	AS5	VR	1	1	11250	12
E21EIC	AS6	HS	1	1	11700	12
JH4UYB	AS7	JA	1	1	10534	12
JH1EAQ	AS7	JA	2	2	10346	12
NP4Z	CA1	KP4	1	1	9974	12
ES2RR	EU1	ES	1	1	11291	12
LY7Z	EU1	LY	2	1	10678	12
IZ8JAI	EU10	I	1	1	10955	12
GI04XUM	EU2	GD	1	1	10706	12
RL5D	EU2	GU	2	1	10309	12
DJ5MW	EU3	DL	1	1	11467	12
SP7GIQ	EU3	SP	2	1	10662	12
DL5AXX	EU3	DL	3	2	10418	12
RA3CO	EU4	UA	1	2	11200	12
R2AA	EU4	UA	2	3	9844	12
EC2DX	EU5	EA	1	1	10810	12
F5DBF	EU6	F	1	1	8439	11
9A7DX	EU7	9A	1	1	11181	12
IZ1LBG	EU7	I	2	2	10752	12
S53MM	EU7	S5	3	1	10329	12
UB7K	EU8	UA	1	1	11321	12
UR0MC	EU8	UR	2	1	11025	12
E77DX	EU9	E7	1	1	11696	12
WA1Z	NA1	K	1	12	10446	12
K5ZD	NA1	K	2	13	10369	12
K3PA	NA10	K	1	14	10351	12
VA2EW	NA2	VE	1	2	10857	12
NN3W	NA3	K	1	4	11249	12
KD4D	NA3	K	2	5	11105	12
W9RE	NA4	K	1	3	11607	12
NE9U	NA4	K	2	18	9429	12
K4AB	NA5	K	1	8	10832	12
K5GN	NA6	K	1	6	11095	12
K7RL	NA7	K	1	2	11629	12
VE5MX	NA8	VE	1	1	11647	12
KI6RRN	NA9	K	1	1	11900	12
9M6NA	OC1	9M6	1	1	10864	12
KH6CJJ	OC2	KH6	1	1	10575	12
ZL3CW	OC3	ZL	1	1	11510	12
W2GD	SA1	P4	1	1	10777	12
PT7ZT	SA2	PY	1	4	7288	10
CE2LR	SA3	CE	1	1	11463	12
PY2NY	SA4	PY	1	1	10620	12

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Let's know a bit more …

Of course the object of this presentation is:

1) Stimulate everybody to partecipate in WRTC 2022 as competitor, referee, volunteer or visitor.
2) Consider donations for this project.
3) All visitors and guests will be welcome. Plan to visit Italy and Marconi House.
4) Participate in the IARU contest 2023, look for WRTC stations and send your logs also to the WRTC committee to help competitors log checking.
5) Consider being a volunteer or an ambassador for your region

PPartecipate in IARU on.

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WRTC 2022 Board of directors

	Name	Call	e.mail
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	Antonello D'Asta	IT9EQO	it9eqo@wrtc2022.it

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How can we donate ?

WWROF Partners with WRTC2022

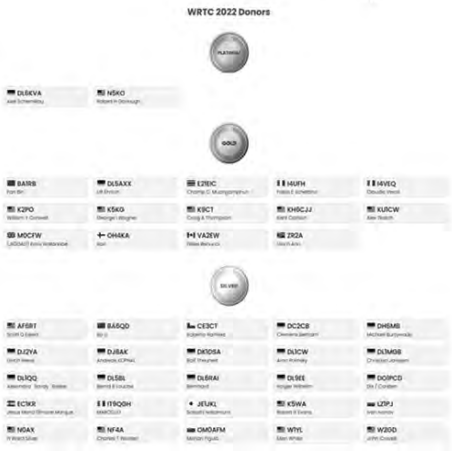
WWROF will help WRTC2022 by facilitating donations from the United States as tax-exempt.

Individuals contributions are possibly tax-deductible under U.S. law, so check with your tax advisor.

Donations (U.S Dollars only), from US taxpayers only, can be sent via PayPal to WRTC2022@wwrof.org, or by check to:

WWROF, Inc. – WRTC2022 Fund
P. O. Box 529 Fredericksburg, TX 78624

Or directly on our web site :
WWW.WRTC2022.IT Donations



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ARRL National Convention

CONTEST UNIVERSITY 2022

HAMCATION

Antenna Notebook

Tim Duffy K3LR

1

HI-Z 8 circle – 113 foot diameter spacing

2

3

4

5

6

7

8

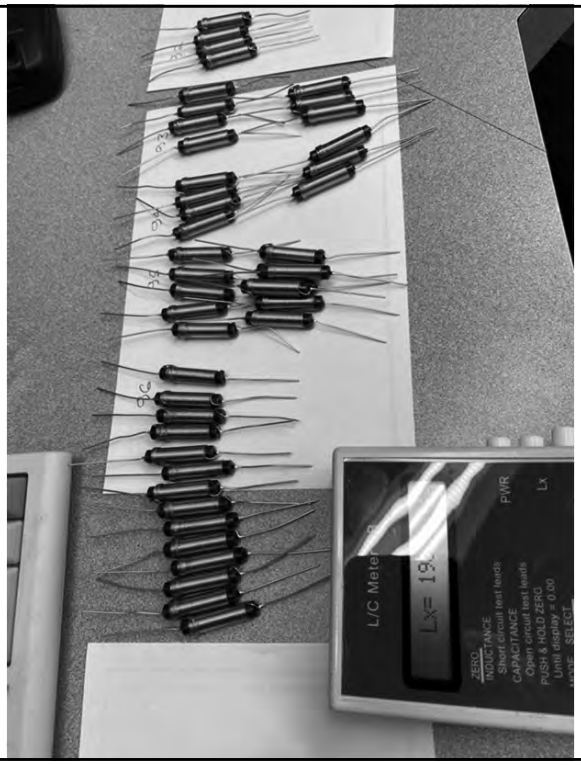
9

10

11

12

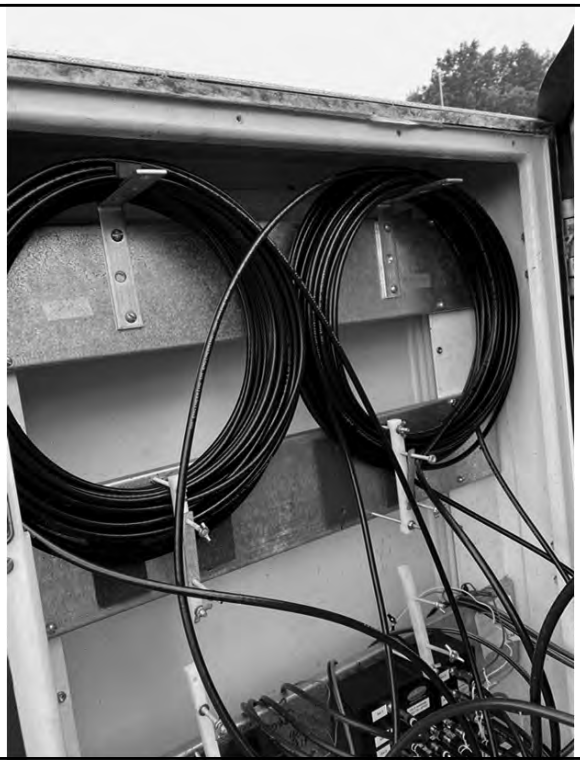
13


L/C Meter
Lx= 19
ZERO
INDUCTANCE
Short circuit test leads
CAPACITANCE
Open circuit test leads
PUSH & HOLD ZERO
Until display = 0.00
PWR
Lx

14

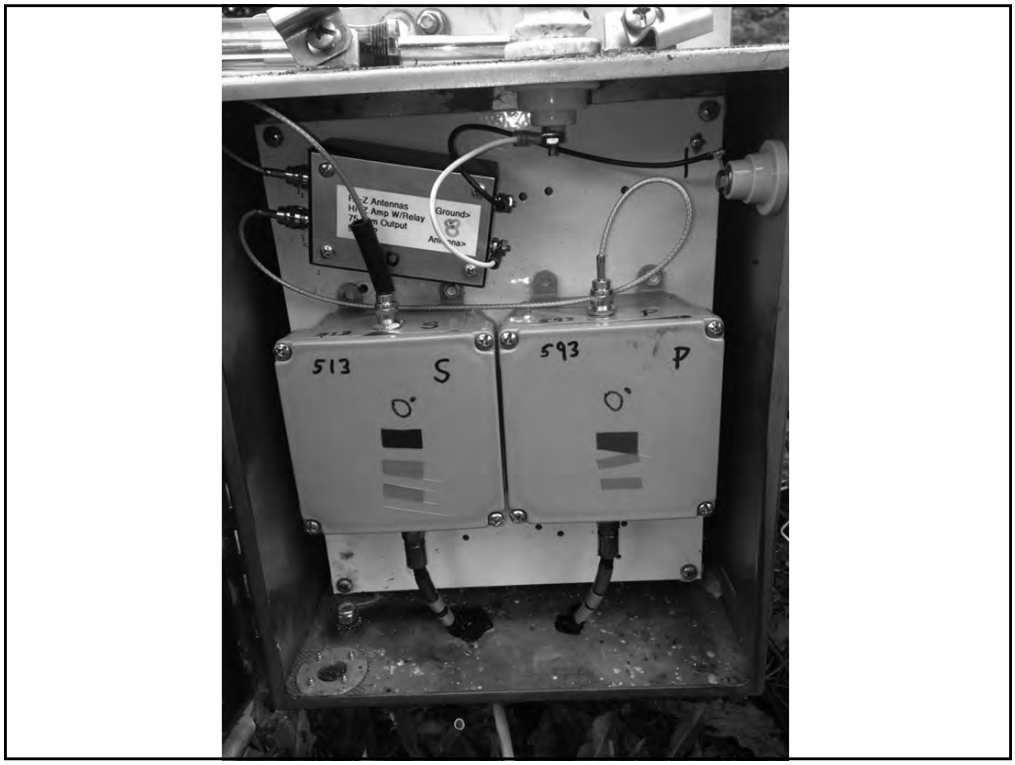

L/C Meter IIB
Lx= 198.0 µHy
ZERO
INDUCTANCE
Short circuit test leads
CAPACITANCE
Open circuit test leads
PUSH & HOLD ZERO
Until display = 0.00
MODE SELECT
With Lx and Cx out
Push ZERO/MODE
PWR
Lx
Cx
ZERO
Almost All Digital Electron
DXE-NOTEPAD

15



16

17



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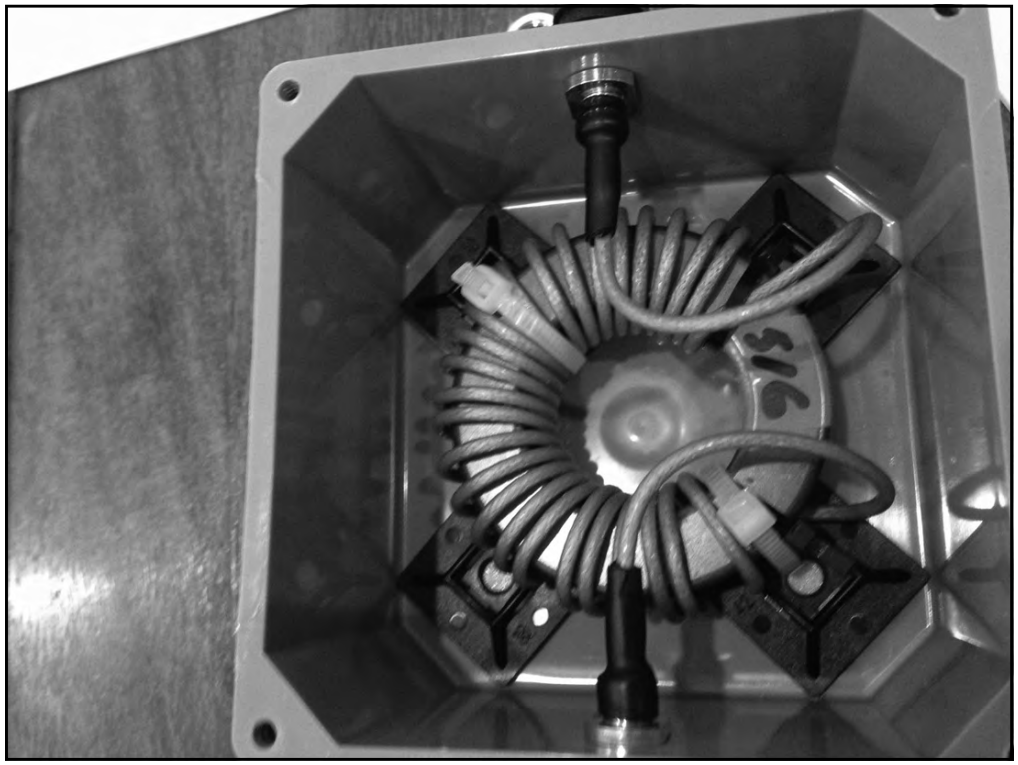

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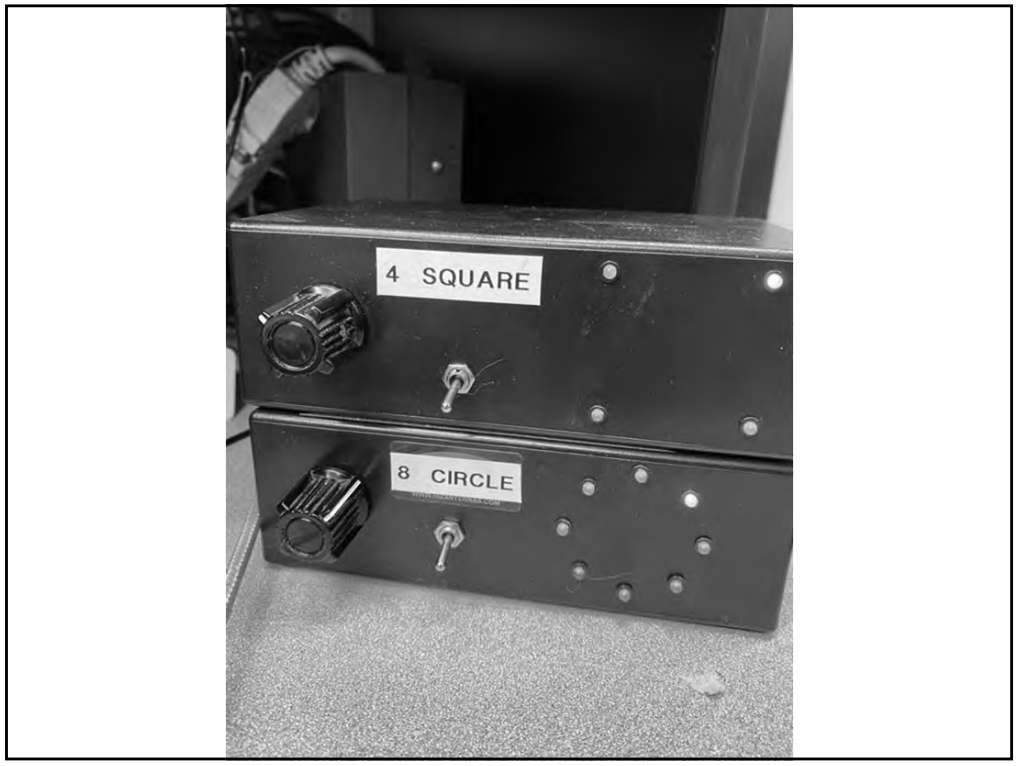

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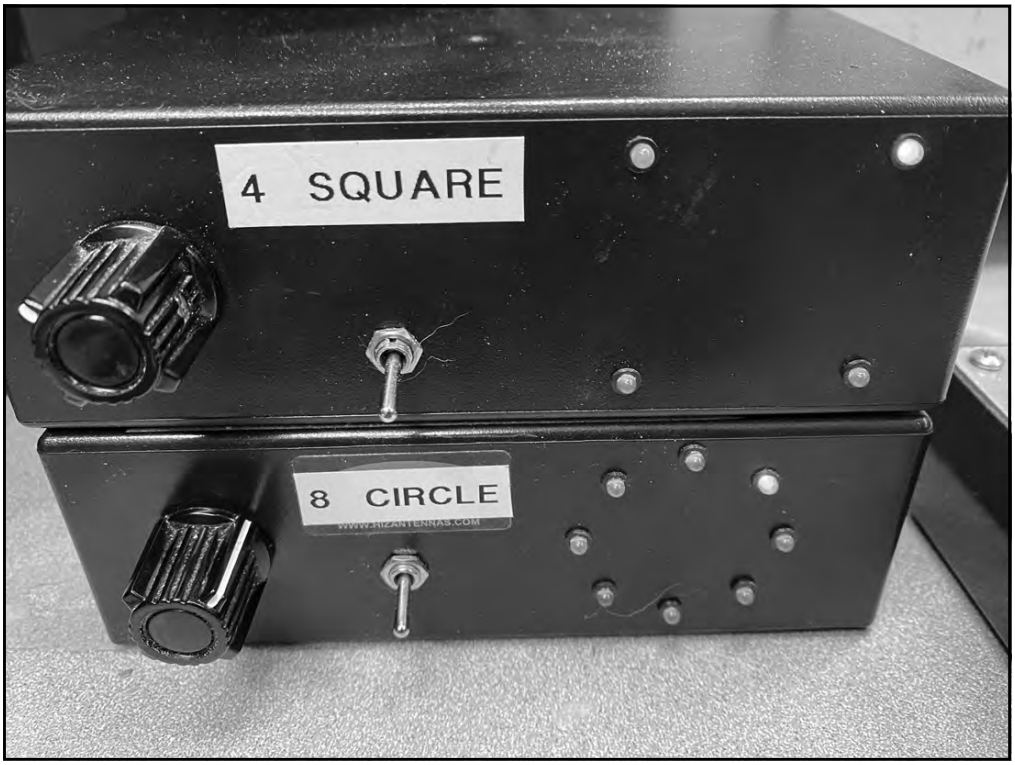
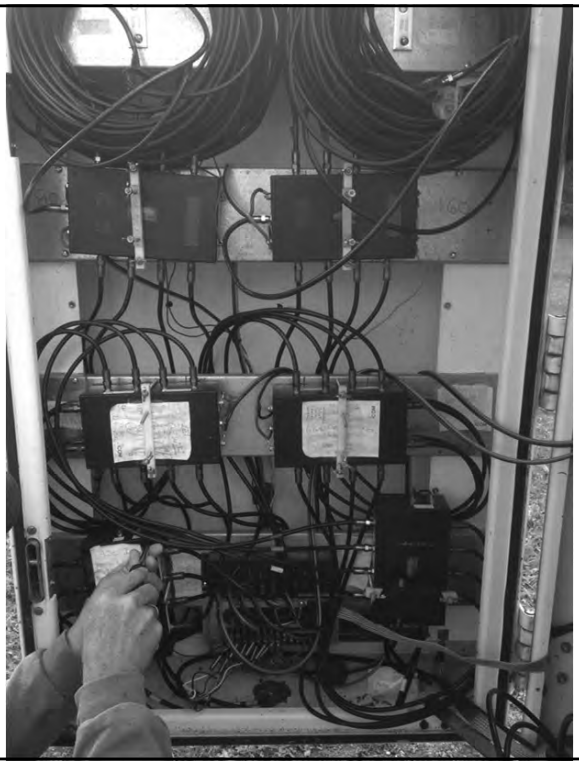

4 SQUARE
8 CIRCLE

21


PWR
8CR
4SQ
BIP
BOP
1
2
3
4
HI—Z BBE
EEN HERON ENGINEERING

22

23



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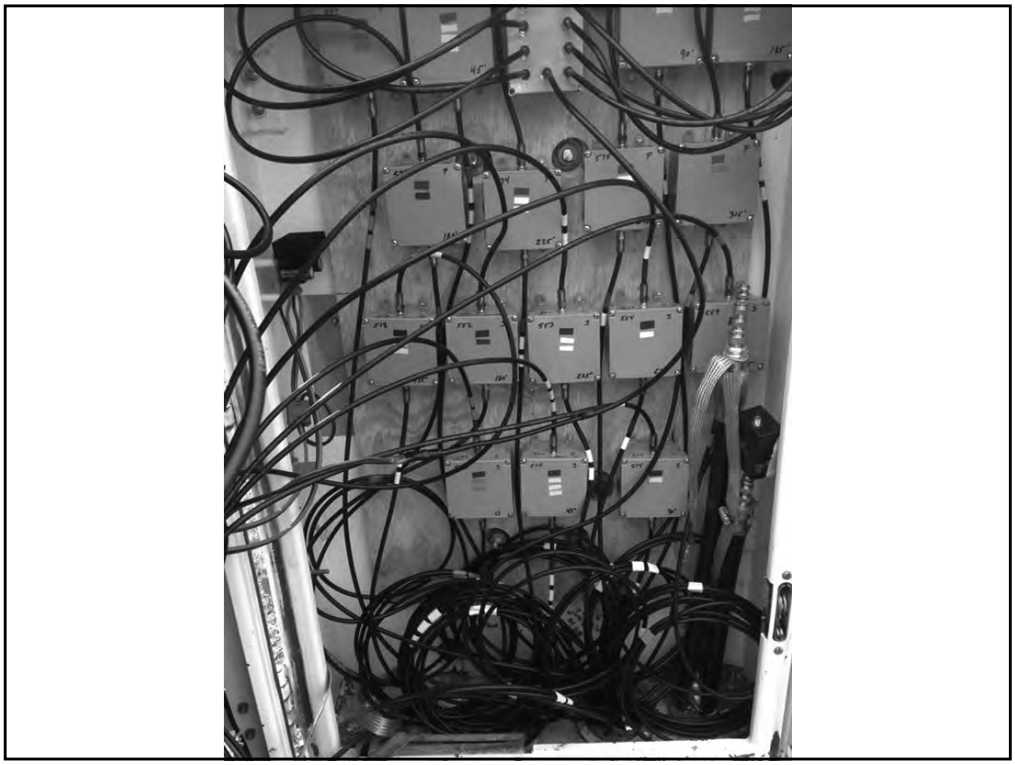

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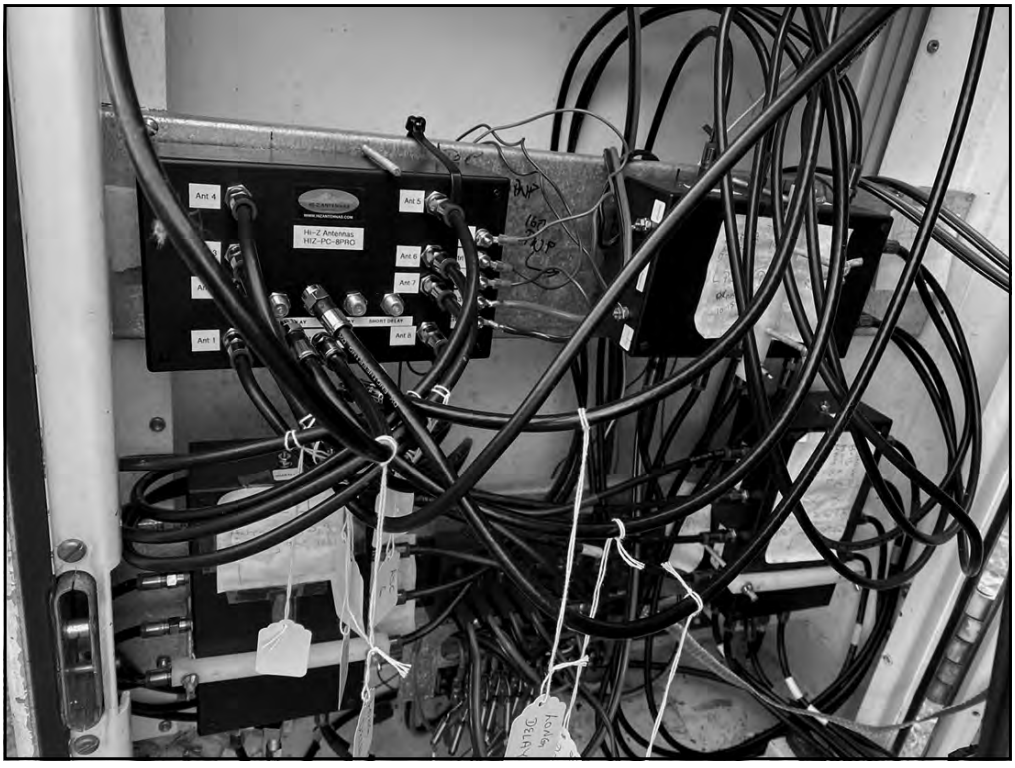

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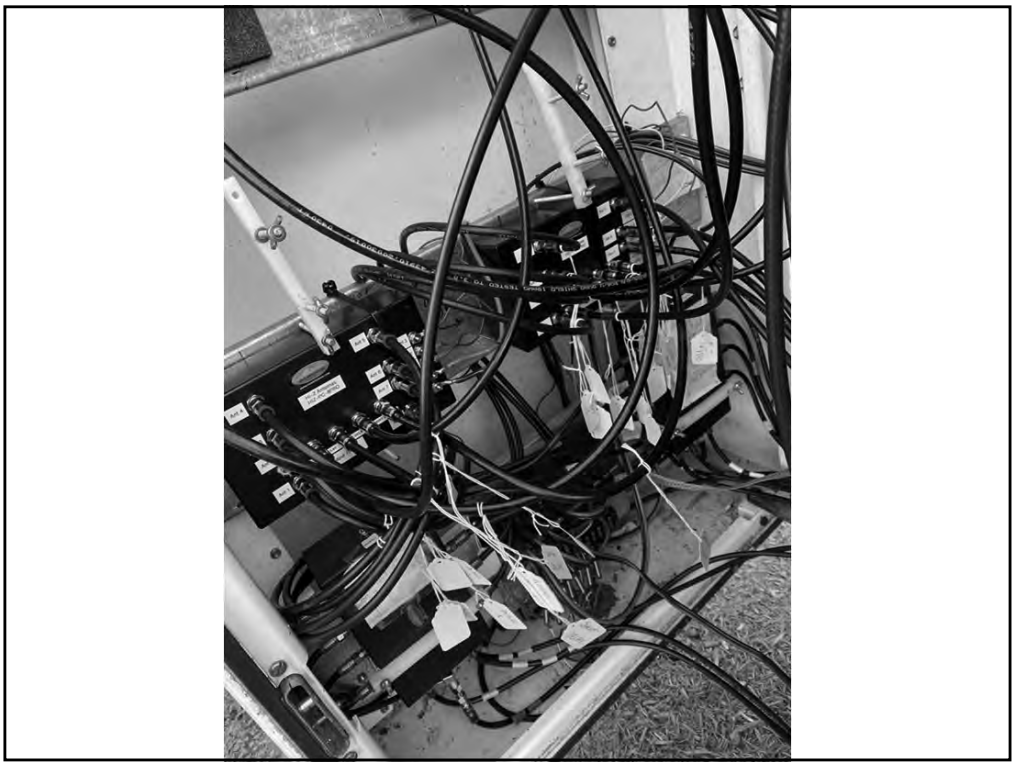

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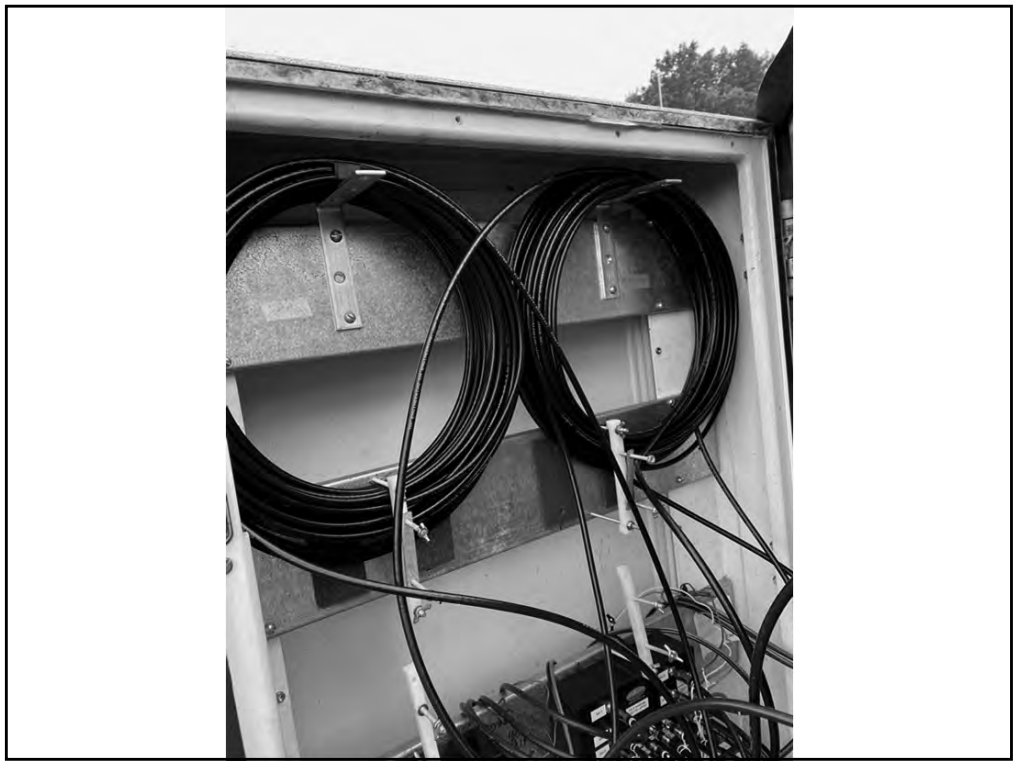

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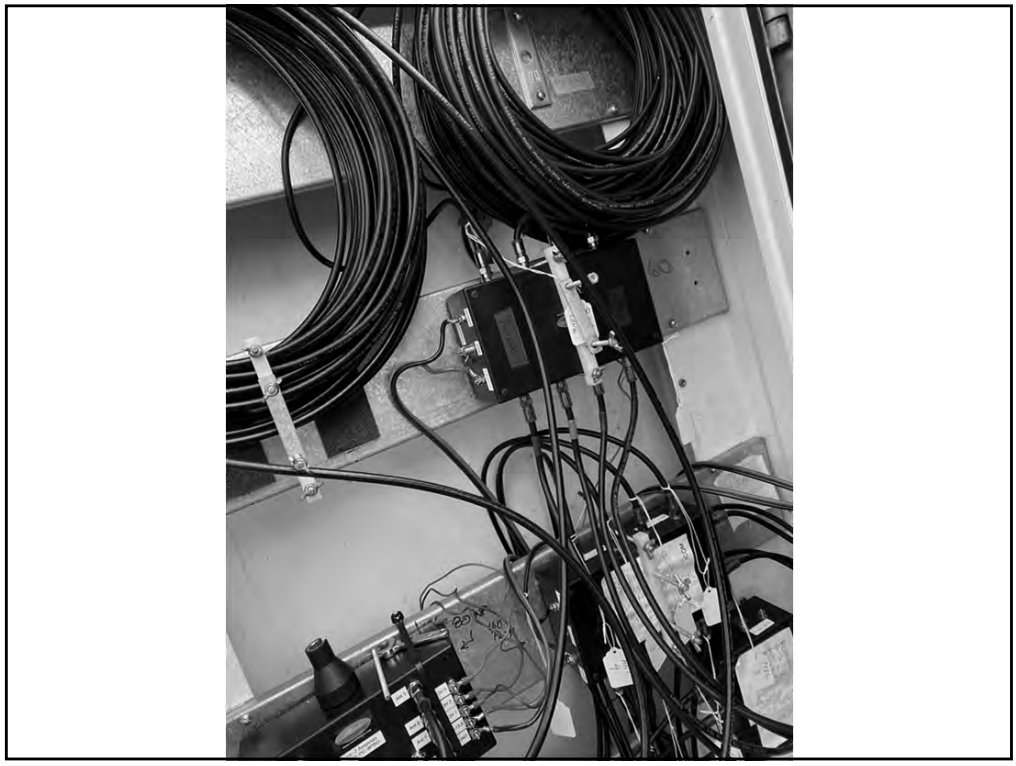
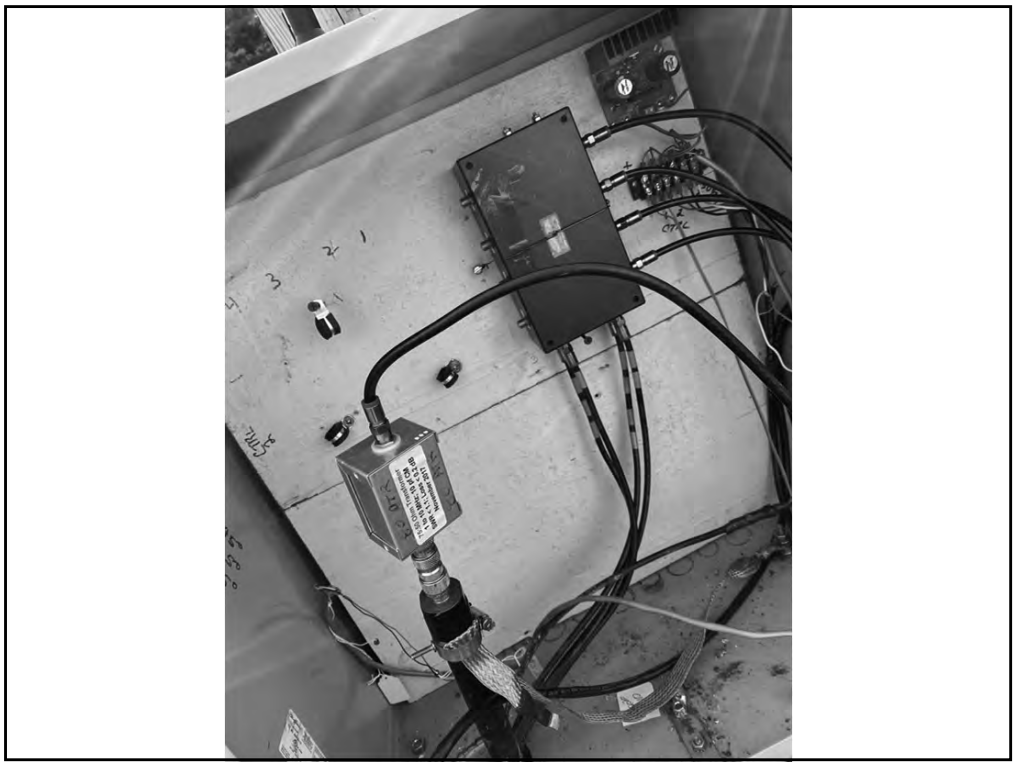


30


Hi-Z Antennas
HIZ-PC-4A
Ant 2
3
Ant 1
Ant 4
SHORT DELAY
LONG DELAY
SHORT DELAY
Output 75 Ohm
Ctrl 2
Ctrl 1
+13.8
GND

31

32



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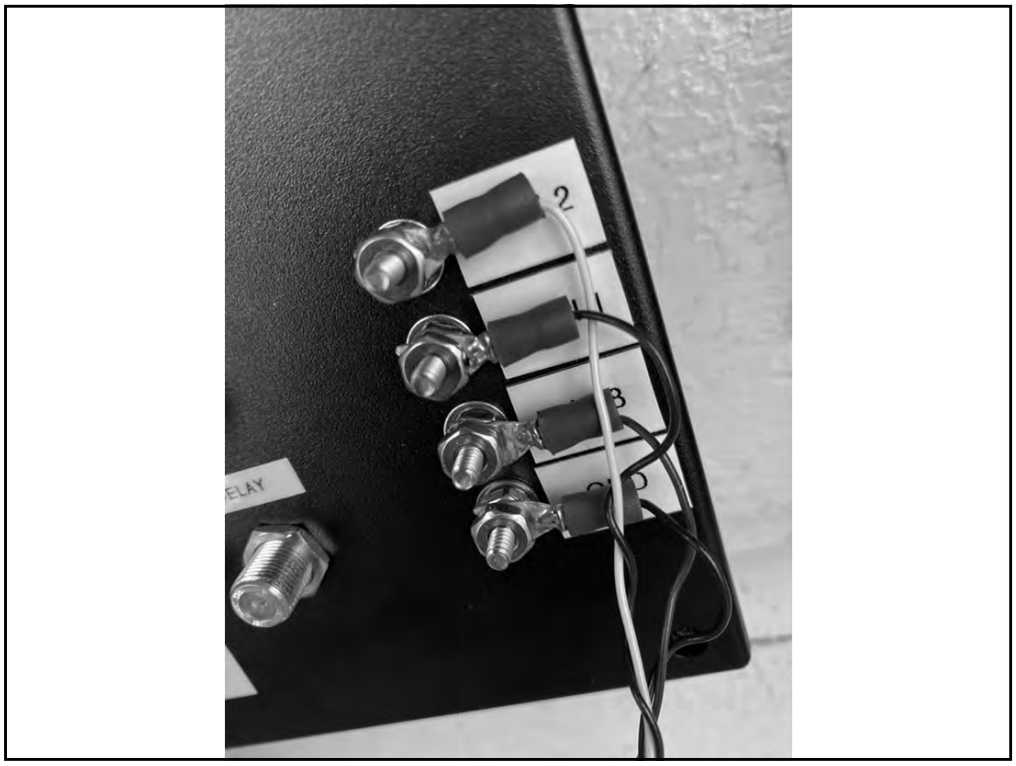


34

35

36

37


RF OUT
11-14VDC
PC
160
80
60
40
30
20
17
15
12
10
6
2
Band
PF1
PF2
HOLD
-107 dBm
1 µV
-73 dBm
50 µV
-33 dBm
0 dBm
Level
On/Off
HOLD
Slow flash: Low Battery
Fast flash: Firmware Load
ELECRAFT XC
Signal Sour

38


RigExpert
SWR
Min.: 1.59 at 1.847 MHz
AA-230 ZOOM
fq–
r+
fq+

39


K3LR MULTI-MULTI TEAM
8 CIRCLE
3.805.00

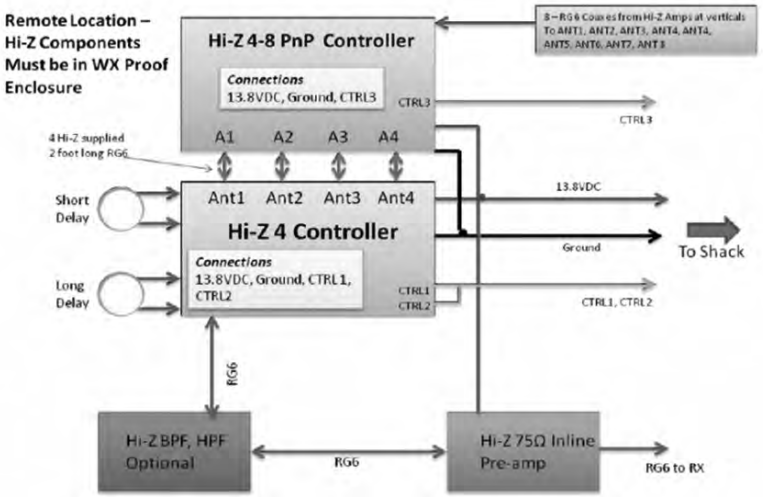
40


4 SQUARE
8 CIRCLE

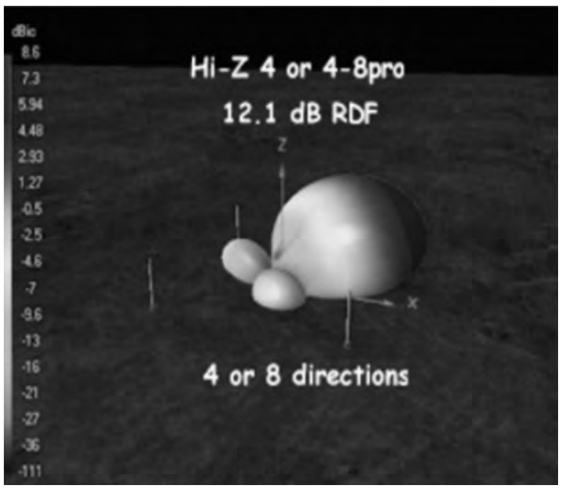
41


NCC-1 B CHANNE
PWR
8CR
4SQ
BIP
BOP
1
2
3
4
HI—Z BBE

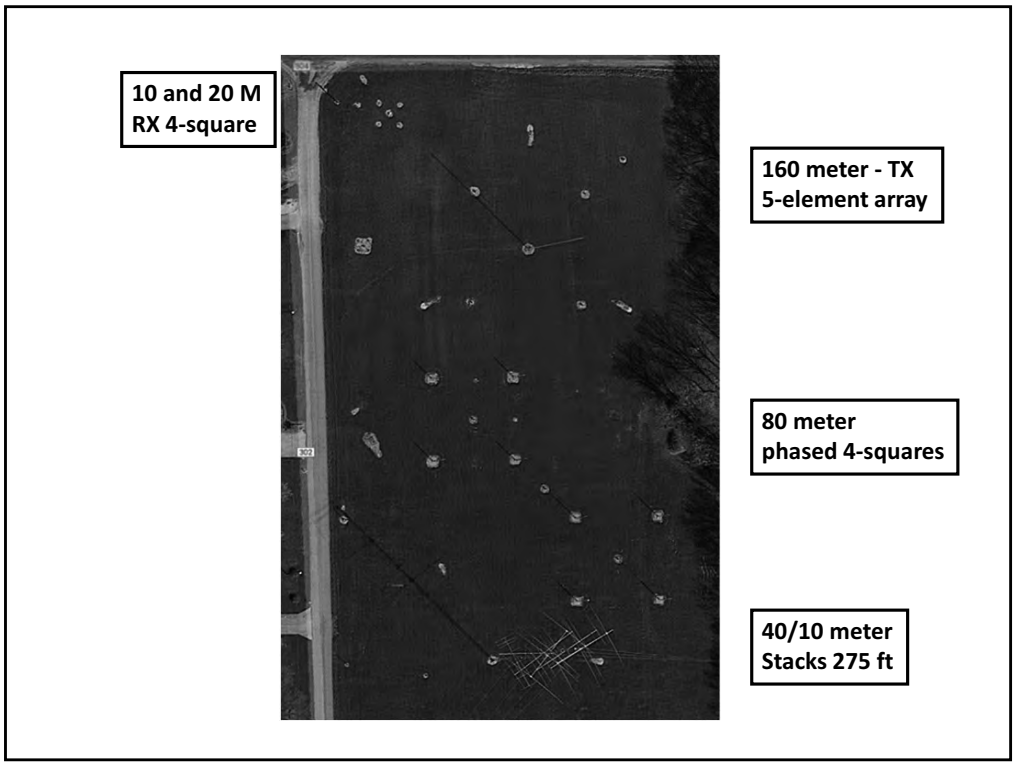
42


Remote Location –
Hi-Z Components
Must be in WX Proof
Enclosure
Hi-Z 4-8 PnP Controller
Connections
13.8VDC, Ground, CTRL3
CTRL3
A1 A2 A3 A4
4 Hi-Z supplied
2 foot long RG6
Short
Delay
Long
Delay
Ant1 Ant2 Ant3 Ant4
Hi-Z 4 Controller
Connections
13.8VDC, Ground, CTRL1,
CTRL2
CTRL1
CTRL2
13.8VDC
Ground
To Shack
CTRL1, CTRL2
RG6
Hi-Z BPF, HPF
Optional
RG6
Hi-Z 75Ω Inline
Pre-amp
RG6 to RX

43


dBic
8.6
7.3
5.94
4.48
2.93
1.27
-0.5
-2.5
-4.6
-7
-9.6
-13
-16
-21
-27
-36
-111
Hi-Z 4 or 4-8pro
12.1 dB RDF
Z
X
4 or 8 directions

44


10 and 20 M
RX 4-square
160 meter - TX
5-element array
80 meter
phased 4-squares
40/10 meter
Stacks 275 ft

45

46

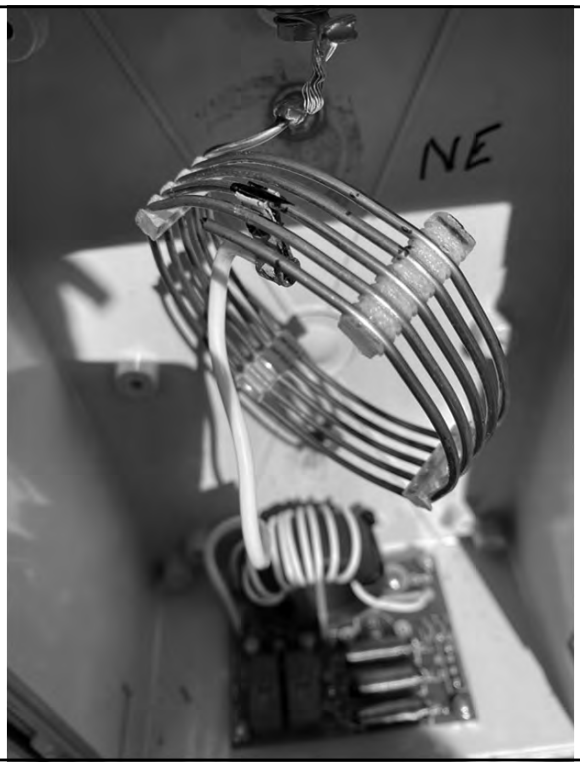
120 foot
PiRod tower
¼ wave on 160

47

48

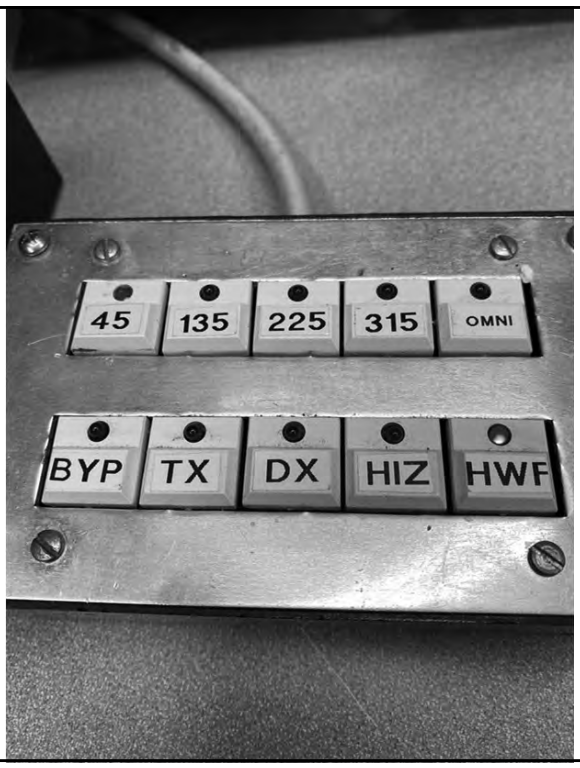
49

50



51

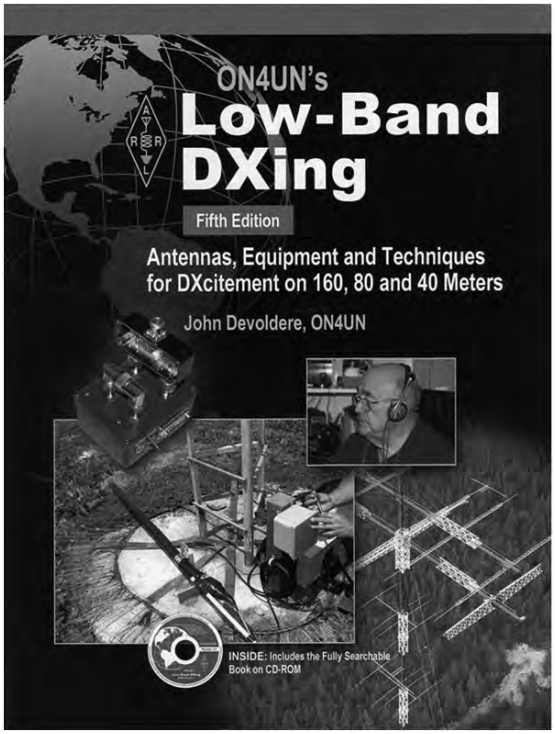
52


45
135
225
315
OMNI
BYP
TX
DX
HIZ
HWF

53


EC-4
RTX RX1 RX2 RX3 RX4 160 80 75 40 LP ON/OFF
HWF
MODEL NCC-2
ENGINEERING
A dB
-10 -20
0 -30
BALANCE
B dB
-10 -20
0 -30
RTR
Main On
Norm
POWER
On
Off
On
CH A
On
CH B
B
PHASE
Norm

54



55

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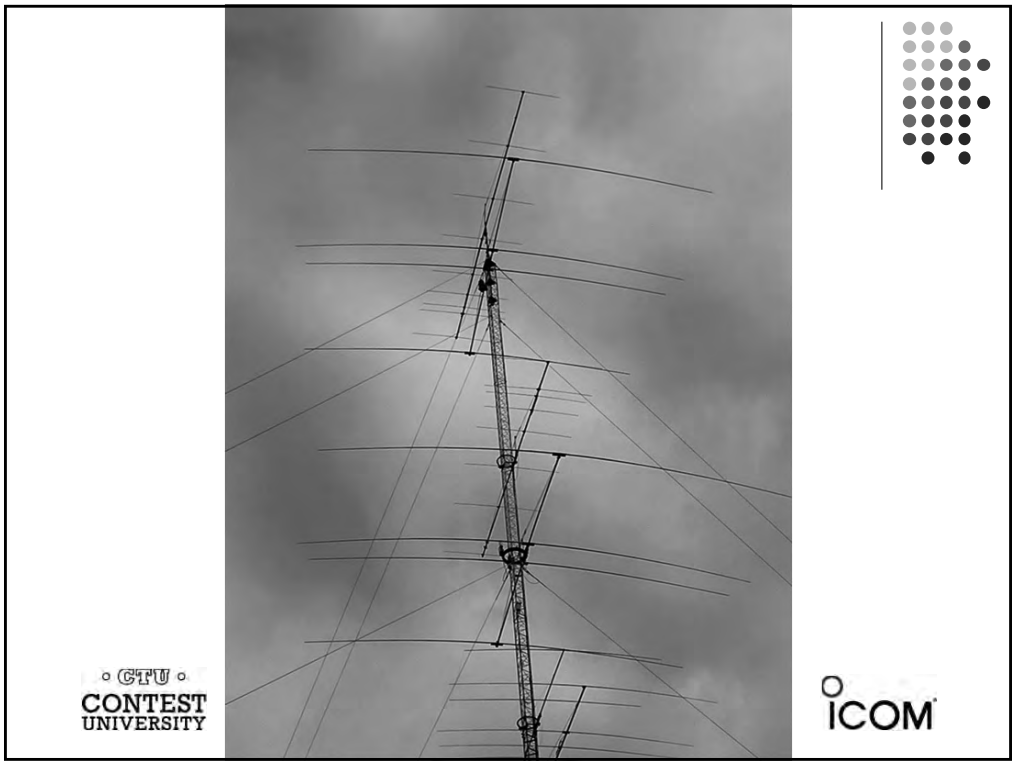

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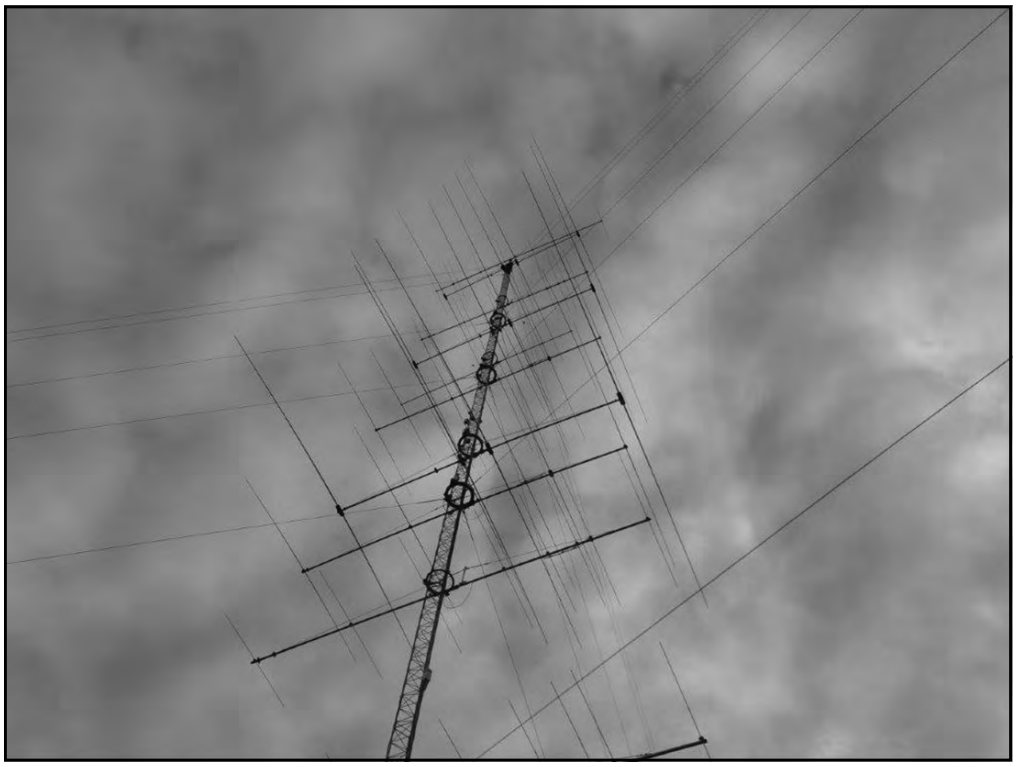

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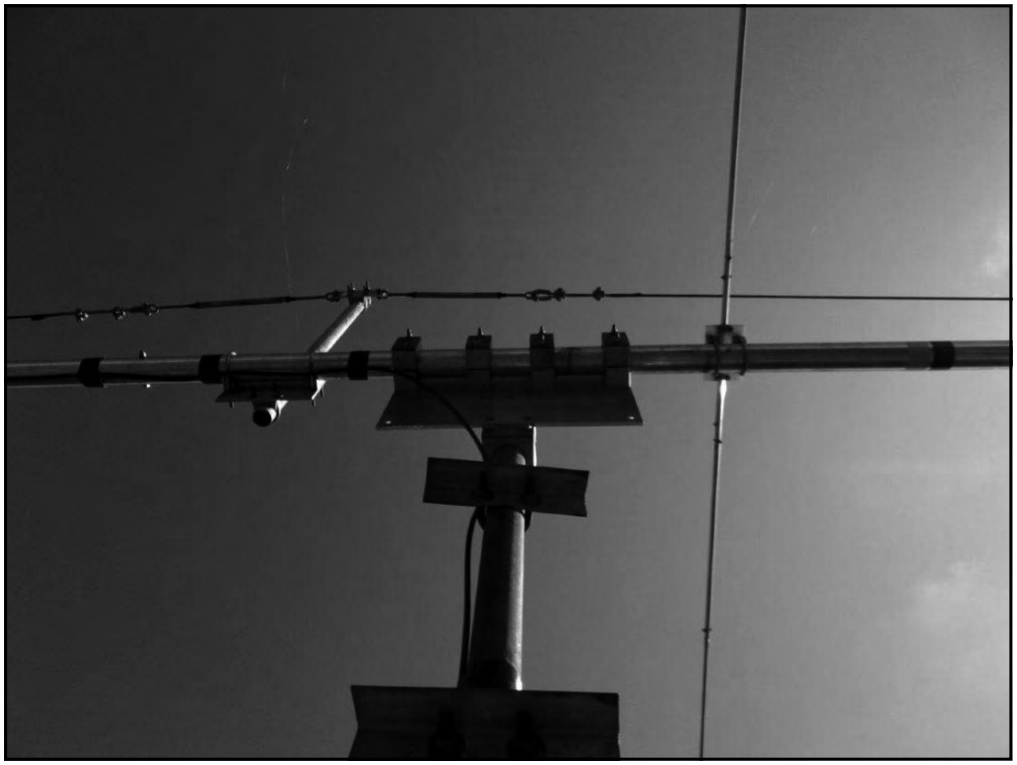

81

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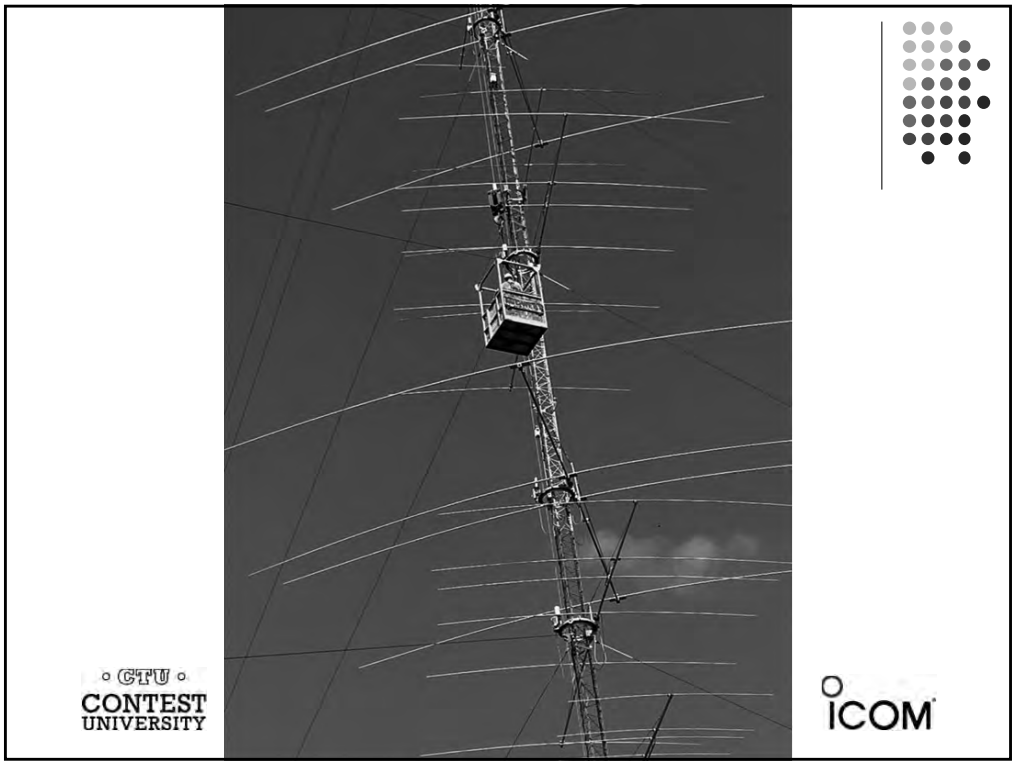
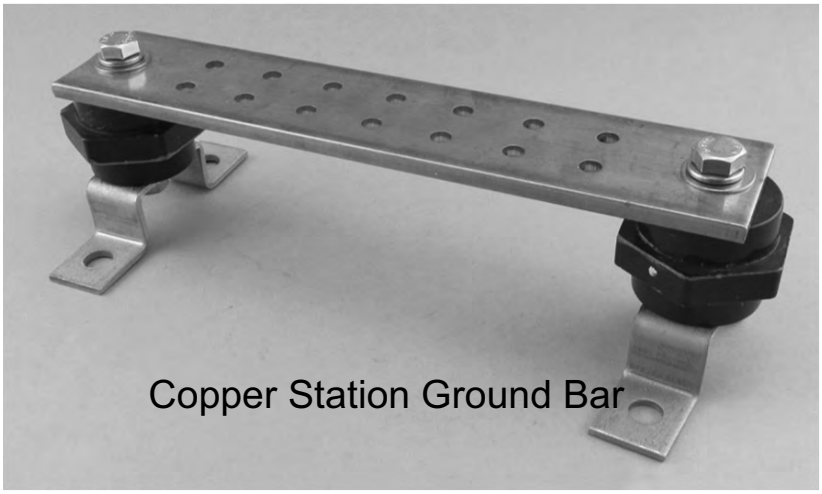


86

87

88



Copper Station Ground Bar

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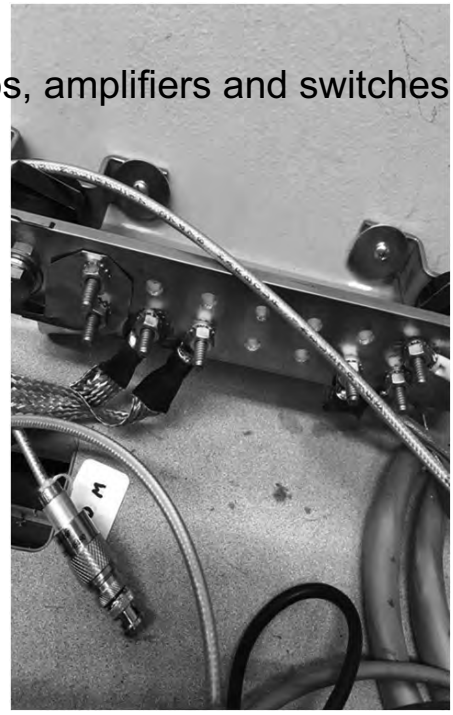
Connect radios, amplifiers and switches



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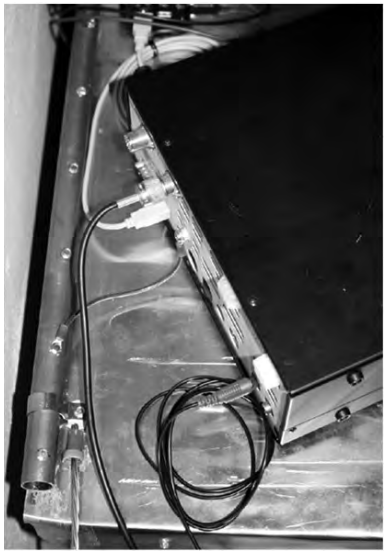
RF Management

- RF ground plane
- Sheet of metal
- Helps equalize voltage
- Run cables along the ground plane
- Bond to station ground system



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Dayton 2017

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Radio is placed on top

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Dayton 2017

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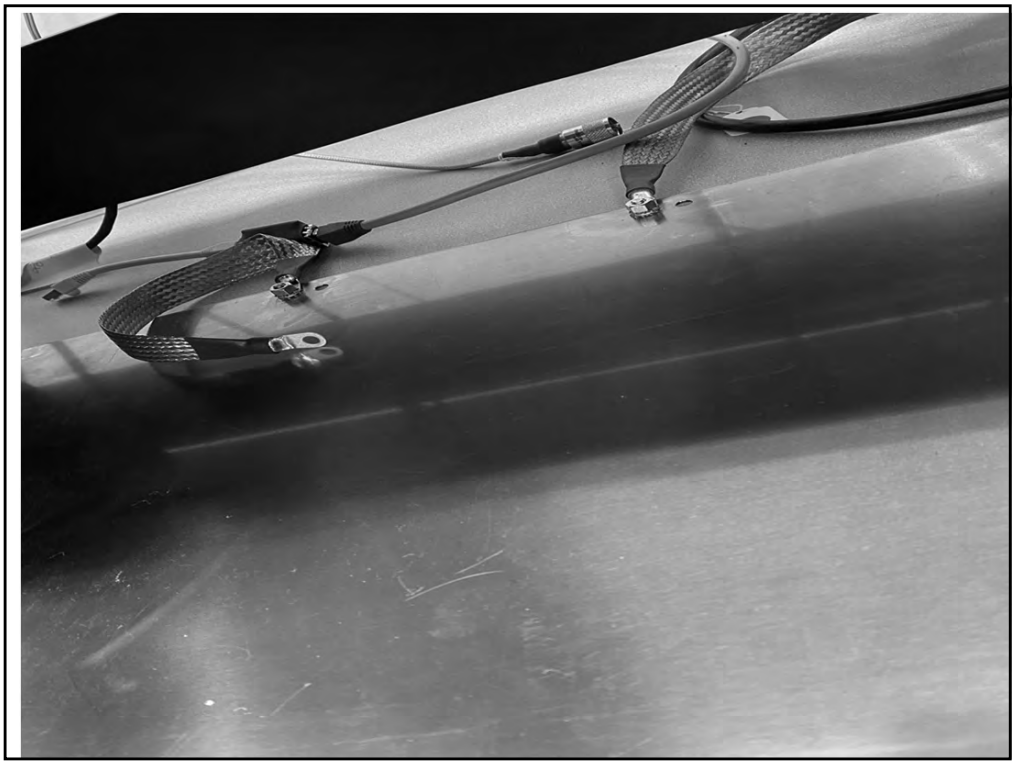
94



95

Thick 1 inch wide – indoor use only

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RG-400 with good connectors

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High Quality RG-400 double shield

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Teflon – aircraft grade 50 ohms

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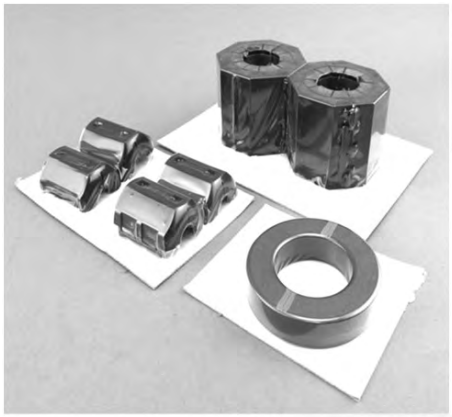
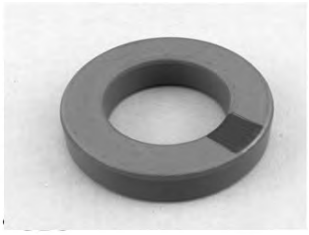
DEX Ferrite cores
Color coded





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Every AC line cord - #31

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100

Coax cables
And DC cables
#31 - BLUE

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101

Intel NUC computers - choke RFI

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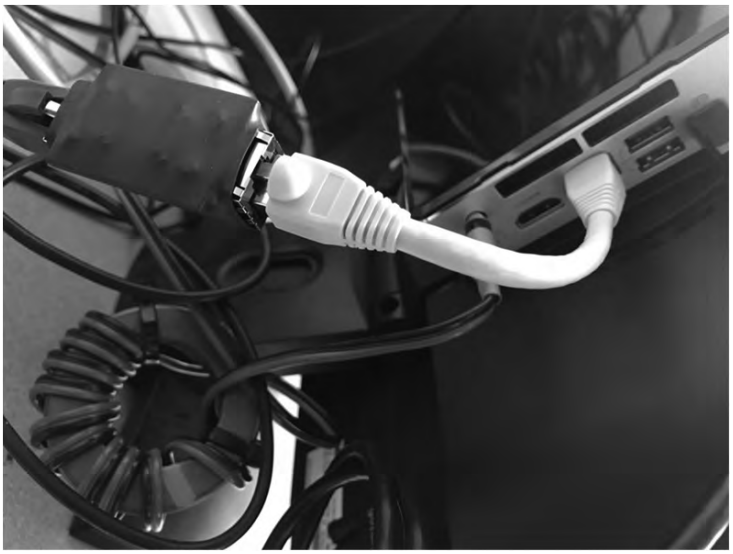
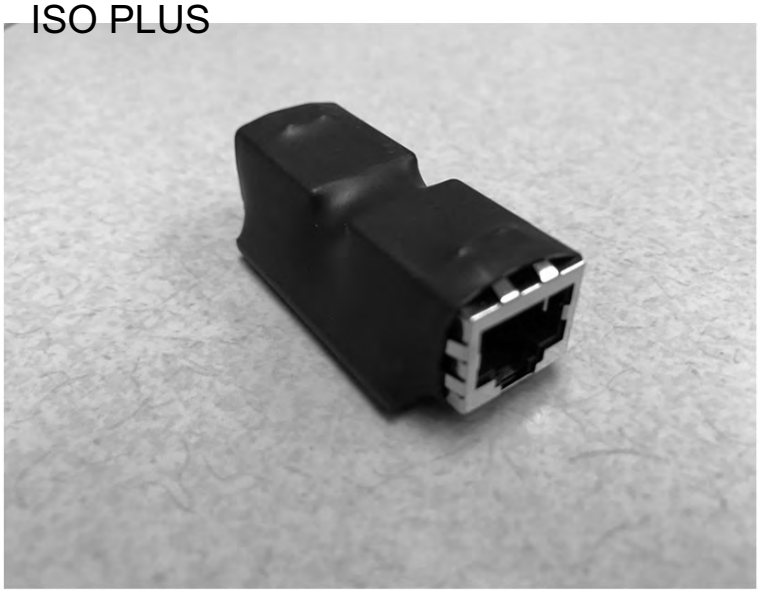
102



DC Cable with #31 & ISOPLUS

103

ISO PLUS



New RJ45 Ethernet RFI filter

104

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ISOPLUS in use at K3LR

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105

It's 0000 Zulu – Are you worried about your connectors?

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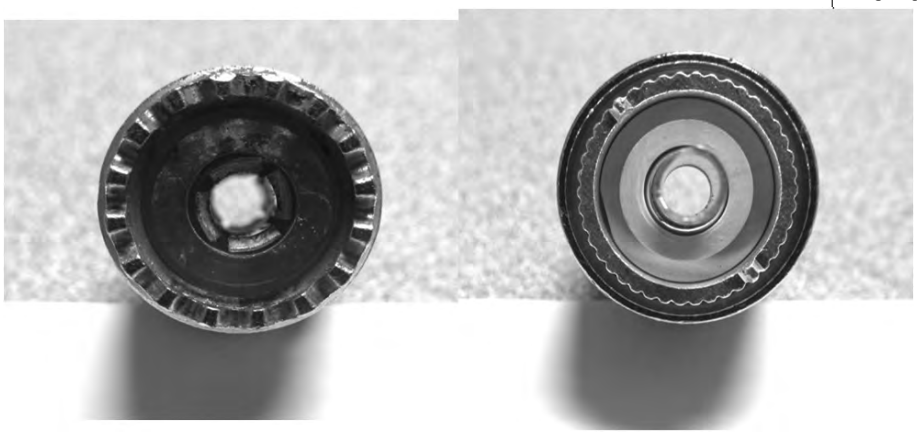
Keep the water out!



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Even good COAX goes BAD in time

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One nick and the water gets in

Coax shields will break at the rotation loop

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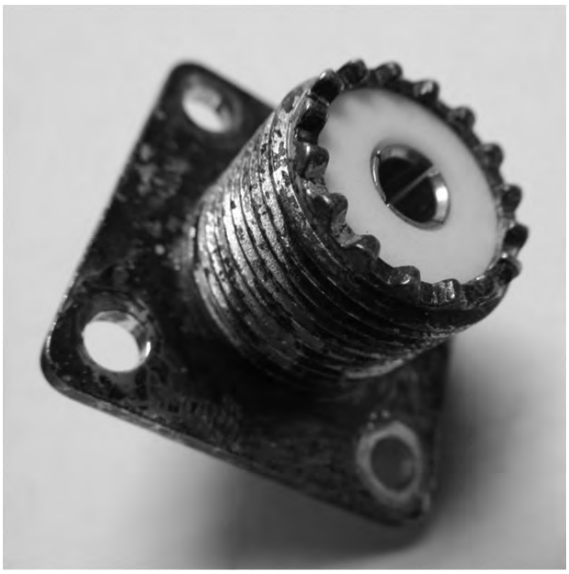

Time to replace!

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Do your shields look like this?

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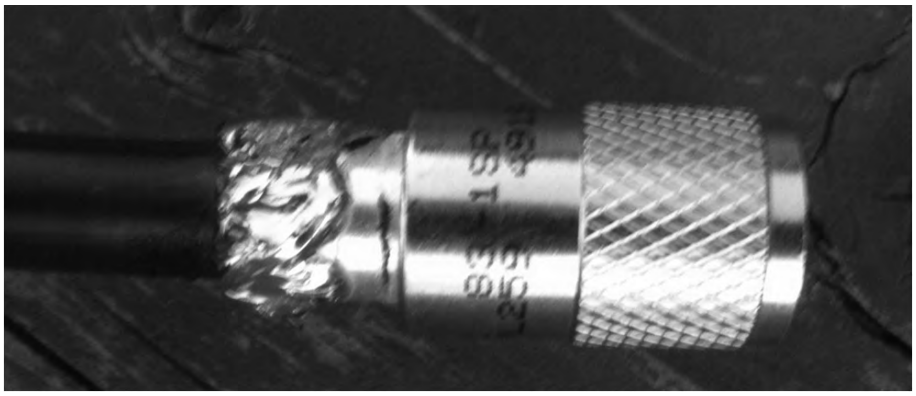
111

Or this?



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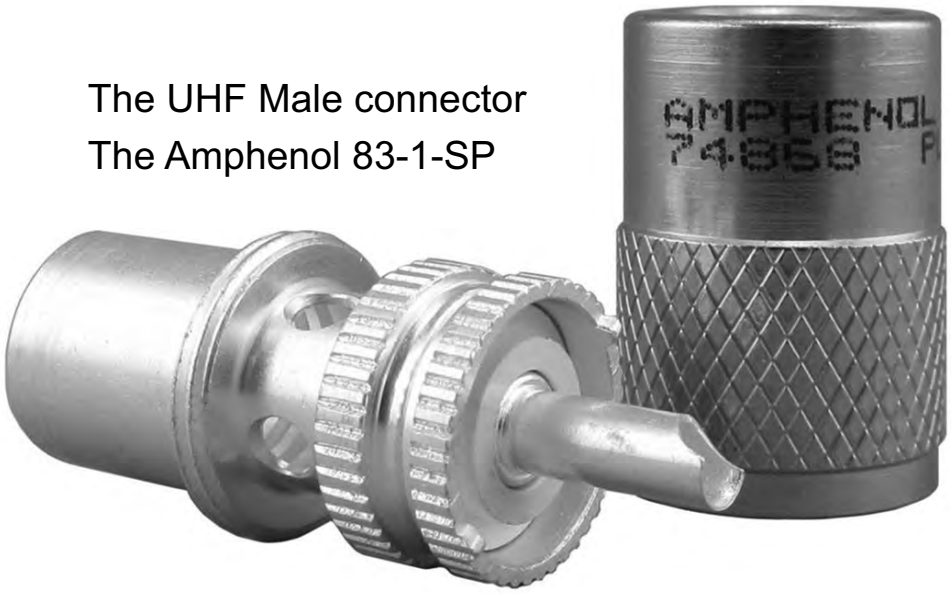
The UHF Male connector

The Amphenol 83-1-SP



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Channel Lock

CNL-426

"Tighten Up"

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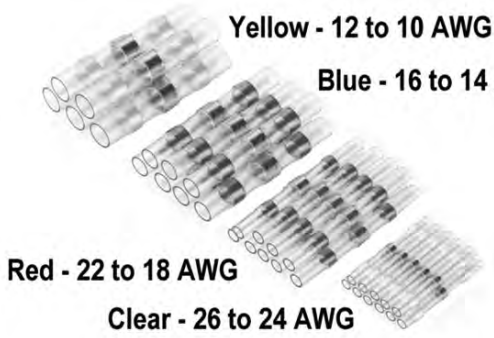
Heat Shrink Self-Solder Butt Splices



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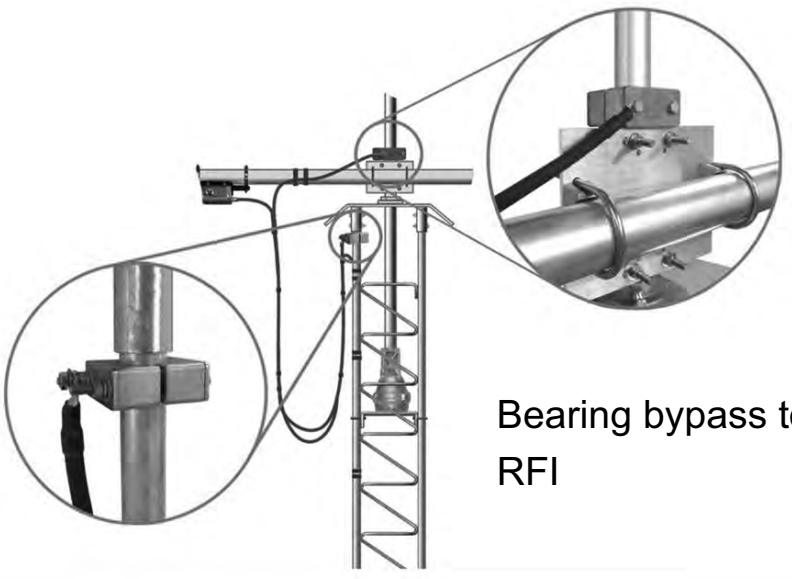
Bearing bypass to reduce RFI



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Notes

DX Engineering can supply you with what you need to stay competitive, including advice from serious Amateur Operators, access to great gear, and the fastest shipping in the industry.

RG400 High Isolation Coaxial Cable Assemblies

Made to military-spec (MIL-C-17), this RG400 provides extremely high noise and signal isolation and will handle up to 8 kW. It boasts an efficient, stranded silver covered copper center conductor and double silver covered copper braided shields. The cable is wrapped in a tough, waterproof fluorinated ethylene propylene jacket. It terminates in silver plated Amphenol 831SP PL-259 connectors with UG-175 reducers. The cable has a 0.195" OD.

HF Multiplexers and Band-Pass Filters

Use Low Band Systems' Multiplexers to connect multiple radios to a single multi-band antenna, so you can use each radio to operate on a different band simultaneously. This reduces equipment installation hassles and saves money since there's no need for extra antennas and coax cable.

The multiplexers work with Low Band Systems' multi-stage band-pass filters to limit the RF to a single band, effectively eliminating most RF interference issues. Sold separately, the filters deliver the isolation demanded by the multiplexer's band input.

ON ALL BANDS
AN AMATEUR RADIO BLOG POWERED BY DX ENGINEERING

NCC-2 Receive Antenna Variable Phasing System

The NCC-2 combines the NCC-1 Phase Controller and our RTR-1A Receive Antenna Interface technologies into one box. It also has enhanced balance functionality, expanding its ability to phase between two different types of antennas. This is a handy feature if you've got space constraints on your property. We've also made it easier (and more economical) to expand the NCC-2's versatility by providing internal slots for modules like the plug-in versions of our Receiver Guard 5000HD and RPA-2 preamplifier.

DXE-NCC-2 ..... **$849.99**

ISO-PLUS Ethernet RF Filter

This patent-pending filter joins two RJ-45 connectors to reduce interference for frequencies from below 1 MHz to over 100 MHz without affecting Ethernet data signal levels or speed. ***Enter "ISO Filter" at DXEngineering.com for complete information.***

DXE-ISO-PLUS-2 2 Filters..... **$49.99**
DXE-ISO-PLUS-10 10 Filters..... **$239.99**

TFS4 Series B Transmit Four Square Systems

Available in 160, 80, or 40 meter models, the easy-to-install and solidly constructed DX Engineering Transmit Four Square Systems consistently deliver optimal directional control. They let you receive or transmit with 5.5 dB gain in any one of four directions with a 20+ dB front-to-back ratio for interference reduction from unwanted directions. You can also switch to an omni-directional pattern with the push of a button. Unhindered by pattern nulls, this system allows you to select the best direction for signal reception and noise rejection. For use with four monoband vertical antennas (not included), the systems include a four-square control console with hot-switch lockout and the versatile four-square relay unit that has a 5 kW CW power rating. ***Enter "TFS4" at DXEngineering.com.***

DXE-TFS4-160B-P Transmit Four Square System, 160M..... **$769.98**
DXE-TFS4-80B-P Transmit Four Square System, 80M..... **$749.98**
DXE-TFS4-40B-P Transmit Four Square System, 40M..... **$739.98**

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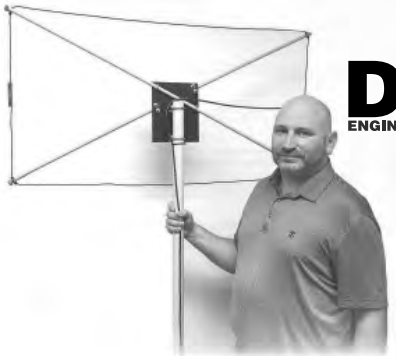

NOISELOOP Portable Receive Flag Antenna Kit and Preamplifier-Attenuator

For operators frustrated by unidentified RFI problems, the NOISELOOP is an easy-to-build solution for locating noise sources from 1.8 through 30 MHz. It also is ideal for low-noise, general coverage reception from the AM broadcast band through 30 MHz. Based on the design of Don Kirk, WD8DSB, (featured on the March 2021 cover of *QST*), the NOISELOOP can be used while walking or stationary with your portable HF receiver. It features a cardioid pattern at the horizon with a deep null of up to 30 dB rejection. Kit includes high-quality fiberglass tubing for the frame and handle, mounting plate, PC boards, antenna wire, coaxial cable, and stainless steel hardware. An optional Portable Preamplifier-Attenuator Unit may be attached to the loop mast handle for enhanced operations.
Enter "NOISELOOP" at DXEngineering.com.

DXE-NOISELOOP Portable Receive Flag Antenna Kit **$119.99**
DXE-NL-PRE-ATT-1 Portable Preamplifier-Attenuator **$134.99**

Maxi-Core® 20 Baluns and Feedline Choke

DX Engineering ushers in an exciting era of upgraded RF performance across the 1.8 to 54 MHz frequency range with its four new Maxi-Core 20 baluns and one feedline choke. The Maxi-Core 20 lineup—the culmination of years of research and development, equipment advancements and extensive testing— handles full-legal-power-plus and provides higher common mode impedance over the 160 through 6 meter bands . More of your signal gets to the antenna and you can hear more signals with less noise. Easy installation is provided by the optional DX Engineering Mounting Plate and Bracket Kit (DXE-MC20K-BRKT) or Wire Antenna Balun Mounting Bracket (DXE-WA-BMB).
Enter "Maxi-Core" at DXEngineering.com for applications and more details.

DXE-MC20-1-1 High CMI 1:1 Current Choke Balun **$125.99**
DXE-MC20-FC High CMI 1:1 Feedline Choke, Line Isolator..... **$139.99**
DXE-MC20-1-1T High CMI 1:1 Current Choke Balun, Tuner Model; . **$124.99**
DXE-MC20-C4-1 High CMI 4:1 Current Choke Balun **$147.99**
DXE-MC20-V4-1 Low CMI 4:1 Voltage Balun **$124.99**

Complete Telescopic Fiberglass Tubing and Cam Lock Clamp Kits

These kits make it easy to set up a reliable temporary antenna mast at home or in the field. They feature durable, smoothly telescoped fiberglass tubing collapsible to either 4 or 7.5 feet for convenient transport. Sections are secured in place with easily adjustable cam lock clamps. Available in heights of 15, 25, and 46 feet.
Enter "Cam Lock Kit" at DXEngineering.com for complete specs.

Coaxial Cable Assemblies

These low-loss cable assemblies are available in standard lengths with DX Engineering's revolutionary patented PL-259 connector.

Use the online Custom Cable Builder at DXEngineering.com to build assemblies made to your exact specs. DX Engineering's coaxial cable is also available by the foot or in bulk spools.

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