CTU
CONTEST UNIVERSITY

Dayton Contest University

May 19, 2022

Hope Hotel

Dayton, Ohio

Youth On The Air

There is youth in ham radio!

YouthOnTheAir.org

Stop by our website for all the information about the Youth on the Air movement in the Americas. We promote all youth ham radio programs, contests, and opportunities across the region. In addition, we sponsor a summer camp and participate in December YOTA month and the YOTA contest.

Listen for **W8Y** on the air June 12-17, 2022 from our next camp!

The **World Wide Radio Operators Foundation** was created in 2009 by a group of experienced radio operators who saw the need for an independent organization devoted to the skill and art of radio operating. Until now, many of the elements of modern radio contesting such as log-checking software, log submission robots, etc., have been developed and supported by volunteers. Who will organize and fund the enhancement of these tools into the future? The **World Wide Radio Operators Foundation** was created to help fill that need.

WWROF is dedicated to improving the skills and fun of amateur radio operators around the world by utilizing education, competition, advancement of technology and scientific research, promoting international friendship and goodwill, and preparing them to better serve society in times of communication need.

WWROF Programs

- Webinar series on contesting and operating topics
- Stewardship of the Cabrillo log file standard
- Log submission and processing infrastructure
- Contest award management including certificate and plaque distribution
- Support of Contest University and WRTC
- Other projects that support contesting

WWROF Contester's Code of Ethics

- I will learn and obey the rules of any contest I enter, including the rules of my entry category.
- I will obey the rules for amateur radio in my country.
- I will not modify my log after the contest by using additional data sources to correct callsign/exchange errors.
- I will accept the judging and scoring decisions of the contest sponsor as final.
- I will adhere to the DX Code of Conduct in my operating style.
- I will yield my frequency to any emergency communications activity.
- I will operate my transmitter with sufficient signal quality to minimize interference to others.

Leadership

Tim Duffy, K3LR, Chair
Doug Grant, K1DG, Vice-Chair
Ralph Bowen, N5RZ, Treasurer
Tom Lee, K8AZ, Secretary
John Dorr, K1AR, Founding Director
Mark Beckwith, N5OT, Founding Director
Bob Cox, K3EST, Founding Director
John Sluymer, VE3EJ, Director
Tine Brajnik, S50A, Director
Randy Thompson, K5ZD, Director
Teri Grizer, K8MNJ, Executive Administrator

Donate

Can you imagine contesting without electronic logs? Sophisticated log checking software? Certificates for winners? The World Wide Radio Operators Foundation is completely dependent on contributions for our funding. We welcome donations of any amount to help us fund our projects.

WWROF is recognized by the Internal Revenue Service as a tax-exempt public charity under section 501(c)(3) of the Internal Revenue Code.

Learn more. Visit wwrof.org

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May 19, 2022
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First Edition

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Welcome!

On behalf of the CTU Board of Directors K1DG, N9JA, K1AR, and K8MNJ and the 12 CTU Professors of Dayton Contest University 2022 we are pleased you are here, and we extend a warm welcome to you!

There have been more than 50 CTU's held in the past fifteen years. CTU's have been held here in Dayton, Chicago, Brazil, England, Germany, Finland, Italy, Australia, and Puerto Rico.

Over 20 presentations are available here at Dayton Contest University 2022. They are the work product of many hours of effort by your Professors and the CTU staff (thank you again to K8MNJ, N9RV, DL1QQ and K1SO for all they do). Frank, W3LPL is back in person this year! Continuing with our attention to youth in ham radio we are proud to have Marty Sullaway, NN1C here. Marty will lead a small group session about Youth in Contesting.

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

Finally, while we have tried to make everything as perfect as possible for you here at CTU, I ask for your patience as we work out any problems. Your ongoing support for CTU is critical as we move forward to more Contest University's in the future.

Thanks so much to Teri, K8MNJ – all of this would not be possible without her.

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

Very 73!

Tim Duffy K3LR
CTU Chairman

2022 Dayton Contest University "CTU" – COURSE OUTLINE – 7:00 AM to 5:00 PM

7:00 ALL ROOMS – Student Registration and Contest Buffet Breakfast – ALL – 60 minutes
8:00 ALL ROOMS – Welcome to CTU 2022 – K3LR & W8CI & NA2AA – ALL – 10 minutes
8:10 ALL ROOMS – Inside vs. Outside – How to Enjoy Contesting – K5GN – ALL – 40 minutes

9:00 CONTEST TOPIC SESSION #1 – attend ONE of 4 sessions – 60 minutes

ROOM 1 – Easy to Build Low Band Receiving Antennas for Small & Large Lots – W3LPL
ROOM 2 – Contesting 101: Operating – K1DG
ROOM 3 – The Advantages of Waterfall Displays for Contesting and DXing - N6TV
ROOM 4 – Digital Contesting – RTTY and FT8/FT4 – W0YK

10:00 ALL – *CONTEST SNACK* – 15 minutes

10:15 CONTEST TOPIC SESSION #2 – attend ONE of 4 sessions – 60 minutes

ROOM 1 – How to Improve Your Transmitting Antennas for Solar Cycle 25 – W3LPL
ROOM 2 – Grounding and Bonding for Your HF Contest Station – N0AX
ROOM 3 – Operating Mechanics: The Xfactor in Contesting Success – N9RV
ROOM 4 – Upping Your Digital Contesting Game – W0YK

11:20 CONTEST TOPIC SESSION #3 – attend ONE of 4 sessions – 55 minutes

ROOM 1 – Preparing Your Station for Competition – W3LPL
ROOM 2 – Field Measurements and Comparison of Low Band Receive Arrays – W5ZN
ROOM 3 – Everything You Want to Know about USB & Serial Interfaces – N6TV
ROOM 4 – Perspectives on 45 Years of Contest Station Building – N9RV

12:15 ALL ROOMS – *CONTEST LUNCH* – ALL – 35 minutes

12:50 ALL ROOMS – 2022 Eye Ball Sprint Contest "LIVE" – ALL – 10 minutes – K1DG

12:59 ALL ROOMS – N9JA from Icom America
1:00-1:35 ALL ROOMS – Teamwork and Multi-Operator Innovations – N6WIN

***1:45 CONTEST TOPIC SESSION by REQUEST to RERUN** – 50 minutes

ROOM 1 – As determined by *vote 1
ROOM 2 – As determined by *vote 2
ROOM 3 – As determined by *vote 3
ROOM 4 – As determined by *vote 4

2:40 CONTEST OPEN DISCUSSION Q&A GROUPs Attend ONE of 4 sessions – 30 minutes

ROOM 1 – Grounding, Bonding and RF – N0AX
ROOM 2 – Waterfalls, Ports and the Reverse Beacon Network – N6TV
ROOM 3 – Youth in Contesting – NN1C
ROOM 4 – Tower Climbing and Tower Safety – W3YQ

3:15 CONTEST OPEN DISCUSSION Q&A GROUPs Attend ONE of 4 sessions – 30 minutes

ROOM 1 – Stations and Antennas – W3LPL
ROOM 2 – Digital and RTTY Contesting – W0YK
ROOM 3 – Remote Operating Projects – NN1C
ROOM 4 – Your Roadmap to Radiosport Improvement – K1DG & N9RV

3:45 ALL – *CONTEST SNACK* – 15 minutes

4:00 ALL ROOMS – Transceiver Performance for the HF Contest and DX Operator – NC0B – ALL – 50 minutes
4:50 ALL ROOMS – 2022 CTU Survey – K3LR – ALL – 10 minutes

*** 1:45 PM CONTEST SESSION by REQUEST vote to RERUN**
CTU students will vote for 4 topics/classes that they missed and would like to have presented again – the top 4 WANTED by vote – will RERUN in this time slot.

Author Biographies

Pat Barkey, N9RV

Pat, N9RV, has been an active contester since high school and college days in Michigan when he was active as WA8YVR. Almost exclusively HF contests on CW/SSB, with a preference for DX contests from the Midwest until 2007, and from Montana since then. He has been involved with the construction of five different contest stations, the last three of which he owned in various places where he lived in Ohio, Indiana, and Montana. He has also had considerable experience in operating from other contest stations, including: W8UM, K4GSU, KN8Z, K8LX, K8AZ, K3TUP, K3LR, W9RE, and NK7U to name a few. He participated as a competitor in four WRTCs in San Francisco, Finland, Brazil and Germany with K3LR and N6TR.

He currently serves as President of the Big Sky Contesters and has served in the past as editor of the National Contest Journal and as a member of the CQ WW Contest Committee. He works as a research director at the University of Montana in Missoula.

Tim Coker, N6WIN

Tim Coker, N6WIN, has been an active ham and contester since he was licensed in 1989 at the age of 11. He has been fortunate to have partnered with N6MJ and KL9A to develop his home contest station. He also holds the call ZF2IN and has been operating from the Cayman Islands for the previous 3 years as part of many multi ops. He has operated from some of the biggest stations across the country, including K3LR, KL7RA, W6YI, and ND7K among others.

Dan Craig, N6MJ

Dan Craig, N6MJ, has been an active ham and contester since he was licensed in 1989 at the age of 8. He has been fortunate to have participated in the last 5 WRTC's, finishing in the top 4 all 5 times including a win in 2014 in Boston. He also holds the call ZF2MJ and has been operating from the Cayman Islands for the previous 7 years as both a single op and part of many multi ops. He has operated from some of the biggest stations across the country, including K3LR, KC1XX, K4XS, K5TR, NK7U and ND7K among others.

Frank Donovan, W3LPL

Frank's contesting career began as twelve-year-old at the Providence Radio Association 1959 ARRL Field Day, W1OP/1, on Neutaconkanut Hill two miles from his home in Providence, Rhode Island. Soon afterwards he began to slowly build his own small contest station on 1/10th acre in his densely populated urban neighborhood. At 15 years old he produced the highest score in the 1962 New England QSO Party.

At 17 years old he finished first place USA in the 1964 ARRL CW DX Contest low power category. He was the leader of the 1968 W1OP/1 Field Day that finished in first place in the 4A category from the former World War II FCC Radio Intelligence Division signals intelligence monitoring and direction-finding site in Scituate, RI. Immediately after college, US Air Force 2nd Lieutenant Frank Donovan's first military assignment was in the Washington D.C. area where he worked under PVRC member W3GN (SK) and with his multi-multi mentor W4BVV (SK).

Frank finished first place USA single operator in four CQWW CW and four ARRL CW DX contests from 1973 to 1978. His first multi-multi-DX contest experience was with the world high scoring 1974 PJ9JT CQWW CW team. W3LPL multi-multi teams started 45 years ago with a small entry in the 1977 ARRL Phone DX Contest. Five years later two incredible long nights of 10-meter JA runs unexpectedly produced his team's first USA multi-multi win in the 1982 ARRL Phone DX Contest, the same year that renowned multi-multi competitor W2PV became a silent key.

W3LPL multi-multi teams have completed more than one million DX QSOs and achieved more than 50 first place USA finishes out of more than 150 multi-multi entries in the CQWW and ARRL DX contests. Frank was inducted into the prestigious CQ Contest Hall of Fame in 1999 and is a regular presenter at Contest University. He retired 11 years ago as a Chief Engineer at General Dynamics Corporation after a 45 year career in electronics and systems engineering.

Tim Duffy, K3LR

Tim has been an active contest operator for 50 years. He has hosted over 150 different operators as part of the K3LR multi operator DX contest efforts since 1992 – which have made more than 800,000 QSOs. Tim served on the ARRL Contest Advisory Committee as a member and multi-year Chairman. K3LR has been an active member of the CQ Contest Committee for 32 years. Tim was the Atlantic Division Technical Achievement award winner in 1998. He was moderator of the Dayton Contest Forum for 10 years and has been moderator of the Hamvention Antenna forum for 38 years. He is a founding member and Vice President of the North Coast Contesters. K3LR serves as founder and chairman of Contest University (15 years) and the Dayton Contest Dinner (28 years), chairman of the Top Band Dinner (10 years) – as well as coordinator of the Contest Super Suite (36 years) in Dayton. He is founder and moderator of the popular RFI Reflector (RFI@contesting.com). He has been a guest on Ham Nation many times. Tim was a member of Team USA at WRTC – five times. Tim serves on the board of directors of the World Wide Radio Operators Foundation (WWROF) as Chairman. He was President of The Radio Club of America (RCA) from 2016 to 2018. Tim is President of the Mercer County Amateur Radio Club - W3LIF (20 years). K3LR was elected to the CQ Contest Hall of Fame in 2006. He was honored with the prestigious Barry Goldwater Amateur Radio service award by RCA in 2010. Tim served as ARRL Section Manager for Western Pennsylvania 2015/2016. K3LR currently serves as a director on the ARRL Foundation board. Tim was honored to be the 2015 Hamvention Amateur of the Year. K3LR was awarded the YASME Excellence Award in 2016. K3LR is a graduate of the Pennsylvania State University. Tim is the Chief Executive Officer of DX Engineering.

Doug Grant, K1DG

Doug has been licensed since 1967. Over the years, he has managed to collect plaques for first-place scores in single-op, single-op-assisted, multi-single, multi-2 and multi-multi categories from his own station and numerous host stations. In addition, he was a competitor in six WRTC events, winning one gold and two bronze medals.

Doug is a past president of the Yankee Clipper Contest Club, past member and Chairman of the ARRL Contest Advisory Committee, member of the CQWW Contest Committee and has chaired the Dayton Hamvention Contest Forum for over 20 years. He is a Director of Contest University and the World Wide Radio Operators Foundation, and was Chairman of the WRTC2014 Organizing Committee. He is the author of *Amateur Radio Contesting for Beginners*, published by the ARRL.

Joel Harrison, W5ZN

Joel was first licensed as WN5IGF in 1972. His first contest was the 1993 ARRL Novice Roundup followed by the old ARRL CD Party in 1973 as a General Class licensee. His interests later turned to VHF contesting, finally breaking into the top 10 in the ARRL June VHF contest in 1993. In June 1996 he won first place in the single op category setting a new world record under the callsign WB5IGF. In 1998 he returned to the June contest as W5ZN, once again winning first place and breaking his previous 1996 record. In 2001 he won first place single op in the ARRL UHF Contest and in 2011 the W5ZN team won first place in the Limited Multiop category of the ARRL June VHF Contest. W5ZN was a team member of the record setting WA8WZG contest team in 1999 and 2000 and the K1WHS team that finished first in the multiop category of the 2010 ARRL September VHF contest outing multi-year winner W2SZ. W5ZN is also very active in the CQWW CW and the CQWW 160 CW contest. In the 2006 ARRL DX Contest he set a new 80-meter CW record for the W5 call area that held until 2009. In 2011 he reclaimed that record that still holds today. He is a member of the N2CEI Multi-op team for the ARRL 160 Meter Contest and in 2016 was a team member of the W2GD CQWW 160 CW Contest Team finishing with the top claimed NA score. In 2015 he challenged a group of “Rookies” in his local club to learn CW and the prize was to operate in the 2015 ARRL Rookie Roundup – CW contest from his station as a Multi-op team that finished with the most Q’s. Joel holds 11 band DXCC, 11 band VUCC, and is an A-1 Operator. In December 2021 he completed his 12th Worked All States band, becoming the 11th recipient of a 222 MHz WAS. He served as ARRL President from 2006 until 2010 when he retired from ARRL elected volunteer service after 27 years. In 2014 he was awarded the ARRL Medal of Honor for outstanding service to amateur radio. In 2021 he was elected to serve as Secretary of the International Amateur Radio Union and is active in the IARU HF World Championship contest providing the coveted “AC” multiplier! Professionally Joel is a Research Analyst in the Applied Physics group of the Pacific Northwest National Laboratory’s Nuclear Engineering & Analysis Division.

Tim Jellison, W3YQ/KL7WV

Tim was licensed in 1973 at 13 years of age. He achieved 5BDXCC then went on to confirm 100+ countries on 160. He is on the air regularly, chasing DX, and he participants in CW DX contests, these days primarily as an operator at the K8AZ multi-op station.

Professionally, he took a job managing a satellite communication facility following his graduation from Penn State in 1981. He then changed career paths in 1999 and accepted a position running a cellular network throughout the state of Alaska. He left corporate life in 2012 and is now semi-retired, working for a commercial tower company.

Tim has been a technician and a technical manager all of his adult life. He’s been involved in all aspects of electronics, radio, towers, and antennas. He holds a valid FCC Radiotelephone License and is Comtrain and CITCA certified as an Authorized Tower Climber/Rescuer. He's installed, maintained, and repaired numerous towers and antennas and can often be found working on K3LR's equipment and towers.

Dave McCarty, K5GN

Dave McCarty, K5GN, was first licensed in New Jersey as WN2GAV in 1972. He moved to Houston, Texas in 1975. He is married, with two adult daughters also in Texas. He is a follower of Jesus Christ and is active in church and community. He enjoyed a 40-year career in the petrochemical industry as an engineer and leader, including assignments in Italy, Qatar, and Saudi Arabia, retiring in 2021. He is a member of the Texas DX Society and an ARRL Life Member. Dave's first contests were Field Day and the ARRL CD Parties in NJ. Today he enjoys DX and domestic HF contesting, mostly on CW. He maintains a four-tower station with W5KU in Sealy, Texas. His second favorite sport is soccer. He has several world Top-Ten finishes in CQ WW DX CW from YV, VP5, and A7, and holds the Asia SOABHP Record. He has made the Top Ten (USA) in the IARU HF, CQ WW, ARRL DX, and ARRL SS, and has won the NA Sprint. He has also enjoyed multi-ops with friends in the US, Italy, and Qatar and serving as referee in WRTC2014 and 2018.

Ed Muns, WØYK

Ed, WØYK, entered CW and SSB DX contests initially in the early 1970s as a way to work new band/mode-countries for DXCC. His interest rapidly evolved from DXing to contesting with his early learning at the KØRF multi-multi. Today, CW and RTTY contesting dominate Ed's operating time. His local contest club, the Northern California Contest Club (NCCC), mounted an effort for the club competition gavel first offered in the 2004 ARRL RTTY Round-Up where Ed reluctantly (kicking and screaming) learned how to setup RTTY and ultimately won the Pacific Division SOHP plaque. He ironically enjoyed that induction into RTTY so much that he now includes all the major RTTY contests in his contesting schedule. With his P49X call sign, Ed holds the world SOHP record in ARRL RTTY Round-Up, having broken the record eight times, and the world SOHP record in CQ WPX RTTY, having broken that record seven times and set a world SOHP record in the 2010 CQ WW RTTY. Ed is the contest manager for the NCJ NA RTTY Sprint and the contest director for the two CQ RTTY contests, CQ WW RTTY and CQ WPX RTTY. He and Don, AA5AU, sponsor the FT Roundup which they initiated as the Ten-Meter RTTY Contest in December 2011 with nearly 700 logs submitted. In 2018, it became the FT8 Roundup with over 1200 logs using ARRL RTTY Roundup rules. He was inducted into the CQ Contest Hall of Fame in May 2014. This is his fifteenth year at CTU delivering the two Digital Contesting presentations and Q&A.

Rob Sherwood, NCØB

Ham radio began for me in 1961 in Cincinnati, Ohio, as both a novice and general-class operator. After graduating college in 1969 with a degree in physics, I moved to Denver and worked for KOA radio as an engineer until 1987. While at KOA, I maintained their 50 KW AM and FM transmitters, microwave links and studio equipment.

1974 saw the beginning of Sherwood Engineering, offering roofing filters and upgrade kits for the Drake R-4C. In 1976 I started measuring receiver performance on dozens of radios, since reviews in QST did not correlate with actual on-air observations at crunch time in CW contests. In 1977 "ham radio magazine" published the first of several of my articles on receiver problems and cures, vertical antenna ground systems and mobile antenna efficiency. Those articles are available on my web site as PDF files. Receiver test data is now web based with 150 transceiver and receiver listings.

www.nc0b.com/table.html.

In the 80s I was invited to be a forum speaker at the Dayton Hamvention on several occasions, discussing both receiver and antenna performance issues. In 2004 I returned to the Dayton Contest Forum, giving a talk on the status of receivers both old and new, with special emphasis on the Orion and the Icom 7800. In 2007 the Drake Forum had me present a talk on the pros and cons of the new batch of DSP transceivers. In 2009 I made a presentation at the Dayton Hamvention Antenna Forum on ground systems for vertical antennas.

2016 included a presentation at the Visalia DX Convention. In 2017 I spoke at ARRL Hamcon in Cody Wyoming, and a second appearance at the Duke City Hamfest in Albuquerque, NM.

Contest University 2022 is my 15th annual presentation at this great event.

Other speaking invitations at ham events have included WØDXCC, W9DXCC, W4DXCC, YCCC, New Orleans, Austin, Huntsville, Tucson & St. Louis. Locally around Colorado I have discussed receiver performance at the Boulder Amateur Radio, Northern Colorado Amateur Radio, Colorado QRP & 285 TechConnect Radio Clubs.

Fifteen years ago, my XYL encouraged me to build my dream contest station on 10 acres east of Ft. Collins, Colorado on the Pawnee Grassland. This has made it possible to evaluate top transceivers in major contests in a real-world environment to augment my laboratory data. This rural setting has allowed me to focus my interest on effective antennas. Six towers support 9 mono-band HF Yagis, plus 6m, 2m and 70cm, and wire antennas for 160, 80/40 and 30 meters.

I use WSJT X on the 475 kHz band with a 630 meter transverter manufactured in Australia driven with an IC-7610. I use my 160-meter Marconi T antenna with a separate tuner on 475 kHz.

My 630m log includes 35 states, including Hawaii, Alaska and Maine using JT9 / FST4. My best DX on 475 kHz is over 8000 miles between Colorado and Australia, having worked Roger, VK4YB, three times.

Ward Silver, NØAX

Ward has been an active contester since before his Novice days began in 1972, participating with high school club friends. His list of contest operating spans four continents and includes a variety of good scores from home and multioperator stations such as HC8N, PJ4Q, KH6RS/NH6T, K3LR, K9CT, W7RM, KL7RA, W5ZN, and W1AW.

Ward is a founder of the World Radiosport Team Championships (WRTC) which began in 1990. He was inducted into the CQ Contest Hall of Fame in 2015. In 2013 he was elected President of the Yasme Foundation which supports amateur radio activities around the world. He is the Lead Editor of the ARRL Handbook, Antenna Book, and is the author of Ham Radio for Dummies. He received the Bill Orr Technical Writing Award from the ARRL twice - once in 2003 and again in 2017.

He considers himself fortunate to have a few top finish plaques on the wall of the radio room, but the best part is participating in record-setting team efforts with friends from around the world.

Bob Wilson, N6TV

"TV Bob" is an active CW contester, Elecraft K4 Field Tester, and Win-Test supporter. Licensed for 50 years, Bob competed at the World Radiosport Team Championship (WRTC) in San Francisco (1996), Slovenia (2000), and Moscow (2010). He finished first in the 2013 and 2019 ARRL November CW Sweepstakes (from W7RN), and won the September 2014 NA Sprint CW from his home station. In 2017, he was inducted into the CQ Contest Hall of Fame.

He was a member of K2KW's original "Team Vertical" group (6Y4A, 4M7X), and has been part of the multi-op teams at HC8N and K3LR. Bob worked as a software engineer at IBM for 36 years, retiring in 2015.

2022 Contesting Related Events

May 18th – Wednesday night
7:00 PM Contest Super Suite at the Hope Hotel opens hosted by the Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and the North Coast Contesters (NCC).
8:00 PM to 10:00 PM Dayton Contest University 2022 Registration at the Hope Hotel
9:00 PM HamNation Live, at the Hope Hotel
10:30 PM Pizza Party at the Hope Hotel sponsored by Dayton Contest University 2022. http://www.contestsupersuite.com.

May 19th – Thursday daytime
7:00 AM Dayton Contest University 2022 Registration opens at the Hope Hotel. Must sign up in advance – http://www.contestuniversity.com.
8:00 AM – 5:00 PM Dayton Contest University 2022 at the Hope Hotel.

May 19th – Thursday night
7:00 PM Contest Super Suite at the Hope Hotel hosted by the Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and the North Coast Contesters (NCC).
10:30 PM Pizza Party at the Hope Hotel sponsored by the Society of Midwest Contesters (SMC).
http://www.contestsupersuite.com

May 20th – Friday daytime
11:55 AM – 1:05 PM Digital Contest Forum at Hamvention in Xenia, Ohio, Room 3 Moderator: Ed Muns, W0YK
"FT Contest NILs", Ed Muns W0YK
"RTTY Contesting: How to Win When Geography is Working Against You", Jeff Blaine AC0C
2:00 PM – 5:00 PM Antenna Forum at Hamvention in Xenia, Ohio, Room 1 Moderator: Tim Duffy, K3LR.
"Important Tower and Antenna Installation, Maintenance and Safety" - Tim Jellison, W3YQ
"Low Band Inverted L's and Vertical Antennas: Improving Radiation Performance" - Dr. Ted Rappaport, N9NB
"High Performance 6 meter Yagi Antenna Systems" - Frank Donovan, W3LPL
"K7AGE's Tower and Antenna Project Overview: Goals, Design, and Implementation" - Randy Hall, K7AGE

May 20th – Friday night
7:00 PM Contest Super Suite at the Hope Hotel hosted by The Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and North Coast Contesters (NCC).
7:00 PM 31st Annual Top Band Dinner at the Hope Hotel. Speaker is John Sluymer, VE3EJ. Tickets in advance from http://www.topbanddinner.com.
10:00 PM Spurious Emissions Band at the Hope Hotel.
11:00 PM Pizza Party at the Hope Hotel sponsored by the Potomac Valley Radio Club (PVRC).
http://www.contestsupersuite.com

May 21st – Saturday daytime
2:00 PM – 3:50 PM Contest Forum at Hamvention in Xenia, OH, Room 1 Moderator: Doug Grant, K1DG.
"Taking Remote Contesting to the Next Level" - Ray Higgins, W2RE, and Rockwell Schrock, WW1X
"A Funny Thing Happened on the way to Checking Digital Contest Logs" - Ed Muns, W0YK
"Building a World-Class Contest Station...in Arizona" - Tim Coker, N6WIN
"WRTC2022/2023 Update" - Fabio Schettino, I4UFH, and Claudio Veroli, I4VEQ

May 21st – Saturday evening
6:30 PM - 28th Annual Dayton Contest Dinner hosted by North Coast Contesters at the Hope Hotel. Dinner speaker is Joe Rudi, NK7U. Space is limited. Details and tickets in advance are available at http://www.contestdinner.com.
7:00 PM Contest Super Suite at the Hope Hotel hosted by The Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and North Coast Contesters (NCC).
8:00 PM to 12:00 AM Kansas City DX Club CW Pileup Competition at the Hope Hotel.
11:00 PM Pizza Party at the Hope Hotel sponsored by the Yankee Clipper Contest Club (YCCC).
http://www.contestsupersuite.com

World Wide Radio Operators Foundation

Contester's Code of Ethics

- I will learn and obey the rules of any contest I enter, including the rules of my entry category.
- I will obey the rules for amateur radio in my country.
- I will not modify my log after the contest by using additional data sources to correct call sign/exchange errors.
- I will accept the judging and scoring decisions of the contest sponsor as final.
- I will adhere to the DX Code of Conduct in my operating style.
- I will yield my frequency to any emergency communications activity.
- I will operate my transmitter with sufficient signal quality to minimize interference to others.

Table of Contents

Advertising

CTU Presents

Inside vs. Outside

How to Enjoy Contesting

Dave McCarty, K5GN

CTU CONTEST UNIVERSITY

ICOM

1

Who is this guy?

WB2GAV ORS NNJ

K5GN, Check 72, STX @W5KU

A73A 5921

NU5A Cat Texas

CTU CONTEST UNIVERSITY

ICOM

2

Who are you?

It’s an important question, when it comes to contesting.

CONTEST UNIVERSITY

ICOM

3

Contesting Ethics

What goes on inside and outside *matters*

CONTEST UNIVERSITY

ICOM

4

The topic:

CHEATING

5

It's a hot topic:

cq-contest@ contesting.com

topband@ contesting.com

6

Cheating is pure hypocrisy.

– Carla Burnham Martin

Are you a winner if you cheat?

– Frank Sonnenburg

If you are good at your game, you would not cheat.

– D J Kyos

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ICOM

7

Radiosport – an unusual game

- Entrants keep their own score in real time
- Complex rules govern scoring
- Individuals and team entries permitted
- Competitors and casual participants all together
- Winners of top-level events often invest $50K or more including travel to favorable locations
- An on-line network helps participants increase their scores
- Spectators don't find it particularly interesting

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ICOM

8

In other words ...

An open, massively multi-player, on-air, real-time, intensely interactive game of cooperative exchanges, defined by rather arbitrary rules.

CONTEST UNIVERSITY

ICOM

9

Why are we here?

- The contest rules set the boundaries of the playing field
- What goes on within those fences …

IS A TOTAL BLAST!

CONTEST UNIVERSITY

ICOM

10

What do we mean … Ethics?

- Ethics denote the theory of right and wrong actions
- Ethics in practice is knowing the difference between right and wrong and choosing to do what is right
- N0AX refers to our "Good Arrow." We know which way it points. Our ethics begin here.
- We also know where it doesn't point (narcissism, psychopathy, Machiavellianism)

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11

Cheating hurts you and us

- Cheating degrades you
- Cheating hurts other participants
- Cheating undermines the sport

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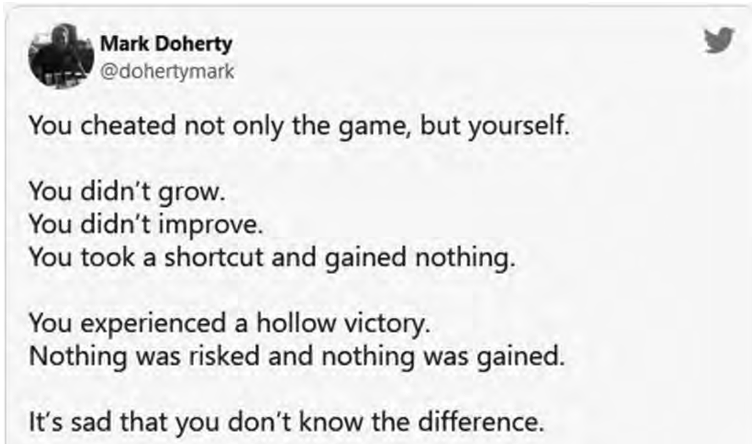
12



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When people cheat in any arena, they diminish themselves – they threaten their own self-esteem and their relationships with others by undermining the trust they have in their ability to succeed and in their ability to be true.

– Cheryl Hughes

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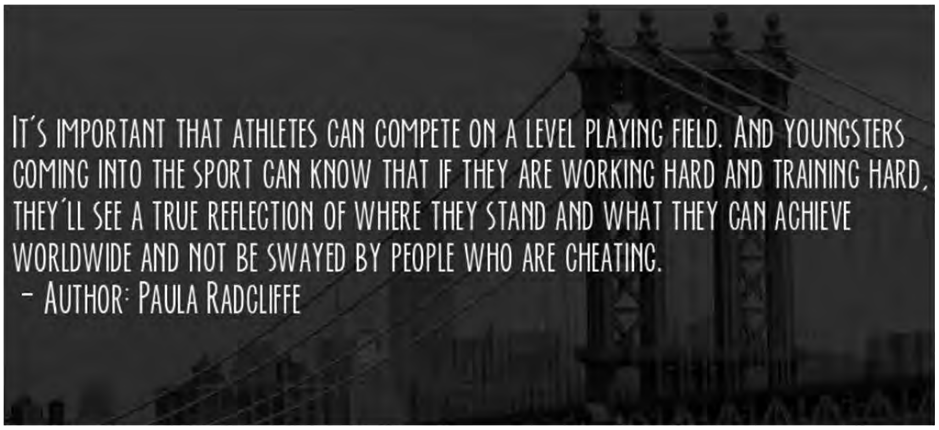

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Lance Armstrong

- Led the cycling world for years
- Win at all costs attitude
- Thought of himself as invincible

- In the headlines for years suspected of doping
- “Confessed” in 2012 on Oprah

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Cyclist Lance Armstrong overcame incredible personal adversity to reach the highest levels of success. Then, just as spectacularly, he fell from grace in a public scandal that destroyed not only his reputation, but also the reputations of many others who had devoted themselves to him—**in the end, tarnishing the entire sport** of professional cycling.

– Michael Blanding

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Inside Factors

What does winning the contest mean to you?

How important is your radio identity to you?

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Who am I?

Born in Virginia to W8 dad and PT7 mom

Graduated HS in Houston

Texas Aggie

Husband and father of two

Engineer

Soccer enthusiast

Follower of Christ

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Who are we?

- When we sit down at the rig, we sometimes find ourselves taking on a different persona.
- Do we forget that we are brothers, fathers, professionals?
- Does our chronically self-centered human nature lead us astray?

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Ethics and Respect

- Ethical behavior requires ***respect***…
  - Respect for ***others***
  - Respect for ***the game***
  - Respect for ***yourself***
- Our fellow competitors want the same respect that we want for ourselves (the Golden Rule)
- To get respect, you have to ***give*** respect

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We judge ourselves by our internal motives and everyone else by their external actions…it's just easier to know those motives when we are the perpetrator. The adverse consequences of this are wide and deep. Moreover, the pull towards judging yourself less harshly than others easily resists the rationality of deterrence.

– Robert M. Sapolsky

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Man looks on the outward appearance, but the Lord looks on the heart.

– 1 Samuel 16:7

God's standards and weighing scales differ from that of the world.

– Janneker Lawrence Daniel

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How do we know what to do?

- Written Rules
  - Specified by the contest sponsor in writing
  - Black and white
  - May, can, must …
- Unwritten Rules
  - Expectations about behavior
  - Interpreted norms
  - Gray areas

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Some written rules are very clear

- (some people break these anyway)

A. **Single Operator categories:** For all single operator categories, only one person (the operator) can contribute to the final score during the official contest period.

B. **High Power:** Total output power per band must not exceed 1500 watts or the output power regulations of the country in which the entrant is operating, whichever is less.

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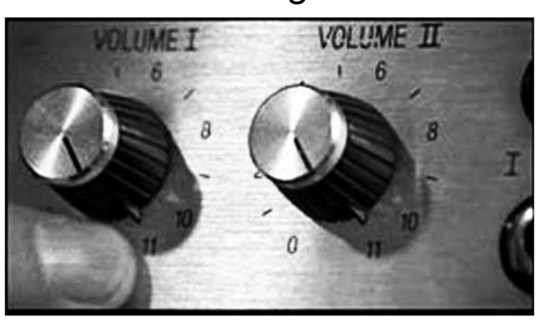
"It's the *size* of the watts!"

- Don't exceed the power limits for the contest and your category
- Just because the knobs go to 11 …



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Unwritten Expectations

- "Can" is not the same as "Should"
- Just because it's not specifically prohibited by the written rules doesn't mean you should do it!
- Learn and follow the spirit of the rules
- Keep the contest on the radio and within the contest period.
- Don't give or take unfair advantage of others
- Pay attention to changes to the rules (RTFR)

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Examples of Unwritten "Rules"

- **Do not** make pre-arranged schedules
- **Do** identify frequently
- **Do not** ask friends to work only you
- (**Do** encourage friends and club members to work you and everyone)
- **Do not** work friends with multiple calls
- **Do** log the QSO at the time of the QSO (no "rubber clocking")

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Examples of Unwritten “Rules”

- **Do not** use non-amateur means to get others on the air to work you
- **Do** make an effort to help casual callers enjoy the contest and make contacts
- **Do not** let others “help” your single-op effort
- **Do** not cheerlead
- **Do** work and spot stations equally

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No “Log Washing”

- **Do not** scrub your log after the contest
- ⦸ Using QRZ.com, spot history, 3830 reports, LoTW, club databases, QSLs & emails received to make corrections to QSOs
- ⦸ Using utilities to analyze and correct the log
- ⦸ Asking others who they worked or if a callsign is correct
- ⦸ “Fixing” off times or band change times
- **It’s over when the clock rolls over**

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No "ghost" QSOs

- **Do** make sure **you** are the one being worked in the QSO
- **Do not** log an incomplete QSO (no wishful thinking)
- **Do** log duplicate QSOs (the log-checker will handle them)
- **Do not** log QSOs you haven't made ("working the callbook")

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Unobservable vs. Observed

- Behavior inside the shack is not typically observed
  - Only WRTC has on-site referees
- Behavior on the air is observable
  - Considerable tools are available to log-checkers

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For everyone who does wicked things hates the light and does not come to the light, lest his works should be exposed. – John 3:20

It's amazing how many cheaters and liars believe they won't be caught. News Flash: in today's age of technology, there won't just be a paper trail. There will be multiple electronic and digital trails, as well.

– Carla Burnham Martin

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CHEATING is a CHOICE, not a MISTAKE.

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At some point, you make a decision

Play by the rules

- Work on improving skills
- Power consistent with class
- Assistance consistent with class
- Submit log as logged when the contest ends

Make your own rules

- Work on being obnoxious
- More power (amps to "11")
- Use the cluster – who will know?
- Wash the log (fix calls, add calls, "adjust" times, etc.

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Overall, cheating is not limited by risk, it is limited by our ability to rationalize the cheating to ourselves.

– Dan Arielly

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How do people excuse cheating?

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Let us count the ways...

- Everybody does it
- I like being an outlaw
- It was exciting to push the rules
- Nobody was getting hurt
- Nobody was watching
- Rules don't mean much to me, I'm bigger than that
- It doesn't make a difference anyway
- Little to lose and much to gain by it
- It helped me overcome my unfair disadvantage
- I had to do it to win!
- The rules weren't clear but it seemed to me it might allow it
- The rule I broke was unfair anyway

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Hat tip: AB7E

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Which ways tempt you?

- Many of us are well-trained, morally
  - But, we're also well-practiced at rationalizing
- Others don't see this as a moral issue
  - So we make judgments based on peer norms and cost-benefit assessments
- Let's go through the list, briefly

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"Everybody does it"

- K5**, NR5*, IQ2*, IR4*
- A little "evidence" easily becomes a widespread suspicion - "That guy is loud. He beats me all the time. He must be running power. I better get me a big amp, too."
- But the truth is that <u>not</u> everybody does it
- In fact the *top* competitors *don't* do it

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Photo Credit: K5GN

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K3LR vs. W3LPL, CQWW CW

- This is the very top level of competition
- Both strictly hold their amps and ops to the 1500W maximum power limit

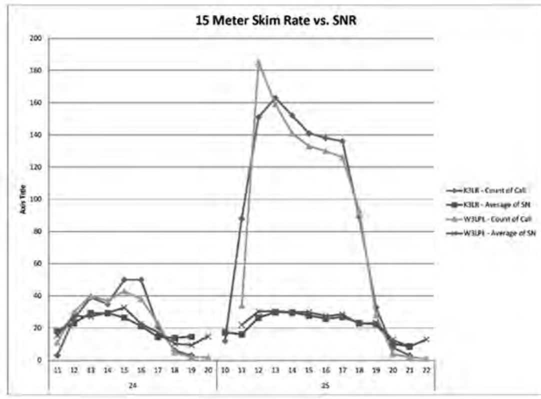

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Photo credit; K3LR

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K3LR vs. W3LPL

- Zooming in on the Skimmer SNR data

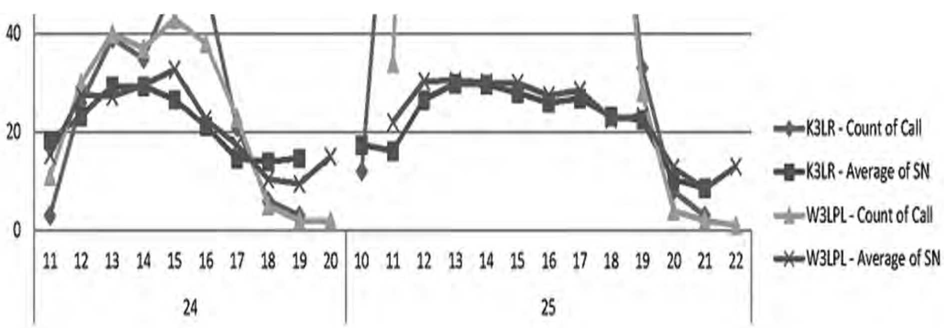

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Photo credit; K3LR

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Living Dangerously?

- “It’s exciting to break the rules”
- “I like being an outlaw”

- “Nobody is watching”

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Photo Credit: K5GN
http://www.rfconcepts.com/

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Stolen water is sweet, and bread eaten in secret is pleasant.

– Proverbs 9:17

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In my mind, it's justified

- "It helped me overcome my unfair disadvantage"
- "I had to do it to win!"
- "The rule I broke was unfair anyway"

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CQ-contest@contesting.com

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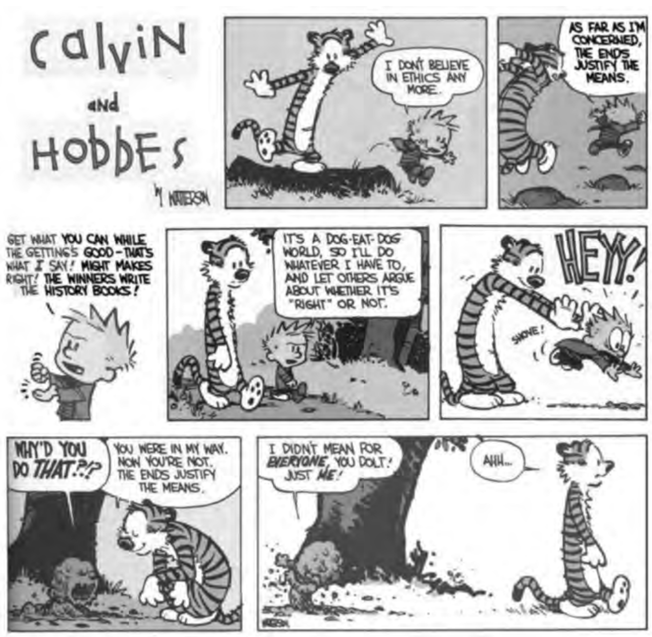

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No harm, no foul

- "Nobody is getting hurt"
- "It makes no difference anyway"

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http://www.hayseed.net/~jpk5lad/Assorted%20Ham%20Stuff/K5LAD%20Awards/

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Cheating is cheating. No reason can justify it and no explanation can make it better.

– Sarvesh Jain

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“That’s not how the world works”

- Only cheaters prosper

  – Howard Tayler

- There’s no such thing as cheating. There is only winning or losing.

  – Kiersten White

- If you can cheat, so can I. I won’t let you beat me unfairly – I’ll beat you unfairly first.

  – Orson Scott Card

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The thought of cheating to win will never even cross a true competitive player's mind. For the true win, the competitive player will accept defeat. The cheater already accepted defeat for the false win.

– ijie

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I'm at the top of the food chain

- "That rule was unclear so I thought I could stretch it to suit my operation"
- "Rules don't mean much to me, I'm bigger than all that "

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Cheating is cheating, no matter who is doing it. It's wrong.

– Carla Burnham Martin

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I'm just a little gun

- "I'll never be #1 so what does it matter?"
- "It won't matter if I cut corners a bit – it's just for fun"

- Bad habits early on become seriously bad habits later.
- Your reputation is established early

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Claiming to love self, but willingly defaulting to cheating at the first sign of trouble is nothing short of playing yourself.

– T. F. Hodge

Cheating, loyalty, unfaithfulness – they start out as little things justified by clever reasonings of the brain, but never do they fully convince the knowing heart.

– Richelle E. Goodrich

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Another factor or two

- Fear of loss of status
- E.g., a 10x increase in research misconduct (chasing grants to keep the lab alive)

- Cheating begets cheating – once the initial barrier is overcome, the next hurdle may seem smaller (the “what the hell” effect)
- E.g., Dr. Yoshitaka Fujii – 183 articles faked

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Reputation

- You are responsible for your own reputation
  - Follow the rules!
  - Don't participate with people who cheat
- Lead by example
  - You never know who is listening or watching
  - Don't do anything you would not want to be made public
- Be vocal
  - Confront cheating when you see it
  - Every incident is an opportunity to teach proper behavior

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Negative Peer Recognition

- "That station was too loud in the NAQP"
- "That guy uses a pair of 8877s and has remote receivers in Europe"
- "He uses spots but enters as unassisted"
- "His 'cousin' was there as a second operator to help him"
- "He always operates with a broad signal to push away nearby stations and keep his freq clear"
- "He pads his logs with dead people's callsigns"

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I’ll spend the rest of my life trying to earn back trust and apologize to people for the rest of my life.

… people will see me as somebody [who] has disrespected the event, the sport, the color yellow, the jersey, and ... I disrespected the rules.

I’d do anything to go back to that day.

– Lance Armstrong

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Men [who cheat] do not cheat because they are dogs. They are [regarded as] dogs because they cheat.

– Mokokoma Mokhonoana

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62

Where do you get your norms?

- From those who taught you morality
- From people you admire – your heroes
- From the people you run with – your multi-op team and hosts, your club members
- After childhood, you are responsible for the development of your character

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63

There is a way that seems right to a man,
but its end is the ways of death.
– Proverbs 14:12

Golf shows your character.
– Victoria Brown

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Tim Duffy, K3LR

- Strictly legal
- Lockouts, amplifiers, property limits
- High expectations of his guest operators
- #1 CQ WW SSB 2012
- #1 CQ WW CW 2012
- #1 ARRL DX CW 2013
- #1 ARRL DX CW 2013

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And other heroes of mine...

K5ZD	N6ZZ	W2SC (8P5A)
N2NT	K1ZZ	N6TR
K4BAI	N5RZ	K1EA
N9RV	K0DQ	N2IC
N5TJ	K5TR	W3LPL
K5KA	N2NL	And ...

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As cliché as it might sound, I'd rather lose than win by cheating. The latter is a much deeper, more personal loss in that one is admittedly whispering to himself his lack of competence. His cheating then begets more cheating, as he is ever-privately, ever-subconsciously insulting himself; thus gradually deteriorating any remaining confidence.

– Criss Jami

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What do we really want?

We put a huge value on our competitive hobby.

We value our radio identities, too.

We know what's right.

We know how to apply the smell test.

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Cheating is very easy, try something more challenging like being faithful to yourself, dreams, and partner. After all, it is how responsible we are [to] ourselves, dreams, and partner that we get to mature and grow wiser and more responsible.

– Kabelo Mabona

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So here's the challenge

Let's strive individually and together to keep our reputations and our sport clean

Let's strive to emulate our heroes in the observable and the non-observable

Let's work within our clubs and on the 'net to bring our peers – both those who get it and those who don't – to the same goals

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When my daughter was about five, she made up a game. I asked her what the rules were, and she said "No lying, no spitting, no cheating."

That covers most things in life.

– Kenneth Wolfe K1EA

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Thanks for your attention

Go! Fight!! Win!!!

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Acknowledgements

- Prior presentations by K5ZD, K4RO, W5ZN, K1DG, N0AX
- Additional input from N6TR, K1TO, K1EA

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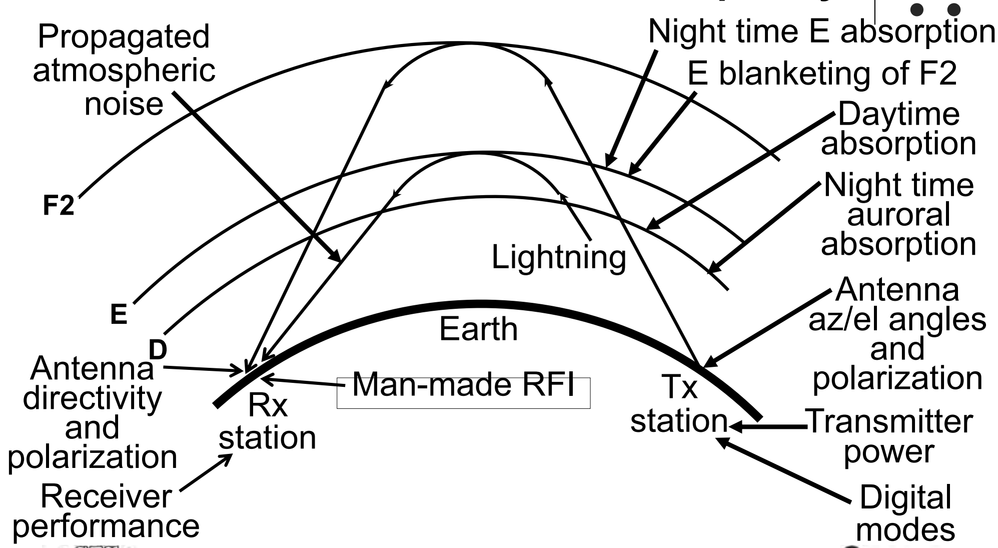
Easy to Build
Low Band Receiving Antennas for Small and Large Lots

- Small antennas
- High performance antennas
- Diversity reception

Frank Donovan
W3LPL

1

160 Meter Propagation
What's So Hard About Communicating Near or Below the Lowest Usable Frequency?



2

Why Receiving Antennas?

Much better performance than most transmitting antennas

- much lower cost
- greatly reduced footprint
- greatly reduced height (7 to 25 feet)
- good directivity on as little as 650 to 2500 square feet
- excellent directivity on less than an ¼ acre
- directivity equivalent to a 5 element Yagi on less than 3/4 acre
- greatly reduced mutual coupling between individual receiving verticals
- greatly reduced need for efficient matching and extensive radial systems

High performance arrays perform equivalent to a 5 element Yagi!

Combining two antennas with a variable phase controller

- steerable nulls
- optimizes the front-to-back ratio of phased Beverages and phased verticals

Diversity reception with dual phase locked receivers

All receiving antennas dimensions are for
160 meters - simply scale them to 80 meters

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3

Receiving Directivity Factor (RDF)

proven measure of receiving antenna performance

Compares forward gain <u>at the desired azimuth and elevation angle</u> to average gain <u>over the entire hemisphere</u>

- EZNEC computes antenna RDF

Assumes noise is equally distributed over the entire hemisphere

- an invalid assumption for suburban and especially urban locations where noise is often concentrated on the horizon at specific azimuths

Assumes that RFI is more then 1000 feet away, in the far field of the antenna

- where the antenna pattern of large antennas is fully formed, and
- RFI sources look more like a point sources

www.w8ji.com/receiving.htm

Re-radiation from antennas, towers and power lines
within about 1000 feet can degrade your actual RDF
<u>especially for high RDF arrays</u>

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Small Receiving Antennas
4 to 11 dB RDF

4 dB: Bidirectional 8 foot diameter "magnetic" loop *close to the ground*

5 dB: Single vertical antenna (short vertical or ¼ wavelength vertical)

6 dB: 225 foot Beverage on Ground (BOG) *poor low angle sensitivity*

7 dB: 250 foot Beverage about 7 feet high better low angle response

7 dB: Unidirectional terminated small loop *close to the ground*

- flag, pennant, EWE, VE3DO

8 dB: Two switchable small terminated loops at right angles to each other

- K9AY Array
- Shared Apex Loop Array

8 dB: Pair of 250 foot staggered Beverages about 7 feet high

9 dB: Two phased short verticals with 60 to 80 foot spacing

9 dB: Triangle array of phased short verticals with 60 to 80 foot spacing

11 dB: Vertical Waller Flag: two phased vertical loops *close to the ground*

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Small antennas provide better RFI reduction when local RFI sources are within about 1000 feet

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5

High Performance Receiving Antennas
10 to 14 dB RDF

10 dB: Pair of 400 foot staggered Beverages about 7 feet high

10 dB: 500 to 600 foot Beverage about 7 feet high ideal for both 160 and 80 meters

11 dB: Two or three close spaced 500 to 600 foot Beverages, staggered 125 feet

11 dB: Vertical Waller Flag: 2 phased close spaced vertical loops close to the ground

12 dB: 750 to 1000 foot Beverage about 7 feet high *too long for 80 meters*

12 dB: 4 square array of active or passive short verticals 80 x 80 ft

12 dB: 3 element YCCC tri-band array of short active verticals 120 ft long

12 dB: 5 element YCCC tri-band array of short active verticals 84 x 84 ft

12 dB: 9-circle YCCC tri-band array of short active verticals 120 ft diameter

12 dB: Horizontal Waller Flag: 2 phased horizontal loops *100 feet high minimum*

13 dB: BSEF array of 4 short verticals switchable in two directions 350 ft x 65 ft

13 dB: 8-circle array of short verticals with 106º phasing 200 ft diameter

13 dB: 8-circle BSEF array of short passive verticals 350 ft diameter + radials

14 dB: Four broadside/end-fire 750-1000 foot Beverages 750 ft x 330 ft

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Large antennas are less effective than small antennas for suppressing local RFI sources within about 1000 feet

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6

Single Small Loop Antennas
4 - 7 dB RDF 120 to 150º 3 dB beam width

8 foot diameter bidirectional "magnetic" loop 4 dB RDF

- *bi-directional* 150º 3 dB beam width
- 24 dB deep vertically polarized null with very narrow 2º null width
- must be installed *close to the ground* to optimize the depth of the null by suppressing horizontally polarized signals
- a specialized antenna for steering a deep narrow null onto the RFI source onto a single ground wave propagated vertically polarized RFI source
- a 17 foot diameter loop has better DX sensitivity but only 20 dB deep nulls

Unidirectional terminated small loop antennas 6 - 7 dB RDF

- Flag Pennant EWE K9AY VE3DO
- 120º 3 dB beam width

Mechanically rotatable unidirectional terminated small loop antenna

- rotatable flag 6 - 7 dB RDF
- 120º 3 dB beam width

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Small antennas are the best RFI reduction antenna when RFI sources are within 1000 feet

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7

Two End-Fire Phased Vertical Loops 1919

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worldradiohistory.com/UK/Wireless-Age/Wireless-Age-1919-Apr.pdf

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8

Two End-Fire Phased Vertical Loops 1919

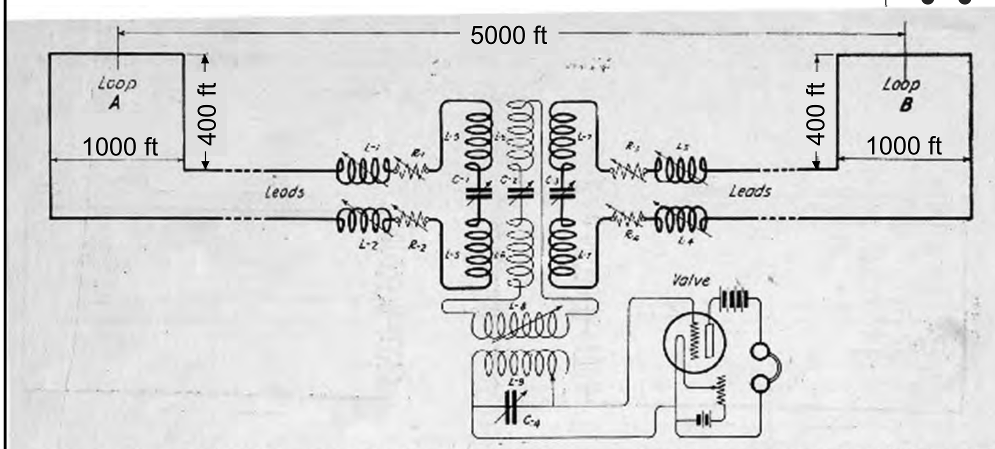

Figure 6—An early form of Weagant's system for eliminating static interference showing two single turn loop antennae spaced 5,000 feet apart. Each loop was 1,000 feet long at the base and 400 feet high. The leads from each loop were connected to the primary coils, L-5 and L-7, of the radio goniometer which were coupled to the secondary coil L-6. By rotating L-6, a position was found where the static currents neutralized and the signal currents were retained. This apparatus and antennae permitted the reception of signals from stations in Europe under conditions of static interference which with ordinary receiving apparatus and antennae would render reception impossible.

CONTEST UNIVERSITY worldradiohistory.com/UK/Wireless-Age/Wireless-Age-1919-Apr.pdf ICOM

9

Arrays of Two Small Loops

8 - 11 dB RDF 80 to 120º 3 dB beam width

Electrically switchable compact arrays of two small loops

- two switchable K9AY loops installed close to the ground — 8 dB RDF
- Shared Apex Loop Array installed close to the ground — 8 dB RDF
- 120º 3 dB beam width

350 ft broadside spaced small terminated loops — 9 - 10 dB RDF

- Flag pennant EWE K9AY VE3DO installed close to the ground
- 80º 3 dB beam width

Mechanically rotatable array of two end-fire close spaced small loops

- Vertical Waller Flag: 2 phased vertical loops close to the ground — 11 dB RDF
- Horizontal Waller Flag >100 feet high - superb RFI suppression — 11 dB RDF
- 80 degree 3 dB beam width
- Close spaced end-fire small loops produce extremely low signal levels
  - requires at least 40 dB of preamp gain and 2 dB preamp noise figure or less
  - extreme attention to common mode signal suppression – invest in ferrites

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Small antennas are the best RFI reduction antenna when RFI sources are within a few thousand feet

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10

BOGs and Arrays of BOGs

BOGs have poor low angle sensitivity

6 to 8 dB RDF 60 - 90º 3 dB beam width

BOG 100º 3 dB beam width 6 dB RDF

- 225 foot wire supported *just above* ***but not on*** the surface of the ground

Switchable bi-directional BOG 100º 3 dB beam width 6 dB RDF

- 225 foot coax cable supported *just above* ***but not on*** the surface of the ground

Close spaced staggered BOGs 100º 3 dB beam width 7 dB RDF

- two or three close spaced BOGs with 125 foot end fire spacing
- significantly improves front-to-back ratio especially if a variable phase controller is used

Two wide spaced BOGs 60º 3 dB beam width 8 dB RDF

- 350 foot broadside spaced BOGs reduces beam width to 60º

BOGs are very low sensitivity antennas especially at low angles requiring excellent suppression of coaxial cable common mode signals

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11

Beverages and Beverage Arrays

only 7 feet high to suppress horizontally polarized signals
single wire Beverage or two wire reversible Beverage

6 to 14 dB RDF 45 to 120º 3 dB beam width

250 foot Beverage	120º	3 dB beam width	8 dB RDF
400 foot Beverage	100º	3 dB beam width	9 dB RDF
500 to 600 foot Beverage	80º	3 dB beam width	10 dB RDF
600 to 750 foot Beverage	70º	3 dB beam width	11 dB RDF
750 to 1000 foot Beverage	60º	3 dB beam width	12 dB RDF

Staggered Beverage arrays 80º 3 dB beam width 11 dB RDF

- two or three 500-600 foot Beverages with 125 foot end-fire spacing
- significantly improves front-to-back ratio with a variable phase controller

Broadside Beverage arrays 45 - 60º 3 dB beam width 12-14 dB RDF

- two Beverages with 350 foot broadside spacing, or
- four Beverages with 125 foot end fire spacing and 350 foot broadside spacing
- significantly improves front-to-back ratio with a variable phase controller

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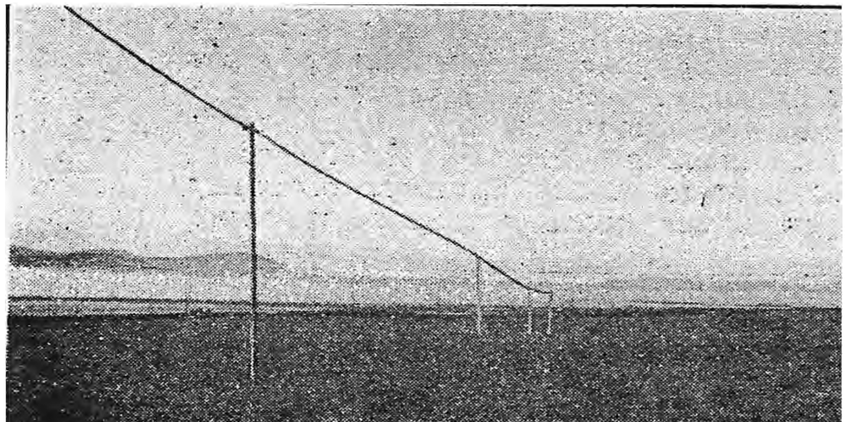
12

1300 Foot Beverage installed by Paul Godley 2ZE
Near the waterfront in Ardrossan, Scotland
During the successful 1921 Transatlantic Tests



Beverages were all but forgotten by hams for 45 years until K1PBW re-introduced them to 160 meter DXers in 1967

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13

Arrays of Short Phased Verticals
9 - 14 dB RDF 50 to 135º 3 dB beam width

Active high impedance 20 foot verticals

- capable of multi-band operation with some performance compromise
- no radials
- requires a high input impedance amplifier *at the base of each vertical*

----- or ----

Passive low impedance 25 foot verticals

- mono-band operation only
- very easy to troubleshoot and repair low parts count very reliable
- eight 70 foot or sixteen 35 foot radials *at the base of each vertical*
  - stabilizes the feed point impedance during all weather conditions
  - decouples the coax shield to suppress common mode signals
- four 25 foot umbrella wires
  - reduces the required height to 25 feet
  - increases the array bandwidth
  - or 35 foot verticals with no umbrella wires

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Any monoband array of phased short verticals can use either high or low impedance verticals

ICOM

14

Small Diameter Loop Antenna
Eight Foot Diameter "Magnetic" Loop

Excellent for nulling *a single* nearby RFI source
- RFI to be nulled must be vertically polarized and received via ***ground wave***

Superb for precisely locating RFI very small loops have deeper nulls
Bi-directional figure-8 pattern very broad 150º 3 dB beam width
- Must be installed close to the ground to suppress horizontally polarized signals

Very deep approximately 2º wide nulls off *both sides* of the loop
- mechanically rotate the loop until the single local RFI source is nulled
- the null is not as deep for skywave propagated signals

Small loop antennas produce very low signal levels
- requires a 20-30 dB gain, very low noise figure preamplifier
- a low sensitivity receiving antenna for DX, limited by preamp noise figure

All attached cables must be choked to suppress common mode signals
- install common mode chokes on the coaxial feedline and preamp power cable
- bury cables about 12 inches deep for optimum null depth

Avoid re-radiated signals from nearby antennas and power lines
- locate the antenna as far as possible from other antennas and power lines

CTU CONTEST UNIVERSITY **The "Magnetic" Loop is a specialized antenna** ICOM

15

8 Foot Diameter Loop Antenna 4 dB
RDF 150º 3 dB beam width deep 2º nulls

Inexpensive and very easy to build and use
Good compromise size with 24 dB null depth and fairly good sensitivity
24 dB nulls 2ºº wide broadside to the loop for local RFI suppression
Very broad 150º figure-8 bidirectional 3 dB beam width
Poor sensitivity for weak DX signals
Needs a preamplifier with 20-30 dB gain and 2 dB noise figure

CTU CONTEST UNIVERSITY www.seed-solutions.com/gregordy/Amateur%20Radio/Experimentation/160loop.htm ICOM

16

Electrically Steerable Small Loops

- Two K9AY loops
  - switchable in four directions
  - footprint is only 25 x 25 feet and 25 feet tall
  - 120º 3 dB beam width
  - 7 dB RDF
- Shared Apex Loop Array
  - switchable in eight directions
  - footprint is only 50 x 50 feet and 25 feet tall
  - 75º 3 dB beam width
  - 8 dB RDF
- All small loop antennas produce very low signal levels
  - a high gain, low noise figure preamplifier is essential
  - requires very careful attention to choking unwanted common mode signals
    - choke the coaxial cable feed line and filter the control cable and power cable
    - bury the cables about 12 inches deep for best unwanted signal suppression
- Avoid re-radiated signals from nearby antennas, towers and power lines
  - locate the antenna as far as possible from antennas, towers and power lines

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17

Two K9AY Loops

7 dB RDF in only 625 square feet

very small 25 x 25 foot square x 25 feet high
switchable in four directions
120º 3 dB beam width

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www.arraysolutions.com/antennas/as-ayl-4-ant

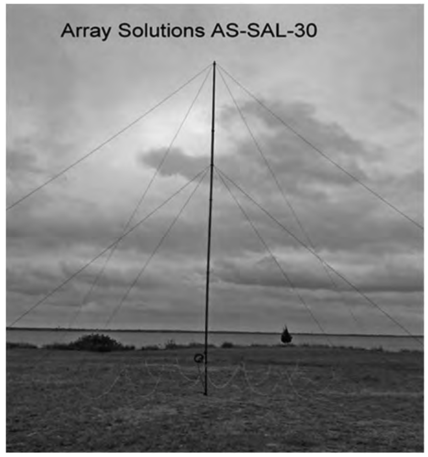
ICOM

18

Shared Apex Loop Array

8 dB RDF in only 2500 square feet

50 x 50 foot square x 25 feet high
switchable in eight directions
75º 3 dB beam width



CONTEST UNIVERSITY www.arraysolutions.com/antennas/as-sal-30 ICOM

19

Waller Flag Array – Vertical or Horizontal

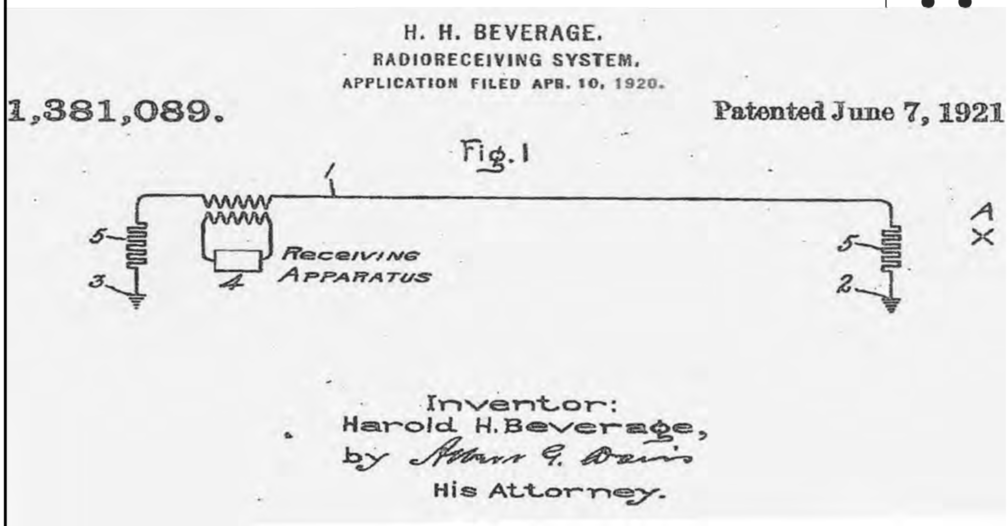
11 dB RDF in only 30 feet of length

Two small terminated loops with very close end-fire phasing
For most locations: 14 feet tall and 30 feet long
For quiet locations: 20 feet tall and 50 feet long
80º 3 dB beam width
Requires a 30-40 dB gain preamp with very low 2 dB noise figure
A horizontal Waller Flag must be at least 100 feet high but higher is better

CONTEST UNIVERSITY wwrof.org/wp-content/uploads/2016/03/WWROF-WEBNAIR-RX-Antennas-for-a-Small-Lot-.pdf ICOM

20

Single Wire Beverage Antenna 1920



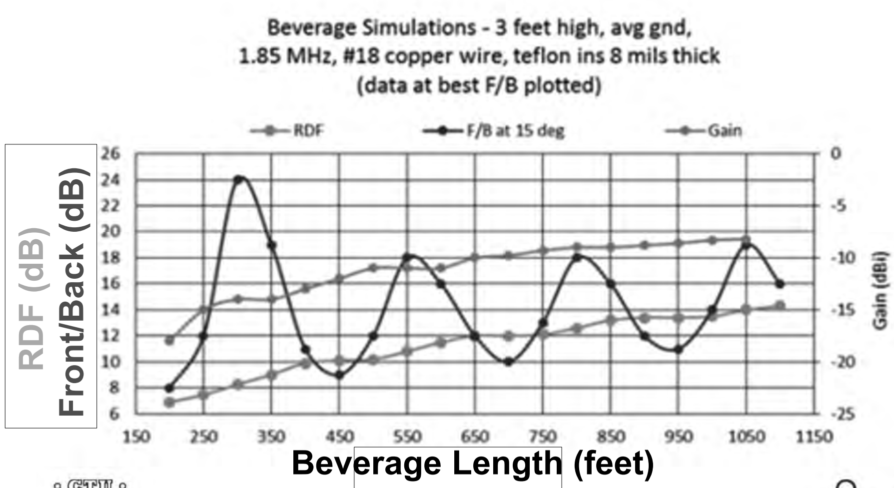
CONTEST UNIVERSITY www.w8ji.com/beverages.htm ICOM

21

Single Wire Beverage

The simplest and most reliable high performance receiving antenna

250 to 400 feet long	100º-120º	3 dB beam width	7-10 dB RDF
500 to 750 feet long	70-80º	3 dB beam width	10-12 dB RDF
750 to 1000 feet long	60º	3 dB beam width	12-13 dB RDF

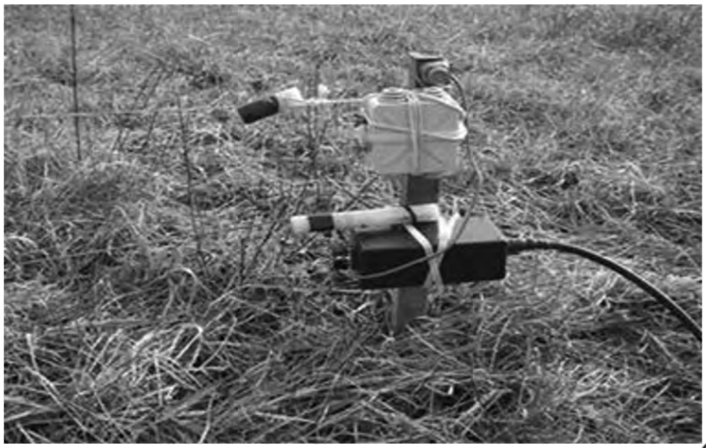


CONTEST UNIVERSITY k9la.us/Trends_in_Beverage_and_BOG_Performance.pdf ICOM

22

Beverage on (very near) Ground
6 dB RDF with only 225 feet of length

a good choice when stealth is important
signal levels are *much stronger* if the wire is elevated just a few inches
only about 225 feet long -- *longer lengths significantly degrade performance*
90 to 100º 3 dB beam width
Very low signal levels – requires a high gain preamp with very low noise figure



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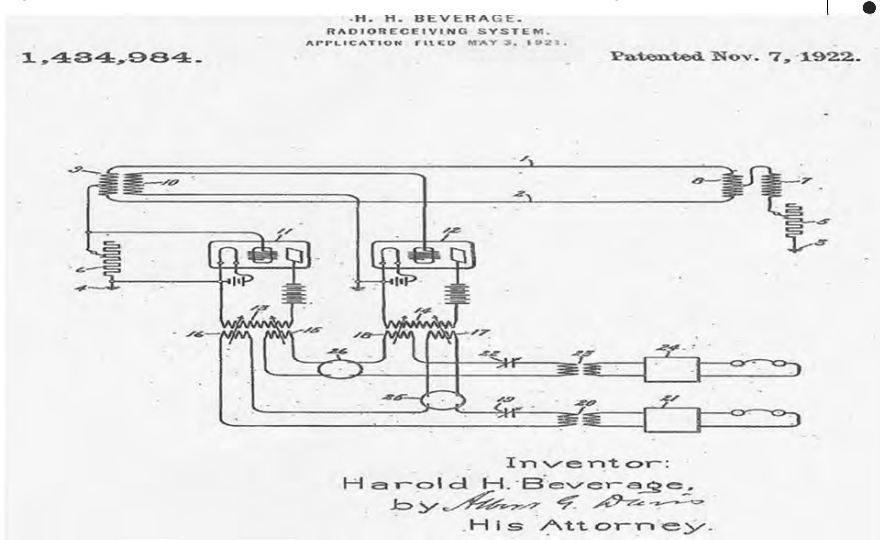
vimeo.com/199235390

ICOM

23

Two Wire Bi-directional Beverage - 1921

Switchable in two directions with one feed line
deep steerable rear null if both feed lines feed a variable phase controller



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w0btu.com/Beverage_antennas.html

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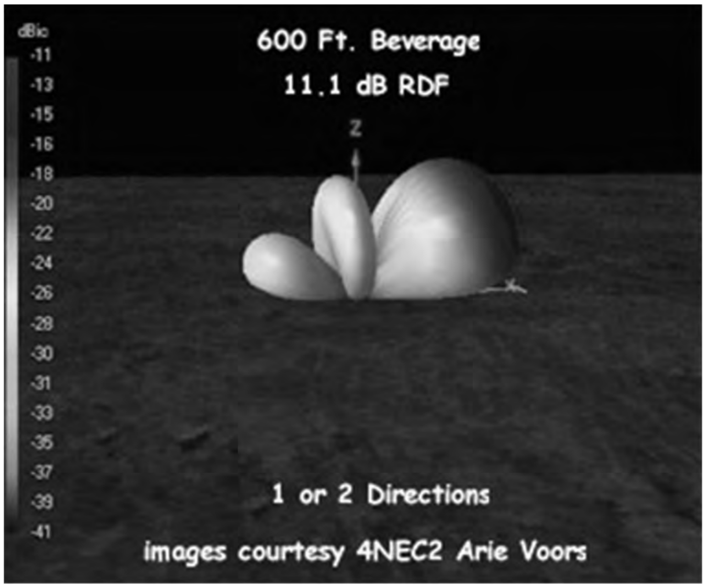
24

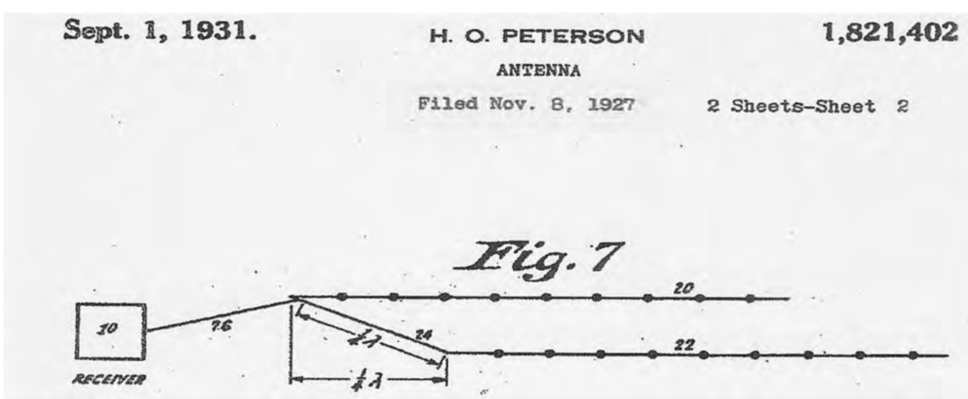
Radiation Pattern of a 600 Foot Beverage



25

Staggered Beverage Array - 1927
11 dB RDF on one acre

Two or three close spaced, 500 to 600 foot staggered Beverages
or two or three close spaced 225 foot BOGs – but only 7 dB RDF
Enhanced front-to-back ratio compared to a single Beverage or BOG
The deep rear null can be steered by a variable phase controller



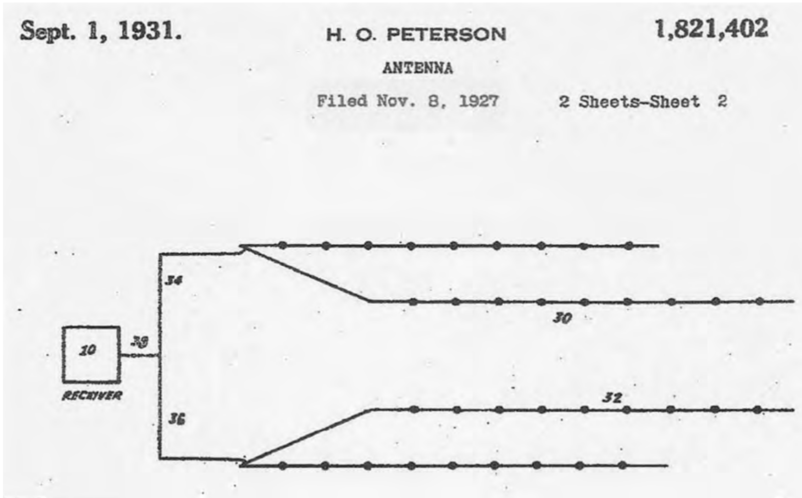
http://ncjweb.com/features/sepoct11feat.pdf

26

Broadside Pair of Staggered Beverages - 1927
14 dB RDF on 8 Acres

800 foot Beverages, 350 foot broad side spacing

50º 3 dB beam width



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27

Phased *High Impedance* Verticals
Two or More 20 Foot Verticals

No radials

No umbrella wires

Switchable in multiple directions

Multi-band operation with compromise 65 foot element spacing

80 foot element spacing for improved 160 meter performance

- somewhat closer spacing is possible by using a variable phase controller

High input impedance amplifier at the feed point of each vertical

- stray capacitance must be reduced to a very low amount in the construction of the feed point of each vertical and amplifier input

Verticals must not be installed within ten feet of nearby objects

- Avoid nearby trees or any conductive or partially conductive structure

Avoid re-radiated signals from nearby antennas and power lines

- locate the antenna as far as possible from antennas, towers and power lines

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hizantennas.com

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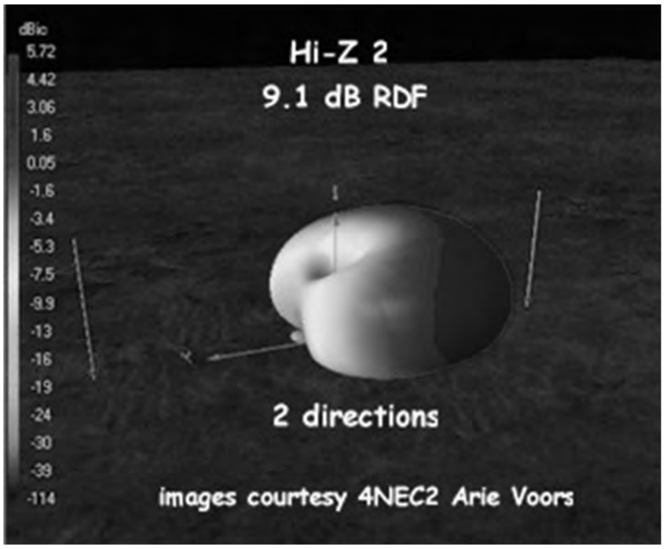
28

Radiation Pattern of a Two Element Array of 20 Foot Verticals 9 dB RDF in 80 feet or less



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29

Electrically Steerable 4-Square Vertical Array 12 dB RDF on less than ¼ acre

four *high impedance* 20 foot verticals

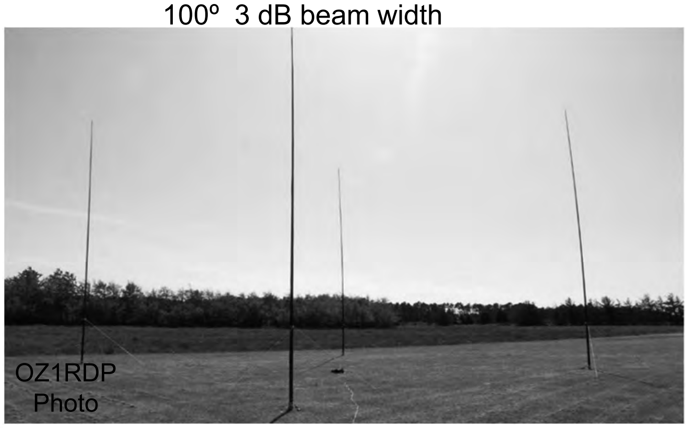
no radials no umbrella wires

80 x 80 foot square x 20 feet high

high input impedance amplifier at the base of each vertical

switchable in four or eight directions

100º 3 dB beam width



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dxengineering.com/parts/hiz-4-lv2-80

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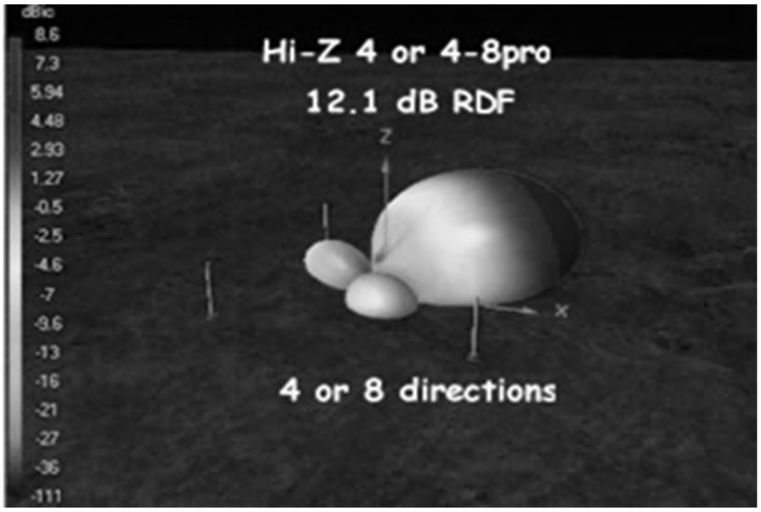
30

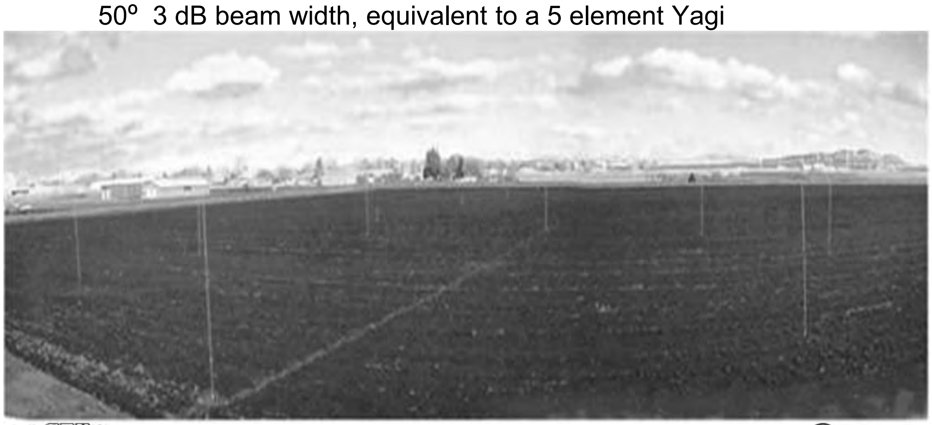
Radiation Pattern of a 4-Square Array of 20 Foot Verticals 12 dB RDF on less than ¼ acre



31

Electrically Steerable 8-Circle Vertical Array 13.5 dB RDF on only ¾ acre

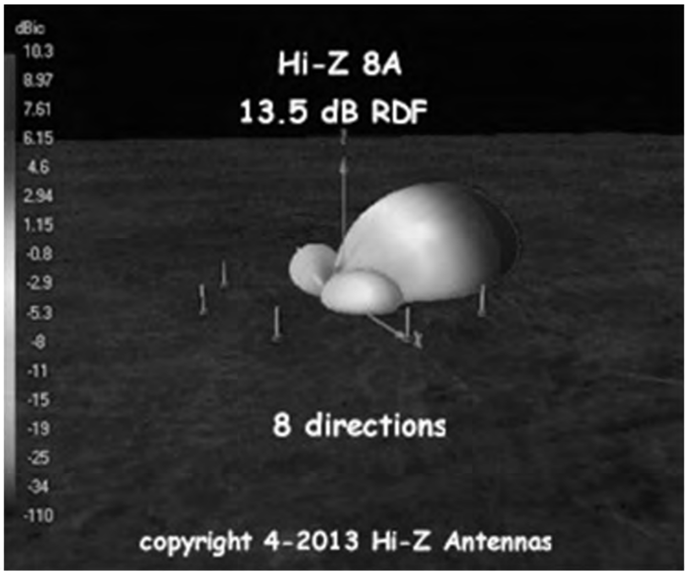
eight *high impedance* 20 foot verticals
no radials and no umbrella wires
requires a high input impedance amplifier at the base of each vertical
only 200 feet in diameter
switchable in eight directions with 106º phasing
50º 3 dB beam width, equivalent to a 5 element Yagi



hizantennas.com/8_element_arrays.htm

32

200 Foot Diameter 8-Circle Array Radiation Pattern



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High impedance verticals with 106° phasing

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33

YCCC Triband Receiving Array
12 dB RDF on only ¼ acre

3, 5 and 9 element configurations with identical performance
- switchable in 180º, 90º and 45º azimuth steps respectively
- 80º 3 dB beam width
- slightly wider beam width and slightly lower RDF on 80 and 40 meters

120 feet in diameter

No radials

No umbrella wires

High impedance amplifier at the feed point of each 20 foot vertical

A common mode choke must be attached to each feedline where it connects to the controller

Install at least 10 feet from nearby trees and metallic structures

Avoid re-radiation from nearby towers, antennas and power lines
- locate the antenna as far as possible from other antennas and power lines

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static.dxengineering.com/global/images/instructions/dxe-yccc-3inline.pdf

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34

Phased *Low Impedance* Verticals

Two or More 25 Foot Monoband Umbrella Verticals

Short radials are required at the base of each vertical
- eight 70 foot radials, sixteen 35 foot radials or chicken wire
- randomly laid on the ground or shallow buried, symmetry is not important

Four 25 foot umbrella wires attached to the top of each vertical
- umbrella wires reduce antenna height and improve array bandwidth
- or use 35 foot verticals with no umbrella wires

As little a 65 foot element spacing
- small spacing works best when used with a variable phase controller

Amplifiers not needed at the base of each vertical - better reliability

Switchable in multiple directions

Very easy and low cost to homebrew your own antenna
- large diameter arrays are very tolerant of moderate amplitude and phase errors

Low impedance verticals are tolerant of nearby trees and buildings

Avoid re-radiated signals from nearby towers, antennas and power lines
- locate the antenna as far as possible from other antennas and power lines

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Excellent Performance and High Reliability

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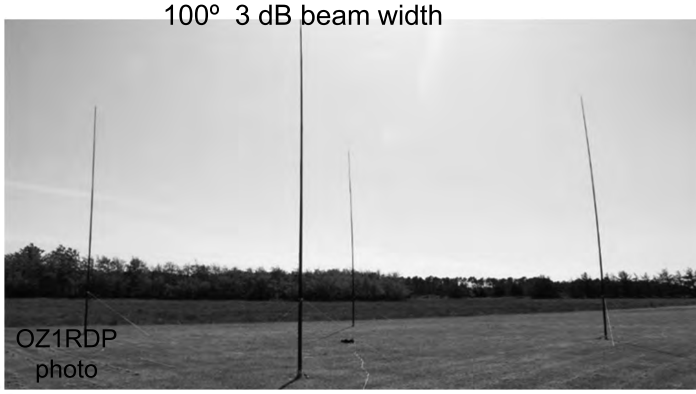
35

Electrically Steerable 4-Square Vertical Array

12 dB RDF on ¼ acre

four *low impedance* 25 foot umbrella verticals
four 25 foot umbrella wires attached to the top of each vertical
eight 70 foot radials or sixteen 35 foot radials per vertical
65 x 65 foot square footprint plus additional space for short radials
switchable in four directions
easy and inexpensive to build
100º 3 dB beam width



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www.iv3prk.it/user/image/site2-rxant.prk_4-square_1.pdf

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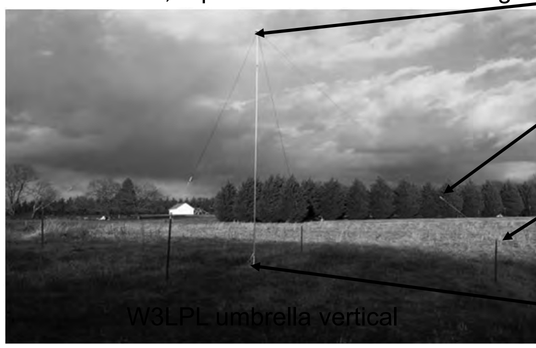
36

Electrically Steerable 8-Circle Vertical Array 13.5 dB RDF on four acres

eight *low impedance* 25 foot umbrella verticals
four 25 foot umbrella wires installed on each vertical
eight 70 foot radials or sixteen 35 foot radials installed under each vertical
350 foot diameter plus space for radials
or only 200 foot diameter when used with a Hi-Z 106º phasing controller
switchable in eight directions
Very easy and inexpensive to build
50º 3 dB beam width, equivalent to a 5 element Yagi



25 foot vertical

Umbrella wires

Seven foot fence posts

Two foot rebar base

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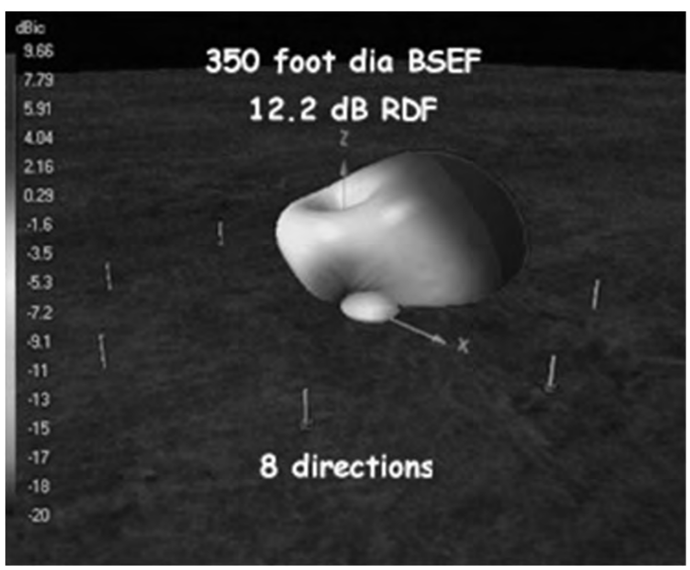
construction details: www.w5zn.org

ICOM

37

350 Foot Diameter 8-Circle Array Radiation Pattern



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Four phased elements with 115º end fire phasing

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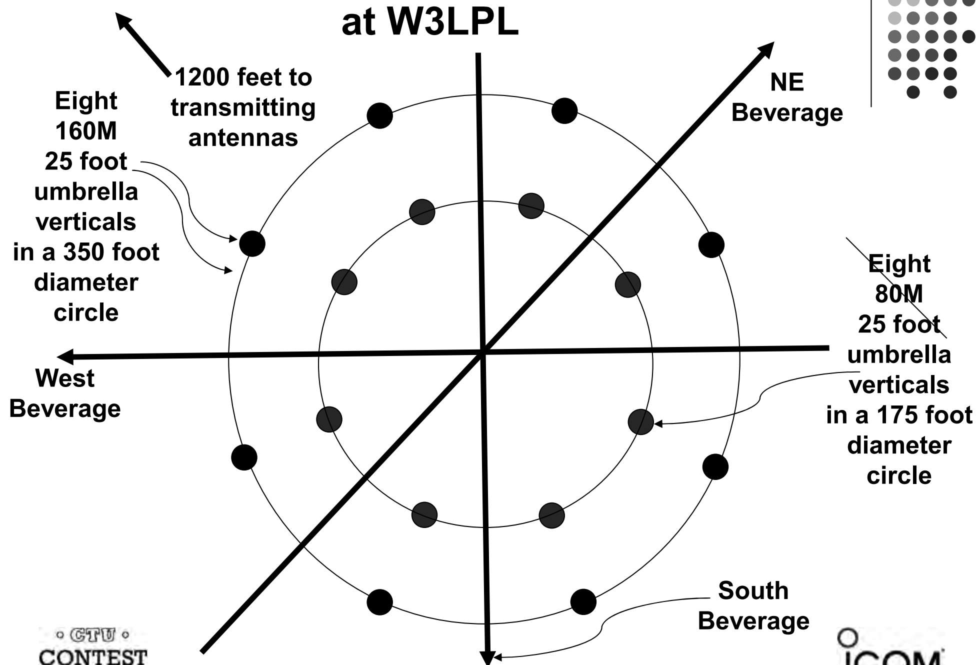
38

160 and 80 Meter Receiving Antenna Layout at W3LPL



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39

Receiving Antenna Phasing System
DX Engineering NCC-2

Combines the inputs from two antennas
- creates a directional pattern with steerable deep nulls
- significantly improves the performance of phased Beverages and phased verticals
- very well engineered and exceptionally easy to use

dxengineering.com/parts/dxe-ncc-2

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40

Phase Synchronous Diversity Reception

Two widely spaced antennas (at least 500 foot spacing)
feed two identical high performance phase locked receivers

Elecraft K3s transceiver with KRX3 sub-receiver

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41

Contesting 101
Operating

Doug Grant K1DG

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1

The reason for this talk

- Many talks about station building/improving
- Operating skills seem to be declining
- Some in the audience are new here
- Many in the audience can carry the message
- You are welcome to re-use this talk at your local radio club(s)

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2

The Object of the Game

- Contact as many other stations as possible…
- …in as many other states/countries/zones…
- …in a given time period (anywhere from 30 minutes to 48 hours)
- Contacts only count if they are accurately executed (callsign and "exchange" logged correctly)

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3

During the contest - A Contest QSO

- "CQ Contest, Kilo One Delta Golf"
  - *K1DG, using standard phonetics is soliciting contacts*
- "*Whiskey One Alfa Whiskey*"
  - *W1AW is calling K1DG*
- "W1AW, 59 1234 New Hampshire"
  - *K1DG is giving W1AW a signal report, serial number, and his state*
- *"Thanks - 59 001 Connecticut"*
  - *W1AW confirms he copied K1DG's exchange, then gives his exchange*
- "Thanks…K 1 Delta Golf, Contest"
  - *K1DG confirms he has received W1AW's exchange, announces he is ready for the next caller*

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4

A More Realistic Contest QSO

- "CQ Contest, Kilo One Delta Golf"
  - *K1DG, using standard phonetics, is soliciting contacts*
- "*Whiskey One GLB#FY%ST%KQ@WX&ZSK*"
  - *A W1 and a bunch of other guys are calling K1DG*
- "W1something, 59 1234 New Hampshire"
  - *K1DG only heard the W1 part of the callsign, and is giving that station a signal report, serial number, and his state*
- *"K1DG, my call is W1 Alfa Whiskey…QSL, 59 001 Connecticut"*
  - *W1AW repeats his call, confirms he has copied K1DG's exchange, then gives his exchange*
- "W1AW…thanks…K 1 Delta Golf, Contest"
  - *K1DG confirms he has the callsign correct now, has received W1AW's exchange, announces he is ready for the next caller*

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5

A Very Bad Contest QSO

- "CQ Contest, Kilo One Delta Golf"
  - *K1DG, using standard phonetics is soliciting contacts*
- *"Whiskey One PQMN&XW%PR$YO@WI#LJDHFKSLJ"*
  - *A W1 and some other stations are calling K1DG*
- "W1something, 59 1234 New Hampshire"
  - *K1DG only heard the W1 part of the callsign, and is giving that station a report, serial number, and his state*
- *"K1DG, this is KC4XYZ - Kentucky Cocacola 4 X-Xray Y-Yellerbelly Z-Zinjanthropus - KC4XYZ - did you come back to me?"*

What part of this is wrong?

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6

How do you make more QSOs?

- Call CQ if you are loud enough and conditions permit it
- Search and pounce if you cannot CQ
- Say as little as possible, but not less
- Keep moving

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7

Two basic operating modes

- “Search and pounce” (or: “Click and call”)
  - You find a station that is calling CQ or has a pileup
  - You call him
  - He answers you, you exchange reports
  - You log it
  - Rinse, repeat
- “Running” (or: “Park and Bark”)
  - You call CQ
  - Other stations answer you

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8

How to Search and Pounce

- You tune in a station
  - (maybe on a "partial kHz"...that is OK!)
  - If you click a spot, you may have to adjust tuning a bit
  - Make sure it is not a duplicate
- Call once, ***with phonetics***
- Possible outcomes:
  1. He answers you and gives a report
  2. He answers someone else
  3. He answers with a partial call (not yours)
  4. He answers with a partial call (yours)
  5. he just calls CQ again

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9

S&P Case 1

- He answers you with your call correct and gives a report
- You respond with your report – no more, no less
  - DO NOT SAY "PLEASE COPY"!
  - Would you want to hear that a few thousand times on a weekend?
- Do not repeat his call or report back to him unless you did not copy it (he already knows what he said)
- Make sure he got your report
- Log the QSO, move on to the next station

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10

S&P Case 2

- He clearly answers someone else
  - Unlike FT8, if you transmit, you will interfere with the station he is working, so stand by!
- Wait until he finishes the QSO, then call again (once, with phonetics)
  - If many stations are calling, figure out his timing
- Repeat until logged…or move on
  - "Know when to hold 'em, know when to fold 'em"
  - If he is answering stations in another region, move on…

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11

S&P Case 3

- He responds to a partial call (not matching anything in your call)
- Refer to Case 2 – Stand by!
- If you call again, you will slow everybody down

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12

S&P Case 4

- He answers a partial call matching yours
  - If he also gives a report, he thinks he will copy your next transmission OK
    - Give your full call and report
  - If he only says the partial call, he is not sure he will get it
    - Give your call again with phonetics
    - Repeat until he copies your call and gives your report
    - Once he has your call, don't repeat it – he will think you are correcting him!

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13

S&P Case 5

- He just calls CQ again
  - Try a few times – he may have QRM or QRN that will go away
  - If other stations are also calling and not getting through, the problem is on his end – move on
  - Check your wattmeter, antenna, "Split", etc.
- After a few unsuccessful tries, move on

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14

Efficient S&P Operating

- Don't get stuck on one station
  - Exception: ATNO for you
- Keep moving
- Make sure you have the call correct
  - Many bad spots, especially late in the contest
  - Logging a bad callsign makes your score go down

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15

Limits to S&P operating

- 15M SSB example
  - Stations spaced 2 kHz apart
  - 21200 – 21450: 250 kHz; 125 stations
  - There are always more stations S&Ping than CQing
- If you are loud enough, that is about 1-2 hours
- Then what?

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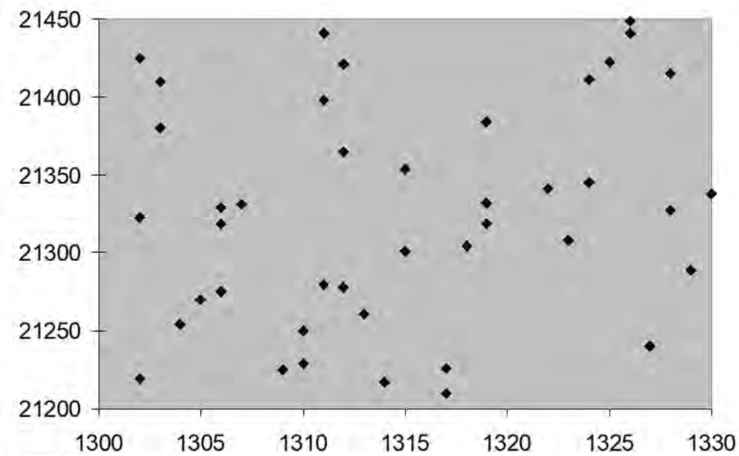
16

A good rate in S&P mode
~40 QSOs in 30 minutes



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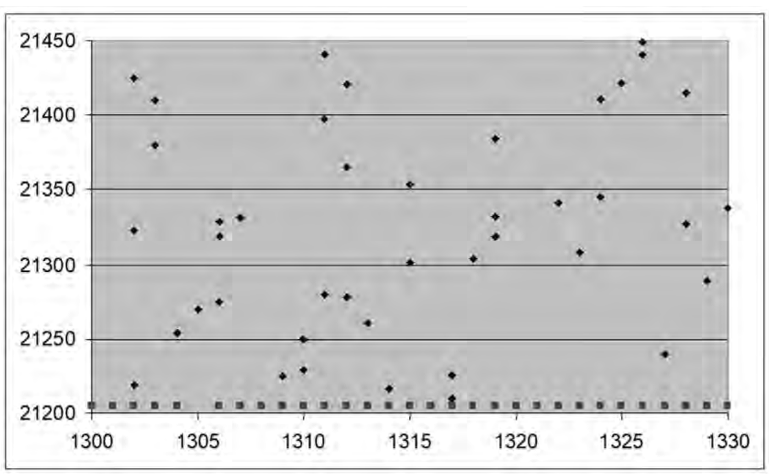
17

A better rate running (83 Qs)



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18

Run vs. S&P
15M, 2005-ish, Two W1 Ops

Hour	Runner QSOs	S&P QSOs
D1-1300Z	166	83
D1-1400Z	132	81
D1-1500Z	120	49
D1-1600Z	124	42
D1-1700Z	136	17

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19

A pretty good run

05-Mar-22	1350	348	21200	HA5PP	59	KW		3
05-Mar-22	1350	349	21200	F1GRH	59	K		3
05-Mar-22	1350	350	21200	OZ4MU	59	100	OZ	3
05-Mar-22	1351	351	21200	PA1H	59	400		3
05-Mar-22	1351	352	21200	PF1SCT	59	100		3
05-Mar-22	1351	353	21200	DL9MDI	59	100		3
05-Mar-22	1351	354	21200	G3ZAY	59	400		3
05-Mar-22	1351	355	21200	DL1ATZ	59	500		3
05-Mar-22	1351	356	21200	EA5N	59	500		3
05-Mar-22	1351	357	21200	IT9SSI	59	500		3
05-Mar-22	1352	358	21200	HB9CVE	59	K		3
05-Mar-22	1352	359	21200	PA3ETM	59	400		3
05-Mar-22	1352	360	21200	5Z4VJ	59	400	5Z	3

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20

A pretty ridiculous run

- V47T first burst of Ws on 15M
  - “Where everybody knows your call”
- Two ops listening to two receivers on different antennas pulling out calls using WinTest partner mode
- Sorry about the audio quality…

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21

10 QSOs in one minute

2015 V47T	59 8	NJ2F	59 05
2015 V47T	59 8	N1CC	59 04
2015 V47T	59 8	K0MZN	59 04
2016 V47T	59 8	N4RA	59 05
2016 V47T	59 8	W1GD	59 05
2016 V47T	59 8	W3MF	59 05
2016 V47T	59 8	AB0RX	59 04
2016 V47T	59 8	K1JB	59 05
2016 V47T	59 8	K3OQ	59 05
2016 V47T	59 8	W3GM	59 05
2016 V47T	59 8	K3PH	59 05
2016 V47T	59 8	WD8S	59 04
2016 V47T	59 8	N7YK	59 03
2017 V47T	59 8	WM7D	59 03
2017 V47T	59 8	VA3OB	59 04

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22

How to Run stations

- Find a clear frequency
  - Listen a little to make sure there is not a loud guy in your skip zone (you don't want QRM on the other side)
- Ask if frequency is in use
- Keep CQs short, use phonetics

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23

If you get a caller...

- Three possibilities:
  - You get the whole call and it is in the "Check Partial" window
  - You get a partial call due to QRM from the side
  - You get a partial call due to QRM from too many callers

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You get the whole call and it is in the "Check Partial" window

- Answer him with the same phonetics he used, give exchange once
  - If really loud and native/fluent English speaker, skip the phonetics
- When you get his exchange, just say "thanks" and sign your call (maybe with "QRZ?")
- DO NOT repeat his call or exchange back to him (why?)
- If you don't get the exchange ask for a repeat. If you're not sure about something, ask for that part again.
  - Your score will go down if you get it wrong

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25

You get a partial call due to QRM from the side

- Decide if you think you'll get it next time
  - Loud caller, mostly-clear frequency, respond with the partial call and report
  - Weaker caller, not-so-clear frequency, just respond to the partial call; only give the exchange when you know you have the call OK
- If the caller is strong and you need a lot of repeats, it takes too long, you should QSY
- Repeats are rate killers.
- If you get the missing part of the call on the second (or third) try, you only need to repeat the corrected part

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You get a partial call due to QRM from too many callers

- Come back to the partial and stick with it until you complete it or it becomes hopeless
- End the QSO with just "thanks" - the other caller(s) already know who you are and you don’t want more callers!
- Pileups are rate killers!
- ***If you have a big pileup, you are talking too slow or saying too much***

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27

If you don't get a caller

- Try, try again. And again.
- After a few unsuccessful tries, either you are on the wrong band or a bad frequency.
- Move. Or go back to S&P.
- Rate!

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Field Day

- Not really a contest, but the higher scores are listed first
- "Gateway drug" of radiosport
- Best way to teach new ops the right way to operate

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Don't say more than necessary, and NEVER EVER say…

- "Please copy"
- "QSL the 59 1234 New Hampshire, my report to you is…"
- "Who is your QSL manager?"
- "Do you know my friend Charlie up there in New Hampshire?"

Imagine you are the guy on the other end, listening to "Please Copy" 5000 times in a weekend!

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30

The Advantages of Waterfall Displays for Contesting and DXing

Presented by N6TV

n6tv@arrl.net

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1

Presentation Overview

- Legacy “Panadapters”
- Waterfall scope in CW Skimmer
- Latest radios with waterfall displays
- Waterfall display advantages & disadvantages
- How to use waterfall displays while contesting or DXing
- Q & A

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ICOM 2

2

Legacy Panadapters

- Kenwood SM-230 Station Monitor (25, 100, or 250 KHz):

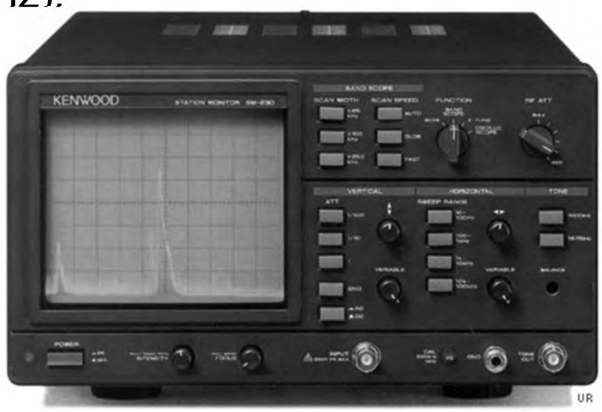

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Photo courtesy http://www.universal-radio.com/

ICOM 3

3

Legacy Panadapters

- “Band Scopes” in Icom IC-781, IC-756ProIII, IC-7600, IC-7800, IC-7700 (before new firmware)

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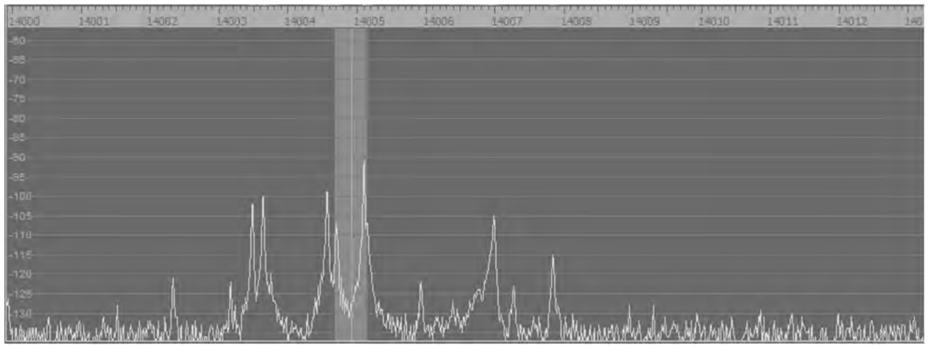
ICOM 4

4

Spectrum Displays Hide Weak Signals



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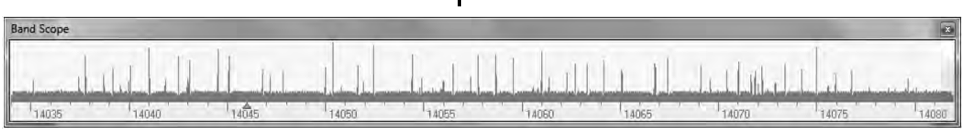
ICOM 5

5

CW Skimmer's Band Scope

• From the CW Skimmer menu, select
  View → Band Scope



• Much better resolution, but display is very jumpy
• No "peak signal" memory
• Not useful on SSB

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ICOM 6

6

Legacy Panadapter Limitations

- Big signals dominate the display
- Weak signals very difficult to spot
- Signal peaks disappear, no history
- Difficult to find “clear spots” on a crowded band
- Limited zoom in or out
- Display jumpy, distracting
  - Signal averaging helps, but it also hides things

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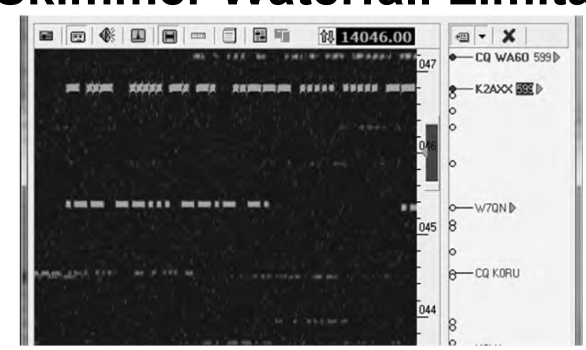
7

CW Skimmer Waterfall Limitations



- You only see 10 - 15 kHz of the band at most
- Scale is fixed, cannot “zoom” in or out, or tune smoothly
- Narrow 500 Hz CW filter – *not* usable on phone

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8

Better Waterfall Displays

- The Elecraft P3 Panadapter

- Major improvement over legacy designs

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Photo courtesy http://www.elecraft.com

ICOM 9

9

Elecraft P3 + P3SVGA Option

- P3 resolution only 480 x 272 pixels
- P3SVGA: internal SVGA Large Screen Adapter
  - 1024 x 768
  - 1280 x 1024
  - 1440 x 900
  - 1920 x 1080
- Displays far more signals

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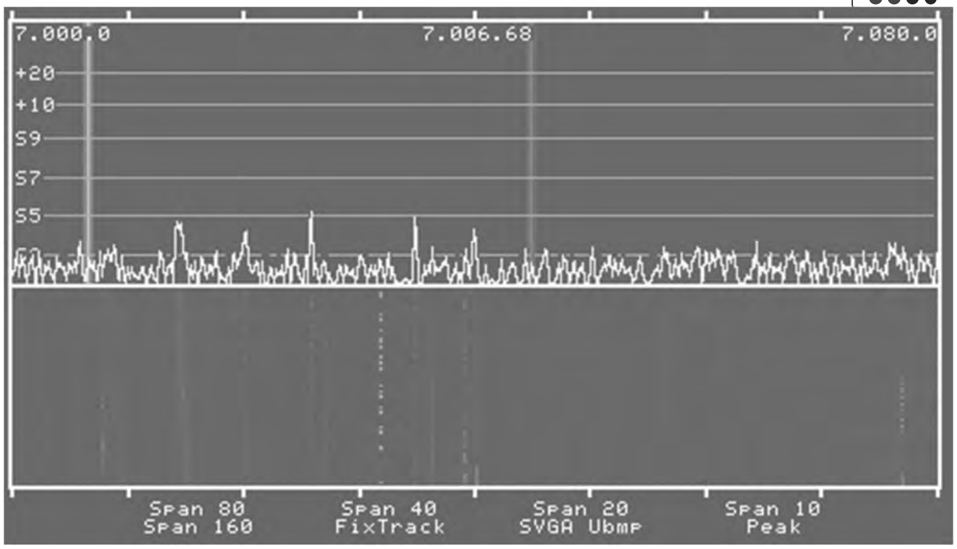
Photo courtesy http://www.elecraft.com

ICOM 10

10

P3 Built-in Display at 480 x 272



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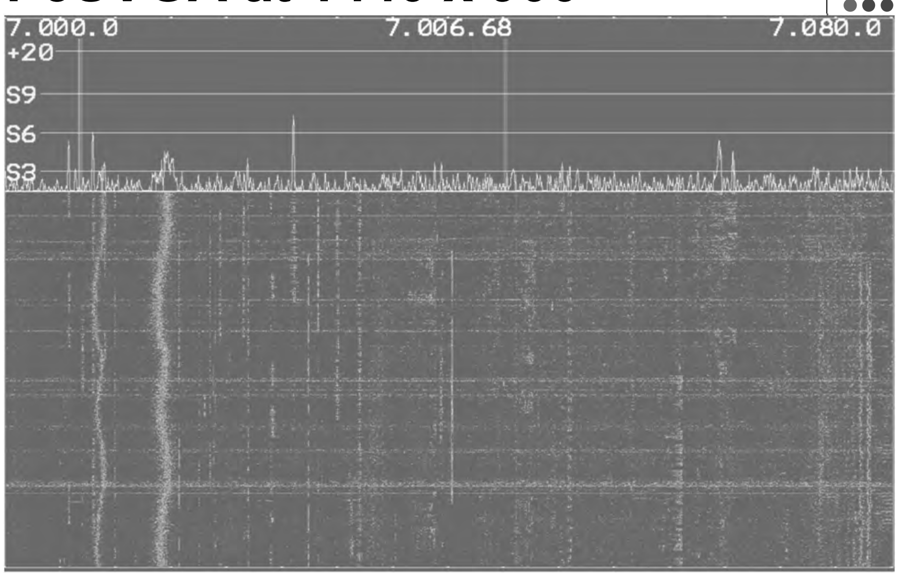
ICOM 11

11

P3SVGA at 1440 x 900



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12

Elecraft K4

- Built-in LCD resolution 1024 x 600
- External HDMI Monitor Up to 4K
- Touch Screen
- Click to Tune with USB Mouse + Mouse Wheel fine tuning / RIT

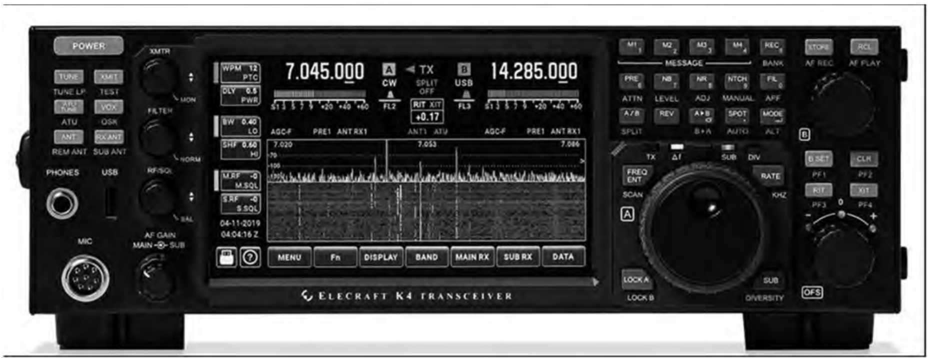

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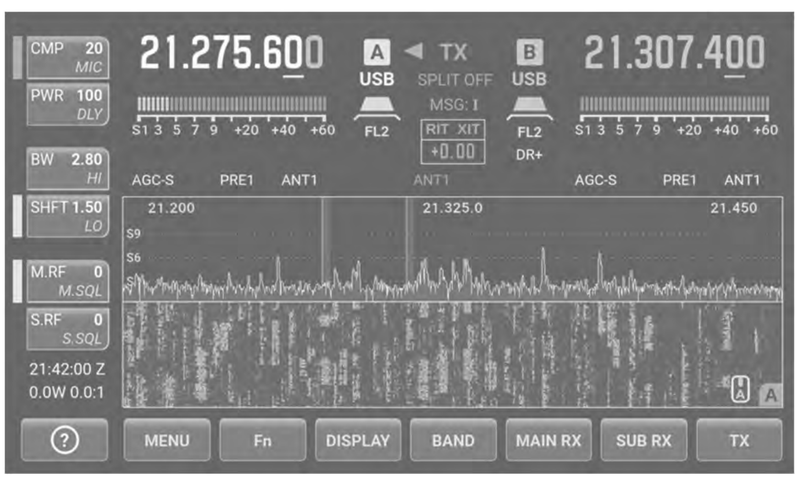
Photo courtesy http://www.elecraft.com

ICOM 13

13

Elecraft K4 Built-in Display at 1024 x 600



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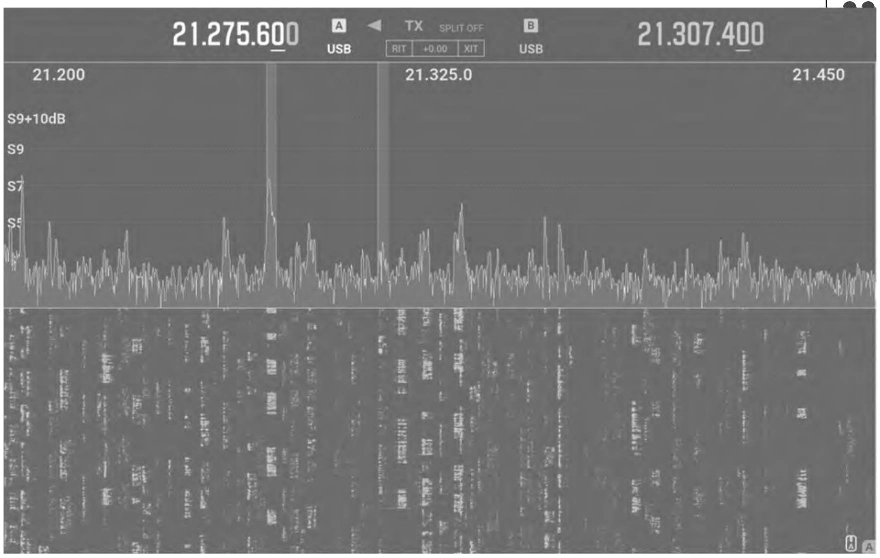
ICOM 14

14

Elecraft K4 Ext. Monitor at 1920 x 1200



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ICOM 15

15

Old Icom IC-7800 firmware

(no waterfall)

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Photo courtesy http://www.icomamerica.com

ICOM 16

16

Icom IC-7800 with V3.0 firmware

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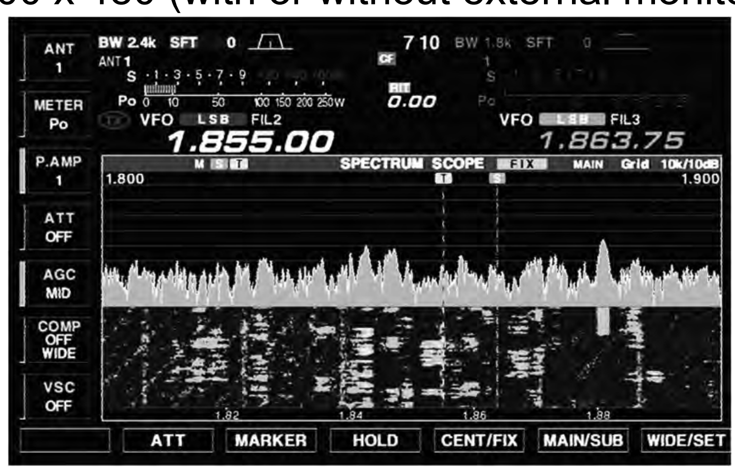
Photo courtesy http://www.icomamerica.com

ICOM 17

IC-7800 V3.0 Screen Shot

IC-7600, IC-7700 V2.0 Also Supports Waterfall

- 800 x 480 (with or without external monitor)



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IC-7850 / 7851 – *Huge* Improvement

- Fast, 800 x 600, MAIN only, or MAIN + SUB
- “Click to tune” with USB mouse

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ICOM 19

New IC-7300 has fast waterfall too!

- With touch screen

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Photo courtesy http://www.icomamerica.com

ICOM 20

IC-7610 with dual band waterfall

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ICOM 21

21

Kenwood TS-990S

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Photo courtesy http://www.kenwoodusa.com

ICOM 22

22

FlexRadio FLEX-5000™, FLEX-6700™

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Photos courtesy http://www.flexradio.com

ICOM 23

23

FlexRadio Systems® SmartSDR

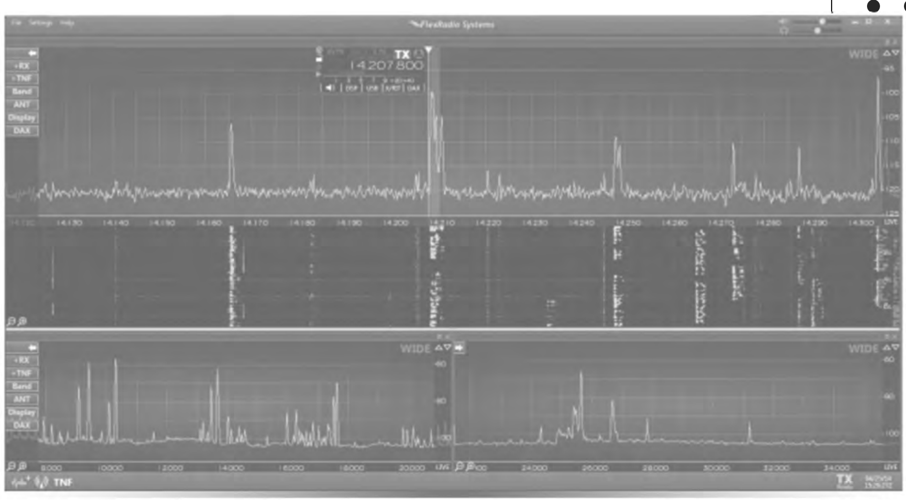

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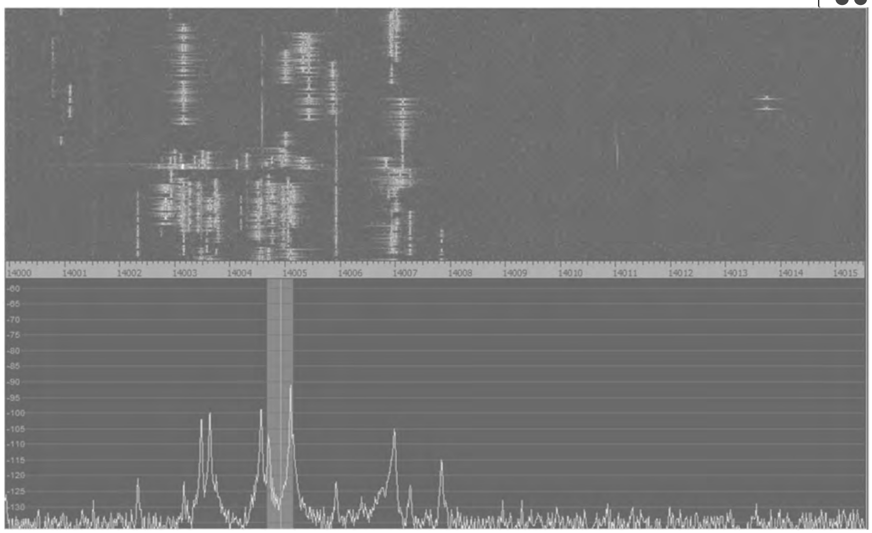
Image courtesy K3UK

ICOM 24

24

Winrad Software for SDRs



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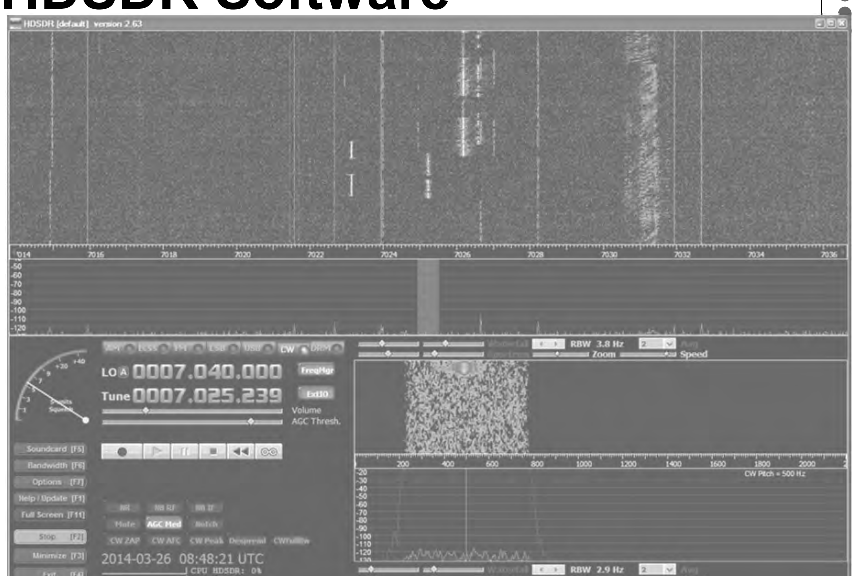
ICOM 25

25

HDSDR Software



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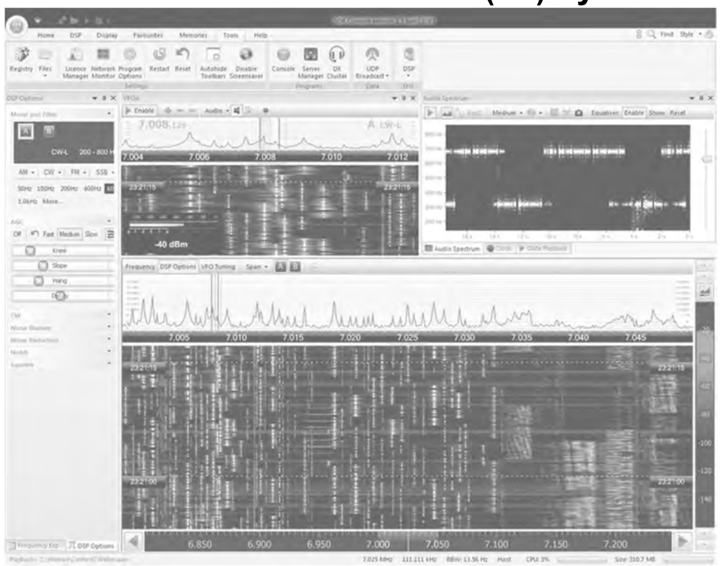
SDR-Radio.com SDRCconsole (V2) by HB9DRV



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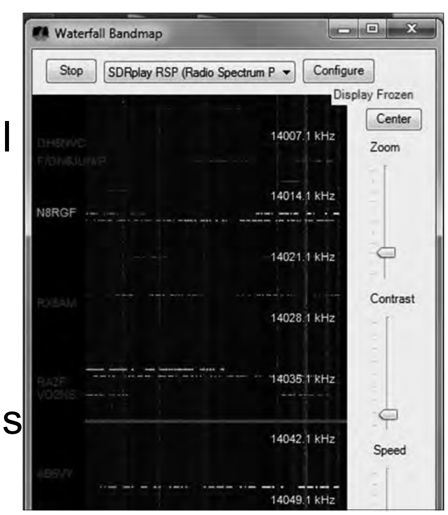
27

Waterfall Bandmap by N2IC (for N1MM+)

- Combines cluster spots from Internet or Skimmer with waterfall from local SDR
- Zoom Feature
- Click to tune feature
- Potential to support other logging programs



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28

LP-Pan and NaP3

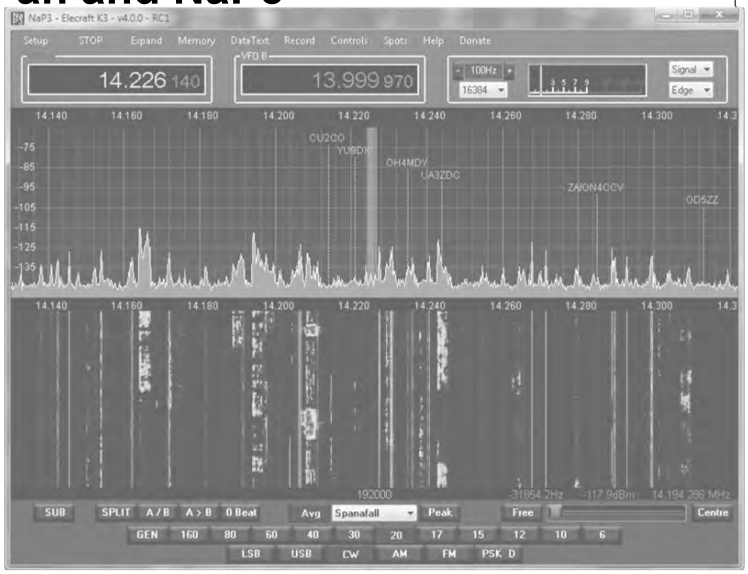

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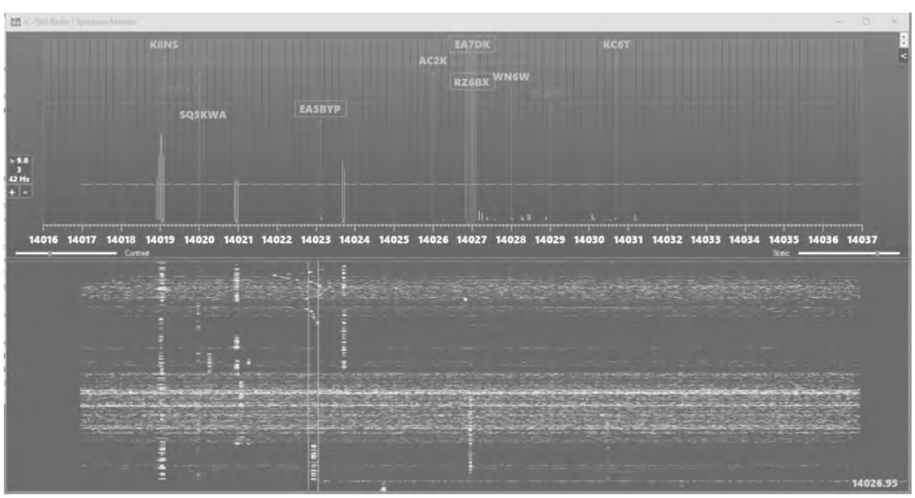
Photo courtesy http://www.telepostinc.com

ICOM 29

29

N1MM+ Spectrum Display Window



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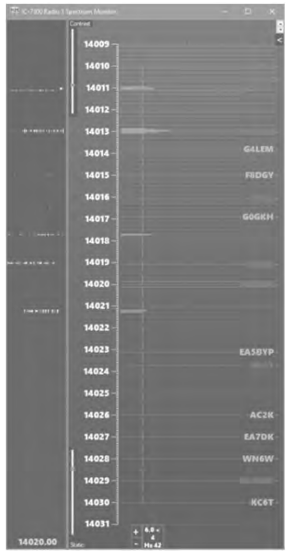
http://n1mm.hamdocs.com/tiki-index.php?page=Spectrum+Display+Window

ICOM 30

30

N1MM+ Vertical Spectrum Display Window



http://n1mm.hamdocs.com/tiki-index.php?page=Spectrum+Display+Window

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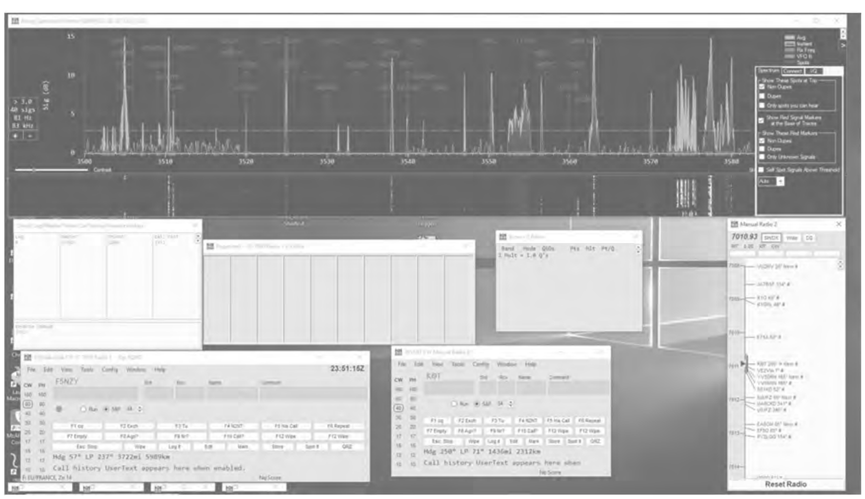
N1MM+ with Spectrum Display



http://n1mm.hamdocs.com/tiki-index.php?page=Spectrum+Display+Window

32

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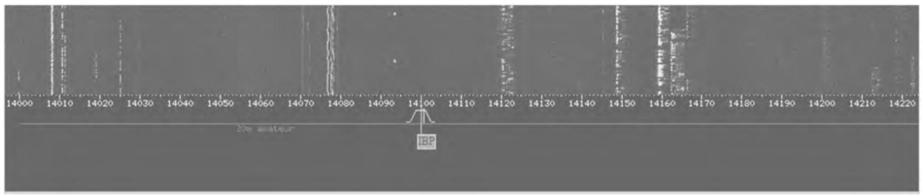
WebSDR: Waterfalls on the Web

- http://websdr.ewi.utwente.nl:8901/



View / Zoom entire HF spectrum

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Waterfall Display Advantages

- “Click to Tune” – direct access using a mouse or tap
  - IC-7300, IC-7610, IC-7800 V3.0, IC-7851, Flex/SmartSDR, HDSDR, SDRConsole, Elecraft K4 (but *not* Elecraft P3)
- Jump to Next Signal (N1MM+ Spectrum Display)
- Find “fresh meat” (unlabeled signals)
- Weak signals easy to spot (faint traces)
- Many zoom levels: 5, 10, 30, 60, …, 800 KHz+
  - Watch the whole band at once, or a small slice
- Find clear frequencies *fast*
- Find who the DX just worked, *fast*
- Spot the gaps in a crowded CW pileup

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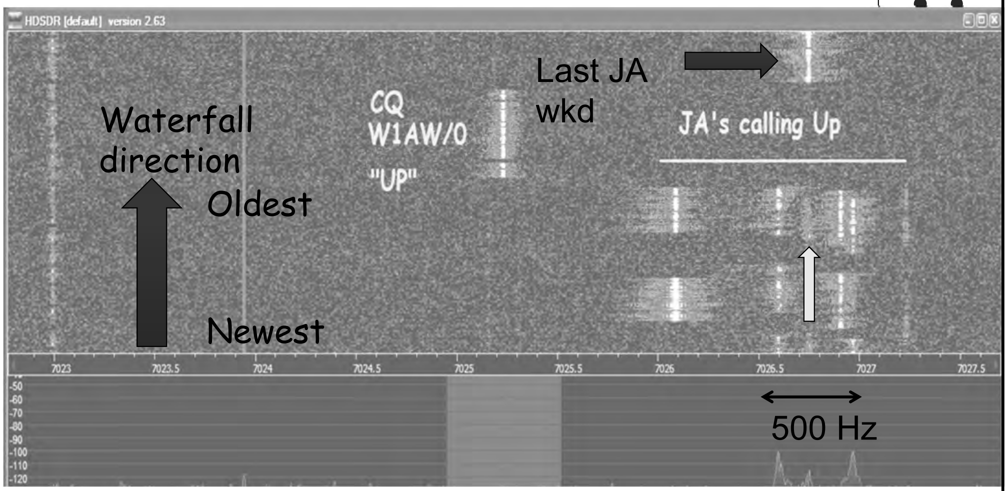
Listening "Up"? Not a problem



Who will W1AW/0 answer next?

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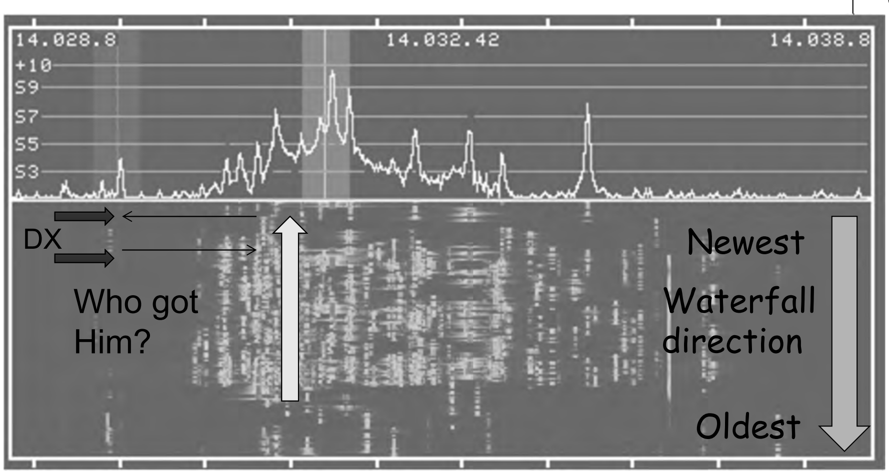
35

E30FB CW Pileup on P3 display



Where will he listen next?

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Advantage: Waterfall

- Find “good spots to call” in a CW pileup
- Find clear spots to call CQ
- QRM? You can *see* where to move your VFO to minimize it
- During S&P, find the “next” signal *fast* (no more slow and careful tuning)
- Position VFO B or 2nd receiver without having to *listen* to it
  - S&P while CQing, “SO2V” (single-op, two VFOs)
- Monitor overall band activity
- Keep an eye on the local competition

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Waterfall Display *Disadvantages*

- Most radios don’t automatically tune from signal-to-signal like CW Skimmer
  - Exception: New N1MM+ Spectrum Display
- Clicking on a signal with the mouse not as precise as tuning with VFO, must still fine tune (mouse wheel in K4 works great)
- Contest software loses focus when you click on waterfall
- Some find it visually distracting
- Cumbersome to adjust scope width and band edges
- **But, if you’re *not* using a waterfall display in a contest, you’re really operating “blind”**
- A waterfall display is really the “killer app”

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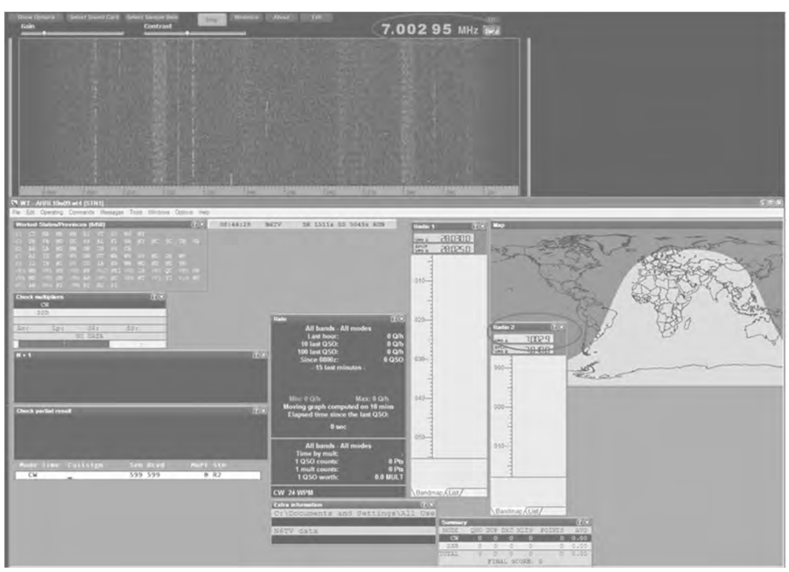
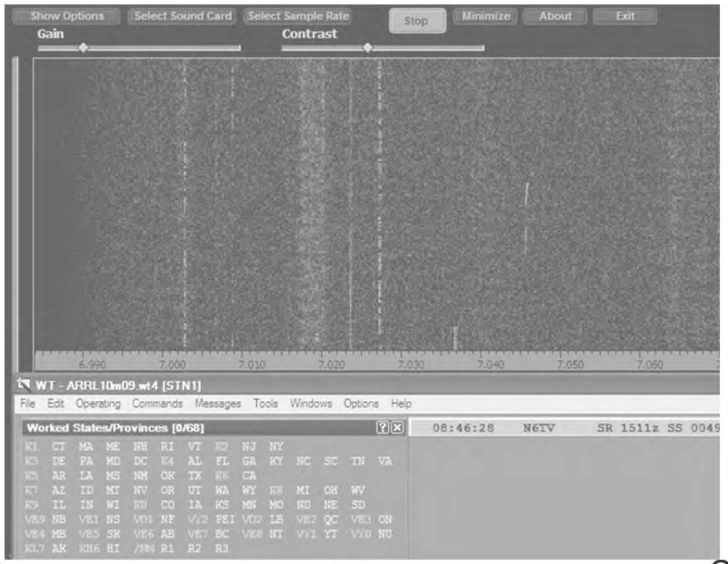
Recommendations While Contesting

- Always enable the waterfall
- Use **Fixed** Mode (never “Center” or “Track” mode)
  - You want the VFO cursor to move, not the scope
- Use narrow 5 - 20 kHz span for CQ, running
- Use wider 40 -100 kHz span for S&P, tuning
- Logging software can and should automate this:
  - In Win-Test, type **SPAN20** [Enter] to set a 20 kHz scope span, limited to band edges
  - See http://bit.ly/wtscripts - Win-Test Scripts P3scripts.zip, IcomScripts.zip, includes source code

Winrad on Top, Win-Test on Bottom



Winrad & Win-Test (zoomed)



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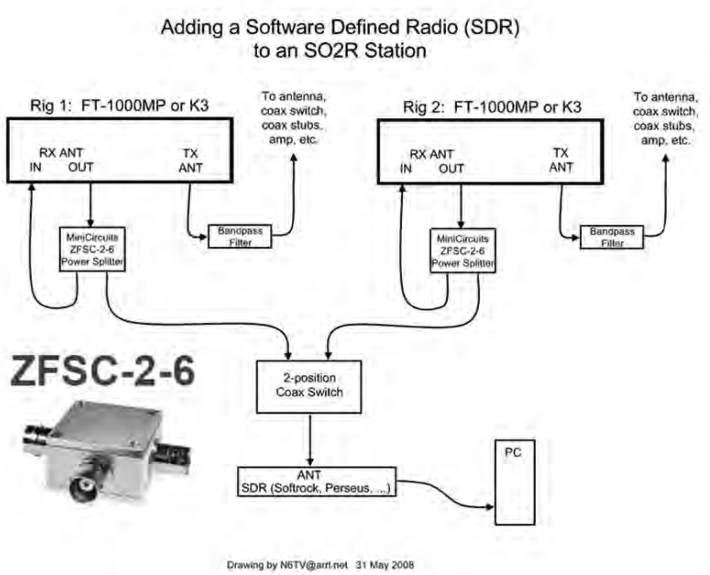
Click-To-Tune with a "Legacy" Transceiver + SDR



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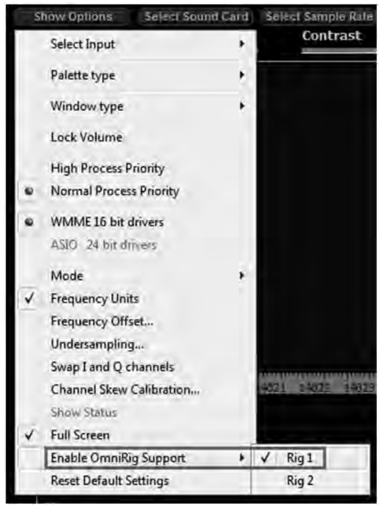
Use Omnirig support in Winrad or HDSDR to sync freq. with any transceiver



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Try Winrad Waterfall Demo

- Perseus SDR used to make a wideband recording (122 KHz for 10 minutes = 300 MB)
- Demo will play back that recording and others
- To try the demo yourself, follow instructions at
  - http://www.kkn.net/~n6tv

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Click-To-Tune, IF OUT to LP-PAN 2, NaP3, LP-Bridge

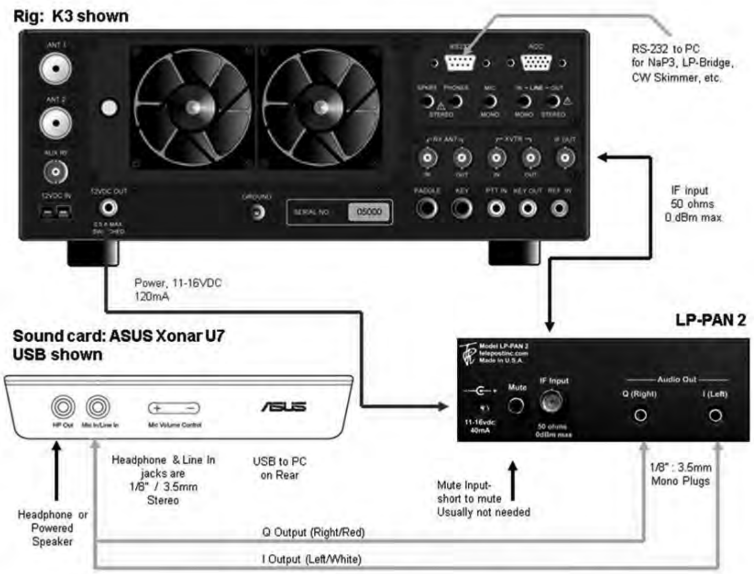

Photo courtesy http://www.telepostinc.com

45

45

Questions?

- http://www.winrad.org - Winrad software
- http://http://www.hdsdr.de/ - HDSDR software
- http://sdr-radio.com/Software - SDRConsole
- http://n1mm.hamdocs.com/tiki-index.php?page=Spectrum+Display+Window – N1MM+ Spectrum Display setup
- http://www.kkn.net/~n6tv - Winrad demo file
- http://www.telepostinc.com/LP-PAN.html
- http://www.qrz.com/db/n6tv - Links to this and other presentations

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CTU 2022 Presents

Digital Contesting – RTTY and FT8/4

Ed Muns, W0YK

1

Digital Contesting is Fun!

- RTTY Contesting → Digital Contesting
- RTTY
  - Operating
  - Setting Up
- FT8/4
  - Operating
  - Setting Up
- 2nd session: "*Taking Digital Contesting to the Limit*"

2/103
19 May 2022

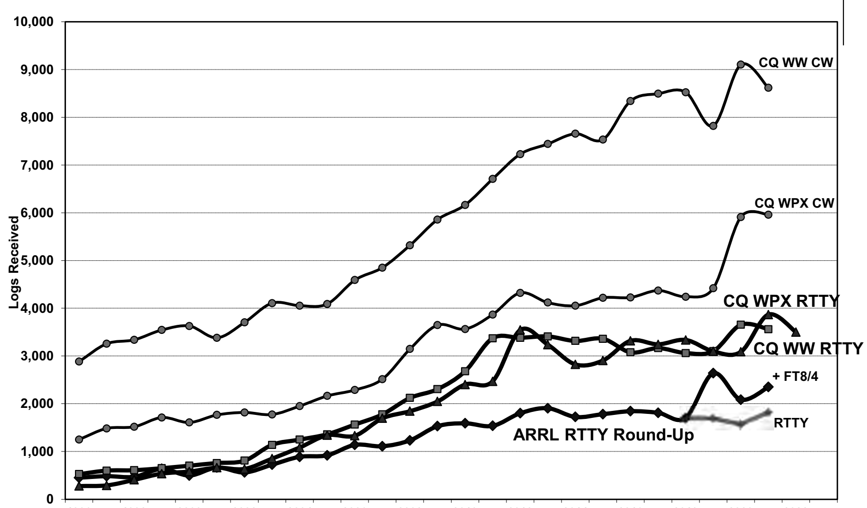
2

Lots of RTTY Contests

> two/month

- **Bigies (7)**
  - CQ WW RTTY (last weekend in Sep)
  - CQ WPX RTTY (2nd weekend in Feb)
  - ARRL RTTY Roundup (1st weekend in Jan)
  - BARTG:
    - Sprint (3rd weekend Jan)
    - HF RTTY (3rd weekend Mar)
    - 75 Baud (3rd weekend Apr)
  - WAE RTTY (2nd weekend in Nov)
- **NCJ contests (4)**
  - NAQP RTTY (3rd Sat. in Feb, 2nd Sat. in Jul)
  - Sprint RTTY (2nd Sat. in Mar & Oct)
- **Other popular RTTY contests (20)**
  - JARTS, Makrothen, SARTG (2)
  - ~~SCC RTTY Championship~~ WW Digi
  - ~~Ten-Meter RTTY~~ (1st Sat. in Dec) FT Roundup

Three Largest RTTY Contests



What Makes a Great RTTY Contester?

1) Contester who happily logs casual callers
2) Uses CW & SSB techniques where useful
3) Strives to exploit RTTY uniqueness
   - Auto-decode frees operator time … use it to do things difficult with CW & SSB, e.g., SO3R!
   - Speed is ~2x CW
4) Applies learning back to CW & SSB

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5

What is RTTY?

compared to CW

CW	RTTY
1) ***One*** RF carrier	1) ***Two*** RF carriers 170 Hz apart *(Space & Mark; Shift)*
2) Local audio ***pitch***	2) Local audio ***tones***
3) On ***or*** off • key up is data 0 • key down is data 1	3) One on ***and*** other off • Space is data 0 • Mark is data 1
4) ***Morse*** code • typically 25-40 wpm	4) ***Baudot*** code • constant 60 wpm *(or 45.45 Baud)*

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6

What is RTTY?

Figures Shift

- 5-bit code→32 chars.
- 2 sets:
  - Letters set & Figures set
  - 6 common control chars.
    - LTRS (unshifted)
    - FIGS (shifted)
    - Null, Space, LF, CR
- LTRS or FIGS toggle set

Code	Control Characters		
11111	LTRS		
11011	FIGS		
00000	Null		
00100	Space		
01000	LF		
00010	CR		
	Letters	Figures	
		ITA2	USTTY
00011	A	-	
11001	B	?	
01110	C	:	
01001	D	ENQ	$
00001	E	3	
01101	F		!
11010	G		&
10100	H		#
00110	I	8	
01011	J	BELL	'
01111	K	(	
10010	L	)	
11100	M	.	
01100	N	,	
11000	O	9	
10110	P	0	
10111	Q	1	
01010	R	4	
00101	S	'	BELL
10000	T	5	
00111	U	7	
11110	V	;	
10011	W	2	
11101	X	/	
10101	Y	6	
10001	Z	"	

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7

What is RTTY?

code history

- Bacon's cipher (1605)
- Gauss & Weber (1833)
- Baudot code (1870)
  - Manual bit entry
  - 5-bit ITA1 code
  - Two 32-bit character sets
    - letters
    - figures
- Murray code (1901)
  - Teletype character entry
  - Western Union variation
- **5-bit ITA2 code (1930)**
    - **USTTY variation**
- ASCII (1963)
  - 7-bit ITA5 code

Code	Control Characters		
11111	LTRS		
11011	FIGS		
00000	Null		
00100	Space		
01000	LF		
00010	CR		
	Letters	Figures	
		ITA2	USTTY
00011	A	-	
11001	B	?	
01110	C	:	
01001	D	ENQ	$
00001	E	3	
01101	F		!
11010	G		&
10100	H		#
00110	I	8	
01011	J	BELL	'
01111	K	(	
10010	L	)	
11100	M	.	
01100	N	,	
11000	O	9	
10110	P	0	
10111	Q	1	
01010	R	4	
00101	S	'	BELL
10000	T	5	
00111	U	7	
11110	V	;	
10011	W	2	
11101	X	/	
10101	Y	6	
10001	Z	"	

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8

What is RTTY?

Figures Shift

- The *LTRS* and *FIGS* characters do not print
  - The code for the characters "Q" and "1" is the same; which one prints depends on if you are in Letters or Figures set
  - Note that the *LTRS*, *FIGS* and *Space* characters appear in both sets
- Example: "***KI7GUO DE K4GMH***" gets sent as:
  - *LTRS* ***K I*** *FIGS* ***7*** *LTRS* ***G U O*** *Space* ***D E*** *Space* ***K*** *FIGS* ***4*** *LTRS* ***G M H***
- Why do we care to understand this?
  - If a burst of static garbles the *LTRS* or *FIGS* character, then what prints after that is from the wrong set until the next *LTRS* or *FIGS* character appears
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What is RTTY?

UnShift on Space

- UnShift On Space (USOS or UOS)
  - Increases noise immunity for alpha text
  - Space character forces a shift to the Letters set
- Contest exchanges are alpha and numeric
  - Should UOS be on or ~~off~~?
  - Should Space or ~~Hyphen~~ delimit exchange elements?
    - 599 1079 1079 or 599-1079-1079
- *Recommendation:*
  - *Turn on both RX & TX UOS and use Space delimiters*

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What is RTTY?

audio tones

- Space and Mark audio tones
  - Default: 2295 and 2125 Hz (“high tones”)
  - Less fatiguing: 1085 and 915 Hz (“low tones”)
- Analogous to CW pitch
  - Operator choice
  - Each operator can use different tone pairs
  - Transmission is two RF carriers 170Hz apart
- Must be same in radio and decoder/encoder

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What is RTTY?

AFSK vs. FSK

Two methods of transmission:

- AFSK (Audio Frequency Shift Keying)
  - keyed audio tones into SSB transmitter via:
    - Mic input, or
    - Auxiliary audio input. e.g., Line In
- FSK (Frequency Shift Keying)
  - on/off keys the transmitter just like CW

Note: Receiving is the same in either case.

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What is RTTY?

dial frequency

spots are often wrong

- RTTY RF is independent of local audio tones and whether LSB or USB is used:
  - The higher RF frequency is the Mark *(14090.000 kHz)*
  - The lower RF frequency is the Space *(14089.830 kHz)*
  - The difference between the two is the shift *(170 Hz)*
- FSK displays Mark *(14090.000 kHz)*
- AFSK displays suppressed carrier which varies with local audio tones and sideband used!
  - For Mark tone of 2125 Hz (Space tone of 2295 Hz):
    - LSB *(14092.125 kHz)*
    - USB – Mark & Space tones reversed *(14087.005 kHz)*

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What is RTTY?

AFSK vs. FSK

AFSK	FSK
• Indirect *(tones → Mic input)*	• Direct *(like CW keying)*
• Any SSB radio *(esp. legacy)*	• “Modern” radios
• SSB (wide) filtering	• RTTY (narrow) filtering
• Dial = sup. car. frequency	• Dial = Mark frequency
• VOX	• PTT
• Audio cable *(a’la FT8, JT65/9, PSK31)*	• COM FSK keying cable
• Must use high tones	• Can use low tones
NET (automatic TX tone control)	*No audio level adjust*
Less bandwidth (depends on radio)	*No disabling speech proc.*
	No erroneous sound keying
Easier hook-up; NET	*Less pitfalls*

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What is RTTY?

summary

- Uses 5-bit Baudot (actually, USTTY) code with two sets of 32 characters: Letters and Figures
- Space & Mark frequencies separated by 170 Hz "Shift"
- Local Space & Mark tones analogous to pitch in CW
- Constant 45.45 Baud (60 wpm) asynchronous character stream with 5 data bits and 2-3 sync bits
- Figures Shift & Letters UnShift
  - Use optional UnShift-On-Space (UOS), plus space delimiter
- AFSK vs. FSK transmission (receiving is the same)
  - Radio dial frequency differences
  - 100% duty cycle!

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The Cynics Say …

- "The RTTY decoder/encoder does everything."
  however, this attribute …
  - frees the operator to improve other skills
  - enables more contest participants
  - provides mode diversity for contest junkies

- "RTTY is a pain to set up and get working."
  … stay tuned, it's really not that difficult!

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RTTY Considerations

Much like CW and SSB, except:

- Non-human decoding implications
  - *serial number repeat, universal “fist” or “voice”*
- Distractions are tempting
  - *watch TV, do email, read, etc.*
- RTTY established practice
  - *‘CQ’ at end of CQ message*
- Whisper-level headphone volume; low tones
  - *just to detect presence & timing*
- Key-down transmission … 100% duty cycle

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RTTY Sub-Bands

- 10 meters: 28080-28100, during contests 28080-28200
  - JA: 21070-21150
- 15 meters: 21080-21100, during contests 21080-21150
  - JA: 21070-21150
- 20 meters: 14080-14100, during contests 14080-14150
  - JA: 14070-14150
- 40 meters: 7025-7050 & 7080-7100, during contests 7025-7100
  - JA: 7030-7100
- 80 meters: 3580-3600, during contests 3560-3600
  - JA: 3520-3575 and 3599-3612
- 160 meters: 1800-2000
  - No RTTY contesting

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RTTY Sub-Bands

don't QRM!

- Avoid audio-digital operations:
  - e.g., 14070-14080
  - (14080-14083 FT4)
- Avoid the NCDXF beacons:
  - e.g., 21150 and 14100
- More details:

  www.aa5au.com/rtty/rtty-sub-bands

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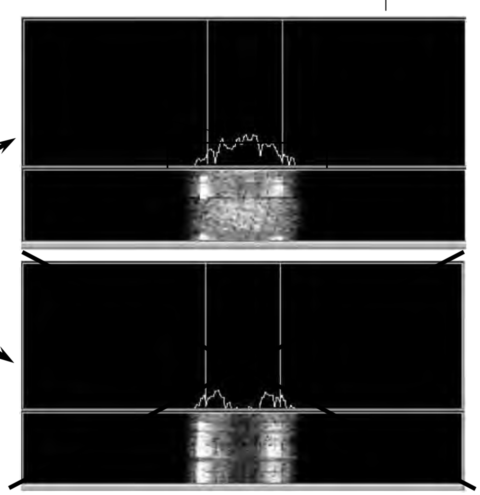
Receiving

radio IF filtering

- Narrow IF filters (Roofing & DSP)
  - 500 Hz - normal
  - 250 Hz - extreme QRM only
  - Tone filters – don't use!
    - Icom Twin Peak Filter
    - K3 Dual-Tone Filter



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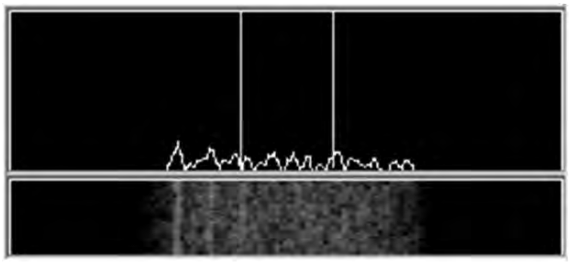
Receiving

adjust audio

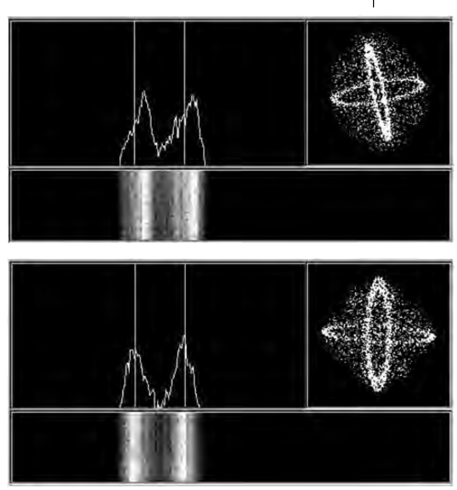


- Set RX audio level for noise 5% of full-scale
  - Receiver audio out level control, and/or
  - *Windows* Recording Volume Control applet

Receiving

tuning a RTTY signal

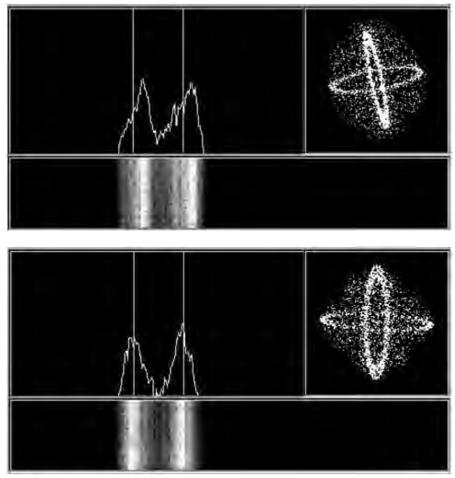
- Use narrow filtering
  - CW filters ~ 500 Hz
- Set RX audio level
  - noise 5% of full-scale
- Learn to tune by ear
  - practice with eyes closed
  - get within 10-20 Hz



Receiving

MMTTY AFC

- Use narrow filtering
  - CW filters ~ 500 Hz
- Set RX audio level
  - noise 5% of full-scale
- Learn to tune by ear
  - practice with eyes closed
  - get within 10-20 Hz
- AFC On or Off
  - 'On' may cause TX frequency to be off



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Transmitting

AFSK adjustment

Insure SSB processor (compression) is Off.

- Adjust:
  - the *Windows* Playback Volume control, and
  - the transmitter Mic (or auxiliary audio input).
- Such that:
  - ALC is just backed off to moderate, and
  - full power output is attained.

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Transmitting

FSK adjustment

- None!

(That's the whole point of FSK.)

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Basic RTTY Contest QSO

CQ WPX RTTY Contest

1. ***WPX K5AM K5AM CQ***
2. ***ZC4LI ZC4LI***
3. ***ZC4LI 599 1349 1349***
4. ***[K5AM] TU 599 985 985***
1. ***[ZC4LI] TU K5AM CQ***

K5AM: running station
ZC4LI: S&P station

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RTTY Messages

CQ WPX RTTY Contest

- Short, as with CW/SSB
- No extraneous info
- 599 (not 5NN) once
- Serial number twice
- Space (not hyphen)
- Omit 'DE'
- RTTY chars
  - %R (CR, LF)
  - %E (drop PTT)
- End with Space

www.rttycontesting.com/tutorials/messages

F02:	%RWPX P49X P49X CQ %O%E
F03:	%R P49X %E
F04:	P49X %E
F05:	%R%C 599 %N2 %N2 %E
F06:	%RTU P49X CQ %O%E
F07:	%RQRV %ZR.1 %E
F08:	%R %C TU .. NOW%L%E
F09:	%RAGN %E
F10:	%RNR? %E
F11:	%R%N3 %E

F02:	%RWPX P49X P49X P49X CQ %O%E
F03:	%RQSL LOTW OR W0YK %E
F04:	%R%C %E
F05:	%RTU 599 %N2 %N2 %L%E
F06:	%RKB %H P49X CQ %L%O%E
F07:	%RQRV %ZS.1 %E
F08:	%R%H %C KB .. NOW%L
F09:	%RQRZ %E
F10:	%RCALL? %E
F11:	? %E

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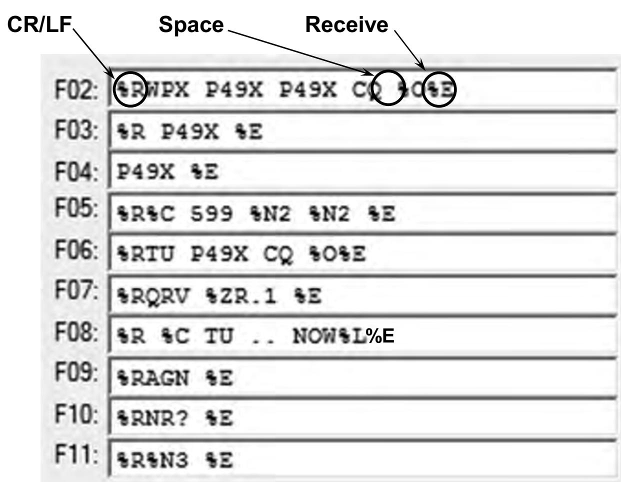
RTTY Messages

formatting



F02:	%RWPX P49X P49X CQ %O%E
F03:	%R P49X %E
F04:	P49X %E
F05:	%R%C 599 %N2 %N2 %E
F06:	%RTU P49X CQ %O%E
F07:	%RQRV %ZR.1 %E
F08:	%R %C TU .. NOW%L%E
F09:	%RAGN %E
F10:	%RNR? %E
F11:	%R%N3 %E

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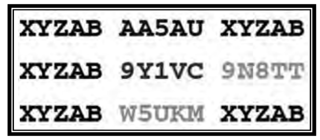
Super Check Partial

call sign selection

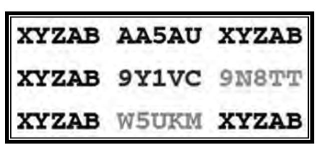
- SCP (Super Check Partial) enables computer to select call signs in receive window
  - Unworked calls (no mult)
  - New mults and double mults
  - Dupes
- Use main SCP from CW/SSB/RTTY contests
  - RTTY SCP is a subset, so use full file



N1MM Logger

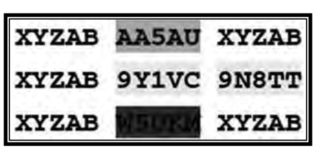
Super Check Partial

logger differences



N1MM Logger

- *Custom colors*
- *Highlight option*



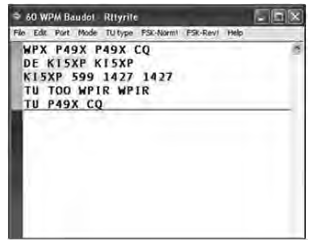
WriteLog

Win-Test

Tips

"All I receive is gibberish!"

- "Upside-down"
  - Reverse Mark & Space
  - LSB vs. USB
- Figures vs. letters
  - TOO=599, WPIR=2084
  - UOS should be on
  - Shift-click to convert, or look at top two rows
- Audio-In level, tones, flutter
- (Other station's signal)



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Tips

"They never answer me!"

- "Upside-down"
  - FSK: polarity switch in radio
  - AFSK: LSB vs. USB; polarity select in software
- Off frequency
  - AFC on with NET (AFSK only) off [recommend RIT instead]
  - AFC & NET on by default in MMTTY
    - changes not sticky; change defaults in USERPARA.INI
- AFSK: Mic & SC levels; speech processor on
- Radio mode, tones, FSK interface

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More Tips

- 100% duty cycle … *caution!*
- Practice
  - During RTTY contests (~ two per month)
  - NCCC Thursday night practices (weekly)
- Multi-Ops

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RTTY Operating

summary

- Many casual RTTY contest participants
- RTTY sub-bands; 10-80 only; avoid audio-digital & beacons
- 500 Hz receive filtering; USOS on
- Messages ("macros")
  - Short, ~~5NN~~, unique exchange twice, Space delimiter
- Common problems
  - "Upside-down" (reversed Space/Mark or LSB vs. USB)
  - Figures vs. Letters
  - Audio:
    - RX audio output level and TX (AFSK only) audio input level
    - Unmuted soundcard inputs and outputs
    - Space and Mark tone consistency between decoder and radio
  - Off-frequency tuning (AFC & NET); band conditions

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The Cynics Say …

- "The RTTY decoder/encoder does everything."
  however, this attribute …
  - frees the operator to improve other skills
  - enables more contest participants
  - provides mode diversity for contest junkies
- "RTTY is a pain to set up and get working."
  … stay tuned, it's really not that difficult!

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How Do I Set it Up?

overview

- ***Acquire*** and set up hardware and/or software to convert between the RTTY audio tones and text:
  - RTTY ***receive*** decoder
  - RTTY ***transmit*** encoder
  - PC-radio interface
- ***Configure*** decoder/encoder
- ***Integrate*** decoder/encoder with logger

The rest of the station setup is the same as for CW and SSB

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How Do I Set it Up?
RTTY decoder/encoder

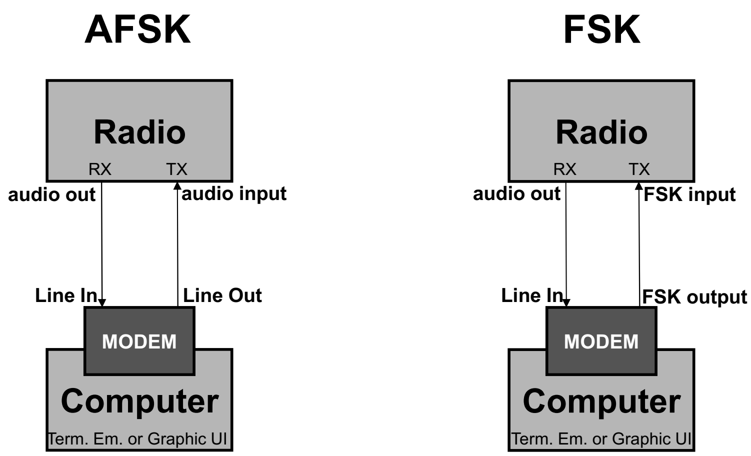
- RTTY ***receive*** decoder converts the two RTTY tones to printed characters.
  - CW decoders seldom used
  - Ears/brain/hands for CW/SSB
- RTTY ***transmit*** encoder converts typed characters (or messages) into the two tones (AFSK) or on/off keying (FSK).
  - logger *CW keyers and SSB DVKs are also used, similar to RTTY encoders*
  - Otherwise, brain/hands/mouth for CW/SSB

How Do I Set it Up?
decoder/encoder terminology

- The RTTY ***transmit encoder*** and ***receive decoder*** is sometimes referred to as a MODEM or a TNC:
  - MODEM = MOdulator DEModulator
  - TNC = Terminal Node Controller
- MODEMs can be:
  - a hardware box, or
  - a software application driving a PC soundcard

How Do I Set It Up?

hardware MODEM



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How Do I Set It Up?

hardware MODEM

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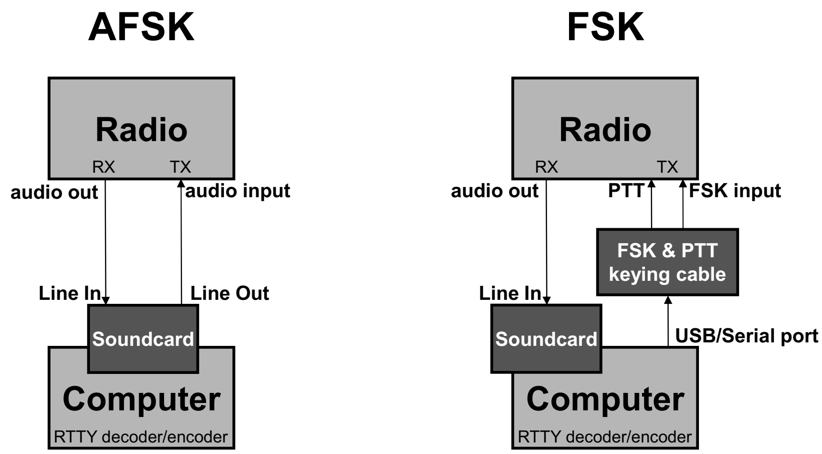
How Do I Set It Up?

software application & soundcard



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How Do I Set it UP?

cables

- Receive:
  - RX audio out to soundcard — 1:1 isolation transformer
  - ***Optional DSP filter*** — ***JPS NIR-12, or …***
- Transmit:
  - AFSK: TX audio in from soundcard, ***or*** — 1:1 isolation transformer, ***or***
  - FSK: FSK/PTT keying — Keying interface

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How Do I Set It Up?

ground loops

- Eliminate ground loops between radio and PC
- Otherwise insert 1:1 audio isolation transformer on:
  - RX output
  - TX Mic input *(AFSK only)*
- Alternatives:
  - Bourns LM-NP-1001-B1L transformer → homebrew cable
  - Ground loop isolators
  - W2IHY iBox
  - Commercial RTTY interfaces
  - K3 (uses Bourns LM-NP-1001-B1L on LINE IN & OUT)

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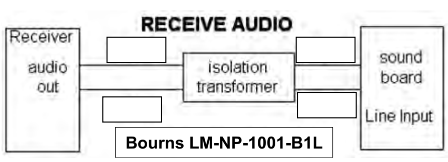
How Do I Set It Up?

homebrew audio isolation



-90 dBc 3rd order IMD

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How Do I Set It Up?

ground loop isolators

Radio Shack $19.49 or eBay $6.99
-64 dBc 3rd order IMD

eBay $3.35

eBay $5.50

eBay $7.45

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How Do I Set It Up?

W2IHY iBox audio isolation

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How Do I Set It Up?
commercial interface audio isolation

Rascal

How Do I Set It Up?
radio audio isolation

K3 audio isolation **IN – LINE – OUT**

How Do I Set It Up?

SDR digital audio isolation

digital: **soundcard**

analog: **IN – LINE – OUT**

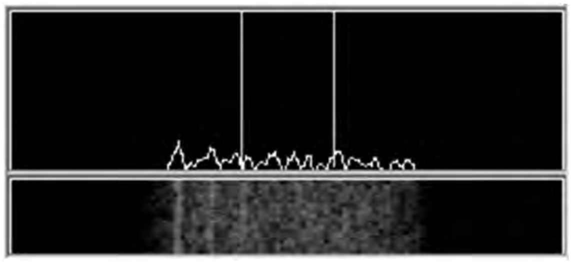
How Do I Set It Up

optional radio AF filtering

- PC Audio isolation
  - Transformer
  - Commercial interface
  - Some radios (K3, Flex)
- Narrow IF filters (Roofing & DSP)
  - 500 Hz - normal
  - 250 Hz – extreme QRM only
  - Tone filters – don't use
    - Icom Twin Peak Filter
    - K3 Dual-Tone Filter
- Audio filtering
  - JPS NIR-10/12
  - Timewave DSP-599zx
  - Modern DSP rigs

How Do I Set It Up?

adjust RX audio



- Set RX audio level for noise 5% of full-scale
  - Receiver audio out level control, and/or
  - *Windows* Recording Volume Control applet

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How Do I Set It Up?

adjust AFSK audio

Insure SSB processor (compression) is Off.

- Adjust:
  - the *Windows* Playback Volume control, and
  - the transmitter Mic (or auxiliary audio input)
- Such that:
  - ALC is just backed off to moderate, and
  - full power output is attained.

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How Do I Set It Up?

PTT vs. VOX

- AFSK uses VOX or PTT
  - radio Mic input will allow VOX
  - rear panel auxiliary audio input may not; then PTT
  - PTT can usually be keyed via the radio CAT cable
- FSK uses PTT
  - Serial port controls FSK and PTT signals

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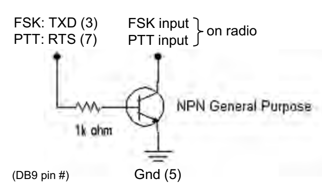
How Do I Set It Up?

homebrew FSK & PTT keying cable



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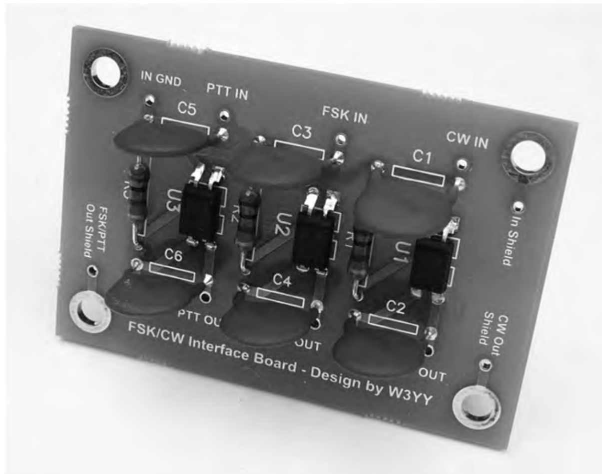
How Do I Set It Up?

***W3YY** FSK & PTT keying cable*



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How Do I Set It Up?

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How Do I Set It Up?

commercial interfaces

RASCAL

RIGblasters

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How Do I Set It Up?

RigExpert Interfaces

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How Do I Set It Up?

commercial interfaces

Vendor	Model	Price	PC In'fc	PTT	Soundcard	Level ctrl	FSK	CW	WinKey	Voice	Radio in'fc
generic (with K3)	(2) 3.5mm M-M audio cables	$ 10	-			√					
Buxcomm	Rascal-IIB or -IIIA	$ 69	-								
Buxcomm	Rascal GLX	$ 79	Serial	√							
Tigertronics	SL-1+	$ 80	-	auto							
Tigertronics	USB	$ 110	USB	auto	√	√					
MFJ	1273B	$ 60	Serial	√							
MFJ	1275	$ 110	Serial	√							
MFJ	1279	$ 140	Serial	√	√						
Mountain Radio	RIGblaster Nomic	$ 60	Serial/USB	√							
Mountain Radio	RIGblaster Plug & Play	$ 120	USB	√				√			some
Mountain Radio	RIGblaster Plus II	$ 160	USB	√			√ or CW	√ or FSK			some
Mountain Radio	RIGblaster Advantage	$ 200	USB	√	√	√	√ or CW	√ or FSK			√
Mountain Radio	RIGblaster Pro	$ 300	Serial/USB	√			√	√			√
Navigator	Navigator	$ 417	USB	√	√	√	√	√	√		√

See May-June 2012 NCJ, "RTTY Contesting" column

How Do I Set It Up?

microHAM interfaces

One Radio

SO2R

How Do I Set It Up?

RigExpert & microHAM interfaces

Vendor	Model	Price	PC In'fc	PTT	Soundcard	Level ctrl	FSK	CW	WinKey	Voice	Radio in'fc	SO2R
RigExpert	Tiny	$ 120	USB	√	√			√		√	√	
RigExpert	Standard	$ 265	USB	√	√	√	√	√	√	√	√	
RigExpert	TI-5	$ 365	USB	√	√	√	√	√	√	√	√	
microHAM	USB Interface II	$ 179	USB	√				√			√	
microHAM	USB Interface III	$ 225	USB	√	√	√		√			√	
microHAM	Digi KEYER II	$ 369	USB	√	√	√	√	√	√		√	
microHAM	microKEYER II	$ 479	USB	√	√	√	√	√	√	√	√	
microHAM	micro2R	$ 369	USB	√		√	√	√	√	√	√	√
microHAM	MK2R	$ 899	USB	√		√	√	√	√	√	√	√
microHAM	MK2R+	$ 999	USB	√	√	√	√	√	√	√	√	√

See May-June 2012 NCJ, "RTTY Contesting" column

How Do I Set It Up?

summary - receive

1. Connect receiver audio output, via isolation, to …
   - MODEM Audio In,
     or
   - MMTTY via Soundcard Line In (or Mic In with pad):
     - Enable/adjust soundcard Line In (or Mic) input, disable/mute other inputs
2. Optional receive audio filtering

How Do I Set It Up?
summary - AFSK

1. Connect radio's Line In (or, Mic In with pad), via isolation, from:
   - MODEM Audio Out

     or …
   - Soundcard Line Out
2. Speech processor off
3. Enable/adjust SC audio level
   - Disable or mute all other SC outputs

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How Do I Set It Up?
summary - FSK

1. Connect the radio FSK and PTT inputs to:
   - the MODEM FSK and PTT outputs and connect the MODEM Serial port to the PC (USB adapter)

     or, if MMTTY …
   - the RTTY interface FSK and PTT outputs and connect the interface Serial port to PC (USB adapter)
2. If no PC Serial port, then use a USB-Serial adapter.
   - Beware that some won't key FSK properly. Edgeport USB-Serial adapters are known good.

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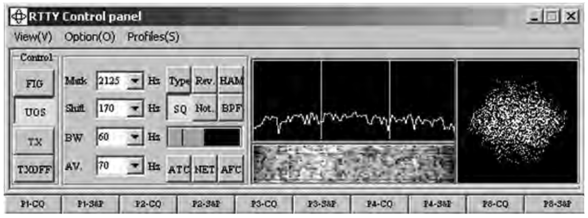
Decoders

MMTTY



- Dominant soundcard MODEM in use today
- Exceeds performance of most other MODEMs
- Freeware since introduction in 2000
- Written by Mako, JE3HHT

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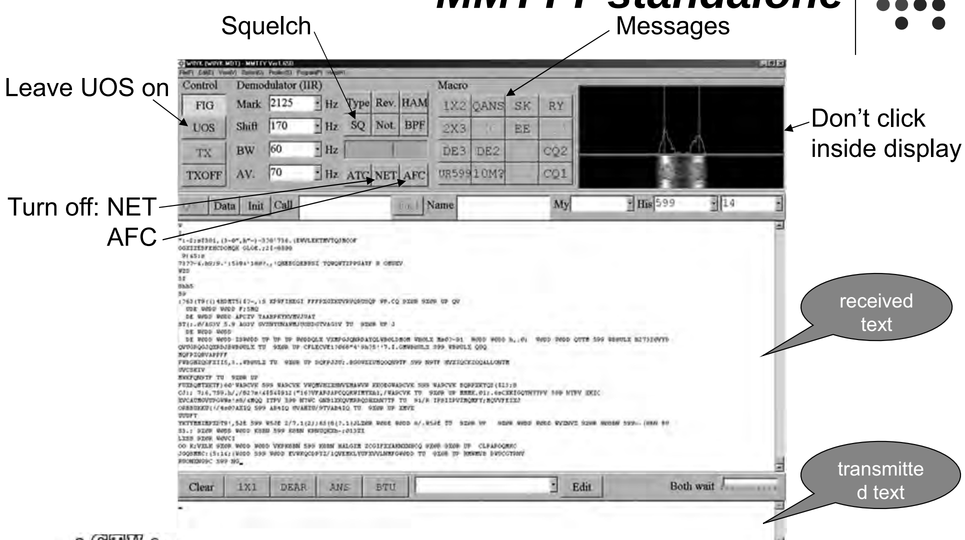
How Do I Set It Up?

MMTTY standalone



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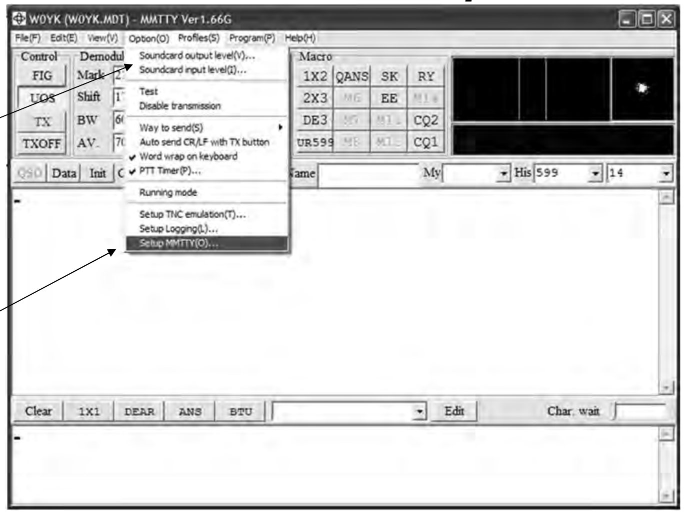
How Do I Set It Up?

MMTTY Option menu

Soundcard levels

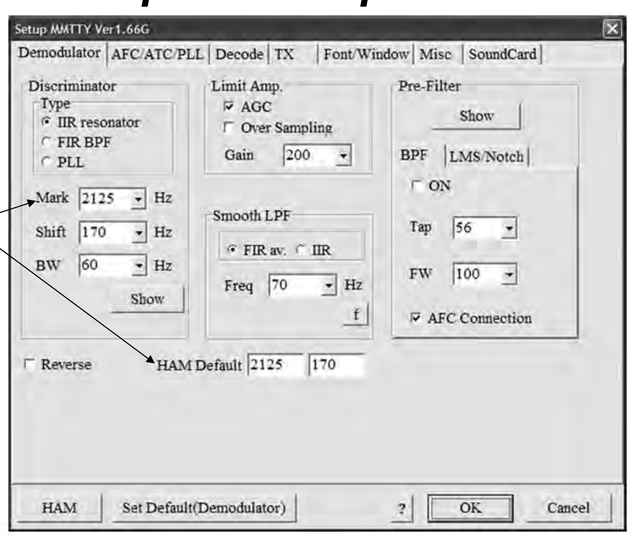


MMTTY setup

How Do I Set It Up?

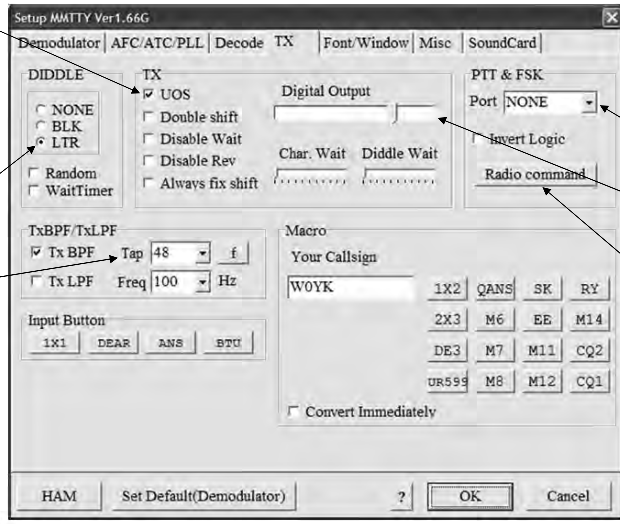
MMTTY Option/Setup/Demodulator

Set tones (radio same)



How Do I Set It Up?

MMTTY Option/Setup/TX



TX UOS on

Select LTR

512 Tap,
if PC has perf.

FSK/PTT port

Soundcard
Line Out level

AFSK PTT

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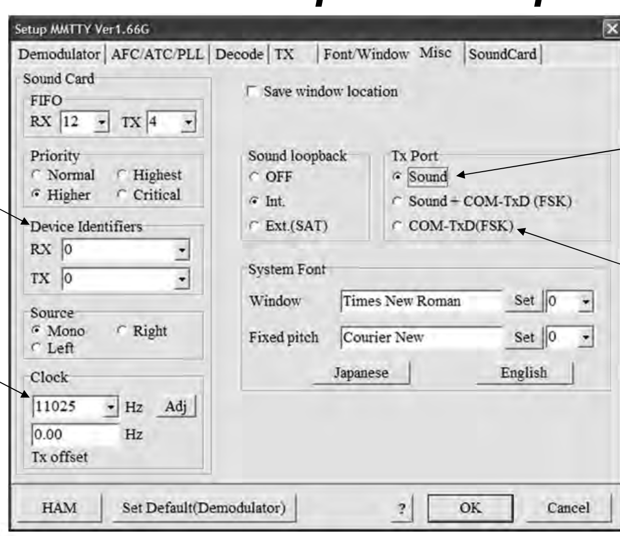
How Do I Set It Up?

MMTTY Option/Setup/Misc



AFSK

Soundcard

FSK

Soundcard
Format, 4x

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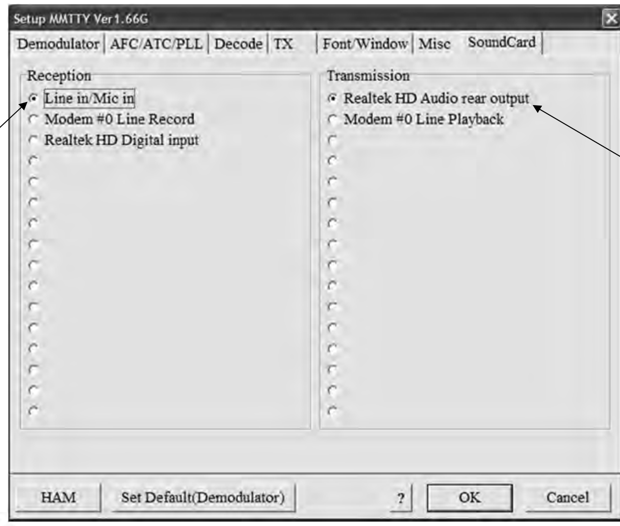
How Do I Set It Up?

MMTTY Option/Setup/SoundCard



Select receive Soundcard

Select transmit Soundcard (AFSK only)

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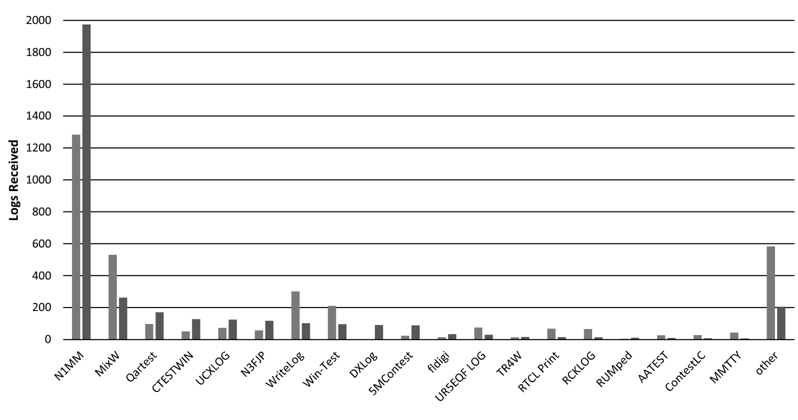
CQ WPX RTTY

logs received: 2022 vs. 2012



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RTTY Contest Loggers

- WriteLog *(1994; created for RTTY)*
  - CW & RTTY came later
  - *www.rttycontesting.com/tutorials*
- N1MM Logger+ *(2000; dedicated RTTY software designer)*
  - Free
  - *www.rttycontesting.com/tutorials*
- Win-Test *(2003; RTTY is low priority)*

All three integrate MMTTY & 2Tone and have similar functionality for basic RTTY contesting.

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A Blizzard of Details!

this is fun??

Start Simple, then Enhance

- MMTTY *(free)*
  - get RX working *(std audio cable from radio to PC)*
  - get TX working using either:
    - AFSK *(2nd std audio cable from radio to PC)*
    - FSK *(keying cable or commercial interface)*
- Integrate MMTTY with logging software
- Enhance later
  - Audio isolation *(highly recommended)*
  - 2Tone
  - Higher capability interface *(DIY or commercial)*
  - Advanced setup: SO2V, SO2R, multiple decoders, ...

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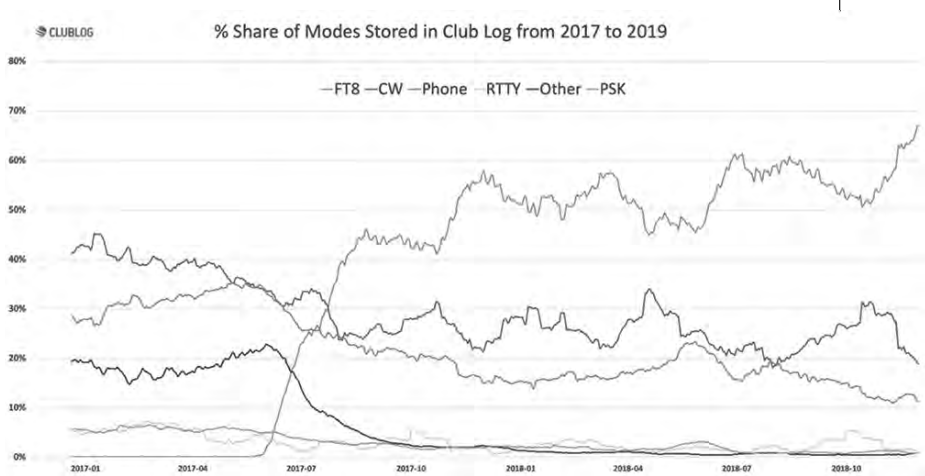
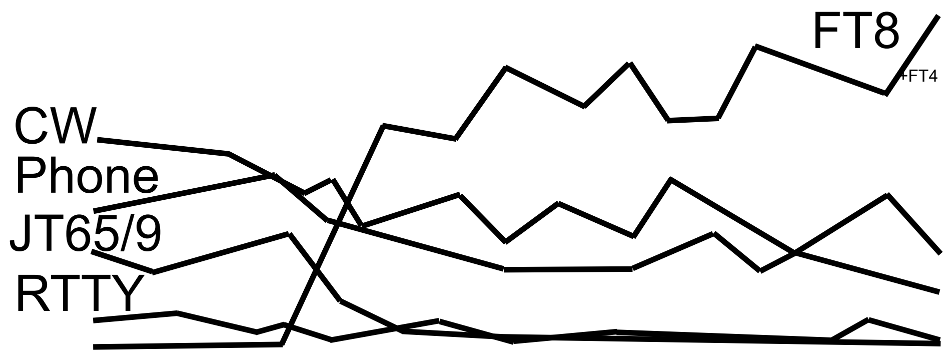
Resources

- www.rttycontesting.com premier website
  - Tutorials and resources (beginner to expert)
  - WriteLog, N1MM Logger+ and MMTTY
- rtty@groups.io Email reflector
  - RTTY contester networking
  - Q&A
- Software web sites
  - hamsoft.ca/ (MMTTY)
  - n1mm.hamdocs.com/tiki-index.php (N1MM Logger+)
  - www.writelog.com (WriteLog)
  - www.win-test.com (Win-Test)
- Software Email reflectors
  - mmtty@yahoogroups.com (MMTTY)
  - N1MMLoggerplus@groups.io (N1MM Logger+)
  - Writelog@contesting.com (WriteLog)
  - support@win-test.com (Win-Test)

Clublog QSOs by Mode



Clublog % QSOs by Mode: 2017-2018



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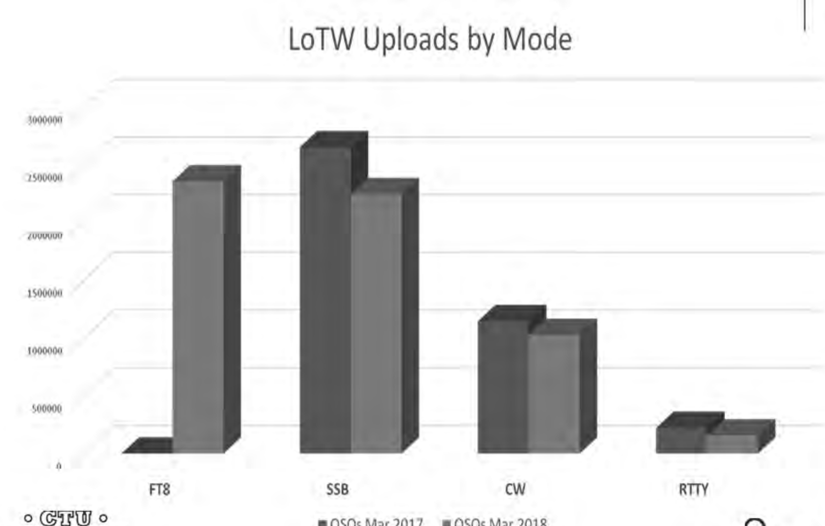
The FT8 Explosion



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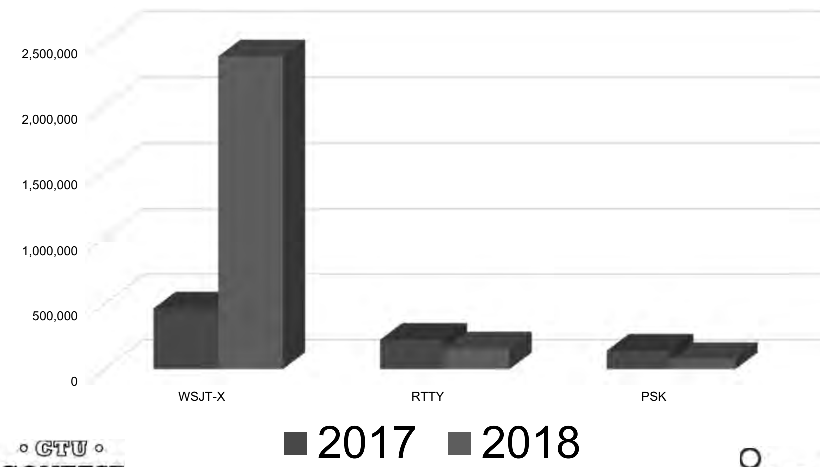
Digital Mode Trends



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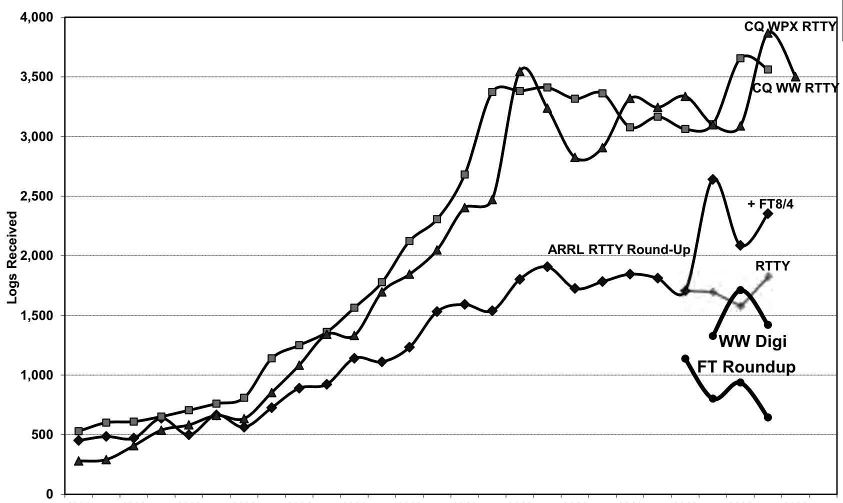
Two Largest FT8/4 Contests



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WSJT & WSJT-X Overview

- Weak Signal communication by Joe Taylor - eXperimental
- Developed for EME; adapted by HF
- Several modes (JT65, JT9, FT8, etc.)
- TX/RX cycles synchronous with time servers

+ Multi-channel (external spotting and CQ/S&P irrelevant)
+ Weak signal (inaudible)
  + Longer DX
  + Lower power
  + Compromised antennas and/or QTH
+ Narrow bandwidth (4-176 Hz)
+ “Perfect” copy (SCP irrelevant)

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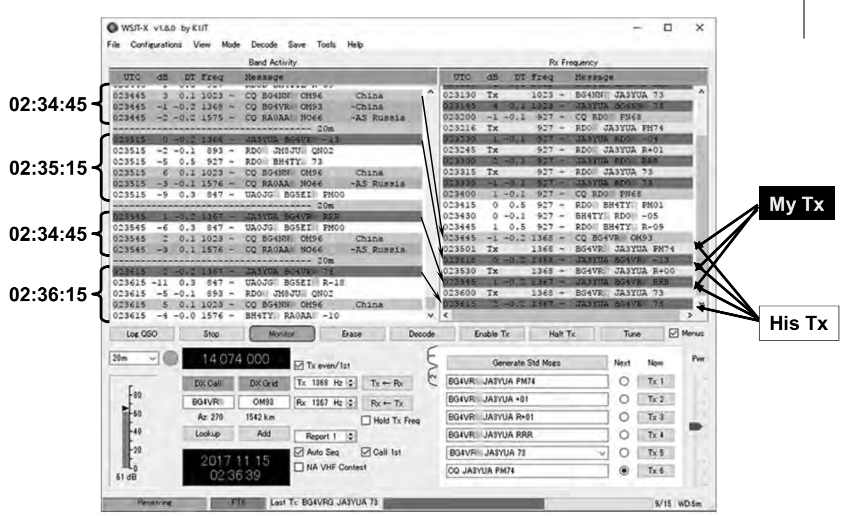
FT8 Multi-Channel Reception



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WSJT & WSJT-X Overview

- \+ Multi-channel (external spotting and CQ vs. S&P irrelevant)
- \+ Weak signal (FT8 -13dB & FT4 -10dB compared to RTTY)
  - \+ Longer DX
  - \+ Lower power
  - \+ Compromised antennas and/or QTH
- \+ Narrow bandwidth (4-176 Hz: FT8=50 Hz; FT4=80 Hz)
- \+ “Perfect” copy (SCP irrelevant)

- \- Slow 1-6 minutes/QSO → 30 seconds (FT4)
- \- Limited, fixed messages → fine for contesting
- \- Minimal reaction time → message automation

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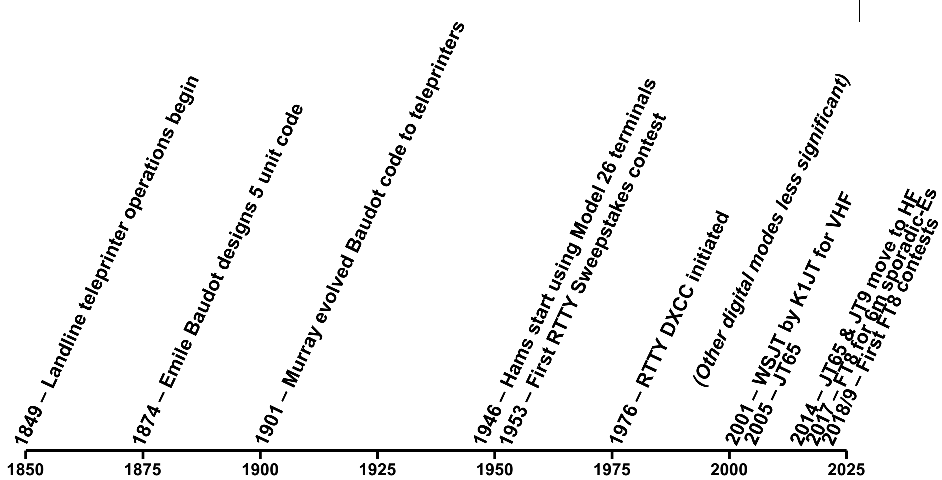
RTTY & WSJT History



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WSJT & WSJT-X History

- **2001: FSK441 for meteor scatter**
- **2002: JT6M for ionospheric scatter**
- **2003: JT65 VHF/UHF EME**
  - **Adopted for QRP HF DXing; 176 Hz bandwidth; 60 sec. transmission**
- **2014: JT9 for LF, MF and HF**
  - **2 dB more sensitive than JT65; 16 Hz bandwidth**
- **Jun 2017: FT8 for 6m Es & HF**
  - **50 Hz bandwidth; 15 second transmission**
- **May 2018: Baker Is. DXpedition > 11,000 FT8 HF QSOs**
- ***Dec 2018: FT8 Roundup (first WSJT-X HF contest)***
- ***Jan 2019: ARRL RTTY Roundup (FT8 permitted)***
- ***Apr 2019: FT8 DX Contest***
- ***Sep 2019: SCC RTTY Championship → WW Digi***
- ***Jun 2022: ARRL International Digital***
- ***Jan 2023: ARRL RTTY Roundup becomes RTTY-only***

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Major FT Contests

- ARRL RTTY Roundup [1st weekend in Jan]
  - 2019: FT8 added
  - 2020: FT4 added
  - 2022: RTTY-only or FT-only or Mixed
  - 2023: RTTY-only; no other modes
- ARRL International Digital [1st weekend in Jun]
  - Distance-based scoring
- WW Digi DX Contest [last weekend in Aug]
  - Same as ARRL Int'l Digital
    - plus Grid multipliers
    - minus 160m and 6m
- FT Roundup [1st weekend in Dec]
  - RTTY Roundup rules

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FT8 Standard QSO

90 sec./QSO

- CQ K1ABC FN42
- K1ABC W9XYZ EN37
- W9XYZ K1ABC -11
- K1ABC W9XYZ R-09
- W9XYZ K1ABC RRR
- K1ABC W9XYZ 73 (superfluous 2nd QSL)

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FT8 Short-Cycle QSO

75 sec./QSO

- CQ K1ABC FN42
- K1ABC W9XYZ -09
- W9XYZ K1ABC R-11
- K1ABC W9XYZ RR73
- W9XYZ K1ABC 73
  (superfluous 2nd QSL)
  <"CQ" K1ABC>

60 sec. rolling QSOs

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FT8 DXpedition QSO

75 sec./QSO
60 sec./5 QSOs

QSO period 1
QSO period 2
QSO period 3

- CQ KH1/KH7Z
- KH7Z K1ABC FN42
- K1ABC KH7Z -12
  <“CQ” for others>
- KH7Z K1ABC R-14
  KH7Z W9XYZ EN37
  KH7Z W0YK CM97
  etc.
- K1ABC RR73
  W9XYZ KH7Z -08
  W0YK KH7Z -13
  <“CQ” for others>
- KH7Z W9XYZ R-11
  KH7Z W0YK R-15
  KH7Z K9YC CM87
  KH7Z W6OAT CN87
  etc.
- W9XYZ KH7Z RR73
  W0YK KH7Z RR73

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FT8 Contest QSO

60-75 sec./QSO
30 sec./rolling QSO

QSO period 1
QSO period 2
QSO period 3

- CQ RU K1ABC FN42
- K1ABC W9XYZ 579 WI
- W9XYZ K1ABC R 589 MA
  (“CQ” for others)
- K1ABC W9XYZ RR73
  K1ABC W0YK 559 CA
- W0YK K1ABC R 569 MA
  (final “QSL” for W9XYZ)
  (“CQ” for others)
- K1ABC W0YK RR73
  K1ABC P49X 529 1743
- P49X K1ABC R 559 M
  (final “QSL” for W0YK)
- K1ABC P49X RR73
- P49X K1ABC 73
  (superfluous 2nd QSL)

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Setting Up for FT8

- Download/install WSJT-X
  - Alternatively MSHV
- Hardware (radio and PC) same as AFSK
- Study the:
  - Quick Start Guide to WSJT-X 2.0, and
  - the WSJT-X User Guide

Time Synchronization
mandatory for reliable QSOs

- Windows Internet Time Sync
  - Weekly updates
  - Can be unreliable
- Alternatives
  - Meinberg NTP (recommended by K1JT)
  - NetTime (recommended by W0YK)
  - Dimension 4
  - Atomic Clock Sync

Sub-Band Choices

Int'l Digi, WW Digi, FT RU

- Suppressed-Carrier dial frequency
  - FT4: 14080
  - FT8: 14090
- Use receiver's maximum BW: 2.5-4 kHz
- QSO partner > 3 kHz … call above 3 kHz
- Move dial frequency up in 3 kHz increments

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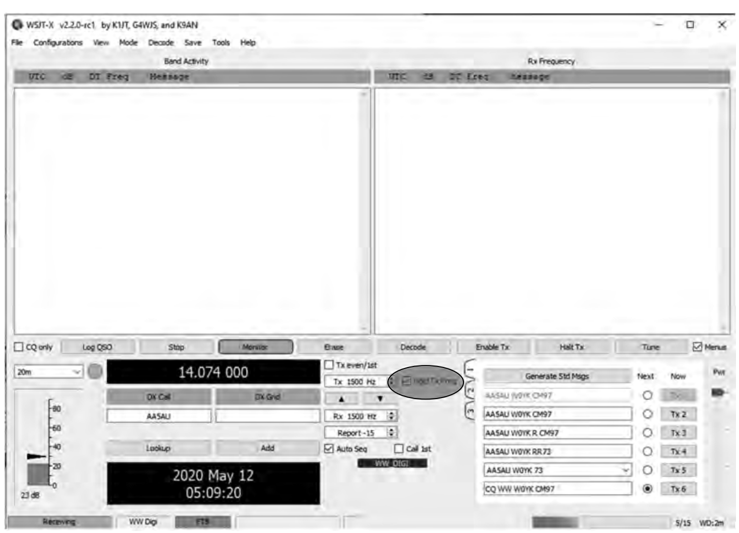
Split Transmit



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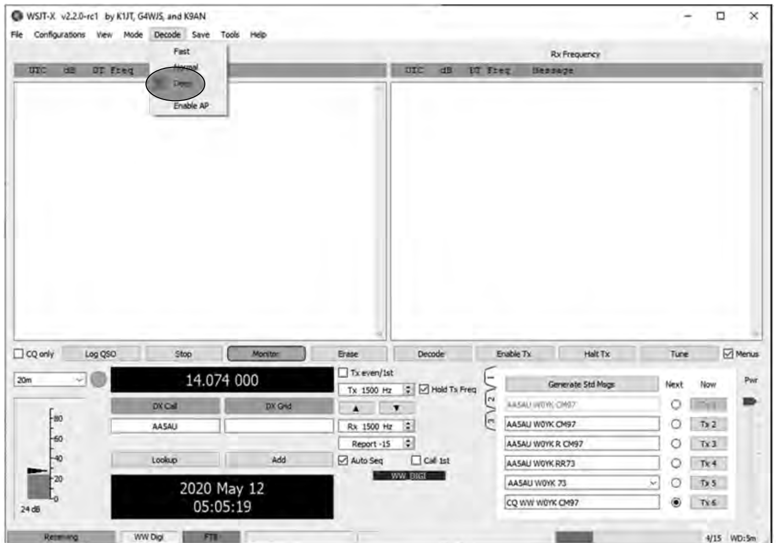
Deep Decode



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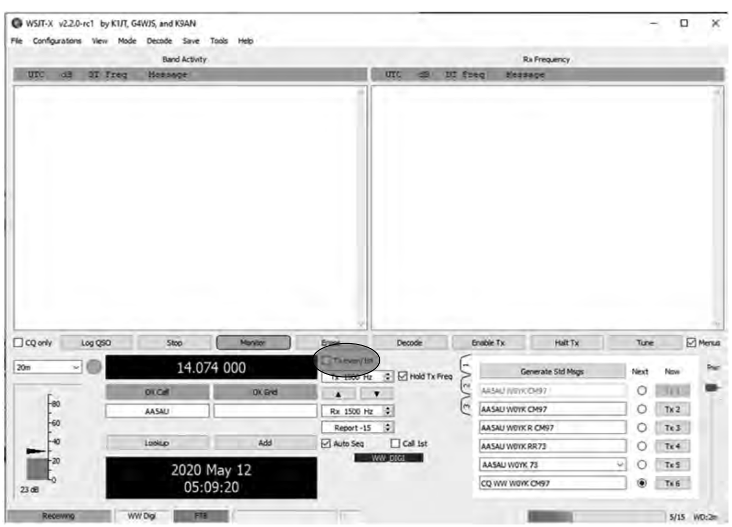
Utilize Odd/Even Cycles



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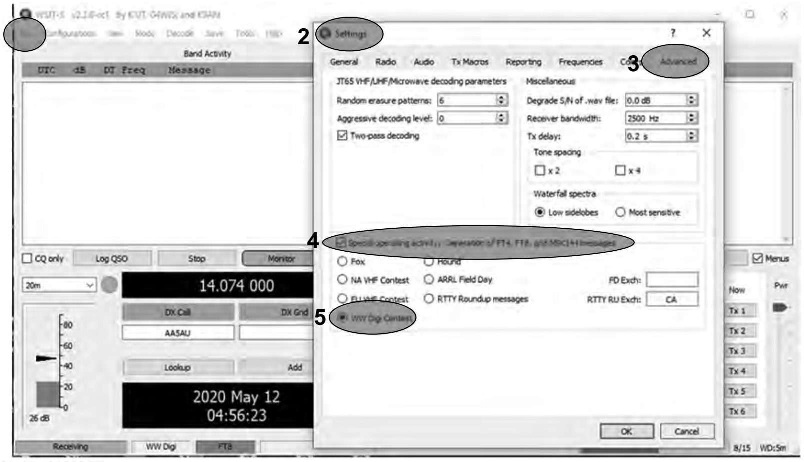
WW Digi DX Contest

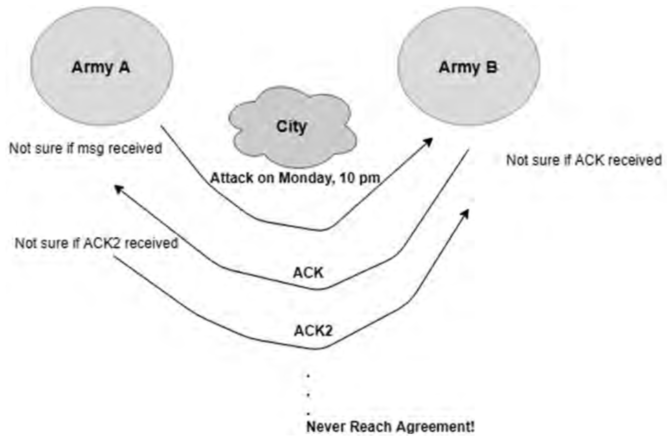


Minimizing NILs in WW Digi

- FT contest NILs are high
  - RTTY is 1-2%, FT is 5%
- QSO partners disagree on QSO completion
  - One doesn’t log, the other logs (and, gets a NIL)

CQ W0YK CM97
W0YK AA5AU EL92 ***←AA5AU answers with exch***
AA5AU W0YK R CM97 ***← W0YK QSLs with exch***
W0YK AA5AU RR73 ***← AA5AU QSLs***
AA5AU W0YK 73 ***← W0YK QSLs AA5AU’s QSL!***
← when does it end?

Two Generals Paradox



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FT Repeat Protocol

CQ W0YK CM97	
W0YK AA5AU EL92	*←AA5AU calls with exch*
AA5AU W0YK R CM97	*← W0YK QSL's with exch*
W0YK AA5AU RR73	*←AA5AU QSL's*
AA5AU W0YK R CM97	*← W0YK missed QSL msg*
W0YK AA5AU RR73	*←AA5AU repeats QSL*

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Minimizing NILs

Recommendation

- Develop skill to dynamically change message
  - e.g., use the Alternate F1-F6 keys in WSJT-X
- Always log the QSO when receiving a RRR, RR73 or 73 message.
- Always log the QSO when sending RRR, RR73 or 73 message.
  - Look for a clue that your message was not received, e.g., your QSO partner re-sends his report.

FT8 vs. FT4 Strategy

- FT4 is faster; FT8 decodes better
  - Intrinsic vs. extrinsic speed
    - FT4 is intrinsically 2x the speed of FT8
    - FT8 is more likely to decode
    - Either might be extrinsically faster at a given time
  - Dynamically use the mode with highest QSO rate
- New stations & multipliers in each mode

Resources

- Software web sites
  - physics.princeton.edu/pulsar/K1JT/wsjtx.html (WSJT-X)
  - n1mm.hamdocs.com/tiki-index.php (N1MM Logger+)
  - https://writelog.com/digirite (DigiRite)
  - www.writelog.com (WriteLog)
- Software Email reflectors
  - wsjt-devel@lists.sourceforge.net (WSJT-X)
  - n1mmloggerplus@groups.io (N1MM Logger+)
  - digirite@groups.io (DigiRite)
  - writelog@contesting.com (WriteLog)
- Tutorials for WW Digi DX Contest
  - rttycontesting.com/tutorials/n1mm/operating-ww-digi-with-n1mm/ N1MM+/WSJT-X
  - rttycontesting.com/tutorials/writelog3/digirite/ WriteLog/DigiRite

103

How to Improve Your Transmitting Antennas as Solar Cycle 25 Approaches Solar Maximum in about 2024

- What's important during the next two years?
- Vertically polarized 160 meter antennas
- Horizontally polarized 80 to 10 meter antennas
- Single Yagi stations
- Stacked Yagis
- Multi-tower stations
- When good antennas go bad…

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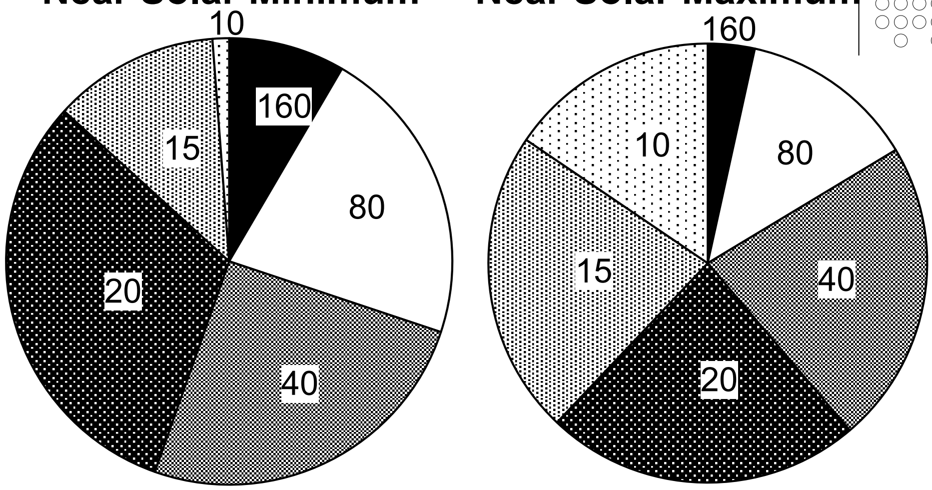
1

Percentage of CW DX Contest QSOs Per Band

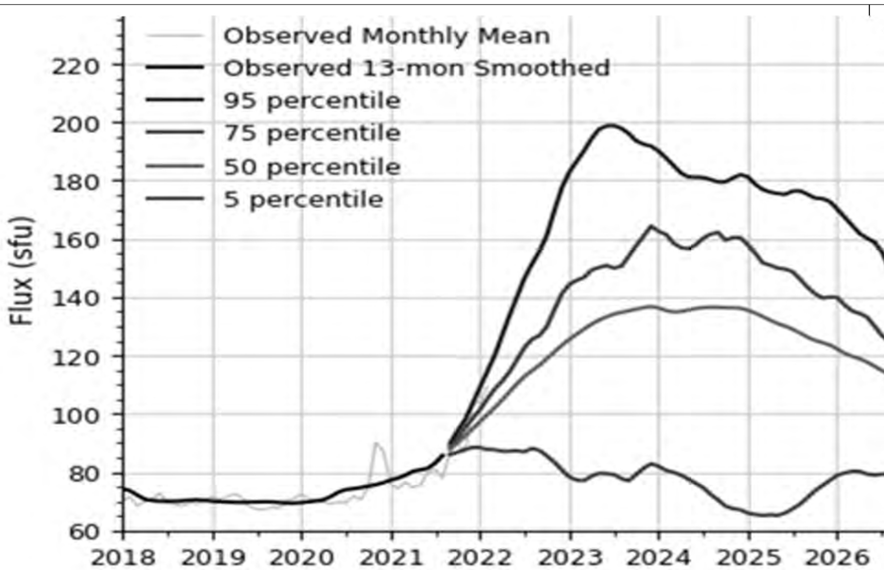
Near Solar Minimum | **Near Solar Maximum**



10 and 15 meters are much more important within a few years of solar maximum
160 and 80 are somewhat less important within a few years of solar maximum

2

Solar Cycle 25 Solar Flux Index Forecast
NASA Marshall Space Flight Center – 10 Mar 2022



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nasa.gov/msfcsolar

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Transmitting Antenna Elevation Angles
as Solar Cycle 25 Approaches Solar Maximum

- **10 meters** - early morning through sunset world wide DX band
  - most DX propagation is at low elevation angles **5 to 10 degrees**
  - marginal DX paths require very low elevation angles **well below 5 degrees**
- **15 meters** - sunrise to early evening worldwide DX band
  - most DX propagation is at low and mid elevation angles **5 to 15 degrees**
  - marginal DX paths require very low elevation angles **well below 5 degrees**
- **20 meters** - 24 hour very crowded competitive worldwide DX band
  - DX propagation covers low, mid and high elevation angles **5 to 20 degrees**
  - marginal DX paths require low elevation angles **below 5 degrees**
- **40 meters** - evening and night very crowded competitive DX band
  - requires a broad range of elevation angles **10 to 25 degrees**
  - marginal DX paths require low elevation angles **below 10 degrees**
- **80 meters** - less reliable and weaker DX signals than recent years
  - use very efficient antennas covering a broad range of angles **10 to 25 degrees**
- **160 meters** - less reliable and weaker DX signals than recent years
  - **vertical antennas** *almost always* provide much better DX performance

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Increased solar activity requires
more effective 15 and 10 meter antennas

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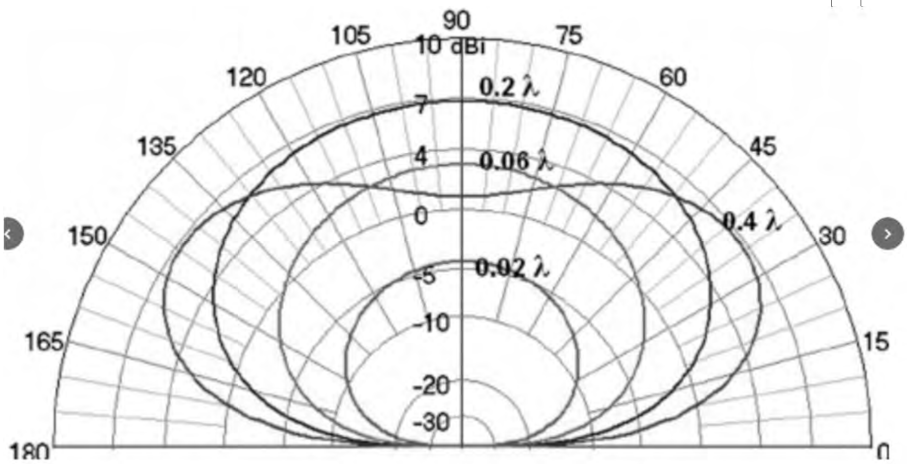
6 dB of Ground Gain
for Horizontally Polarized Antennas At Least 0.2 Wavelengths High



Its very difficult to achieve 6 dB of ground gain with vertical polarization

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6 dB of "Free" Ground Gain

- Horizontally polarized dipoles, Yagis or quads
  - easily provide 6 dB of very important ground gain over almost any soil
  - *must be installed at an appropriate height*
  - terrain must be reasonably smooth and free of large obstructions
  - *but nearby antennas can destroy ground gain, antenna gain and directivity*
- Some vertically polarized antennas achieve nearly 6 dB of ground gain
  - but only over highly conductive soil such as a salt marsh
- Competitive DX contest stations require high horizontally polarized 40 through 10 meter antennas during very low solar activity
- Stacked Yagis provide additional gain by suppressing unwanted high angle radiation and redistributing the power into low angles
  - *if installed at proper heights and spacings to obtain significant stacking gain*
  - a Stackmatch allows selection of the optimum elevation angle

Horizontal antennas easily achieve 6 dB of ground gain when installed at proper heights

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Vertical Polarization for 160 Meters

- Vertical, inverted-L, T, and umbrella antennas
  - *almost always* provide much better DX performance than horizontally polarized antennas at distances beyond 1500 miles
- Nearby tall towers and antennas can significantly degrade the gain and directivity of vertical antennas
  - antenna pattern degradation
  - increased ground losses
- Efficient radial systems are essential to achieving the full performance potential of vertical transmitting antennas

Verticals *almost always* provide much better DX performance than horizontal 160M antennas

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High Performance Transmitting Antennas for 160 Meter DX

- 125 foot vertical: the gold standard 160 meter DX antenna
  - ***well spaced from all nearby tall towers and antennas***
    - at least 140 ft from towers over 80 feet tall supporting large HF Yagis
    - optimum performance with spacing much greater than 140 feet
  - at least 30 to 60 shallow buried 125 foot radials
    - or at least two (preferably four or more) elevated 125 foot radials
      - but only if 30 to 60 shallow buried 125 foot radials are not possible
    - a K2AV folded counterpoise is a good alternative for small lots
- Inverted-L, T and umbrella antennas are good alternatives
  - 50 feet or higher (as short as 35 feet with reduced performance)
  - supported by a tower, mast or trees
- or a corner fed delta loop or corner fed inverted-U antenna

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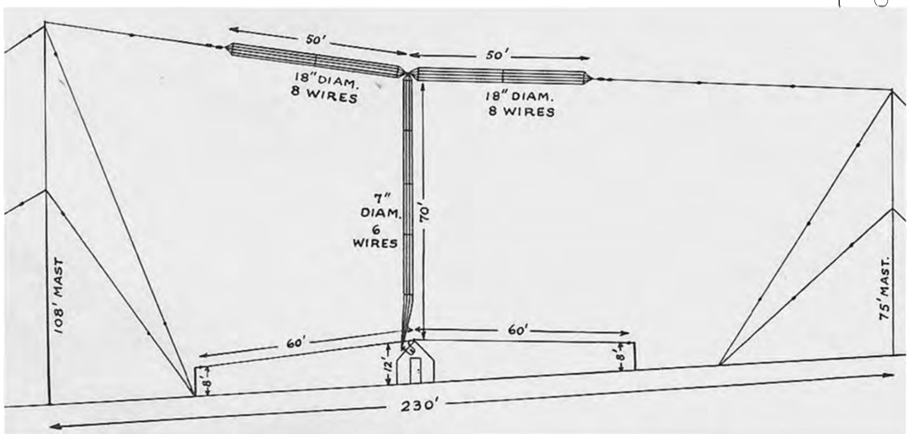
Cage T-Vertical Used by 1BCG at about 1500 kHz during the 1921 Transatlantic Tests



By far the strongest North American signal heard in Europe during the 1921 Transatlantic Tests

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Horizontal Polarization for 80 Meters

easily provides 6 dB of ground gain

- Horizontal dipole or inverted-V dipole about 50 feet high
  - superb antenna for domestic contests: Sweepstakes and Field Day
  - a good DX antenna for distances up to about 5000 miles
- Horizontal dipole or inverted-V dipole at least 70 feet high
  - outperforms a single 65 foot vertical installed over all but the most conductive soils such as a salt marsh
- Use a vertical antenna if you cannot install a dipole or inverted-V dipole at least 70 feet high
  - 65 foot vertical, inverted-L, T or umbrella with at least thirty 65 foot radials
  - or a corner fed delta loop or a corner fed inverted-U
  - ***vertical are very susceptible to degradation by nearby towers***
- Four-square vertical array
  - very competitive with high horizontally polarized antennas
  - at least sixty 65 foot shallow buried radials for each vertical

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High Performance Transmitting Antennas for 80 Meter DX

- Horizontal dipole at least 70 to 100 feet high
  - higher is better
- 65 foot vertical
  - install at least 30 to 60 shallow buried 65 foot radials
    - or at least two (preferably four or more) elevated 65 foot radials
      - only if shallow buried radials are not possible
  - ***verticals are very susceptible to degradation by nearby tall towers***
    - at least 70 feet from towers over 40 feet tall supporting a Yagi antenna
    - optimum performance with much more than 70 foot spacing
- Inverted-L, T and umbrella verticals are good alternatives
  - as little as 25 feet tall -- supported by a tower or trees
  - install at least 30 to 60 shallow buried 65 foot radials
    - or elevated radials
    - or a K2AV reduced size counterpoise for a small lot
  - or a vertically polarized corner fed delta loop or corner fed inverted-U

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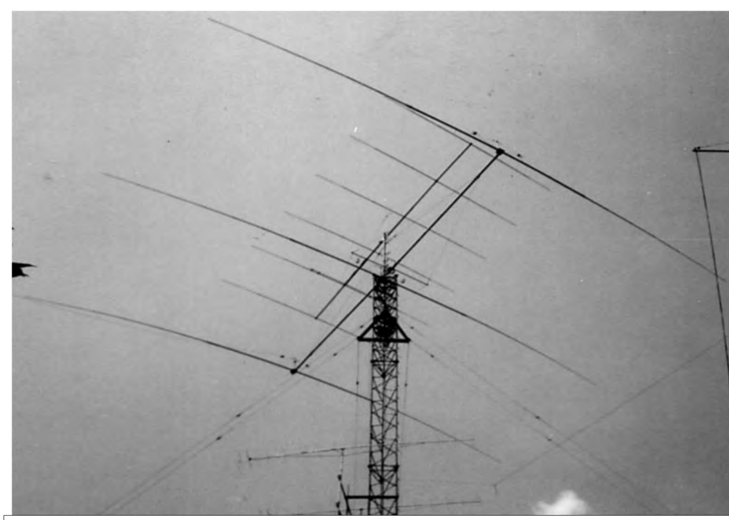
11

K3ZO Installed his 3 Element 80 Meter Yagi at 140 Feet in 1984



K3ZO's horizontally polarized 3 element Yagi changed my thinking about 80 meter antennas for DX

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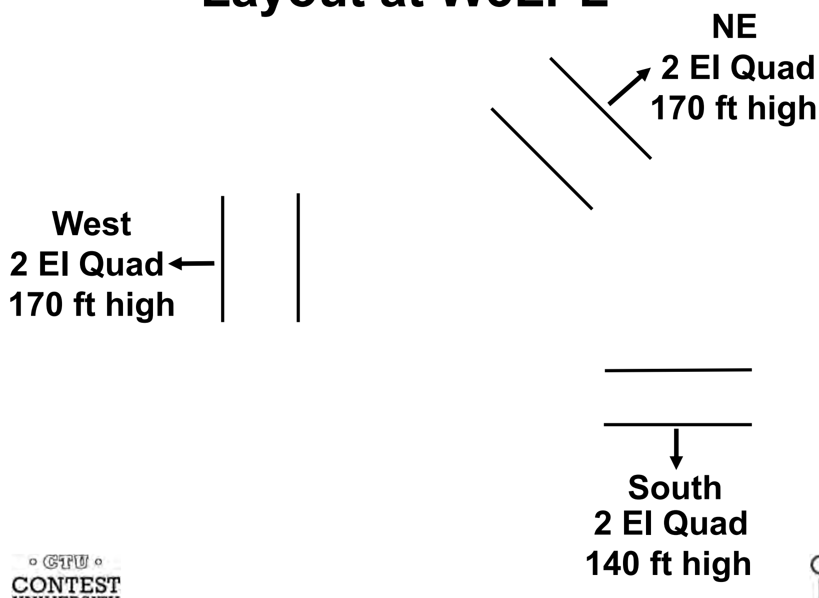
12

80 Meter Transmitting Antenna Layout at W3LPL



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13

80 Meter 4-Square Vertical Array

very competitive high performance alternative to a high 80 meter horizontal antenna

- A four square vertical array is very competitive with high horizontally polarized Yagis and quads
- *Install at least 70 feet from all towers*
  - much more than 70 foot spacing will significantly improve its performance
- Use at least 60 shallow buried 65 foot radials under each vertical
- A 4-square is also an excellent receiving antenna

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Comtek 4-Square Controller

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dxengineering.com/search/brand/comtek

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15

High Performance 40M Antennas

- Horizontal dipole at least 70 feet high
  - 13 to 45 degree elevation pattern at -3 dB points
  - otherwise use a vertical or a four-square vertical array with 30 to 60 radials
- Higher gain: 2 element "shorty 40" Yagi at 70 to 100 feet high
  - 10 to 30 degree elevation pattern at -3 dB points
  - significant improvement over a simple horizontal dipole for DX
  - a Cushcraft XM-240 at 100 feet high is very cost effective
  - a Moxon Yagi is an excellent broad bandwidth low VSWR alternative
- Highest gain: full size 3 or 4 element monoband Yagis
  - single Yagi at least 140 feet high
  - two stacked Yagis on a 200 foot tower and a Stackmatch
    - *selectable* 6 to 30 degree elevation beam patterns at -3 dB points
  - this antenna is often too high for Caribbean and northern South America
  - but don't underestimate the high cost and complexity of a full size 40M Yagi!

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Elevation angles from 5º to 25º are needed

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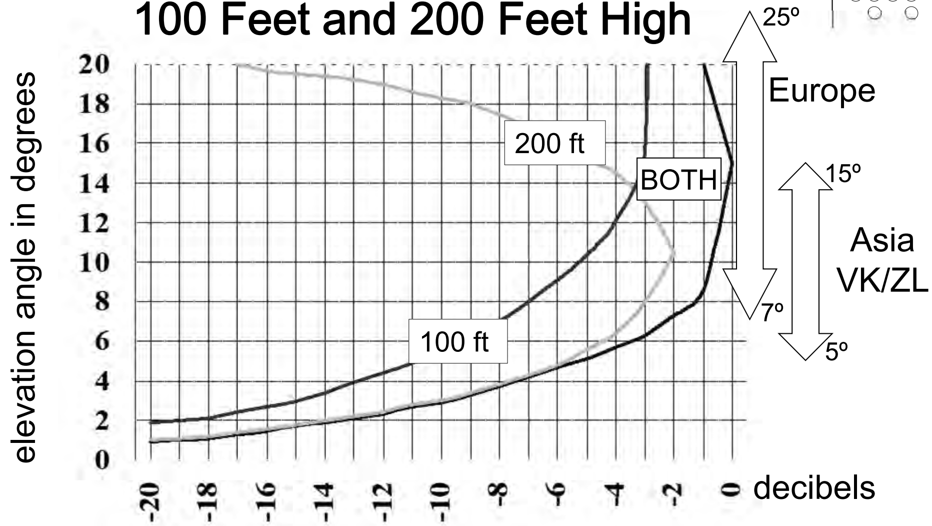
16

Stacked 3 Element 40 Meter Yagis

48 Foot Booms
100 Feet and 200 Feet High



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Elevation angles from 5º to 25º are needed

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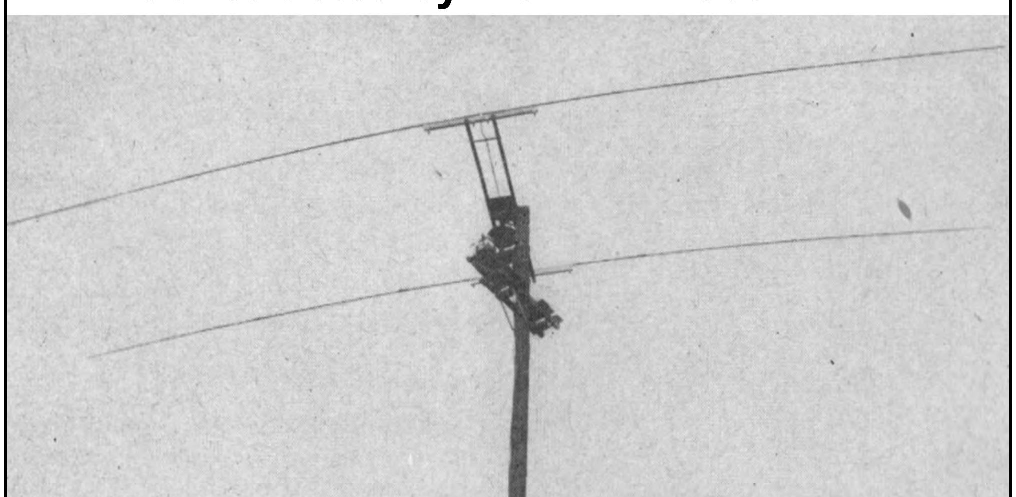
17

First Known 40 Meter Rotatable Yagi
2 Element Full Size Yagi at 60 Feet
Constructed by W9LM in 1950



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Shortly after testing his new 40 meter Yagi,
W9LM removed his 40 meter phased verticals

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Cushcraft XM-240
2 Element 40 Meter Yagi

The most popular "Shorty Forty" Yagi"

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dxengineering.com/parts/csh-xm240

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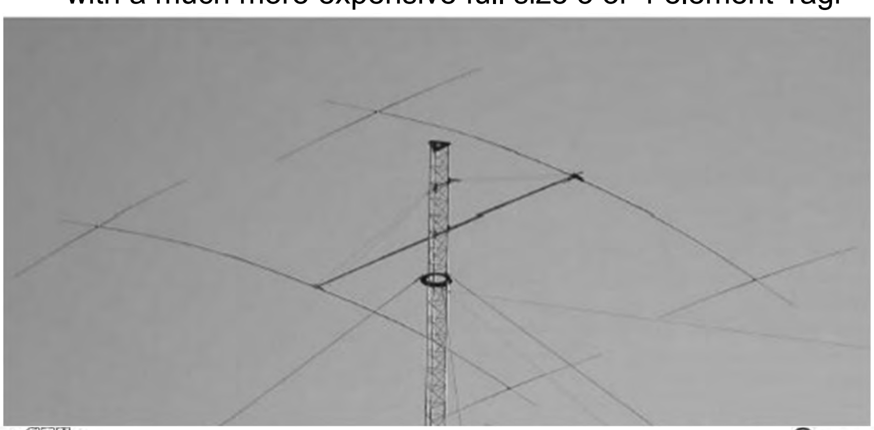
40 Meter Moxon

VSWR less than 1.4:1 from 7.0 to 7.3 MHz
22 foot boom and 48 foot elements

Two stacked Moxons on a 140 foot tower are fully competitive with a much more expensive full size 3 or 4 element Yagi



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www.k3lr.com/engineering/moxon

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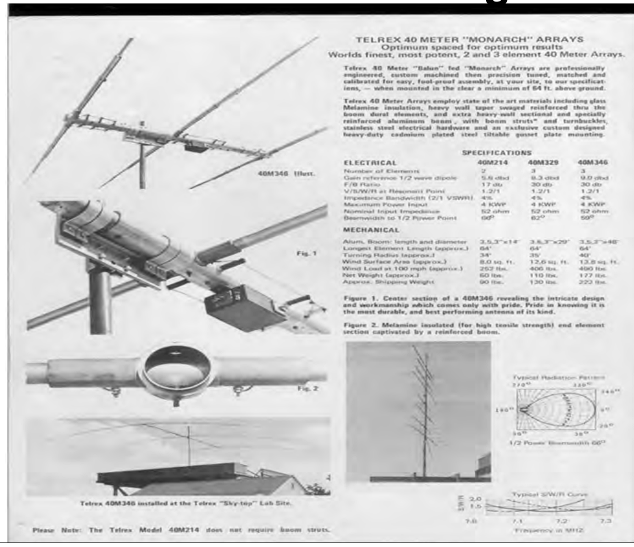
20

Telrex (near) Full Size 3 Element Yagi Revolutionized 40 meter Dxing in 1955



TELREX 40 METER "MONARCH" ARRAYS
Optimum spaced for optimum results
Worlds finest, most potent, 2 and 3 element 40 Meter Arrays.

Telrex 40 Meter "Balun" fed "Monarch" Arrays are professionally engineered, custom machined then precision tuned, matched and calibrated for easy, fool-proof assembly, at your site, to our specificat-ions, — when mounted in the clear a minimum of 64 ft. above ground.

Telrex 40 Meter Arrays employ state of the art materials including glass Melamine insulation, heavy wall taper swaged reinforced thru the boom dural elements, and extra heavy-wall sectional and specially reinforced aluminum beam, with boom struts* and turnbuckles, stainless steel electrical hardware and an exclusive custom designed heavy-duty cadmium plated steel tiltable gusset plate mounting.

SPECIFICATIONS

ELECTRICAL	40M214	40M329	40M346
Number of Elements	2	3	3
Gain reference 1/2 wave dipole	5.8 dbd	8.3 dbd	9.0 dbd
F/B Ratio	17 db	30 db	30 db
V/S/W/R at Resonant Point	1.2/1	1.2/1	1.2/1
Impedance Bandwidth (2/1 VSWR)	4%	4%	4%
Maximum Power Input	4 KWP	4 KWP	4 KWP
Nominal Input Impedance	52 ohm	52 ohm	52 ohm
Beamwidth to 1/2 Power Point	66°	62°	59°
MECHANICAL			
Alum. Boom: length and diameter	3.5,3"x14'	3.5,3"x29'	3.5,3"x46'
Longest Element Length (approx.)	64'	64'	64'
Turning Radius (approx.)	34'	35'	40'
Wind Surface Area (approx.)	8.0 sq. ft.	12.6 sq. ft.	13.8 sq. ft.
Wind Load at 100 mph (approx.)	257 lbs.	406 lbs.	490 lbs.
Net Weight (approx.)	60 lbs.	110 lbs.	177 lbs.
Approx. Shipping Weight	90 lbs.	130 lbs.	222 lbs.

Figure 1. Center section of a 40M346 revealing the intricate design and workmanship which comes only with pride. Pride in knowing it is the most durable, and best performing antenna of its kind.

Figure 2. Melamine insolated (for high tensile strength) end element section captivated by a reinforced boom.

40M346 Illust.

Fig. 1

Fig. 2

Typical Radiation Pattern

1/2 Power Beamwidth 66°

Typical S/W/R Curve

Frequency in MHZ

Telrex 40M346 installed at the Telrex "Sky-top" Lab Site.

Please Note: The Telrex Model 40M214 does not require boom struts.

W0MLY W1FZ K2DGT K2GL K2LWR WA2SFP(W2PV) W8FGX W8VSK W9EWC

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W3KRQ's Homebrew Full Size 3 Element 40 Meter Yagi in 1959

Contesters and DXers built many 3 element 40M Yagis
W3GRF W3KRQ W3MSK (W3AU) W8JIN and many others

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Stacked 40 Meter 4 Element OWA Yagis at K9CT

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k9ct.us/contest-antennas/40-m

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40 Meter 4-Square Vertical Array

- A 4-square vertical array is good alternative to a Yagi
  - if you cannot install a "shorty 40" Yagi at least 70 feet high
- Install at least 60 shallow buried 35 foot radials under each vertical
- *Install at least 40 feet from all towers*
  - more than 40 foot spacing will significantly improve its performance
- A 4-square is also an excellent 40 meter receiving antenna

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High Performance 20M Antennas

- A horizontal Yagi or quad is <u>*always*</u> the best choice
  - if you can install your antenna at least 35 feet high
  - 13 to 45 degree elevation beam pattern at -3 dB points
- Moderate gain: small tri-band Yagi, hex-beam, Moxon or quad
  - a small Yagi at least 50 to 70 feet high will produce good DX results
  - 10 to 30 degree elevation beam pattern at -3 dB points
- High gain: full size tri-band Yagi, small monoband Yagi or quad
  - at least 70 to 100 feet high
  - 7 to 20 degree elevation beam pattern at -3 dB points
- Highest gain: stacked large 20 meter monoband Yagis
  - 100 to 140 foot tower with two stacked Yagis and a Stackmatch
  - 170 to 200 foot tower with three stacked Yagis and a Stackmatch
    - *selectable* 3 to 25 degree elevation beam patterns at -3 dB points
  - stack switching (a "Stackmatch") provides high payoff at low cost

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Elevation angles from <5º to 20º are needed

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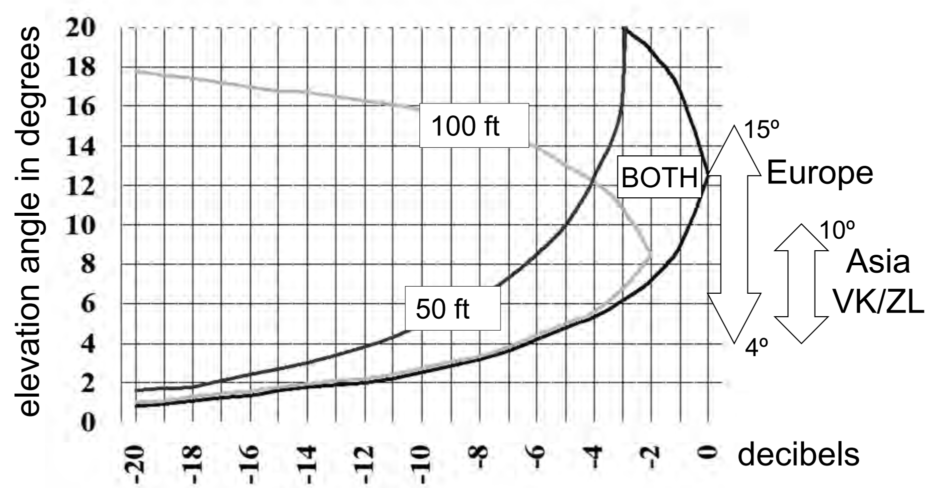
25

Stacked 5 Element 20 Meter Yagis
48 Foot Booms
50 and 100 Feet High



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Elevation angles from <5º to 15º are needed

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26

Telrex 20, 15 and 10 meter stacked Yagis revolutionized competitive HF antennas in 1955

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Array Solutions Stack Match

The Stackmatch revolutionized the performance and flexibility of stacked Yagi antennas

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www.arraysolutions.com/Products/stackmatch.htm

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28

High Performance 15M Antennas

- A horizontal Yagi or quad is *<u>always</u>* the best choice
  - if you can install your antenna at least 25 feet high
  - 13 to 45 degree elevation beam pattern at -3 dB points
- Moderate gain: small tri-bander Yagi, hex-beam, Moxon or quad
  - a small Yagi at least 50 to 70 feet high will produce good DX results
  - 7 to 20 degree elevation beam pattern at -3 dB points
- High gain: full size tri-band Yagi, small monoband Yagi or quad
  - at least 70 to 100 feet high
  - 5 to 15 degree elevation beam pattern at -3 dB points
- Highest gain: stacked large 15 meter monoband Yagis
  - at least a 90 foot tower with two stacked Yagis and a Stackmatch
  - at least a 120 to 140 foot tower with three stacked Yagis and a Stackmatch
    - *selectable* 5 to 25 degree elevation beam patterns at -3 dB points
  - stack switching (a “Stackmatch”) provides high payoff at low cost

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Elevation angles from <5º to 15º are needed

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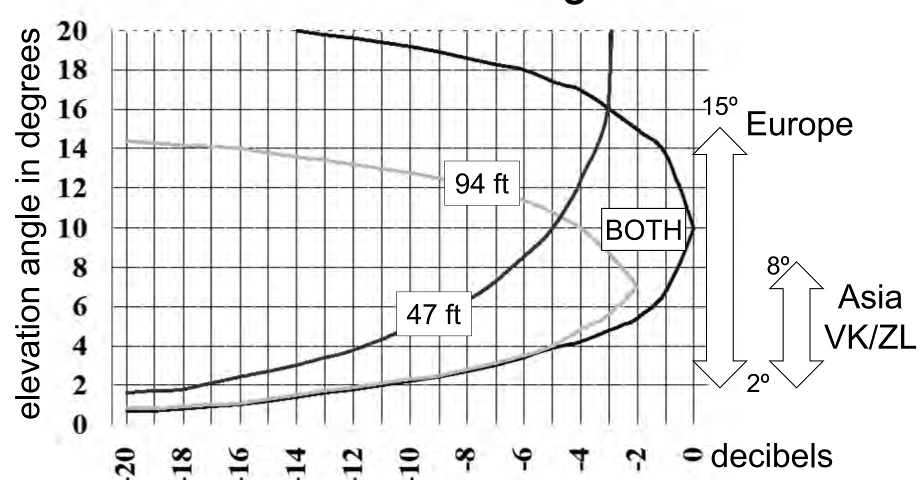
29

Stacked 6 Element 15 Meter Yagis
48 Foot Booms
47 and 94 Feet High



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Elevation angles from <5º to 15º are needed

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30

High Performance 10M Antennas

- A horizontal Yagi or quad is always the best choice
  - if you can install your antenna at 20 feet high or higher
  - 13 to 45 degree elevation beam pattern at -3 dB points
- Moderate gain: small tri-bander Yagi, hex-beam, Moxon or quad
  - a small Yagi at least 35 to 50 feet high will produce good DX results
  - 7 to 20 degree elevation beam pattern at -3 dB points
- High gain: full size tri-band Yagi, small monoband Yagi or quad
  - at least 50 to 70 feet high
  - 5 to 15 degree elevation beam pattern at -3 dB points
- Highest gain: stacked large 10 meter monoband Yagis
  - at least a 70 foot tower with two stacked Yagis and a Stackmatch
  - at least a 90 to 100 foot tower with three stacked Yagis and a Stackmatch
    - *selectable* 4 to 20 degree elevation beam patterns at -3 dB points
  - stack switching (a "Stackmatch") provides high payoff at low cost

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Elevation angles from <5º to 10º are needed

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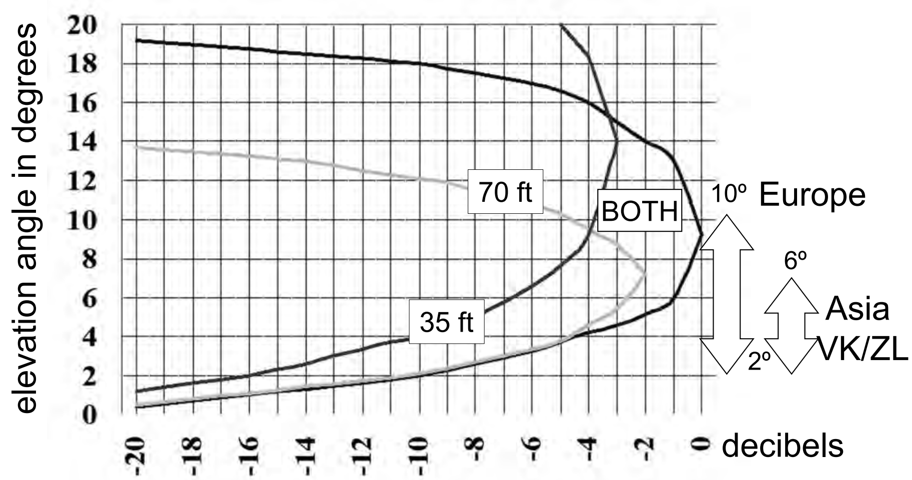
31

Stacked 6 Element 10 Meter Yagis
36 Foot Booms
35 and 70 Feet High



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Elevation angles from <5º to 10º are needed

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32

Competitive One Tower Antenna Systems

- 50-70 foot tower and a small rotator (e.g., HyGain Ham-IV)
  - small tri-band Yagi, Hex-beam or quad
  - 40 and 80 meter dipoles and 160 meter inverted-L
- 70-90 foot tower and a medium rotator (e.g. HyGain T2X)
  - Cushcraft XM-240 two element 40 meter Yagi
  - large tri-band Yagi such as the DX Engineering Skyhawk
  - 80 meter dipole and 160 meter inverted-L
- 100-140+ foot tower and a large rotator (e.g., M2 Orion)
  - Cushcraft XM-240 two element 40 meter Yagi
  - monoband Yagis such as the Hy-Gain LJ series on ring rotators
  - 80 meter dipole and 160 meter inverted-L

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Multi-Tower Antenna Systems

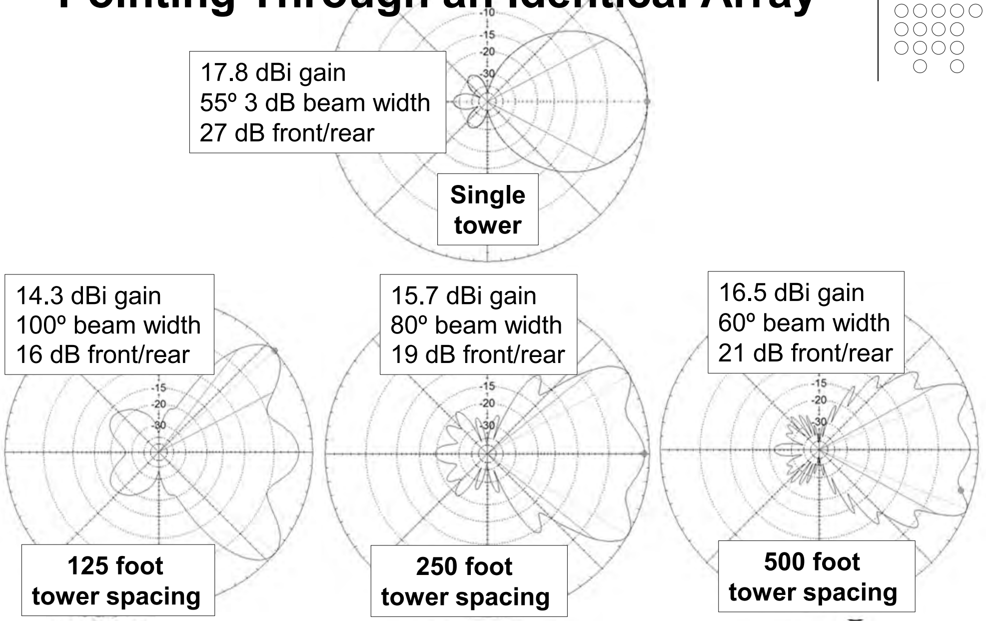
Designing a multi-tower station with acceptable degradation is an antenna modelling challenge

- Placement of Yagis and the relative location of the towers to minimize degradation is critical to achieving high performance
  - in most cases multiple *Triband Yagis* and multiple Yagis for the same band should be installed *on only one tower*
  - placing Yagis covering the same band *on multiple towers* requires detailed antenna modelling
- An excellent design for two towers with minor degradation:
  - tower one: 40 meter Yagi and 10 meter stacked Yagis
  - tower two: 20 and 15 meter stacked Yagis
- An excellent design for three towers with minimal degradation:
  - tower one: 40 meter Yagi and 10 meter stacked Yagis
  - tower two: 20 meter stacked Yagis
  - tower three: 15 meter stacked Yagis

CTU CONTEST UNIVERSITY ncjweb.com/bonus-content/Ant_Interact_Part_6.pdf ICOM

34

20 Meter 6 Element Stacked Yagi Array Pointing Through an Identical Array



35

When Good Antennas Go Bad…
antenna system design issues

- Yagi director installed very close to the tower face
  - spacing *less than one tower diameter* shortens effective director length
- 80 meter dipole installed too close to a 40 meter Yagi
  - improper coaxial cable length makes an 80 meter dipole operate like two 40 meter dipoles tightly coupled to the 40 meter Yagi
- 10 and 15 meter Yagis installed too close to each other
  - use 10 foot minimum spacing unless you model their interactions
- 15 meter Yagi pointed through -- or mounted too close to -- a full size 40 meter Yagi
- Conductive guy wires degrading Yagi antenna performance
- 160 and 80 meter vertical antenna performance degradation caused by installing them too close to towers
- Multiple Triband Yagis or multiple Yagis for the same band installed on two or more towers without detailed modelling

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When Good Antennas Go Bad…
common coaxial cable issues

- Improperly installed connectors
- PL-259 connectors not gently wrench tightened ¼ turn
- Obsolete N connectors with floating pins
  - if you must use N connectors… use *only* captive pin connectors
- Connectors not adequately protected from water and moisture
  - connectors on towers should be mounted horizontally not vertically
- Coax not securely fastened to the tower
- Coax not electrically bonded to the top and bottom of the tower
- Inadequate waterproofing of the coax connection to the antenna
- Coaxial cable shield exposed to rain at the antenna connection
- Undetected rodent damage to coaxial cable jackets and more

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Amphenol 83-1SP
PL-259 Connector

Shell is labeled exactly: Amphenol 83-1SP

Silver Plated Center Pin

Silver Plated Body

newark.com/amphenol-rf/83-1sp/rf-coaxial-uhf-plug-straight-50ohm/dp/59K0534

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This is not a good place to save a few dollars

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Waterproof your Connectors!

Cover your connectors with two 50% overlapped layers of Scotch 130C self-vulcanizing linerless rubber splicing tape
- stretched to 50% of its original width
- sticky side facing out

homedepot.com/p/3M-Scotch-3-4-in-x-30-ft-Linerless-Rubber-Splicing-Tape-41717-BX-10/205523418

Cover the Scotch 130C tape with two 50% overlapped layers of Scotch Super 33+ vinyl electrical tape

homedepot.com/p/Scotch-Super-33-3-4-in-x-66-ft-x-0-007-in-Vinyl-Electrical-Tape-Black-6132-BA-10/304653556

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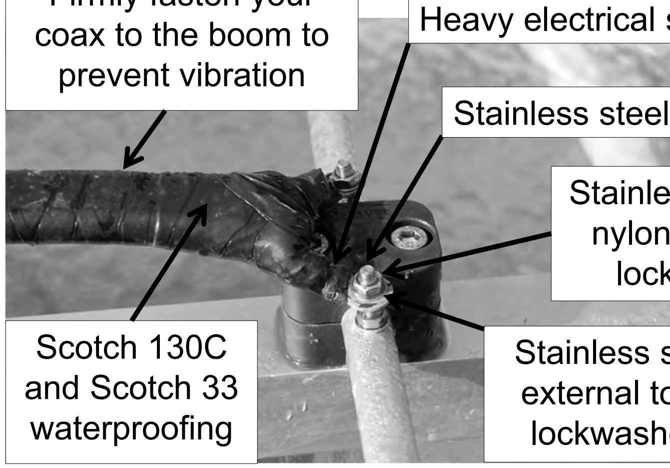
Antenna Feedpoint
Waterproof and Shakeproof Connections



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When Good Antennas Go Bad…
Performance Evaluation
Inspections
Preventive Maintenance

- Maintaining competitive antenna performance
  - antenna performance evaluations
  - tower, foundation and guy wire inspections
  - guy wire, guy hardware and ground anchor inspections
  - rotator inspections
  - coaxial cable inspections and performance measurements
  - coaxial connector inspections   PL-259s and SO-239s

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CTU PRESENTS

Grounding and Bonding For HF Contest Stations

Ward Silver NØAX
Thanks to Contest University and Icom America

1

Goals of the Presentation

- Understand "ground" and "bond"
- Appreciate the different requirements for lightning protection and RF management
- Discuss issues for HF contest stations
- Common system satisfies all requirements
- Provide comprehensive resources

- Note – this in-person talk is an excerpt of the full talk with all slides in the CTU book

Grounding and Bonding for Home and Mobile HF Stations - 2021 2

2

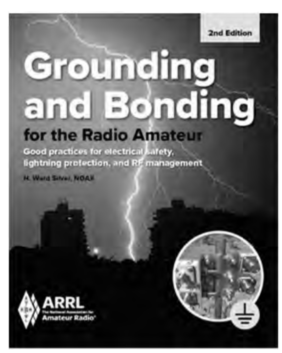
Ham Radio References

- *ARRL Handbook, ARRL Antenna Book*
- *NEC Handbook* – at your library
- *Lightning Protection for the Amateur Station* (Ron Block, NR2B – Jun/Jul/Aug 2002 *QST*) – ARRL website
- *Power, Grounding, Bonding, and Audio for Amateur Radio* and *RFI, Ferrites, and Common Mode Chokes For Hams* – available at **k9yc.com/publish.htm**
- W8JI website (**w8ji.com/ground_systems.htm**) and for mobile stations KØBG website (**k0bg.com**)

Background References

Grounding and Bonding for the Radio Amateur, 2nd Edn

- Covers AC wiring, lightning protection, and RF management
- Reviewed by a number of experts, including the ARRL Lab
- Numerous examples for you to use



What *IS* "Ground" Anyway

- "Ground" has different meanings
  - Noun - an "earth connection" (ac, lightning) or a local reference potential (circuits, RF)
  - Verb - an action "to connect to the reference potential"
  - Adjective - a type of connection, such as a "ground conductor" or "ground system"
- It can mean *all of these things at the same time*
  - "I'm grounding the chassis to ground with a ground wire."

What *IS* "Ground" Anyway

- The Earth is NOT – a magic sink into which we can pour RF or lightning and expect it to magically and safely disappear (same for the vehicle body)
- Fuzzy definitions:
  - "RF ground" – ain't no such thing, only local reference potential
  - "Ground loops" – not the problem you think they are
  - "Single-point ground" – depends on frequency
- Each set of requirements uses "ground" differently

What *IS* “Bonding” Anyway

- Bonding is a connection intended to keep two points at the same voltage
  - Everything goes up and down **TOGETHER**
  - Prevents shock hazards from voltage differences
  - Prevents destructive voltage differences caused by lightning surges
  - Limits current between devices caused by voltage differences from RF pickup

7

What *IS* “Bonding” Anyway

- Sounds hard but it’s not
- Sounds expensive but it’s not
- Requires the right connecting materials and hardware
- Works in your favor for ac safety, lightning protection, and RF management

8

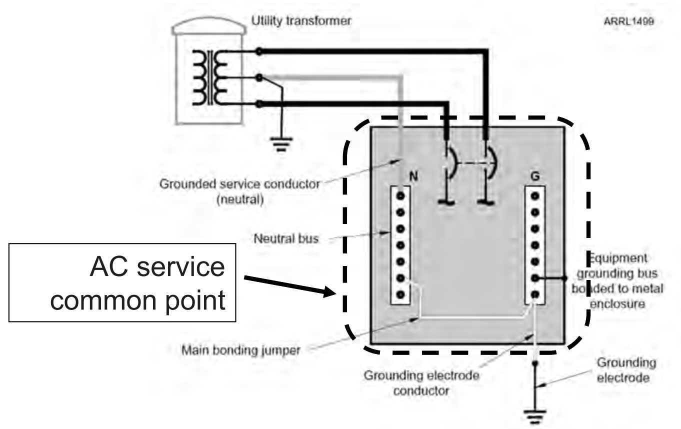
What *IS* "Bonding" Anyway

- For bonding to work, it has to be…
  - Low-Z and "short" at the frequencies of interest
  - Heavy enough to carry the expected current
  - Sturdy enough to survive the environment
- In the ham station, use…
  - Strap (20 ga) or heavy wire (#14 or larger)
  - Flat-weave, tinned braid if equipment moves around (mobile stations, particularly)
    - Exposed braid from old coax deteriorates
    - Protect braid from moisture and chemicals

AC Safety Grounding

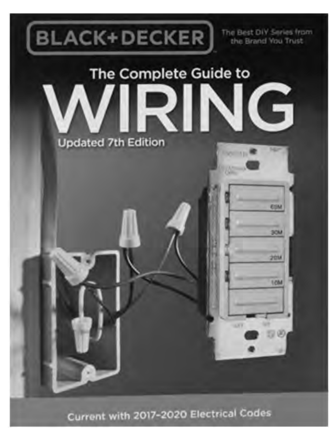
- Grounding for ac safety has several names
  - "Equipment ground", "third-wire ground", "green-wire ground"
- Keep ground connections low-resistance
- Purpose is two-fold
  - Provides a path to ac common point for fault current (shorts, leakage)
  - Earth connections stabilize the ac power system voltage during faults or transients, such as lightning

AC Safety Grounding



AC Safety Grounding

- If you aren't sure you know what you're doing…get a how-to reference
- Follow rules for sub-panels and outbuildings
- Hire a pro electrician to do the work or inspect yours
- Local code is the law



Lightning Protection

- You can't steer lightning, but…you *can* help lightning make "good decisions"
  - Heavy, direct paths to the Earth to dissipate charge in the ground
  - Inductance is more important than resistance
  - Paths should be *outside* your residence
  - Don't make it easy for lightning to go <u>through</u> your station on its way to the Earth

Grounding and Bonding for Home and Mobile HF Stations - 2021

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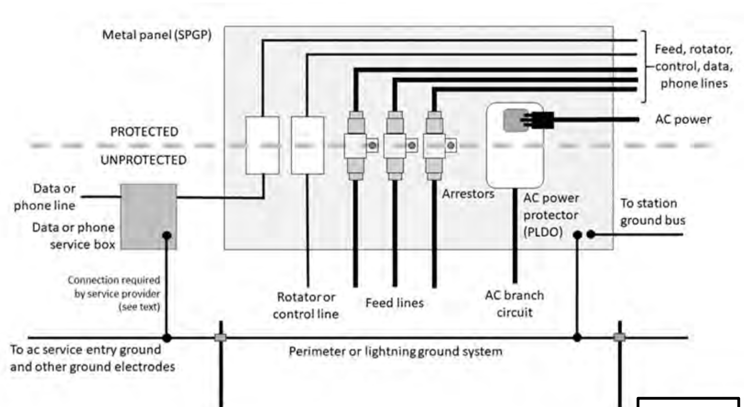
Lightning Protection

- Single-point Ground Panel (SPGP)



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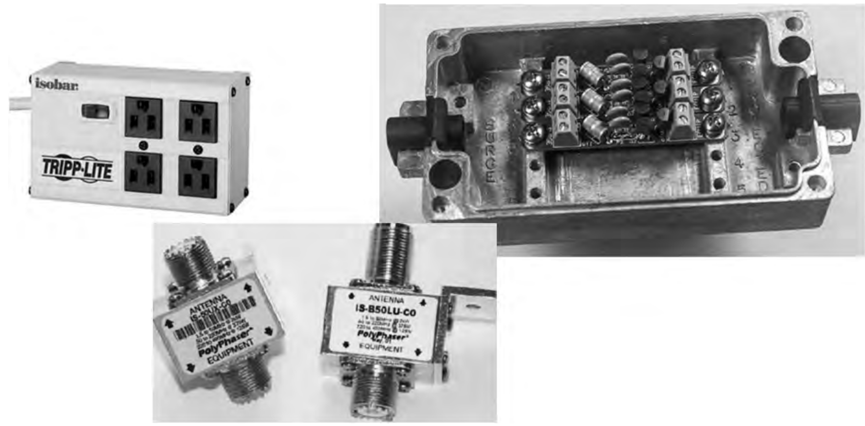
Lightning Protection



Lightning Protection

- Single-Point Ground Panels
  - Bonds grounds of all entry paths
    - Connected to perimeter ground
  - All protectors “fire” at the same time
    - Minimize voltage differences due to transient timing
  - Includes non-RF and AC power
  - Keep protected and unprotected cables separated

Lightning Protection

- Single-point Ground Panel (station entry)

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Lightning Protection

- Single-point Ground Panel (in station)

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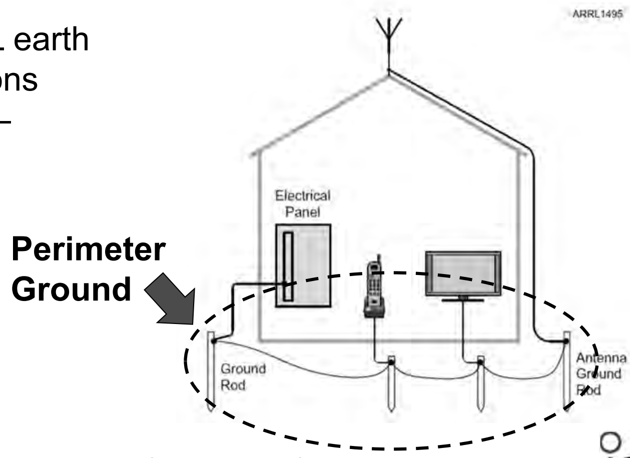
Lightning Protection

Bond ALL earth connections together – required!



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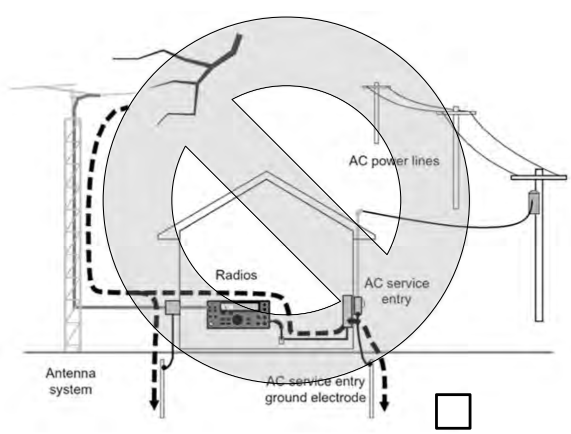
Lightning Protection

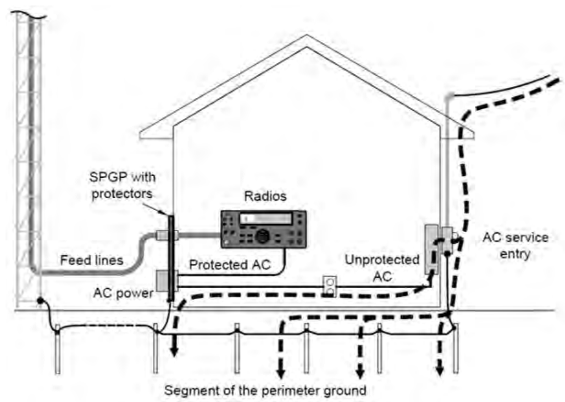
- Don't create low-impedance paths *through* your station



20

Lightning Protection

- Ground paths should go *around* your station



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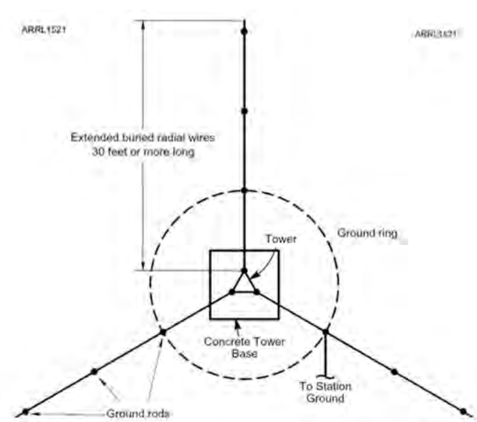
Grounding and Bonding for Home and Mobile HF Stations - 2021

ICOM 21

21

Lightning Protection

- Rods and radials
- Bond feed lines to the tower every 50 feet



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22

Lightning Protection

- Bond feed lines to the tower

- Spark gaps

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23

Lightning Protection

- Single-point Ground Panel (tower base)

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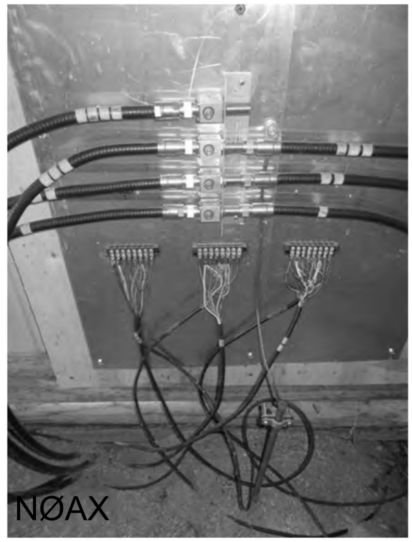
Lightning Protection

- Single-point Ground Panel



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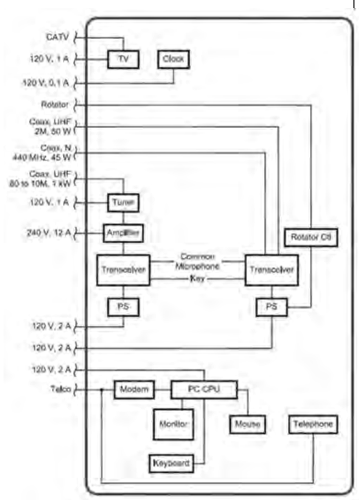
25

Lightning Protection

- Ron Block NR2B's 2002 *QST* articles
- Protected Zones
  - Every line crossing the boundary ***must*** be protected by a common or bonded ground connection
  - Bond equipment within the station



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RF Management

- Everything in the station is an antenna

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HF Stations - 2021

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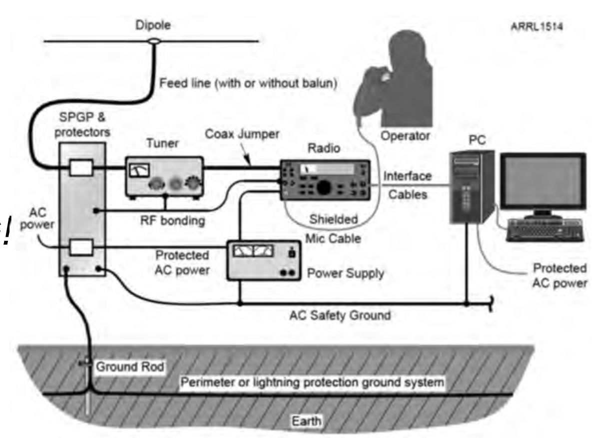
RF Management

- ***EVERYTHING!***



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HF Stations - 2021

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28

RF Management

- <u>Everything</u> in the station is an antenna
- Forget about an all-band "RF ground"
  - Concentrate instead on bonding
  - Keep connections *electrically short*
  - Keep everything at the <u>SAME</u> voltage
- Amplifiers = high RF field strength
  - Requires extra attention to bonding
- Create common reference plane and/or bus

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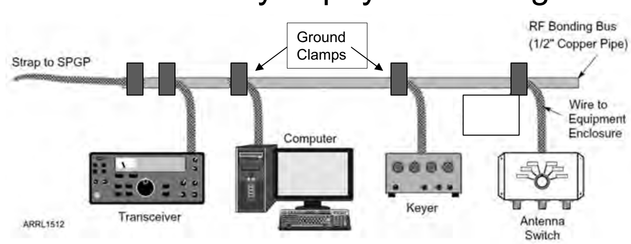
RF Management

- Bonding inside the station
  - Eliminates "hot spots", reduces "buzz" and hum
  - Reduces RFI from common-mode current
  - Reduces sensitivity to physical configuration



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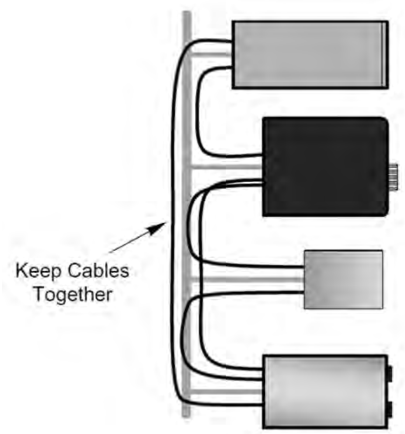
30

RF Management

- Minimize loop area and cable length
- Short or coiled cables
- Use a bonding bus and reference plane
- Use shielded cables
- Short straps or wires



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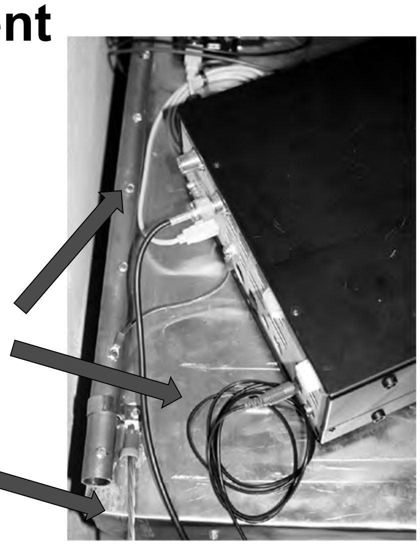
RF Management

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



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32

RF Management

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33

Ground System Review

- A single, solid ground system made of short, heavy, direct connections can satisfy all of the requirements for…
  - AC Safety
  - Lightning Protection
  - RF Management & Clean Audio
- Bond all grounds, keep protectors together
- Perimeter ground helps keep lightning currents outside the building
- All currents flow on all wires

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The Mobile Station

- RF issues can be more intense – you're IN the antenna!
- Special power wiring considerations
- Bonding and the vehicle body
- Mounting antennas

35

Mobile Power

- Fusing, Ampacity, Voltage Drop
- Power return and Battery Monitoring System
- RF pickup
- DC-DC Boosters

36

Fusing, Ampacity, Voltage Drop

- Fuses in BOTH leads – ALWAYS
- Adequate rating of power connection
  - Power sockets in the vehicle not sufficient
- Power wiring must be adequately sized
  - Max R = Max V drop / Max I
  - 0.5 V / 25 A = 0.02 Ω
  - 20 feet of #10 AWG wire
- Mobile radios need at least 11 V and usually more
- Don't forget connector resistance!

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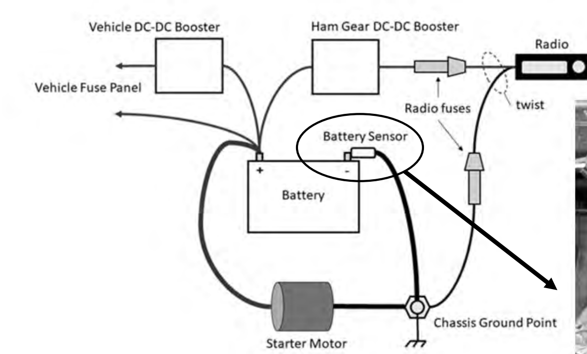
Power Return Connection



Battery Management Systems (BMS)

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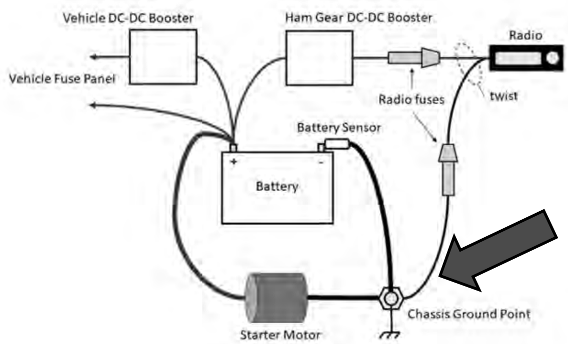
Power Return Connection

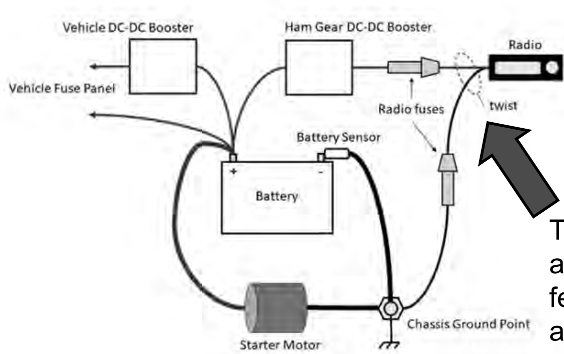


Connect dc return here – NOT to the negative battery terminal

"Home-run wiring"

39

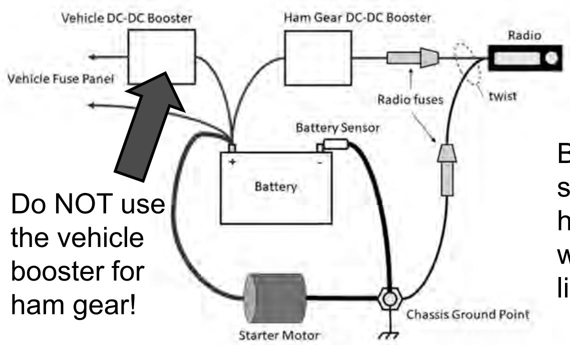
Power Return Connection



Twist wires and install ferrite cores at the radio to reduce RF pickup

40

DC-DC Boosters



Do NOT use the vehicle booster for ham gear!

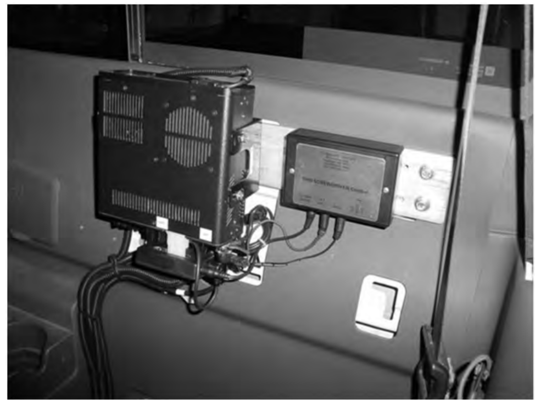
Boosters should use home-run wiring just like radios

Bonding in Mobile Stations

- Body components not always well-bonded or even metallic!
- Don't use sub-system ground points
  - Intermittent dc voltage drops
  - Can upset sub-system operation
- Bonding to body creates new return and RF paths
- Protect connections with anti-corrosion compound designed for vehicle use

Mounting Equipment

- Single pieces of gear don't need bonding
- Body panel is part of the antenna system
  - May require isolated sub-panel mount
- Don't bond control head to body



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Mounting Equipment

- Standalone mini-racks
- Truck toolboxes
- Carry-case stations
- Security issues
- Bond internally
- No need for vehicle bond

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HF Stations - 2021

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44

Mounting Equipment

- Mechanical security is paramount
- Watch out for air bags!
- Use channels under trim strips
  - Helps shield from direct RF pickup
  - Protects cables
- Watch out for hidden wiring!
- Service bulletins and repair manuals may help

Mounting Antennas

- Bond to body *AT* the antenna
  - Through-panel NMO probably the best
  - Lip mounts need additional body bond at HF
  - Beware of paint and coatings!
- Mag-mounts don’t work well at HF
  - Insufficient body coupling (100 pF per magnet)
  - Coax shield is part of the antenna – causes RFI
  - Need extra body bond wire (also part of antenna)
- Decouple at the antenna and at radio

Buying and Planning

- Upfit packages
- Fleet sales and re-sales
- Service department guidance
- Manufacturer's service bulletins
- Car audio and two-way radio shops

ARE WE DONE YET? (almost…)

Additional Resources

- Professional Associations and Companies
  - National Fire Protection Association (**www.nfpa.org**)
  - International Association of Electrical Inspectors (**www.iaei.org**)
  - Mike Holt Enterprises (**www.mikeholt.com**) — training and continuing education for electricians, many tutorials
  - Polyphaser (**www.polyphaser.com/resources/white-papers**) — various papers and tutorials on lightning protection for communications facilities, including ham stations

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Additional Resources

- Standards
  - *Standards and Guidelines for Communication Sites* (Motorola R56) – available online
  - *FAA Document on Practices and Procedures for Lightning Protection, Grounding, Bonding, and Shielding Implementation* — **www.faa.gov/documentLibrary/media/Order/6950.19A.pdf**
  - IEEE Std 1100 – 2006, *IEEE Recommended Practices for Powering and Grounding Electronic Equipment* — **www.ieee.org** (available from most libraries)
  - MIL-HDBK-419A – *Grounding, Bonding, and Shielding for Electronic Equipments and Facilities (Vol 1 and 2)* — **www.uscg.mil/petaluma/TPF/ET/_SMS/Mil-STDs/MILHDBK419.pdf**

50

Additional Resources

- Books and Online Material
  - Block, R. R., The “Grounds” for Lightning and EMP Protection, Second Edition, PolyPhaser Corporation, 1993.
  - Rand, K. A., Lightning Protection and Grounding Solutions for Communications Sites, PolyPhaser Corporation, 2000.
  - ARRL Technical Information Service sections
    - Electrical Safety — **www.arrl.org/electrical-safety**
    - Grounding (various types and topics) — **www.arrl.org/grounding**
    - Lightning Protection - **www.arrl.org/lightning-protection**

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THANKS!!

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Operating Mechanics: The X-Factor in Contesting Success

Patrick Barkey, N9RV

1

The Lesson of the Howie Meeker Hockey School

2

The Lesson of the Howie Meeker Hockey School

- Do you know how to play hockey?
- Sure, you skate around on the ice and slap at pucks
- But can you:

  - find skates that fit
  - skate with power
  - put your weight into your shot
  - pass to a moving player
  - change direction and cross over

- Do you know how to operate contests?
- Sure, you load up your software and answer and run guys
- But can you:

  - copy calls correctly
  - answer a question
  - ask for a repeat
  - deal with an interloper
  - handle a zero beat pileup
  - get through a pileup
  - control your frequency

3

NTS in 1969: Contest Camp?

- Copy it right – no repeats
- Learn how to ask for a fill
- Listen and respond to instructions
- Send CW

4

Boot Camp for CW Contesters

- Send “Mississippi.” (No QRS)
- Ask NO3M to QSY to 10 meters.
- Respond to N2NT when he asks for a fill on your Check (after you mashed your 2nd radio CQ button
- Operate the CW Sprint.

5

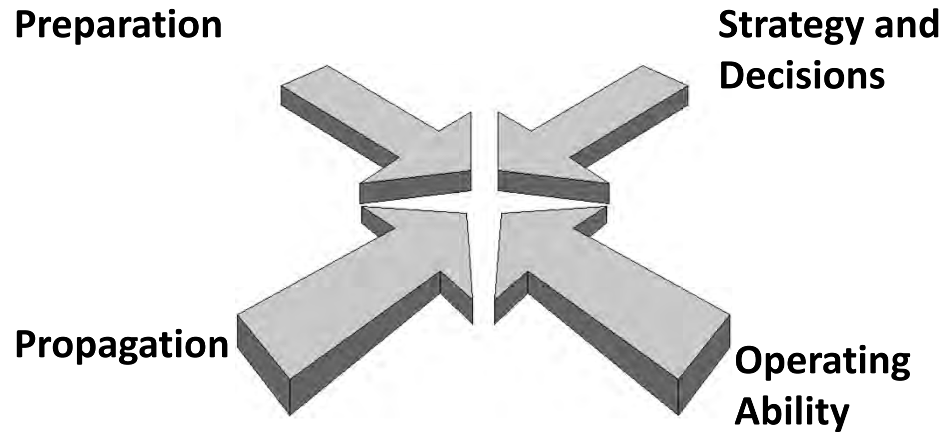
Actual Quotes Heard During Multi-Op Contests*

- “ … the band is really hot. Let’s tune for a while.”
- “ … wow, that was the first 60 hour I’ve ever had.”
- “There’s too many of you calling at once. QRZed”
- “Who reset my keyer memories with all these short CQs?”

* Not at K3LR

6

Keys to Contest Success



7

Operating: Can it be taught?

- No, it can only be "absorbed."
- Yes, but if I teach you I will have to kill you.
- Yes, but the lessons can only be learned through experience.

8

Many Contesters Don't Want to Learn!

- Operating is personal. Egos are fragile.
- Stubborn personalities abound ("This is how I've always done it").
- Some of us cling to "facts" that don't pan out. ("You need to call slower CQs to work more guys")

9

"Natural" Operating Ability

- Hearing
- Reaction time
- CW sending/receiving
- Coordination
- Enunciation
- Typing Ability

10

But there is technology that can help compensate:

- Computer / memory keyers
- Call sign databases
- Filters and directional antennas
- Digital Voice Keyers
- Morse Runner

11

The Logic of Contest Operating

Maximize Score

⇩

Maximize Speed

⇩

Maximize Efficiency

12

The Basics of Running Stations

- What you nominally communicate:

  Callsigns and exchanges

- What you really want to communicate:

  Frequency control

13

Do's and Don't's of Frequency Control

- Complete callsigns
- Establish rhythm
- Be professional
- No "dead time"
- Respond to the flow of rate

- Long pauses before response
- Needless repeat of information
- Cursing competition or chatting with friends
- Out of synch

14

Different Paces of a Contest

- Exploratory / Beacon
- Open for Business
- Normal / Fast
- Turbo / Burst

15

How to Run Faster Rate

- Be prepared for content
- Recognize and respond to complete callsigns
- Transmit only as necessary
- Know when to dig

16

Prepare yourself to copy

- Focus attention at end of each CQ
- Hands on the keyboard
- RIT cleared
- Filters wide

17

Capturing complete callsigns

- The importance of getting complete, accurate data the first time
- Master the mechanical skills first
- Learn to type
- Learn to send
- Learn to use your contest software to respond with no delay

18

The mental side of copying calls

- Using your brain as a time-delay filter
- Know what to expect
- Assess and adjust to overcome your limitations
- Use every crutch and gimmick you can

19

Tightening up your act

- Dead time will kill you
- Learn a way to cut it out or your competition will eat you alive
- Possibilities include:
  - Keep a hand on the paddle
  - Learn to use your software
  - Responding to sounds, not calls

20

Cutting out the fluff

- You are working the next person in line, not the station you're logging
- Every transmission has a purpose
- The most effective way to handle an interloper is to work people

21

Improving your operating mechanics

- Make it a priority
- Get on the air
- Listen to the great ones
- Join a serious multi-op effort
- Evaluate yourself frequently

22

Criteria For Evaluating Your Operating Techniques

- Accuracy
- Efficiency
- Frequency Control
- Ethics

23

Plenty of Bad Habits to Imitate

- “TU”
- “The timing was right”
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

24

Plenty of Bad Habits to Imitate

- "TU"
- "The timing was right"
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

"What's wrong with saying thank you?"

Not signing your call when you are QRZ is a fool's savings.

Frustrates your pileup

Out of synch

Produces errors in other's logs

Not in the spirit of the contest

When should you do it?

NEVER!!!

25

Plenty of Bad Habits to Imitate

- "TU"
- "The timing was right"
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

"Not sure who he came back to?"
Hit F4 (sends your call).

"Hey, I've got a 'V' in my call!" F4

"I really need this guy." F4

"My F4 key sends my call *twice*."

Sadly, this often works

When everyone does it, it slows rate to a crawl.

Your reputation will suffer

26

Plenty of Bad Habits to Imitate

- "TU"
- "The timing was right"
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

We have all done this:

You call in an ugly pile. You hear the guy clearly coming back: "599 34." Oh boy!

But did he come back to you?

Do not, repeat not, send a report.

Send your call again, send "AGN", or just wait.

If he is really calling you, he will repeat his exchange. If not, you have avoided a NIL.

27

Plenty of Bad Habits to Imitate

- "TU"
- "The timing was right"
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

Phone SS True Story:

"… N9 Radio Victor, Check Six Seven, Montana."

"Are you sure you're in Montana? My database says Indiana."

"Well, the view out my window says I'm in Montana."

Do you believe your database *this* much?

28

Plenty of Bad Habits to Imitate

- "TU"
- "The timing was right"
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

Often hear this in state QSO parties or even CW SS from casual contesters.

Lack of response – dead time.

Can occur for many reasons. Software glitch. Spilt your coffee. But most often because something the other guy sent was not understood.

Whatever the reason, the effect on rate is the same: disaster.

Send something! Even a question mark is better than silence.

29

Plenty of Bad Habits to Imitate

- "TU"
- "The timing was right"
- Believing the database
- Deer in the headlights
- Believing the spot
- F4 mashing
- Failing to confirm
- Losing control

If you bust someone's call and they give you the correction, you must send the correction back to them.

You are not "saving time" by omitting this step. You are risking a NIL because they might not log you.

30

See how many operating mistakes you can find in this clip!

31

What About SSB Contesting?

SSB is easier, right?

32

A Few Comments on SSB Mechanics

- SSB is different than CW because you can communicate a tone as well as information
- Friendly, firm, professional
- Rhythm, efficiency just as important as CW
- SSB contesting also draws you into more conflict than CW
- Work people! You don't get points for cursing the competition.
- The art of frequency maintenance (or the decision of whether to try)

33

CTU 2022 Presents

Taking Digital Contesting to the Limit

Ed Muns, W0YK

1

Digital Contesting to the Limit

- RTTY Contesting
  - TX bandwidth
  - RX bandwidth
  - UOS and hyphen
  - Multiple decoders
  - SO2V
  - SO2R
- FT8/4 Contesting
  - CQ vs. S&P mode
  - FT8/4 & even/odd
  - Working non-contesters
  - Superfluous 2nd QSL

2/40
19 May 2022

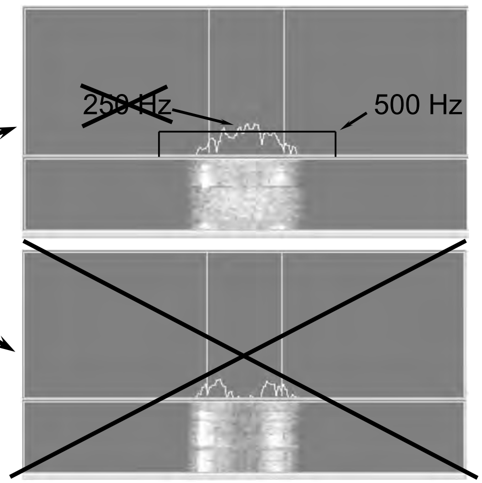
2

RTTY Receive Bandwidth

radio IF filtering

Narrow IF filters

- 500 Hz - normal
- 250 Hz - extreme QRM
- Tone filters – don't use!
  - Icom Twin Peak Filter
  - K3 Dual-Tone Filter



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RTTY Transmit Bandwidth

unnecessary QRM

- Wasted power outside receiving decoder BW
  - Suitably narrow TX BW effectively amplifies signal
- Unnecessary QRM
  - Wide 1.5 KW RTTY can QRM 5-10 channels
  - Similar to CW key click problem of the past

Why hurt yourself AND QRM close-by stations?

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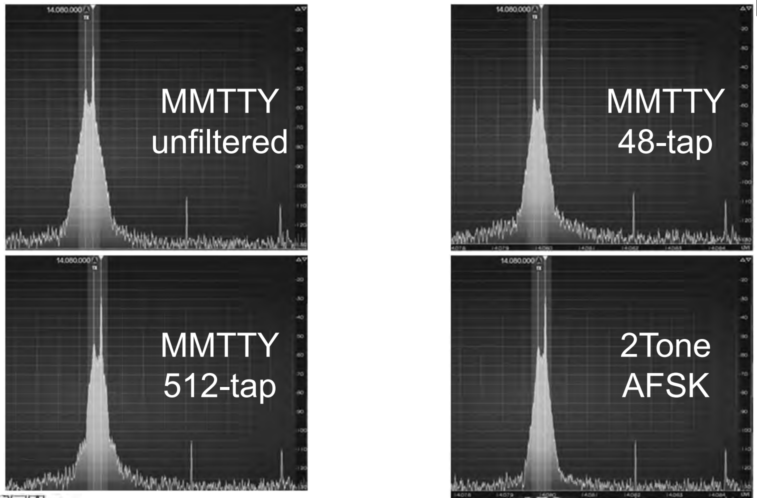
RTTY Transmit Bandwidth

AFSK



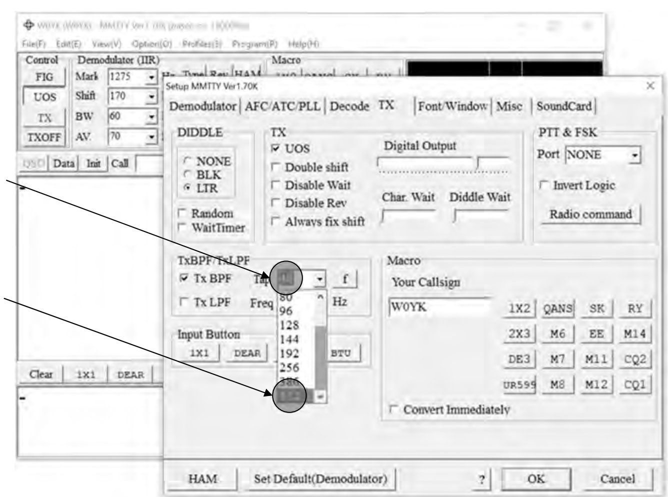
5

Tx BPF Setting

MMTTY

default 48

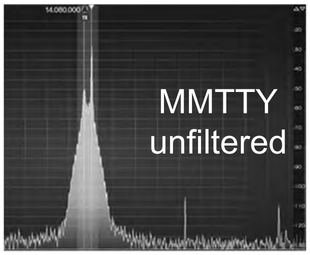
select 512

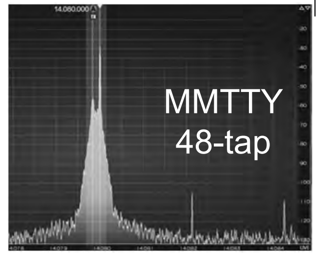


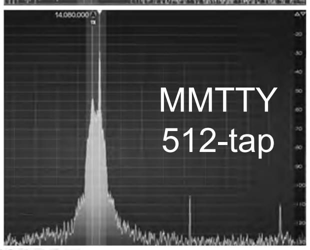
6

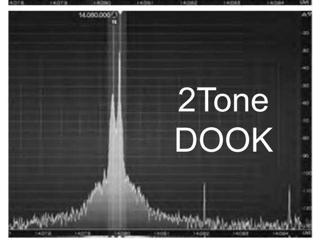
RTTY Transmit Bandwidth

AFSK – 2Tone DOOK









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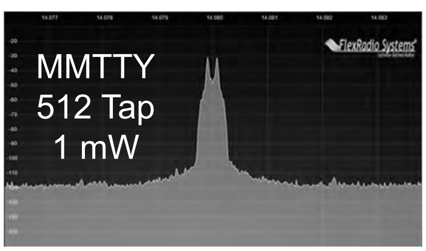
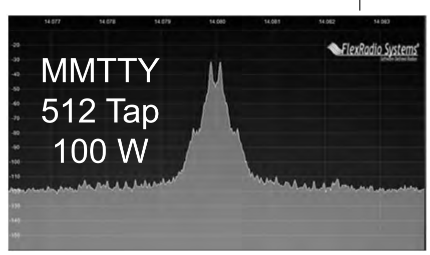
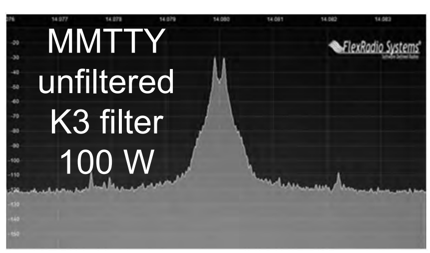
7

RTTY Transmit Bandwidth

AFSK - ***PA IMD effect***







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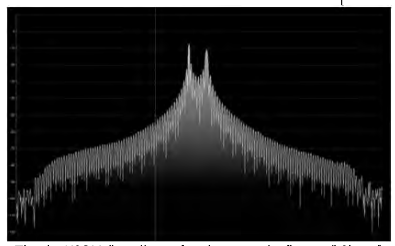
8

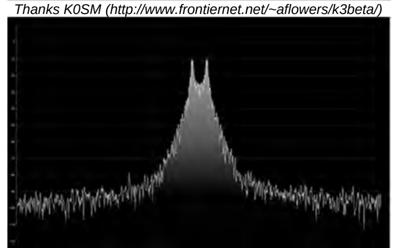
RTTY Transmit Bandwidth

FSK

- Old K3 FSK bandwidth
  - No waveshaping
  - < DSP281 firmware
  - Typical of all radios
  - 50 watts
- New K3 FSK bandwidth
  - Optimal DSP filter
  - DSP281 firmware, March 2013



Thanks K0SM (http://www.frontiernet.net/~aflowers/k3beta/)



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9

UOS

(Unshift-On-Space)

- Receive UOS:
  - Space character forces a shift to the Letters set
  - Increases noise immunity for alpha text
- Transmit UOS:
  - Sends FIGS character after Space, before numeric “word”
- Contest exchanges are alpha and numeric
  - Should UOS be on or off?
  - Should Space or Hyphen delimit exchange elements?
    - 599 1234 1234 or 599-1234-1234
- *Recommendation:*
  - *Turn on both RX & TX UOS and use Space delimiters*

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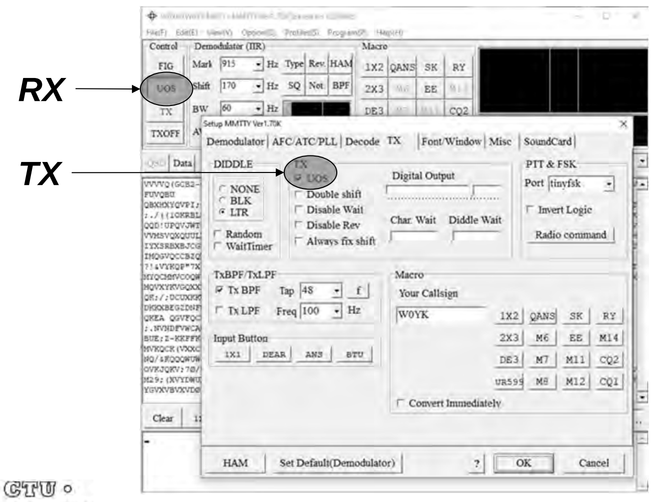
UOS

MMTTY

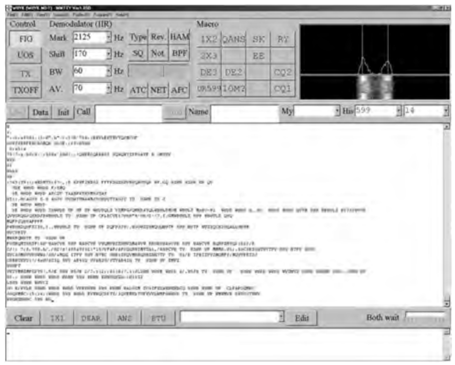


Multiple Decoders

- Parallel decoding with
  - Different decoders
  - Different decoder “profiles”
  - Different RX IF bandwidths (dual receivers)
- Reduces repeats
- Almost “free”
  - Screen space for multiple decoder windows
    - Can be relatively small
  - CPU performance

Multiple Decoders

MMTTY



- Dominant SC MODEM
- Standalone, or …
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced June 2000
- Mako Mori, JE3HHT

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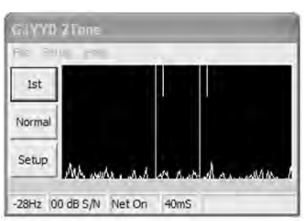
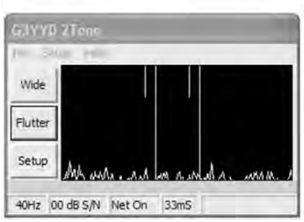
Multiple Decoders

2Tone





- Outperforms MMTTY ?
- Uses less CPU cycles
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced late 2012
- David Wicks, G3YYD

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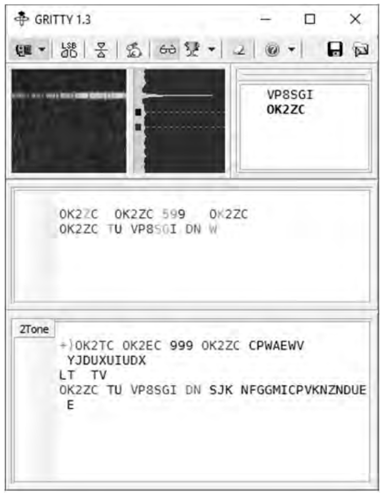
Multiple Decoders

GRITTY

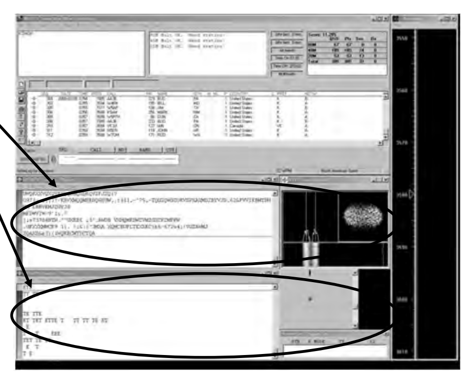


- Best accuracy ?
- Bayesian statistics
- Standalone, or …
- Contest loggers:
  - N1MM Logger+ only
- Introduced late 2015
- Alex Shovkoplyas, VE3NEA

Multiple Decoders

MMTTY & DXP38

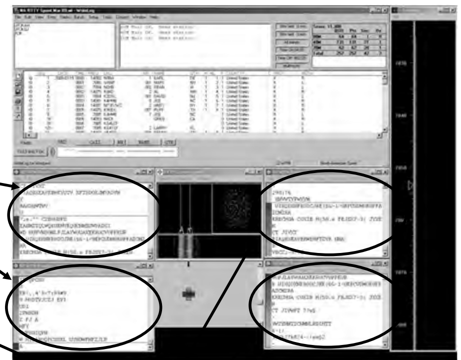
- Parallel decoding
  - Software, e.g., MMTTY
  - Hardware, e.g., DXP38
- Diverse conditions
  - Flutter
  - Multi-path
  - QRM, QRN
  - Weak signals
  - Off-frequency stations



Multiple RTTY Decoders

multiple MMTTY profiles

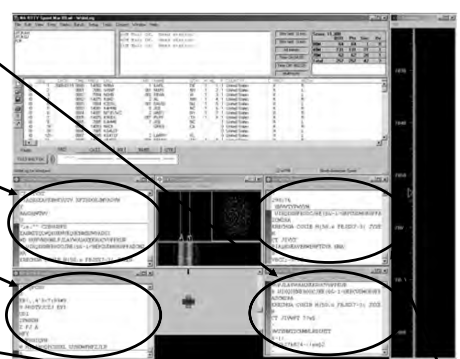
- Parallel decoding
  - same audio stream
  - switching takes too long
- Multiple profile windows
  - Standard
  - Fluttered signals
  - Fluttered signals (FIR)
  - Multi-path
  - hyper sensitive
  - EU1SA
  - AA6YQ-FIR-512
    - weak signals in QRN



Multiple Decoders

two IF bandwidths

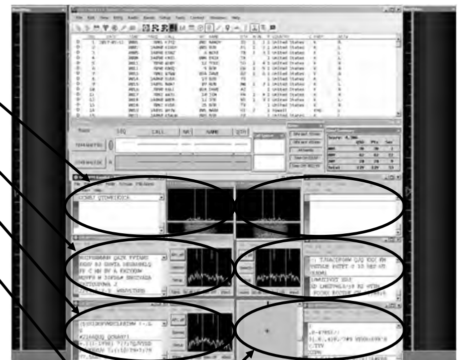
- Narrow IF filtering (main RX)
  - Hardware modem, i.e. DXP38
  - MMTTY profiles:
    - Standard
    - Fluttered signals
    - Fluttered signals (FIR)
    - Multi-path
    - hyper sensitive
    - EU1SA
- Wide IF filtering (sub RX)
  - MMTTY profile:
    - AA6YQ-FIR-512
      - Dual Peak Filter
      - “Matched filter”



Multiple Decoders

SO2V

- VFO-A (main RX)
  - MMTTY Standard profile
  - 2Tone Flutter profile
  - 2Tone Selective profile
  - DXP38
- VFO-B (sub RX)
  - MMTTY Standard profile
  - 2Tone Flutter profile
- 6 decoders
  - A→B



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Multiple Decoders

Tone choices for monitoring

- Low tones are less fatiguing
  - Use high tones for secondary audio stream(s)
- Low/High tones can be mixed to put two audio streams in one ear:
  - SO2R plus SO2V per radio (4 streams)
  - SOnR (3+ streams)

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SO2V

"1BSIQ"

1. [single rcvr] If Assisted and running on VFO-A, then
   - A<>B, click spot, tune, ID station, work station
   - A<>B, resume running

   Toggle as needed
2. [dual rcvr] Set up decoder windows on VFO-A and VFO-B
   - Radio must have two true receivers
   - Monitor both frequencies simultaneously with right/left channels of sound card and separate RTTY windows
     - Left-click call from 2nd RTTY window into VFO-B Entry Window
   - Two ways to transmit on VFO-B:
     1. A<>B, work the mult, A<>B *(but, mixes print from two frequencies)*
     2. SPLIT, work the mult, un-SPLIT, resume running
        - Requires "wire-OR'd" FSK or AFSK and two transmit RTTY windows
          - WriteLog Shared Com Port obviates the wire-OR
        - K3/WriteLog invokes SPLIT when VFO-B call is clicked

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SO2R

- Eliminates SO1R RTTY "boredom"
- Think beyond run and S&P:
  - Dueling CQs; run on two bands simultaneously ***(2BSIQ)***
  - S&P on two bands simultaneously, esp. w/Packet
  - SO2V on one or both radios (SO4V!)
- [optional] Two networked computers:
  - Eliminates swapping radio-focus
  - Display room for more decoder windows per radio
  - RTTY doesn't require much typing; mini-keyboards
  - 2 x SO2V=SO4V for picking up mults on both run bands
  - Easily extendible to SOnR

No time to watch TV or read spy novels!

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SO2R

"M2" configuration

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SO2R in the NA Sprint

maximize TX duty cycle

- Set VFOs at least 10 kHz apart on both radios
- Find a clear spot on one radio and CQ while you tune the other radio for a station to work
- If you don't find a station to work before the CQ finishes, find a clear frequency and duel CQ
- After a QSO, swap VFOs on that radio, search during other transmission, then resume dueling CQ
- Don't waste time trying to work the "couplet" … CQing is OK in Sprint!

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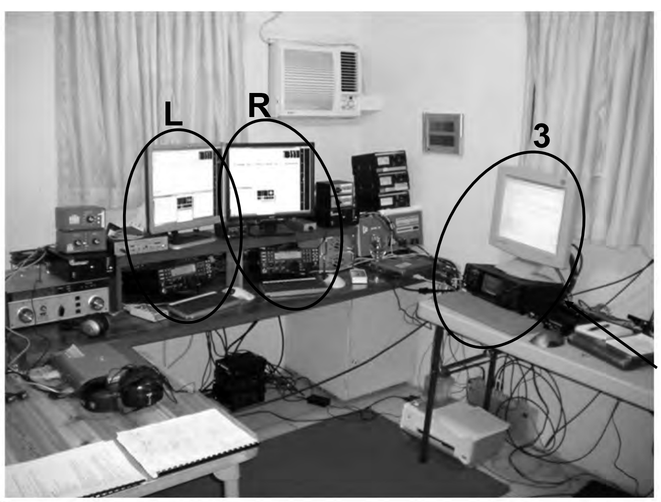
SOnR

> 2 radios

- Simplify antenna/filter band-decoding:
  - Dedicate a band/antenna to the 3rd (or 4th) radio
- Networked PC/radio simplifies configuration
- RTTY (vs. CW or SSB) easier for operator
  - PC decodes for operator
  - Low tones & high tones allows two radios per ear
    - Classic audio headphone mixer (per ear) provides radio A, radio B or both

SOnR

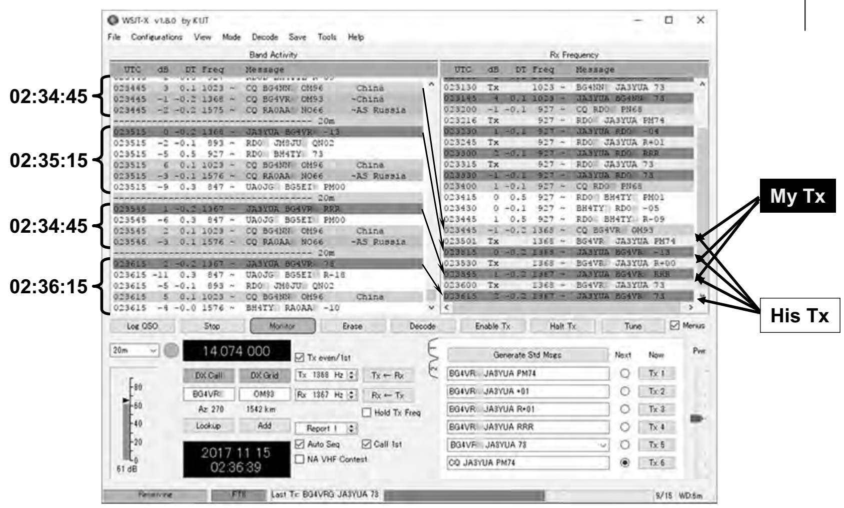
Multi-Multi configuration



dedicated to 10 meters

FT8 Multi-Channel Reception

Run vs. S&P is irrelevant



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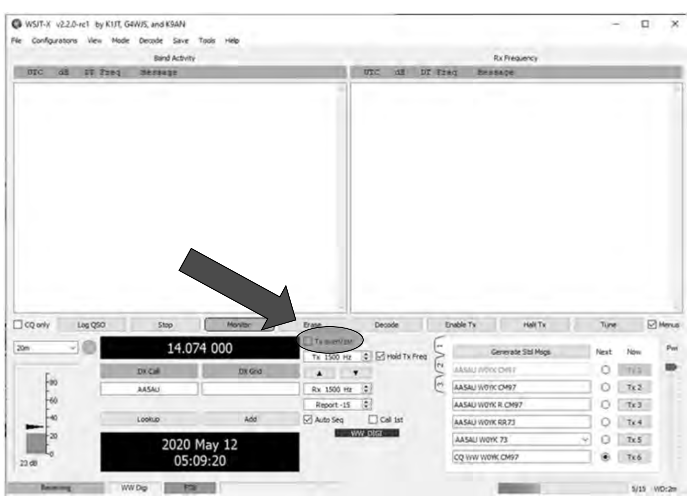
Rotate Odd/Even Cycles



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Rotate FT8/FT4 Modes

Working Non-Contesters

- Depends on contest
  - Grid Square exchange
  - QTH, serial number, name, etc.
- Transparant … unless
  - Non-contester skips Tx2, answering with Tx3
- ***Recommendation: Don't call CQ, only answer CQs or messages with Grid Square***

Two Generals Problem [1]

unreliable communication

[1] E. A. Akkoyunlu, K. Ekanadham, and R. V. Huber, 1975
"Some Constraints and Trade-offs in the Design of Network Communications", page 73

- 1975 computer science thought experiment
- Communication over an unreliable link
  - eg., TCP
- ACKs could theoretically be infinite
- Solution
  - Accept some uncertainty; don't try to eliminate
  - Mitigate to reduce consequence(s)

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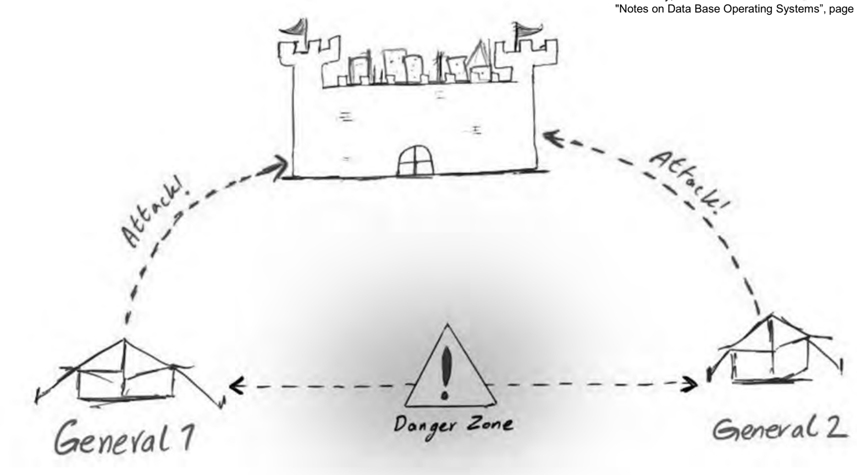
Two Generals Paradox [1]

unreliable communication

[1] Jim Gray, 1978
"Notes on Data Base Operating Systems", page 465



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Radiosport Solution

CW, SSB & RTTY

- Each QSO partner QSLs the exchange ***once***
- Context reduces uncertainty
  - Other station doesn't repeat their last message
  - Other station doesn't ask for a repeat
  - Other station rolls into their next QSO

Radiosport Solution

FT8 & FT4

- One QSO partner QSLs the ***QSL***
- Implied by default WSJT-X logging behavior
- Defacto expectation
  - Many FT ops won't log the QSO without this superfluous QSL of the final QSL
  - Thus, NIL rate increases
    - CW, SSB & RTTY = 1-2%
    - FT = 4-5%

WW Digi QSO

CQ W0YK CM97
W0YK AA5AU EL92 ←*AA5AU calls with exch*
AA5AU W0YK R CM97 ← *W0YK QSL with exch*
W0YK AA5AU RR73 ←*AA5AU QSL*
AA5AU W0YK 73 ← *W0YK QSLs AA5AU's QSL!*

This wastes time because W0YK could have used the message to CQ or answer another caller.

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WW Digi Alternative QSO

context

CQ W0YK CM97
W0YK AA5AU EL92 ←*AA5AU calls with exch*
AA5AU W0YK R CM97 ← *W0YK QSL's with exch*
W0YK AA5AU RR73 ←*AA5AU QSL's*
CQ W0YK CM97 ← *W0YK calls CQ,*
or
AC0C W0YK R CM97 ← *W0YK rolls into next QSO*

AA5AU then knows, by context, that W0YK received his QSL message

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WW Digi Alternative QSO

message repeat

CQ W0YK CM97	
W0YK AA5AU EL92	*←AA5AU calls with exch*
AA5AU W0YK R CM97	*← W0YK QSL's with exch*
W0YK AA5AU RR73	*←AA5AU QSL's*
AA5AU W0YK R CM97	*← W0YK missed QSL msg*
W0YK AA5AU RR73	*←AA5AU repeats QSL*

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Minimizing NILs

Recommendation #1

- Develop skill to dynamically change message
  - e.g., use the Alternate F1-F6 keys in WSJT-X
- Always log the QSO when receiving a RRR, RR73 or 73 message.
- Always log the QSO when sending RRR, RR73 or 73 message.
  - Look for a clue that your message was not received, e.g., your QSO partner re-sends his report.

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Minimizing NILs

Recommendation #2

- Give in!
  - Send the superfluous QSL, but
  - Don't require it from your QSO partner
- Yes, it's unnecessarily slower, but
  - FT contesting is currently slow enough to absorb it

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ROOM 2 – Digital and RTTY Contesting – W0YK

3:15 OPEN DISCUSSION Q&A

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Preparing your Station for Competition

Competitive success often depends more on what you do to prepare for the contest rather than on what you do during the contest

Frank Donovan
W3LPL

1

Necessary First Steps in Identifying Candidate Station Improvements

- Identify realistic time phased personal contest goals for selected contests, entry categories and competition region
  - first place regional, national or world winner, or
  - consistently placing in the top three, or
  - consistently placing in the top ten, or
  - successfully competing with selected peers
- Identify the realistic constraints that limit your station improvements
  - desired time frame for achieving your contest goals
  - amount of available time to implement station improvements
  - available physical space for more antennas and station equipment
  - annual funds available to support your improvements
- Achieve a balance between your goals and constraints

2

Well Before the Contest Evaluate Your Station's Strengths and Weaknesses Compared to Your Peer Competitors

- Identify your station's strengths and weaknesses and evaluate your peer competitor's strengths and weaknesses
  - transmitting and receiving antennas, feedlines and antenna switching
  - transceiver performance -- focusing on receiver performance
  - amplifier output power and reliability
  - audio and CW keying quality
  - computers, software and their internal and external networks
  - all aspects of your station environment that limit operator performance
  - external and inter-station RFI problems
  - all aspects of station reliability
- Identify opportunities to improve your station's weaknesses and reliability relative to your peer competitors
  - in every category above
  - then prioritize your total list of improvement opportunities

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3

During and After Every Contest Prepare Notes Documenting Your Station's Strengths and Weaknesses Compared to Your Peer Competitors

- Identify every aspect of your station's performance that was strongly competitive compared to your peer competitors
- Identify every aspect your station's performance that was not competitive compared to your peer competitors
- Identify improvements that your peer competitors can't match
- Identify every opportunity for station improvement that could have improved your score in this contest, in priority order by:
  - estimated score improvement resulting from each improvement
  - degree of difficulty in achieving each improvement
  - practicality of achieving each improvement
  - impediments to achieving each improvement
  - expense to achieve each improvement

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4

Tower Inspections and Maintenance Will Help You Avoid Mid-Winter Failures and Reliability Problems During Your Next Contest

- Measure all guy wire tensions (7 to 15% of breaking strength)
- Inspect guy wires, guy hardware and guy anchors for damage
- Inspect tower plumb and twist
- Inspect the tower base for standing water and
  - corrosion, settling and cracks at the tower-to-concrete interface
  - regularly remove all debris from tower bases to avoid corrosion
- Inspect rotator performance and play
- Inspect the tower for wind damage
- Pay special attention to damaged, loose, missing or corroded:
  - diagonal and horizontal trusses, welds and hardware
  - especially adjacent to guy attachments

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Annual inspections are essential to tower safety

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5

Antenna Inspections and Maintenance Will Help You Avoid Mid-Winter Failures and Reliability Problems During Your Next Contest

- Inspect coax cable for cuts, cracks, damage and moisture intrusion
  - cuts, chaffing and wear rotator loops
  - water intrusion at electrical and physical attachments to antennas
- Compare coax cable losses and TDR displays to prior results
- Compare antenna VSWRs to prior measurements
- Inspect connector water proofing and PL-259 tightness
- Inspect rope wear -- its much easier to replace rope before it fails
- Inspect antenna wire for wear and connections to feed lines
- Repair or replace unreliable, failing or overloaded rotators
- Inspect antennas and coaxial cables for lightning damage
- Inspect antennas, feed lines and rotators for wind damage

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Annual inspections are essential to tower. antenna, rotator and coax cable reliability and performance

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6

Improving the Competitive Performance of Coaxial Cables for Multi-tower Stations

- Coaxial cables longer than 300 feet are often used in multi-tower stations
- Andrew Heliax is an ideal choice for lengths up to:
  - 10 meters: 600 feet of LDF5-50A or 300 feet of LDF4-50A
  - 15 meters: 700 feet of LDF5-50A or 350 feet of LDF4-50A
  - 20 meters: 900 feet of LDF5-50A or 450 feet of LDF4-50A
  - 40 meters: 1200 feet of LDF5-50A or 600 feet of LDF4-50A
- Be cautious of the windload and weight (including ice load) of large Heliax cables mounted on light duty towers
- Failure to adequately protect connectors from water intrusion is a very common cause of coaxial cable deterioration

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Improving the Reliability of Coaxial Cable Connectors

- N and UHF connectors are the most common choices
- No significant loss in either N and UHF connectors at HF
- No significant difference in the VSWR of N and UHF connectors at HF
- High quality silver plated UHF connectors provide much more center pin <u>mating force</u> than N connectors
  - eliminates cross-station interference and connector failures from potentially unreliable N connector center pin mating force
  - avoid saving a few dollars on cheap unbranded hamfest connectors
- Avoid use of adapters, but if necessary be sure they are name-brand silver plated adapters, not nickel plated
- Use a wrench to gently tighten UHF connectors 1/4 turn
- Inspect SO-239 connectors for center pin mating pressure

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Coaxial Cable
Amphenol 83-1SP PL-259 Connector

Shell labeled exactly:
Amphenol 83-1SP

Silver Plated
Center Pin

Silver Plated
Body

newark.com/amphenol-rf/83-1sp/rf-coaxial-uhf-plug-straight-50ohm/dp/59K0534

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This is not the place to save money

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Coaxial Cable
Connector Waterproofing

Cover the connectors with two 50% overlapped layers
of Scotch 130C linerless rubber splicing tape
stretched to 50% of its original width, sticky side facing out

Cover the Scotch 130C with two 50% overlapped
layers of Scotch 33+ vinyl electrical tape

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Indoor Station Performance and Reliability Improvements

- Transceiver performance (sensitivity, dynamic range, filters)
- Amplifier output power and reliability
- Wattmeters
- Physical environment that degrades operator performance
  - noise, chair, ventilation, desk height, equipment placement, line of sight
- Keyers and paddles
- Microphones
- Computer keyboards
- Computer monitors
- Computers
- Antenna switching
- DX spotting network displays and alarms
- Propagation map displays from the Reverse Beacon Network
- Connectors: PL-259s gently tightened, SO-239 mating force

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11

Execute Your Proof of Station Performance Checklist Before Every Competitive Contest

- Proves that everything in your station is in working properly
  - improve and update your checklist regularly
  - record all performance measurements
- Never enter a competition with unproven station equipment
- Prove that all indoor and outdoor equipment is working far enough in advance so you can make necessary repairs before the contest

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12

Single Operator (non SO2R) Station Improvement Ideas

- Antenna improvements are almost always more effective and less expensive than any other station improvement and they improve both transmitting and receiving performance
- Receiving antennas make a big improvement on 160 and 80 meters
- Identify and mitigate internal and external RFI sources well before the contest
- Many modern transceivers have much improved receiver dynamic range and filter selectivity
  - know how to adjust your receiver for optimum dynamic range
  - verify your receiver's sensitivity every time you sit in front of it
- A wattmeter allows you to monitor transmitter and antenna performance during the contest

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Single Tower Antenna Improvement Ideas

- 50-60 foot tower and a small rotator (e.g., HyGain Ham-IV)
  - small tribander, Hex-beam or quad
  - 40 and 80 meter dipoles and a 160 meter inverted-L
- 70-80 foot tower and a medium rotator (e.g. HyGain T2X)
  - Cushcraft XM-240 two element 40 meter Yagi
  - large tribander such as the SteppIR 4 element Yagi
  - 80 meter dipole and a 160 meter inverted-L
- 100-140 foot tower and a large rotator (e.g., M2 Orion)
  - Cushcraft XM-240 two element 40 meter Yagi
  - monoband Yagis such as the HyGain LJ series on ring rotators
  - 80 meter dipole and a 160 meter inverted-L

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SO2R Station Improvement Ideas in Addition to Single Op Improvements

- Receiving bandpass filters are almost always necessary to protect transceivers from cross-band interference and physical damage
- 100 watt bandpass filters may be needed on transceiver outputs if your transceiver radiates broadband phase noise (many do)
- Stubs may be necessary on amplifier outputs if multiple antennas are in close proximity
- Multiband antennas can cause excessive cross-band interference
- Many operators find it more effective to use multiple networked computers and keyboards
- Identify and resolve all RFI and cross-band interference
  intermodulation caused by transmitted signals entering unprotected consumer electronic devices often re-radiate strong harmonics mixed with AC power or computer network signals creating strong broadband noise modulated sidebands on the transmitter harmonic

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15

CTU Presents

Field Measurements and Comparison of Low Band Receive Arrays

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1

Objectives

- What you should expect from a receive antenna based on station location
- Understand why we use receive antennas
- Understand the difference between vertical arrays
- Review of field measurements
- Vertical array comparison

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2

Why Do We Use Receive Antennas?

- Reduce receive noise (Improve SNR)
- Improve the forward pattern in the desired direction
  - Provide directivity away from noise sources
- Gain antennas for TX aren't necessarily good RX antennas as they provide gain for noise as well as the desired signal

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3

Comparing Receive Antennas

- Evaluation of any antenna system requires you to have a realistic understanding of what to expect!
- Some radio amateurs erroneously assume after installing an RX antenna you will automatically begin to miraculously hear stations that never existed at your location before.
- The most important factor to hear stations on the low bands is propagation characteristics.

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Comparing Receive Antennas

- Low band receive antennas cannot be properly evaluated without taking into consideration geographical and propagation differences.
- Comparing one antenna from a location 1000 miles away on the east coast to the same antenna located in rural Arkansas will not give an accurate comparison.
  - the exact same antenna may perform differently in those two locations for a variety of reasons

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Comparing Receive Antennas

- W5ZN uses three stations for propagation comparison
  - W0FLS in Iowa 425 miles north at 344° azimuth
  - W5UN in Texas 200 miles SW at 235° azimuth
  - K5RK in Texas 450 miles S/SW at 205° azimuth
- The propagation difference of what we each can and cannot hear at any one time is significant!

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Comparing Receive Antennas

- Even close to home, K5UR is 25 miles SW and WD5R is 20 miles north.
  - We compare notes frequently and the differences between signal-to-noise ratios for all of us that close is sometimes eye opening.
- 160 meter propagation is beyond the scope of this presentation. Please read the excellent work by Carl Luetzelschwab, K9LA.

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Comparing Receive Antennas

- My objective was to have all vertical arrays and Beverages erected at my location in order to achieve an as near perfect “A-B” test possible and not rely on comparative readings from another station some distance away.

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Differences in Vertical Arrays

- The BSEF-8, HiZ-8A, and YCCC-9 vertical arrays are not identical and the differences, often confused by radio amateurs, should be understood.
  - There are also several versions of HiZ receive arrays
- High impedance -vs- low impedance
- Active -vs- passive

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Broad Side End Fire (BSEF) 8 Vertical Array

- Uses 25’ “umbrella” verticals
- Typically low impedance
  - 75 Ohm impedance
  - Vertical element natural resonance ~3.9 MHz
  - Requires short radials to stabilize the low feedpoint impedance
  - Does not require amplifiers at elements
- Requires a large area ~350’ diameter

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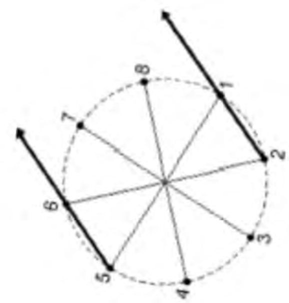
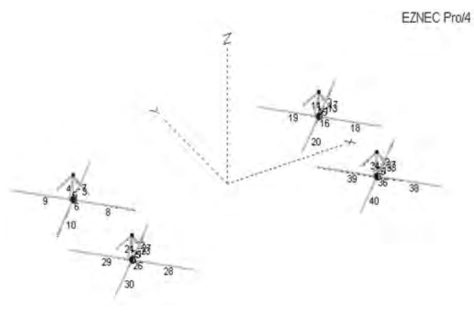
Broad Side End Fire (BSEF) 8 Vertical Array

- Even though it contains 8 verticals, only 4 are used for any one direction





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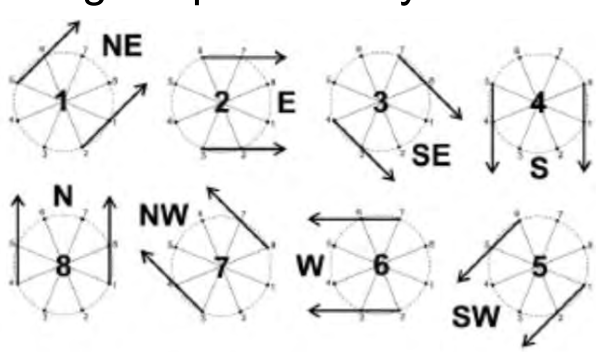
Broad Side End Fire (BSEF) 8 Vertical Array

- Passive array but can be configured as active high impedance system



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HiZ-8A

- Uses 18' to 25' vertical elements
  - No top hat wires or radials required
  - Uses high impedance amplifier at each element
  - Feedpoint impedance ~3KΩ
- 160 meter version requires 200 ft diameter
- 80 meter version requires 100 ft diameter

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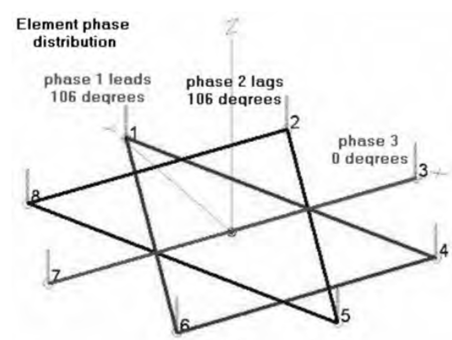
HiZ-8A

- Uses all 8 verticals with active high impedance amplifiers phased together for any one direction.



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Other Hi-Z Arrays

- Not yet evaluated the other Hi-Z arrays
  - HIZ-PC-8PRO
    - 8 vertical array
    - 85’ or 113’ diameter circle
    - Claimed 12.1 dB RDF, 30 dB F/B
  - HIZ-PC-4A
    - 4 square vertical array
    - 60’ or 80’ per side element spacing
    - Claimed 12.1 dB RDF, 30 dB F/B

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YCCC-9

- Designed by John Kaufman, W1FV
- Uses 15’ to 25’ vertical elements
  - No top hat wires or radials required
  - Uses high impedance amplifier at each element
  - Feedpoint impedance ~3KΩ
  - Requires a preamp on output of combiner
- Requires 120’ diameter for 8 directions
  - Covers 160-80-40 meters

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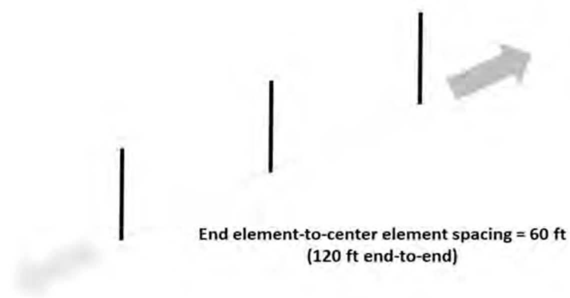
YCCC-9

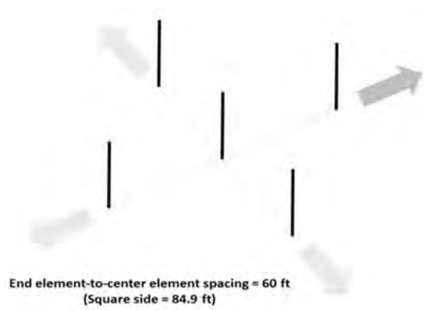
Uses 3 inline verticals with active high impedance amplifiers

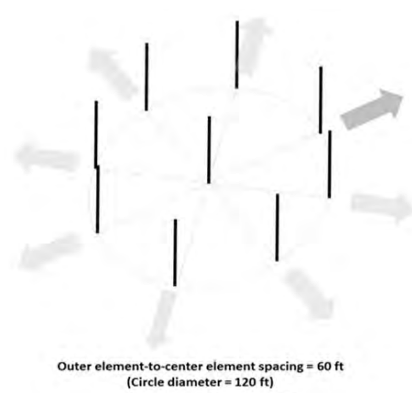


17

YCCC-9

Can be configured with up to 9 verticals for eight direction coverage





18

Vertical Array Pro –vs- Con

BSEF-8		HiZ-8A		YCCC-9	
Pro	Con	Pro	Con	Pro	Con
No expensive Electronics	Requires short radials to stabilize feedpoint impedance	No element tuning required	Requires 12 Vdc at phasing unit and at all ele amplifiers	No element tuning required No radials required	Requires 12 Vdc at phasing unit and at all amplifiers
Ele & switch unit verify with simple antenna analyzer	Requires a large land area (~350' dia.)	No radials required	Requires expensive electronics	Requires smaller area than BSEF, HiZ or Beverage	Requires active electronic components
Only need to 4 ele for 2 direction	Elements require "top hat" wires	Requires smaller area than BSEF or Beverage	Components not repairable at home	Only need to 3 elements for 2 direction	
	Requires additional posts for top hat wire support	Exceptional RDF and F/B pattern	Must utilize all 8 elements for any one direction	Performance equal to 540' Beverage	

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RX Antennas at W5ZN

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Data Recorded for Each Antenna

- Noise floor in each of eight directions
- Peak received signal above noise floor
- Peak received signal compared to the seven other azimuth directions
  - Front to side, front to back, etc

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Equipment Used for Measurements

2 – Elecraft K3 Transceivers & NaP3 Panadapter Software

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Equipment Used for Measurements

- 2 – LP-Pan SDR Receiver

- Elecraft XG3 Signal Generator

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Calibration Procedure

- Measure cable loss from array to station
  - At W5ZN the BSEF & HiZ are 800 ft from station, YCCC-9 is 500 ft.
- Inject -73 dBm (S9) and -107 dBm S3) signal into K3
  - Verify accurate signal readings appear on NaP3 Panadapter

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Recording Procedure

- Record peak, F/B, and F/S received signal readings
  - Relative to the noise floor
- Understand amplitude variations due to spatial separation between antennas

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RX Antenna Signal Comparison

Station	HiZ-8 Signal above noise (dB)	BSEF Signal above noise (dB)	YCCC-9 Signal above noise (dB)	Beverage Signal above noise (dB)
F2DX	14	14	11	10
FT4TA	3	2	0	0
E51NOU	2	2	0	0
W1AW/KH8	11	10	8	8
F2DX	18	19	15	15
VK3XQ	12	11	7	6
5W0UU	18	20	11	10
9K2HN	0	2	0	0
V63DX	2	1	0	0
KH6ZM	18	19	16	15
W1AW/KH6	14	13	10	8
JE1BMJ	12	11	9	8
W1AW/KH6	20	20	17	17

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RX Antenna Signal Comparison

Station	HiZ-8 Signal above noise (dB)	BSEF Signal above noise (dB)	YCCC-9 Signal above noise (dB)	Beverage Signal above noise (dB)
JD1BMH	6	5	2	1
SP5GPM	1	2	0	0
DU7ET	12	11	8	8
HL5IVL	25	25	23	22
JD1BMH	11	10	8	7
K5P	24	25	23	23
VP8STI	2	2	0	0
VP8SGI	3	3	2	0
RA0FF	3	4	2	2

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RX Antenna Signal Comparison

Station			
3C0W	A35T	HL5IVL	VP8STI
3DA0IJ	BD4WN	JD1BMJ	VQ9LA
3X5A	DU7ET	JT1CO	XU7ACY
5V7D	E44CC	OD5NJ	Z81X
5W0UU	E51NOU	RA0FF	ZD8W
9K2HN	EY8MM	V63DX	ZD9T
9M0W	FT4JA	VK3XQ	ZL9HR
9X0CW	FW5RE	VP8SGI	ZM1A

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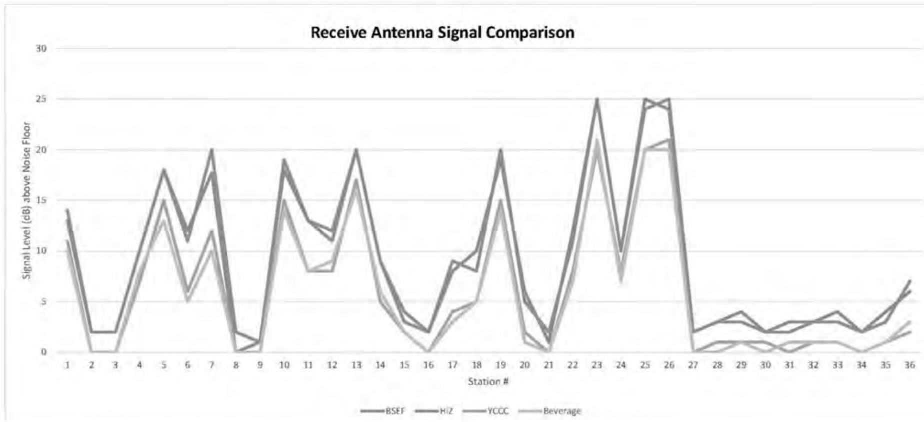
RX Antenna Signal Comparison



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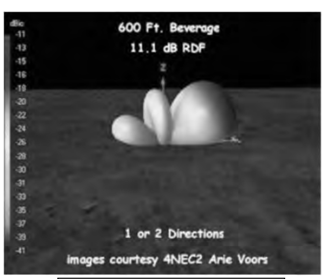
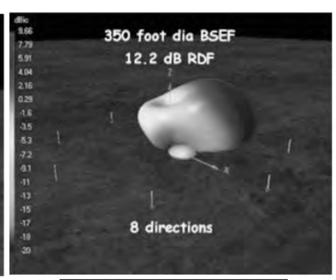
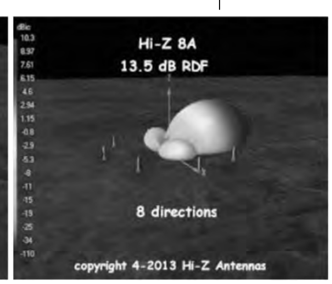
Model –vs- Actual Field Measurements







F/B = 20 dB
RDF ~10 dB*
3 dB BW = 75°

F/B = 21 dB
RDF confirmed*
3 dB BW = 50°

F/B = >30 dB
RDF confirmed*
3 dB BW = 50°

YCCC-9
F/B = 24 dB
RDF confirmed
3 dB BW = 80°

***Based on comparative analysis**

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Summary

- Field measurements validate the model results for the arrays evaluated
- All are outstanding RX antennas and performance, depending on the array, is equal to or greater than a 540 ft Beverage
- Vertical arrays cover less space for 8 direction coverage than eight 540 ft Beverages

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Summary (Cont)

- Utilizing two of these arrays in a diversity receive configuration produces phenomenal results

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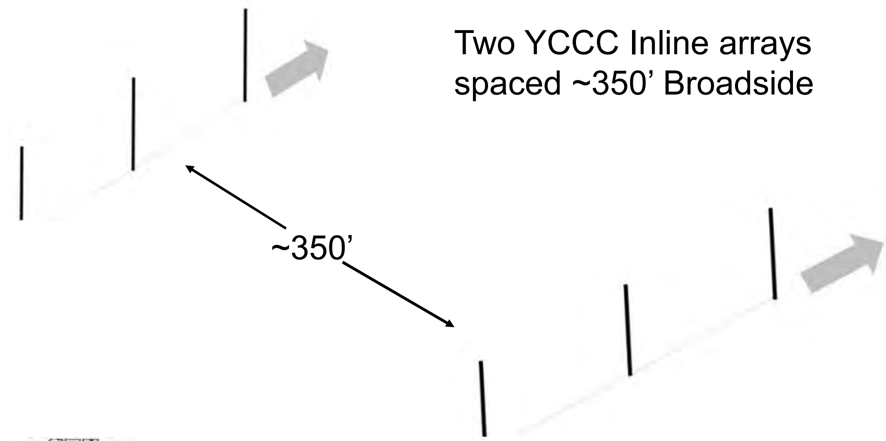
Additional Array Currently Under Evaluation



Two YCCC Inline arrays spaced ~350’ Broadside

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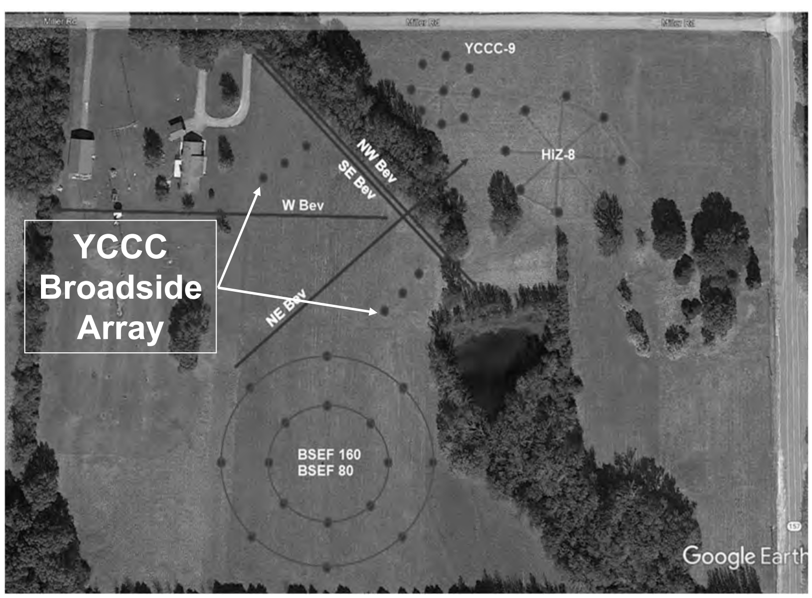

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K3LR "Rules of Sameness"

- To obtain optimum results from any RX array it is *mandatory* that your focus be to assemble each vertical element the same
  - Same element material, same size/diameter
- Amplifiers or matching networks must be connected all in the same manner
- For low impedance verticals, tune each vertical to the same frequency +/- 2 KHz

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K3LR "Rules of Sameness"

- Signal cable to each vertical in the array must be the same
  - Do not use different types of RG6
  - W5ZN will not use RG-6 from different spools in an array
- Waterproof all connections and electronic components. Moisture is your *enemy!*
  - It will create noise in the system

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K3LR "Rules of Sameness"

- If possible avoid using signal cables to provide 12Vdc to amplifiers
- Once your array is in operation, measure and record the noise floor and F/B readings in each direction that the array is designed for.
- Any future change in these readings is a sign of possible component change or failure

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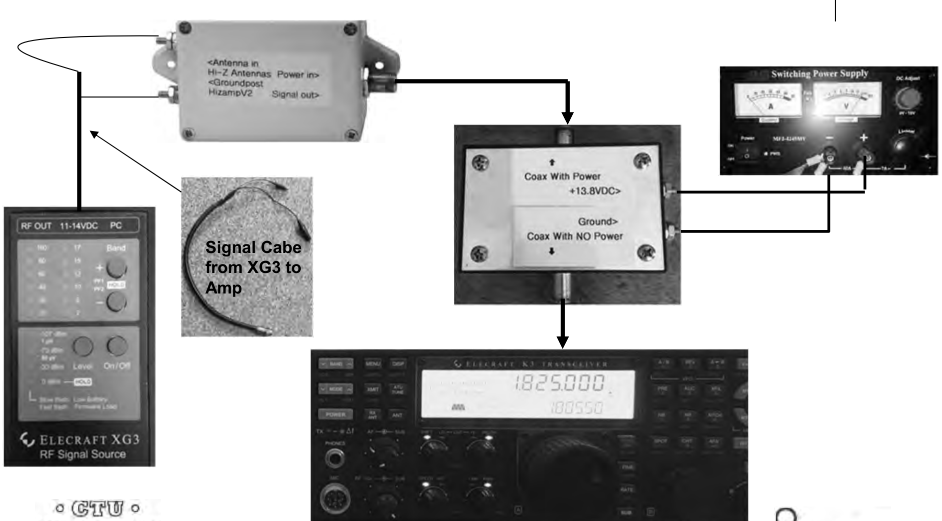
Testing HiZ and YCCC Amplifiers – Simple Method



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Testing HiZ and YCCC Amplifiers – Simple Method

1. Insert a -107 dBm signal from XG3
2. Measure signal on panadapter or S meter
   - Obviously should see a signal increase above -107 dBm.
   - ~ 10 dB or so
3. Ensure all amplifiers used in the array have the same gain (“sameness)

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Testing BSEF Low Impedance Matching Network

1. Calibrate antenna analyzer & test cable with open, short, and 75Ω load
2. Tune each vertical to lowest SWR at desired frequency, e.g. 1828 KHz.
3. Adjust variable resistor for 75 Ω impedance

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Testing BSEF Low Impedance Matching Network

This is your target result

You want a 75Ω match
and no reactance

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Final Thoughts

- Determine the array that fits your need
- Build it
- Test it
- “GET IN THERE AND WORK ‘EM !!!!”

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Thank You

?

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References

- HiZ Antennas https://hizantennas.com/
- "Design, Construction, and Evaluation of the 8 Vertical Circle Array for Low Band Receiving" 2nd Edition by Joel Harrison, W5ZN, Bob McGwier, N4HY, and Frank Donovan, W3LPL - http://w5zn.org
- "A Compact Dual-Band, 9 Circle Receiving Array" by John Kaufmann, W1FV Parts 1 NCJ Sept/Oct 2011, Part 2 NCJ Nov/Dec 2011. See also Steve Babcock, VE6EZ, https://www.youtube.com/results?search_query=ve6wz
- "W8WWV - The Benchmark Beverage" Greg Ordy, W8WWV, http://seed-solutions.com/gregordy/Amateur Radio/Experimentation/Beverage.htm

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Everything You Need to Know About USB and Serial Interfaces

Presented by N6TV

n6tv@arrl.net

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1

Presentation Overview

- Legacy PC Serial Ports
- USB Ports and Devices
- USB-to-Serial Adapters
- Using the Windows Device Manager
- Managing Serial Port Numbers
- Using Serial Ports for CW / FSK / PTT Keying
- Sharing Serial Ports
- USB Sound Cards
- Q & A

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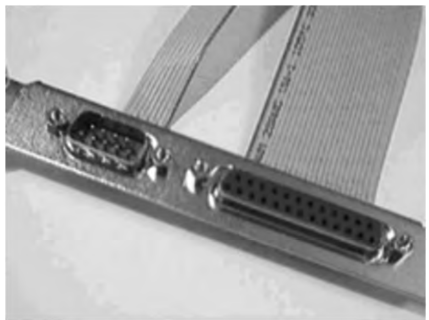
Legacy PC Serial Ports

- Originally a 25-pin male D-SUB connector (DB-25M), used with dial-up modems
- Smaller 9-pin male serial connector became standard (DE-9M) for serial, DB-25F for printers



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Life was Simple

- One or two male DE-9 connectors on PC
- Accessed as COM1: or COM2:
- One DE-9 "CAT" or "RS232" connector on radio
  - Female: Elecraft IC-7700 & IC-7800

  - Male: Yaesu Kenwood

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Computers "Improved"

- "Real" serial and parallel ports disappear, replaced by USB ports
- Radios (until recently) still had 9-pin serial ports
- Peripherals still need to access 9-pin serial ports
  - Automatic linear amplifiers, RemoteRig boxes, rotator controllers, SteppIR antenna controllers, band decoders, etc.
- Common Solution: USB-to-Serial adapters

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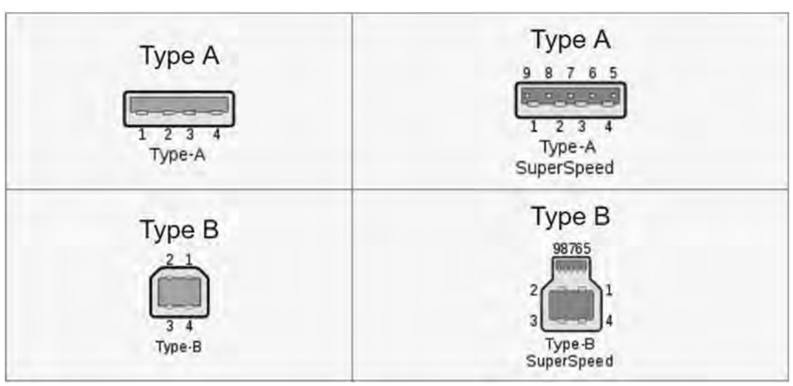
USB 2.0 and 3.0 Ports

- Standard connector on most PCs and MACs

PC:

Radio:



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USB-to-Serial Adapters

- Reliability and Compatibility Varies Greatly

1. Edgeport – Excellent, stable, supports MMTTY directly
2. Eltima – Included with microHAM interfaces
3. FTDI – very good, stable, requires EXTFSK for MMTTY. Used internally by Elecraft K3 & K4.
4. Silicon Labs (built-in to Icom, Kenwood, Yaesu)
5. Prolific – **AVOID!** Uninstall drivers, recycle.

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Digi International Edgeport/4

- One USB 2.0 Type B connector
- Four independent DE-9M serial ports
- Windows automatically finds and installs drivers

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Digi International Edgeport/8

- One USB 2.0 Type B connector
- Eight independent DE-9M serial ports
- Windows automatically finds and installs drivers

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StarTech.com ICUSB2324I 4-Port FTDI

- One USB 2.0 Type B connector
- Four independent FTDI DE-9M serial ports
- Separate 5V Power Supply

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StarTech.com ICUSB2328I 8-Port FTDI

- One USB 2.0 Type B connector
- Eight independent FTDI DE-9M serial ports
- Separate 5V Power Supply

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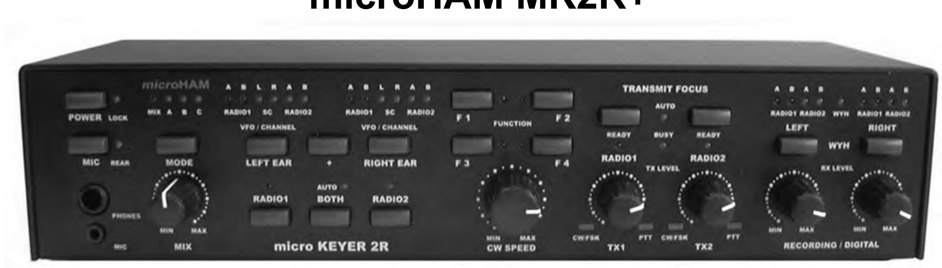
microHAM uses Eltima drivers

microHAM MK2R+



- One USB Type B connector
- Custom Eltima serial port device drivers
- Custom cables for transceiver ports
- Virtual serial ports created by microHAM “Router”

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Recommended FTDI USB-to-Serial Adapters

FTDI CHIPI-X10 - $20

FTDI Chip

GearMo 2-port - $32

GearMo 4-port - $40

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Prolific USB-to-Serial Adapters

- Widely available, cheap (but many counterfeits)
- Device Driver does *not* play well with others
- Please DO NOT USE them, ever
- Uninstall any Prolific device drivers with Device Manager
- Devices often look like this:

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Connecting USB-to-Serial Adapters

- Connect FTDI, Elecraft, or Edgeport device to PC
- Windows (usually) locates and installs appropriate device driver(s)
- COM ports numbers assigned sequentially
- Use Windows Device Manager to view assigned COM Port number
- COM port number will change if you connect a device to a different USB Hub (e.g. from USB 2.0 port to USB 3.0 port)

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Connecting USB Radios / Devices

- Important: Install the manufacturer's device driver first, *then* connect the device
  - Icom, Kenwood, Yaesu, microHAM
  - (Usually not required for Elecraft / FTDI)
- If you forget and connect radio first, use Device Manager to uninstall "Unknown Device", then start over
- COM port numbers assigned sequentially
- COM port numbers can be changed

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Using the Windows Device Manager

- **Right click** on Windows **Start** Button
- Click **Device Manager**
  -or-
- Windows Key + R (Run):
  devmgmt.msc
- Important Tip: (before Windows 10)
  Always set the System Environment Variable
  devmgr_show_nonpresent_devices to **1**

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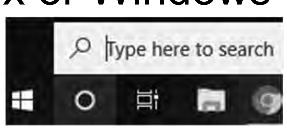
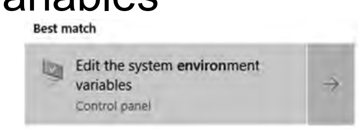
Setting System Environment Variable

- Type “Environment” in Windows Search box or Windows Settings Search box



- Click “Edit the System Environment Variables”



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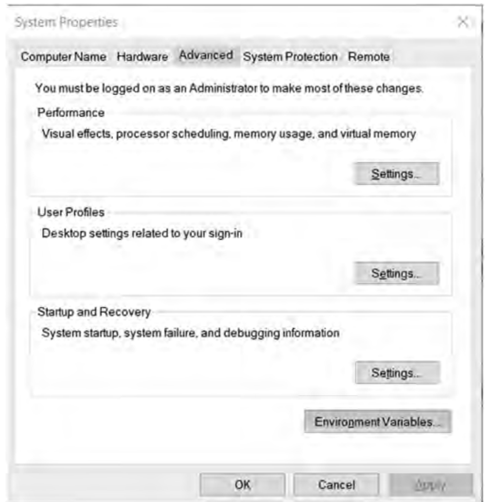
Step 1 – Under Advanced tab click Environment Variables…



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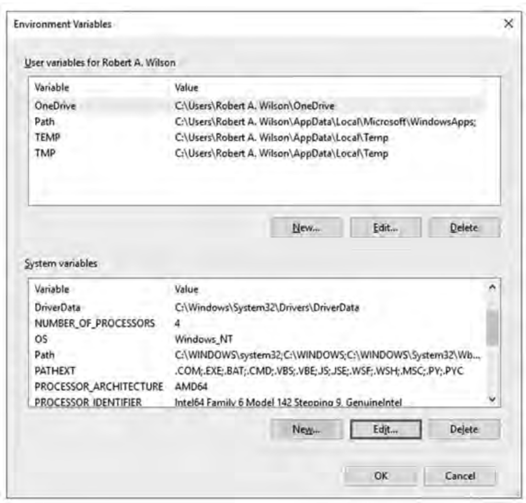
Step 2 – Under System variables, click New…



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Step 3 – Add the new environment variable

Name: **devmgr_show_nonpresent_devices**
Value: **1**

Click **OK**, *then* start Windows Device Manager

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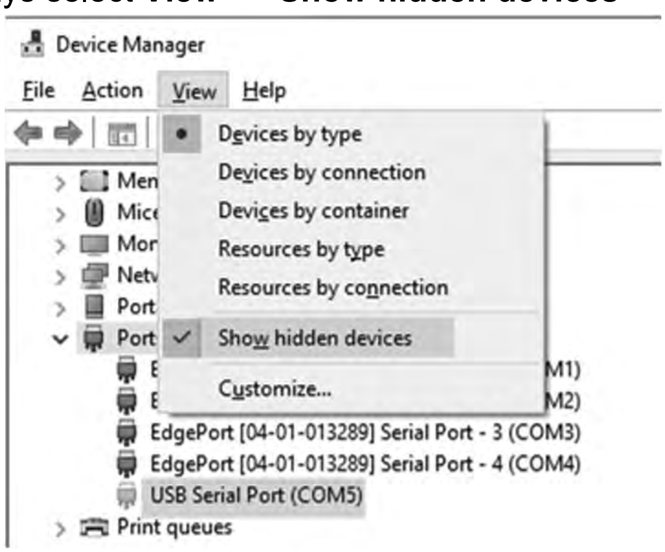
Windows Device Manager:
Always select **View** → **Show hidden devices**



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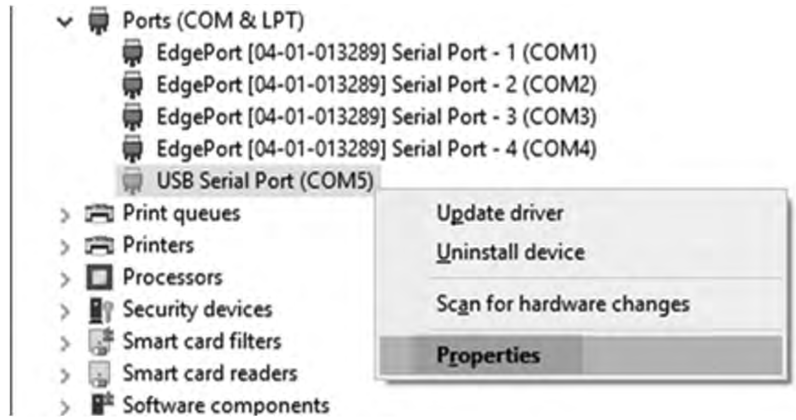
Expand Ports section
Right click gray (offline) devices, **Properties**



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Click Driver Tab
Check that Driver Provider is *not* Prolific

- If you see **Prolific**, click **Uninstall Device**

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Uninstall the Prolific Device
and Delete the Driver Software for this device.

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If Driver is FTDI, go to Port Settings tab Click Advanced… button

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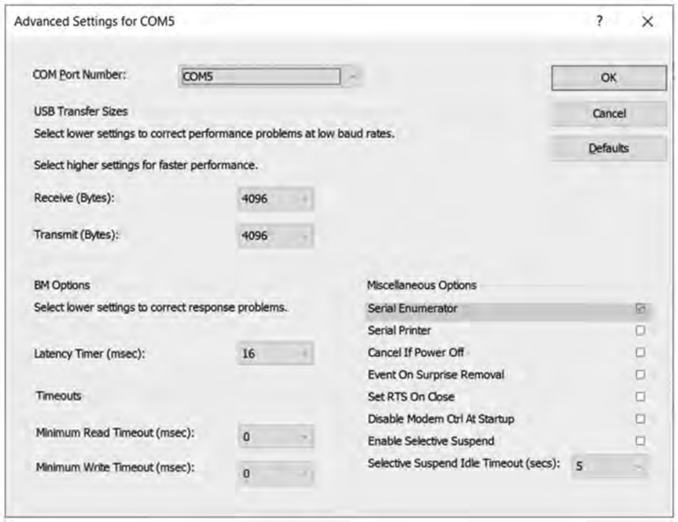
FTDI Default Options – not good, keys radio



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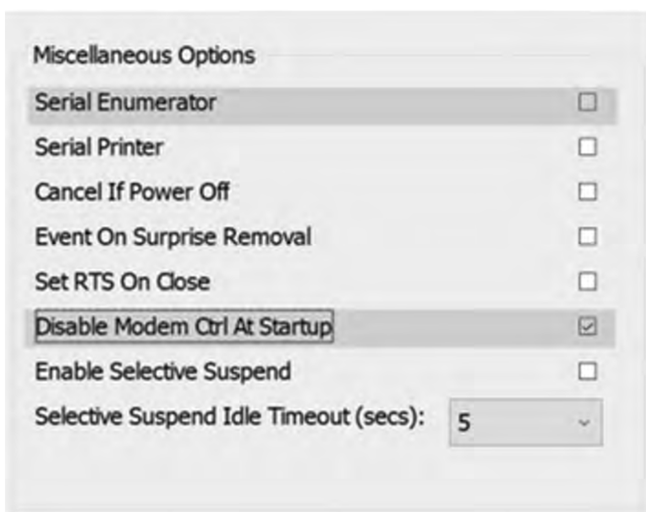
Change the FTDI Options To This



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Disabling Serial Enumeration (unwanted keying) on Legacy Serial Ports (COM1:, COM2:)

- **Requires Registry Edit (run regedit)**
- **Create a System Restore Point to allow recovery, just in case**
- **Locate "UpperFilter" key under HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum\ACPI\PNP0501\0 (or similar)**
- **Rename key to OldUpperFilter**
- **No more unwanted keying**

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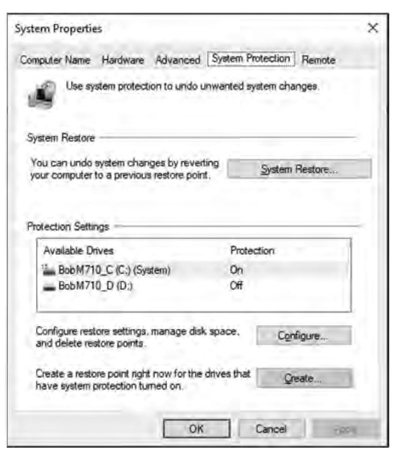
Creating a Restore Point

- **System Properties, System Protection, Create (or use Windows Search box)**



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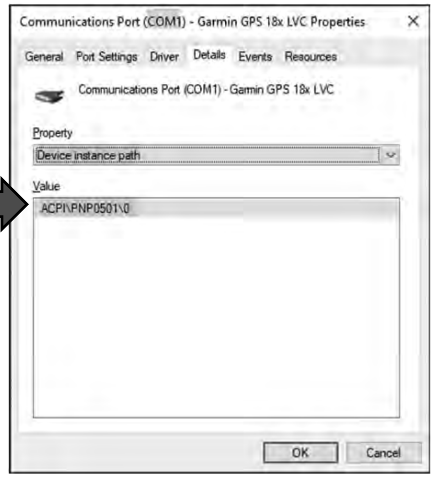
Locate Device Instance Path in Device Manager

- Device Manager (devmgmt.msc), COM1:, Properties, Details



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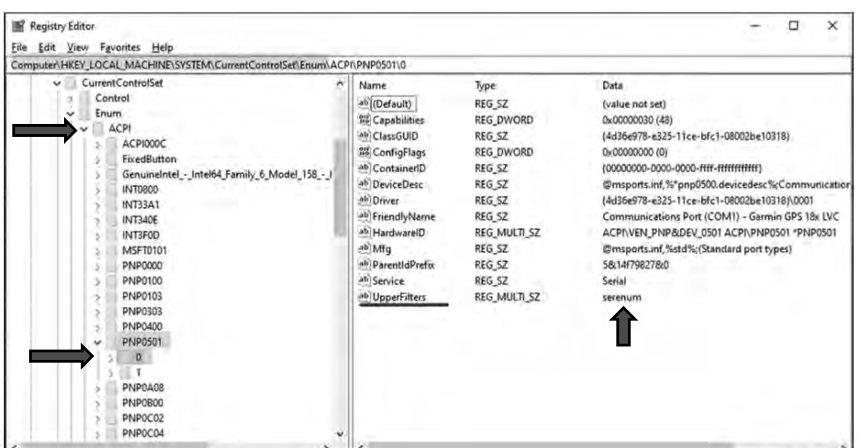
Locate Device Instance Path in Registry

- Regedit: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum



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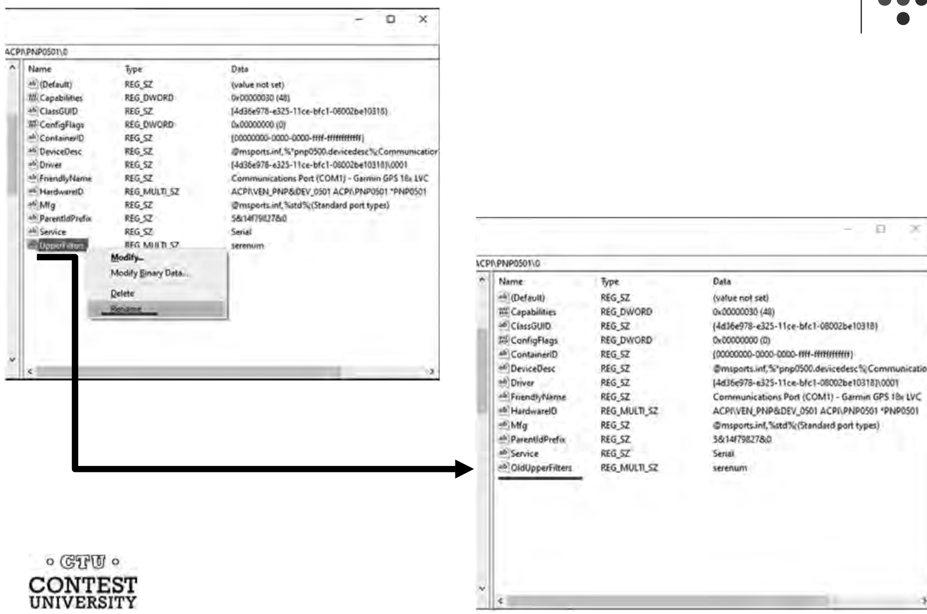
Right Click, Rename key UpperFilters → OldUpperFilters



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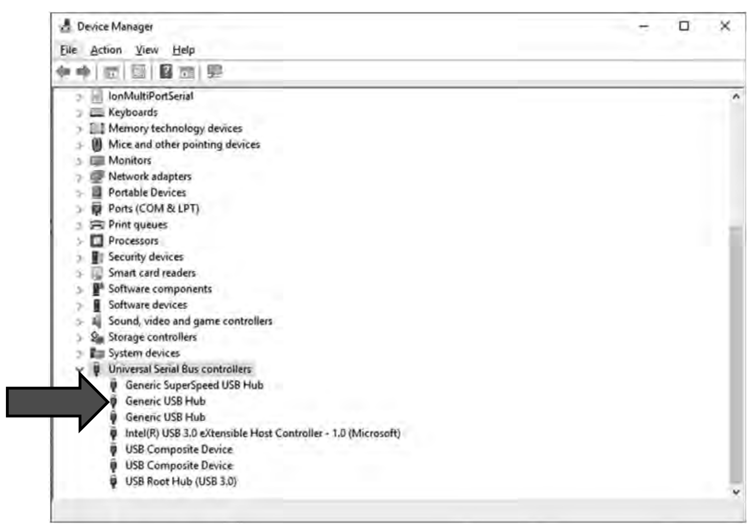
Under USB Serial Bus Controllers: Right-Click each "Hub" device, Select Properties



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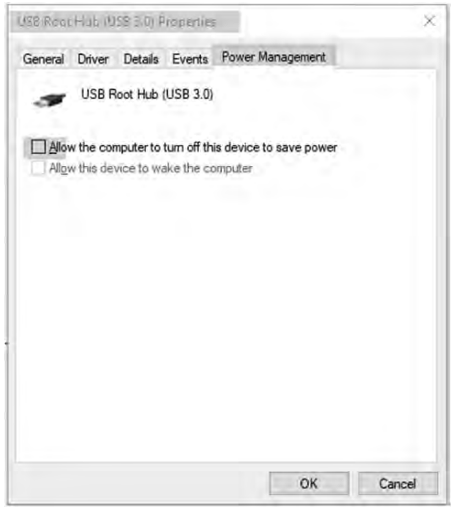
Look for Power Management Tab
Do *not* allow computer to turn off this device



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Another USB Dev. Management Tool: NirSoft's USBDeview

- Stands for USB Device View
- https://www.nirsoft.net/utils/usb_devices_view.html
- Scroll Way Down to the "Feedback" section to find download link:

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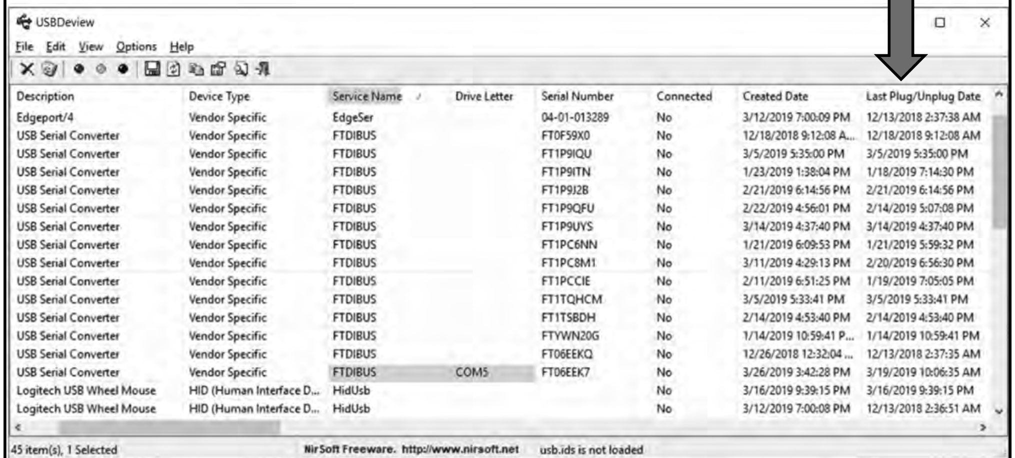
USBDeview Screen Shot


USBDeview

File Edit View Options Help

Description	Device Type	Service Name	Drive Letter	Serial Number	Connected	Created Date	Last Plug/Unplug Date
Edgeport/4	Vendor Specific	EdgeSer		04-01-013289	No	3/12/2019 7:00:09 PM	12/13/2018 2:37:38 AM
USB Serial Converter	Vendor Specific	FTDIBUS		FT0F59X0	No	12/18/2018 9:12:08 A...	12/18/2018 9:12:08 AM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1P9IQU	No	3/5/2019 5:35:00 PM	3/5/2019 5:35:00 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1P9ITN	No	1/23/2019 1:38:04 PM	1/18/2019 7:14:30 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1P9J2B	No	2/21/2019 6:14:56 PM	2/21/2019 6:14:56 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1P9QFU	No	2/22/2019 4:56:01 PM	2/14/2019 5:07:08 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1P9UYS	No	3/14/2019 4:37:40 PM	3/14/2019 4:37:40 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1PC6NN	No	1/21/2019 6:09:53 PM	1/21/2019 5:59:32 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1PC8M1	No	3/11/2019 4:29:13 PM	2/20/2019 6:56:30 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1PCCIE	No	2/11/2019 6:51:25 PM	1/19/2019 7:05:05 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1TQHCM	No	3/5/2019 5:33:41 PM	3/5/2019 5:33:41 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT1TSBDH	No	2/14/2019 4:53:40 PM	2/14/2019 4:53:40 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FTYWN20G	No	1/14/2019 10:59:41 P...	1/14/2019 10:59:41 PM
USB Serial Converter	Vendor Specific	FTDIBUS		FT06EEKQ	No	12/26/2018 12:32:04 ...	12/13/2018 2:37:35 AM
USB Serial Converter	Vendor Specific	FTDIBUS	COM5	FT06EEK7	No	3/26/2019 3:42:28 PM	3/19/2019 10:06:35 AM
Logitech USB Wheel Mouse	HID (Human Interface D...	HidUsb			No	3/16/2019 9:39:15 PM	3/16/2019 9:39:15 PM
Logitech USB Wheel Mouse	HID (Human Interface D...	HidUsb			No	3/12/2019 7:00:08 PM	12/13/2018 2:36:51 AM

45 item(s), 1 Selected NirSoft Freeware. http://www.nirsoft.net usb.ids is not loaded

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Managing COM Port Numbers

- Over time, ever increasing unique COM port numbers are assigned by Windows, difficult to keep track
- Some software doesn’t support COM13: or higher
- Suggestion: renumber serial ports “left to right” to match your station layout, starting with transceivers
- First, use Windows Device Manager to uninstall all serial devices that you no longer use
- Right click on remaining COM ports, Properties, **Port Settings** tab. Click **Advanced…** button
- Renumber ports sequentially, COM3:, COM4:, COM5:, etc., “left to right”

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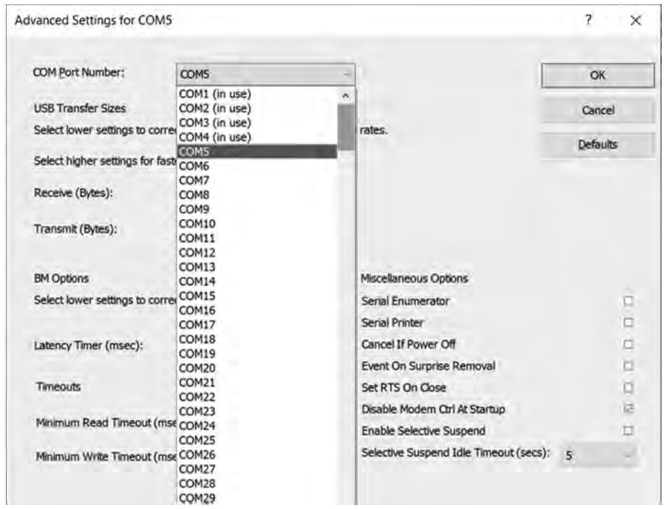
ICOM 38

Renumbering Serial Ports with Device Manager:
Right click, Properties, Port Settings tab, Advanced



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What does "In Use" Mean?

- It means this COM port number was assigned to some device, maybe years ago
- It usually does *not* mean that you can't use it during reassignment, especially if it is "grayed out" (hidden)
- Uninstalling disconnected devices first will help
- Usually safe to ignore this warning and click YES:

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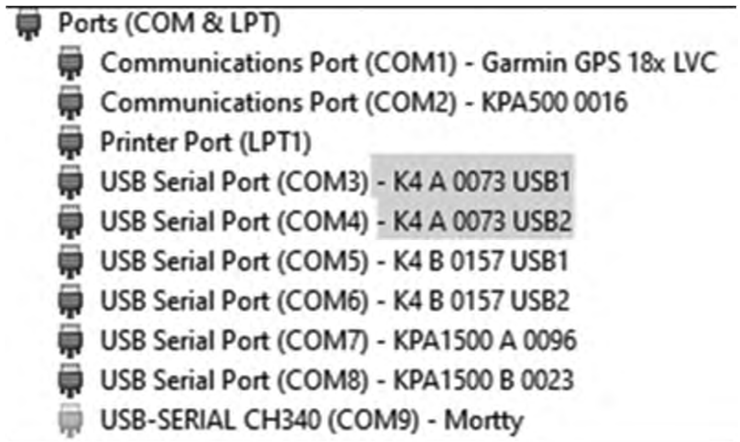
Labeling Serial Ports

- Example:



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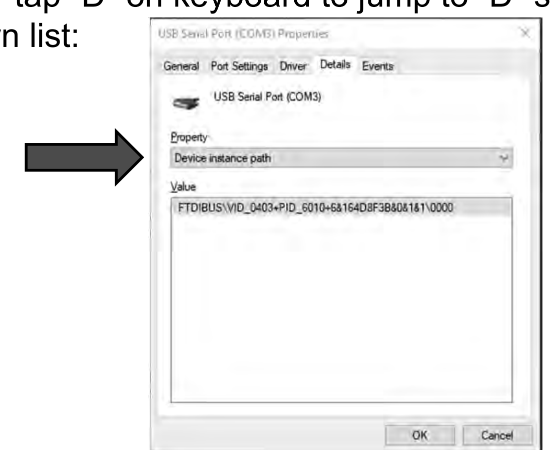
Step 1 – Note the "Device instance path"

- Right click on Serial Port, select *Properties,* select Details
- Tip: tap "D" on keyboard to jump to "D" section of drop-down list:



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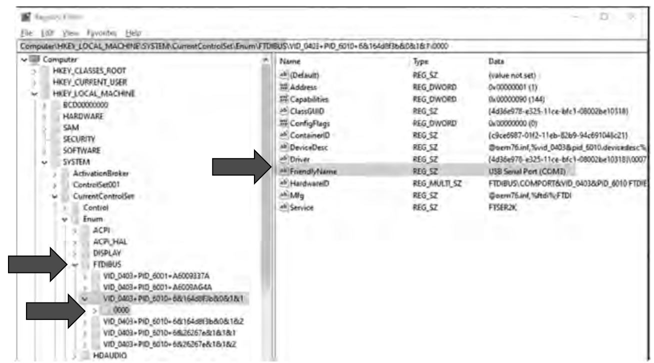
Step 2 – Use Registry Editor (regedit)

- Navigate to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum
- Device Instance Path, Subkey 0000 will have the **FriendlyName**



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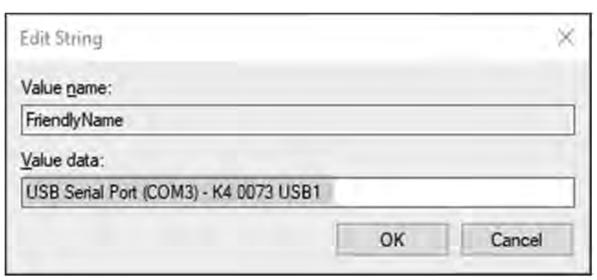
Step 3 – Change the <u>FriendlyName</u>

- Double-click on **FriendlyName** (or Right-click, **Modify…**)
- Edit the FriendlyName value and click **OK**



- Note: If you renumber a serial port, Windows will change the name back to the default, so renumber first, then rename

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ICOM 44

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What program is currently using my serial port?

- Use Windows Process Explorer
- https://docs.microsoft.com/en-us/sysinternals/downloads/process-explorer
- On Windows 10, run **procexp64.exe** as **Administrator**
- Click Search button (binoculars icon)
- Enter one of the following partial search strings:

\Device\VCP	- FTDI virtual COM ports
\Device\Edg	- Edgeport devices
\Device\Ser	- Built-in (COM1:), Mortty (Arduino)
\Device\Sil	- Icom/Kenwood/Yaesu (Silicon Labs)
\Device\VSer	- Eltima / vspMgr virtual serial ports

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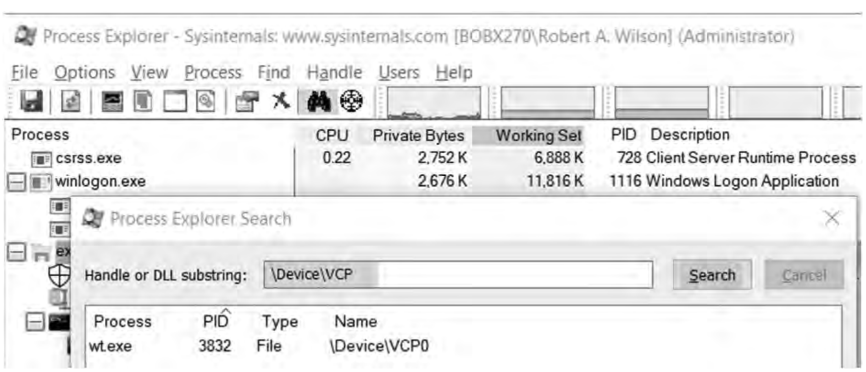
Process Explorer Search – Example 1



Win-Test (**wt.exe**) has opened the Virtual COM Port

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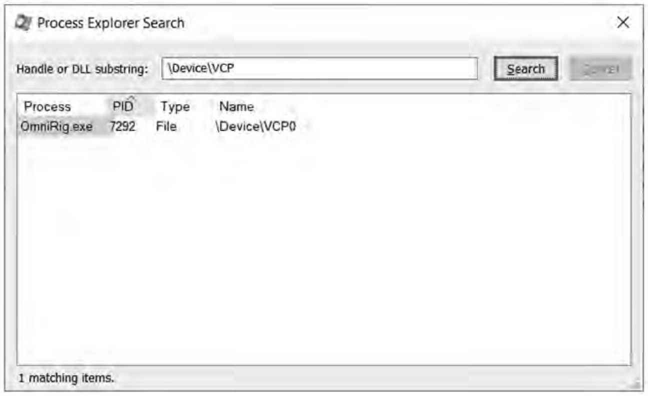
Process Explorer Search Example 2



OmniRig (e.g. WSJT-X, Log4OM) has opened the FTDI VCP

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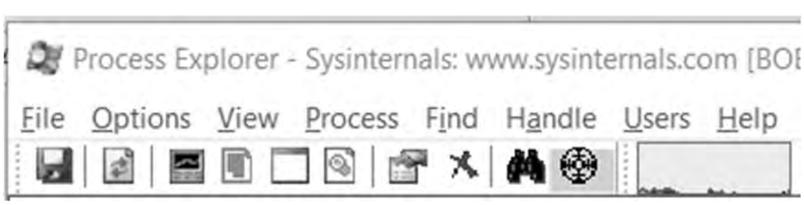
Not sure what to search for?

- Open a program known to use a particular serial port
- In Process Explorer, *drag* the “Find Windows Process” icon on top of the program window



- Process Explorer will jump to the process corresponding to that program window

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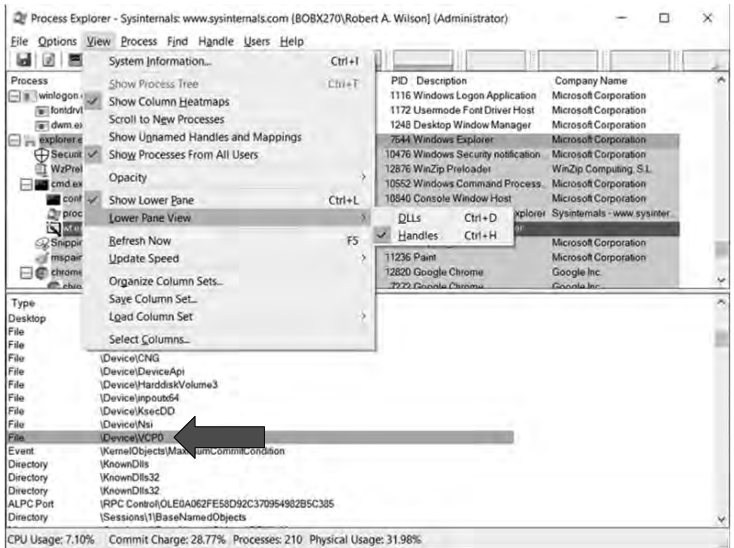
Select View, Lower Pane View, Handles, then sort by Name



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ICOM 49

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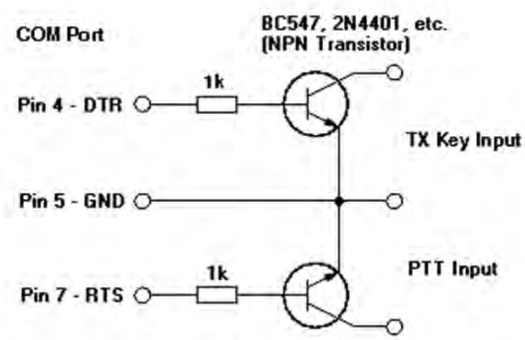
Computer CW, PTT, and FSK RTTY Keying

Using Serial Port pins (DTR=CW or FSK, RTS=PTT)

- A simple hardware "open collector" keying circuit, used for decades:



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ICOM 50

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Elecraft K3 / K3S keying via serial port

- First transceiver to include computer keying circuit *inside the radio*
- Does not use RTS and DTR pins for RS232 “Handshaking”, freeing them for other purposes
- In K3, set **CONFIG:PTT-KEY** to **RTS-DTR** (vs. **OFF-OFF**)
- Works the same over a standard serial cable (CONFIG:RS232 = 38400) -or- the K3S USB connection (CONFIG:RS332 = USB)
- To prevent unwanted transmissions when PC reboots, change FTDI Port Settings:
  - Uncheck “Serial Enumerator”
  - Check “Disable Modem Ctrl At Startup”

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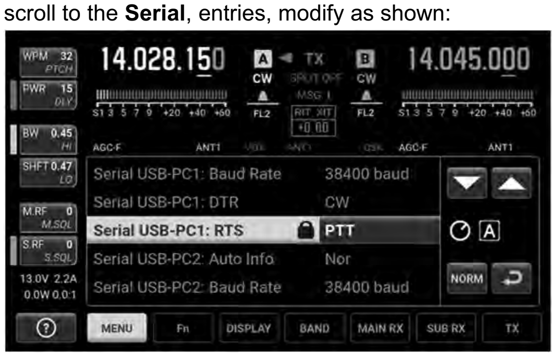
Elecraft K4 keying via virtual serial port(s)

- Same as K3, but THREE (3) serial ports available for CW, PTT, and FSK keying and rig control
- In K4 menu, scroll to the **Serial**, entries, modify as shown:



- Change FTDI Port Settings:
  - Uncheck “Serial Enumerator”
  - Check “Disable Modem Ctrl At Startup”

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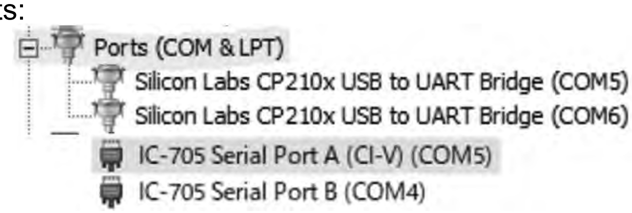
ICOM Copies Elecraft K3, Adds FSK Keying

- CW, PTT, and FSK keying timing OK over USB virtual serial port
- Supported by IC-705, IC-7300, IC-7610, IC-7850, IC-7851
- IC-7300 generates just one virtual serial port
- IC-705, IC-7610, IC-7850, IC-7851 generate *two* virtual serial ports:



- To keep it simple use DTR pin for keying, RTS pin for PTT
- Use port "B" for MMTTY exclusively
- Mnemonic: **C**W : **D**TR : **F**SK • **P**TT : **R**TS : **S**end

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ICOM 53

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ICOM: Determining COM Port A and B

- Use Windows Device Manger, right click on first COM port, Properties, Details tab, Device Instance Path, check last letter

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ICOM 54

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ICOM IC-7300 Keying via USB Cable

- USB cable provides *one* virtual serial port
- In IC-7300 **SET > Connectors** menu:
  Set **USB Keying (CW)** to **DTR**
  -or-
  Set **USB Keying (RTTY)** to **DTR**
- Set **USB Send** to **RTS**
- Logging Software, rig control Port (USB), set DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **EXTFSK64** to select COM port. Cannot use logger at same time; rig has just one serial port. But you can use the REMOTE (CI-V) connector with CT-17 or equivalent for rig control.

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ICOM 55

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ICOM IC-705 Keying via USB Cable

- USB cable provides *two* virtual serial ports
- In IC-7610 **SET > Connectors > USB Send/Keying**:
  Set **USB Keying (CW)** to **USB (A) DTR**
  Set **USB Keying (RTTY)** to **USB (B) DTR**
  Set **USB Send** to **USB (A) RTS** or **USB (B) RTS**
- In Logging Software, rig control COM Port (A):
  DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **EXTFSK64** to select second COM Port (B):
  FSK=DTR, PTT=RTS
- Cannot set *both* ports to use hardware PTT, so use “Software PTT” on Rig Control Port (A) if necessary.

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ICOM IC-7610 Keying via USB Cable

- USB cable provides *two* virtual serial ports
- In IC-7610 **SET > Connectors > USB Send/Keying**:
  Set **USB Keying (CW)** to **USB1(A) DTR**
  Set **USB Keying (RTTY)** to **USB1(B) DTR**
  Set **USB Send** to **USB1(A) RTS** or **USB1(B) RTS**
- In Logging Software, rig control COM Port (A):
  DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** to select second COM Port (B):
  FSK=DTR, PTT=RTS
- Cannot set *both* ports to use hardware PTT, so use "Software PTT" on Rig Control Port (A) if necessary.

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ICOM IC-7850, IC-7851 Keying via USB Cable

- USB cable provides *two* virtual serial ports
- In IC-785x **SET > Others** menu:
  Set **USB Keying (CW)** to **USB1 DTR**
  Set **USB Keying (RTTY)** to **USB2 DTR**
  Set **USB Send** to **USB1 RTS** (CW) or **USB2 RTS** (RTTY)
- In Logging Software, rig control COM Port (USB1)
  set DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** to select second COM port (USB2)
  FSK=DTR, PTT=RTS
- Cannot use *both* ports for hardware PTT, so use "Software PTT" on Rig Control Port (USB1) if necessary.

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ICOM 58

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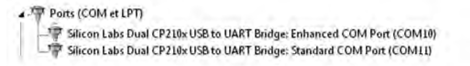
Yaesu FT-991 Keying via USB Cable

- USB cable provides *two* Silicon Labs virtual serial ports:



- In Yaesu Menu, set
  030 232C TOT: 1000 msec (default is only 10 msec)
  033 CAT RTS: Disable (Turns off RS232 handshaking)
  060 PC Keying: DTR
  071 DATA PTT SELECT: RTS
  098 RTTY SHIFT PORT: DTR
  110 SSB PTT SELECT: RTS
- In Logging Software, rig control is via the “Enhanced” COM Port, CW / PTT via “Standard” COM Port: DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** with the “Standard” COM port: FSK=DTR, PTT=RTS

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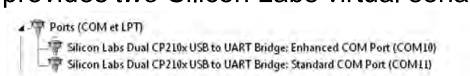
Yaesu FTdx101D or FTdx101MP Keying via USB

- USB cable provides *two* Silicon Labs virtual serial ports:



- In Yaesu Menu, set
  - OPERATION SETTING / GENERAL:
    232C TIME OUT TIMER: 1000 msec (default is only 10 msec)
    CAT RTS: OFF (Turns off RS232 handshaking)
  - RADIO SETTING / MODE SSB, RTTY, and PSK/DATA:
    RPTT SELECT: RTS (FSK will be by **DTR**)
  - RADIO SETTING / MODE CW:
    PC KEYING: DTR (PTT will be by RTS)
- In Logging Software, rig control is via the “Enhanced” COM Port, CW / PTT via “Standard” COM Port: DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** with the “Standard” COM port: FSK=DTR, PTT=RTS

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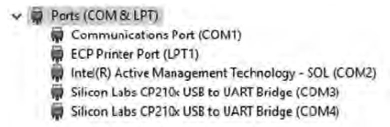
Kenwood TS-890

- USB cable provides *two* Silicon Labs virtual serial ports:



- Right click, Properties, Details tab, Location Path:
  USB1 is "Standard" Serial Port, USB2 is "Enhanced"
- In Logging Software, rig control is via the "Standard" COM Port
  CW / PTT / FSK keying may be assigned to DTR or RTS of either port
- **Menu 17 Virtual Standard COM Port RTS: PTT**
  Menu 18 Virtual Standard COM Port DTR: CW Keying
  Menu 19 Virtual Enhanced COM Port RTS: PTT
  Menu 20 Virtual Enhanced COM Port DTR: RTTY Keying

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ICOM 61

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N1MM+ Contest Software Configuration

- Select Config, Configure Ports, view Hardware Tab
- Check CW/Other box next to Rig's Serial Port
- Click Set button

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ICOM 62

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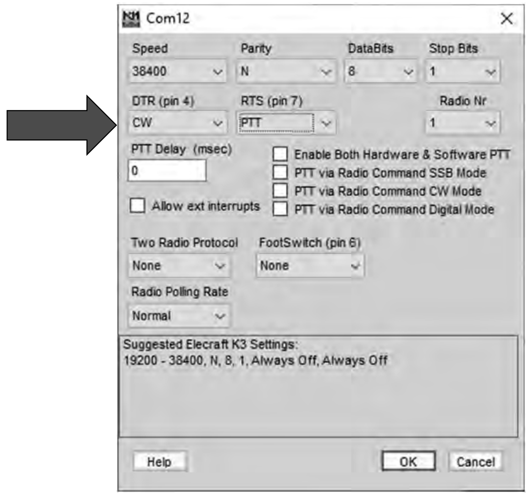
N1MM+ Contest Software Config. (cont'd)

- Set DTR (pin 4) = CW, RTS (pin 7) = PTT



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Win-Test and DXLog.net Contest Software

- Set DTR (pin 4) = CW, RTS (pin 7) = PTT

Win-Test:

DXLog.net:

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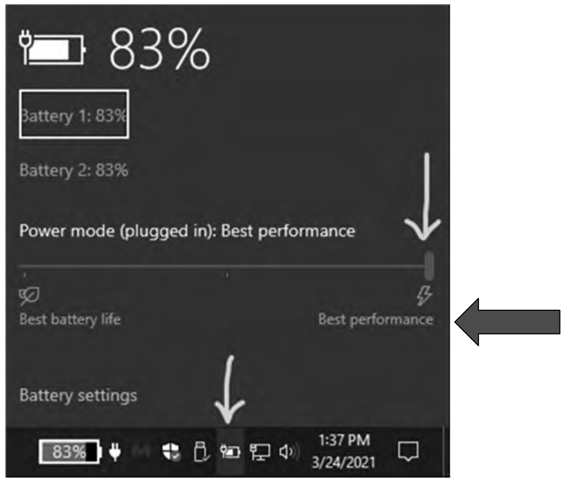
ICOM 64

Notebook PC:
Windows Power Mode Affects CW Timing

- CW Timing over USB is usually very good *if* you set Windows **Power Mode** to **Best Performance**:



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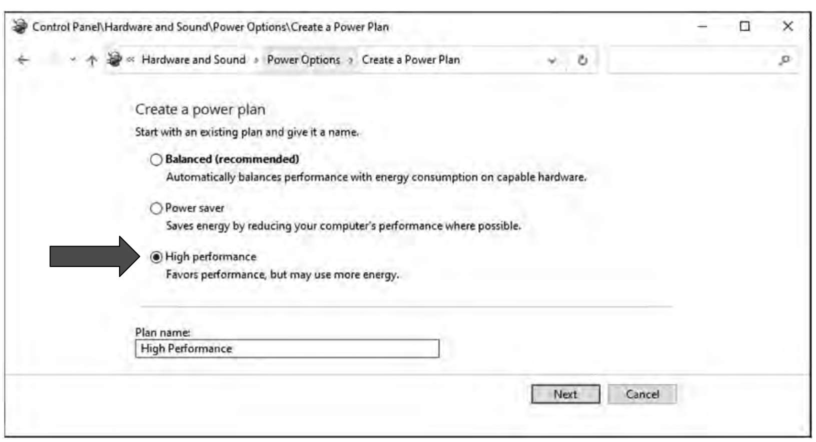
Desktop PC:
Windows Power Options Affects Timing

- CW Timing over USB is usually very good *if* you set Windows **Power Options** to **High performance**:



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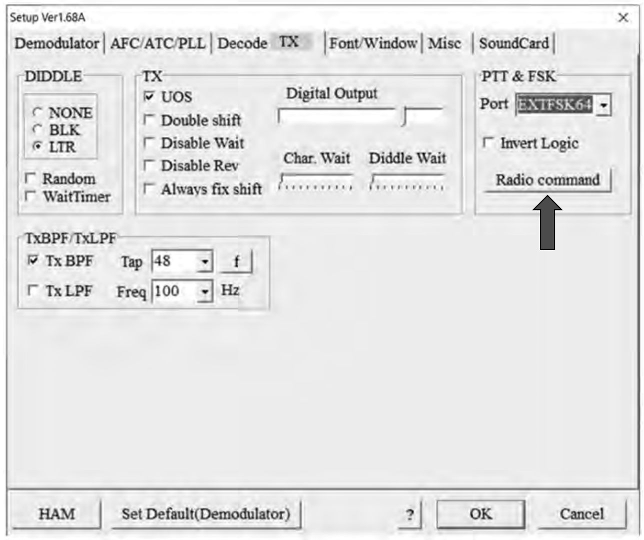
FSK RTTY Keying:
MMTTY Setup Menu, TX Tab

- Set **Port** to **EXTFSK64**, then click **Radio Command**



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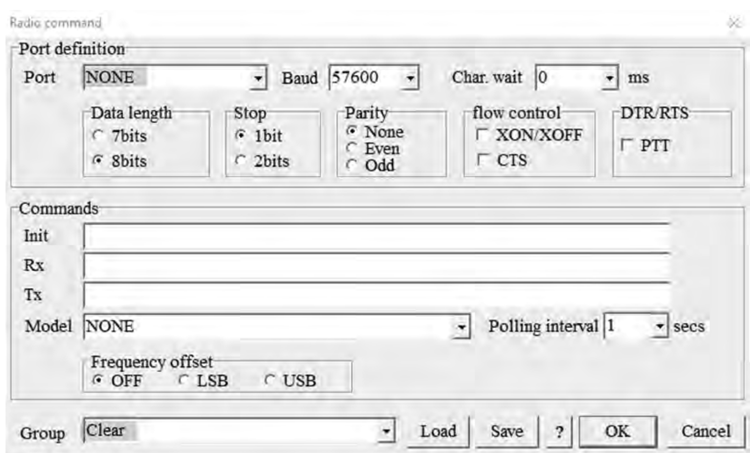
MMTTY Setup Menu
Radio command button

- Set **Port** to **NONE**, Group to **Clear**



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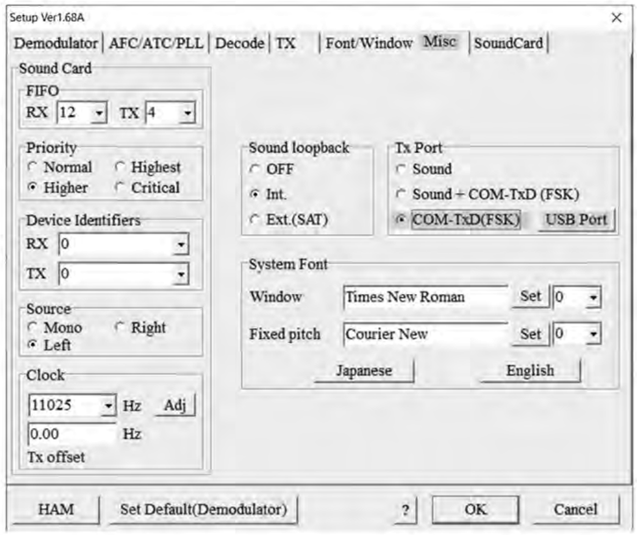
MMTTY Setup Menu, <u>Misc</u> Tab

- Set TX Port to **COM-TxD(FSK)**, click **USB Port**



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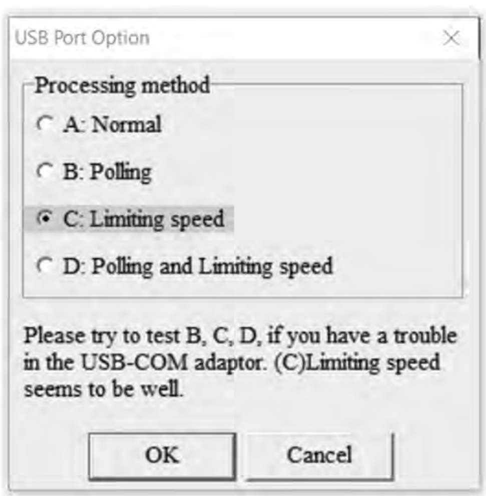
MMTTY USB Port Menu

- Set Processing Method to **C: Limiting Speed**



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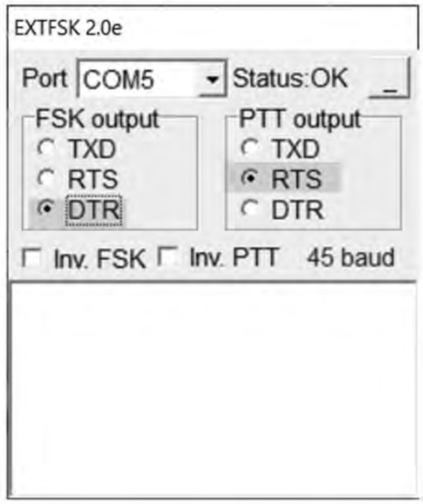
EXTFSK Pop-Up Menu

- Select second COM Port, FSK=DTR, PTT=RTS



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ICOM 71

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Serial Port Sharing and Conflicts

- In RS232 protocol, only **one** TXD line (Pin 3) can be connected between a PC and a Radio
- No other device may connect to Pin 3 if a PC is connected
- PC Polls radio on Pin 3 (TXD), Radio sends response on Pin 2 (RXD).
- AUTO INFO mode provides same output without PC polling
- Multiple devices (SteppIR & Baby Loop controllers, Band Decoders, Elecraft / ACOM / SPE amplifiers) may *monitor* the RXD line in parallel by only connecting to Pin 2.
- RF-Kit amplifiers require connection to *both* Pins 2 and 3

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ICOM 72

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Shameless Plug

- The N6TV "Serial Box" (S-BOX and S-BOX-USB with FTDI) provides parallel connections to a rig's serial port via standard D-SUB cables:

  https://bit.ly/S-BOX

- Connects rig to SteppIR controllers, ACOM amps, SPE amps, …
- Includes *four* NPN keying circuits for rigs that do not support CW, PTT, or FSK keying via DTR or RTS, such as: Elecraft **KX2 KX3**, Yaesu **FT-1000MP FTdx3000 FTdx5000**, Kenwood **TS-590s TS-990s**, ICOM **IC-7600 IC-7700 IC-7800**, etc.

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ICOM 73

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Software for Sharing Serial Ports

- Software sharing: multiple programs simultaneously access the radio's rig control serial port
- Implemented by VE3NEA's **OmniRig** software
- OmniRig may be used by Win-Test, Writelog, HDSDR, WSJT-X, Log4OM, etc. for rig control
- But OmniRig is NOT supported by N1MM+, N3FJP, others
- OmniRig owns the serial port, acts as traffic cop, no collisions or conflicts between applications
- CW / PTT / FSK Keying via OmniRig port is not supported
- Consider N4PY Pegasus Plus
  Allows sharing of Radio COM port with up to five other applications
- Can I use VSPE instead? vspMgr? COM0COM?
  Maybe, but command collisions or VCP driver conflicts may occur

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ICOM 74

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Radios with both USB *and* DE-9 connectors

- Elecraft **K3S**, Yaesu **FTdx3000**: USB and Serial Port do not operate independently (must pick one)
- USB and Serial Port *do* operate independently in:
  - Elecraft **K4**
  - Kenwood **TS-590S**, **TS-890S**
  - Yaesu **FTdx101D**, **FTdx101MP**
- ICOM USB and CI-V Ports (3.5mm, not DE-9) mostly operate independently (if you set **USB CI-V Port** to **Unlink from [REMOTE]**)
- Two devices can poll the radio at same time via independent serial ports, one USB and one DE-9 or CI-V “REMOTE” connector

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ICOM 75

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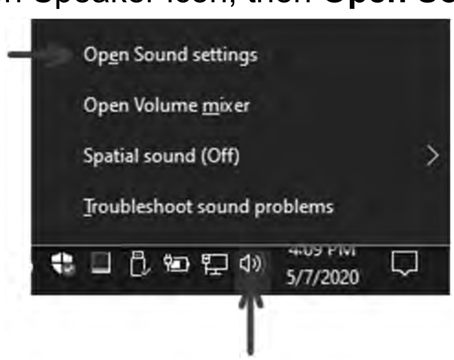
USB connection to radio adds a new Windows Sound Card

- **USB Audio CODEC**
- Can be use for contest recording, voice keying, RTTY / FT8 decoding
- Multiple “USB Audio CODEC” devices – which one is my radio?
- Right click on Speaker icon, then **Open Sound Settings**



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ICOM 76

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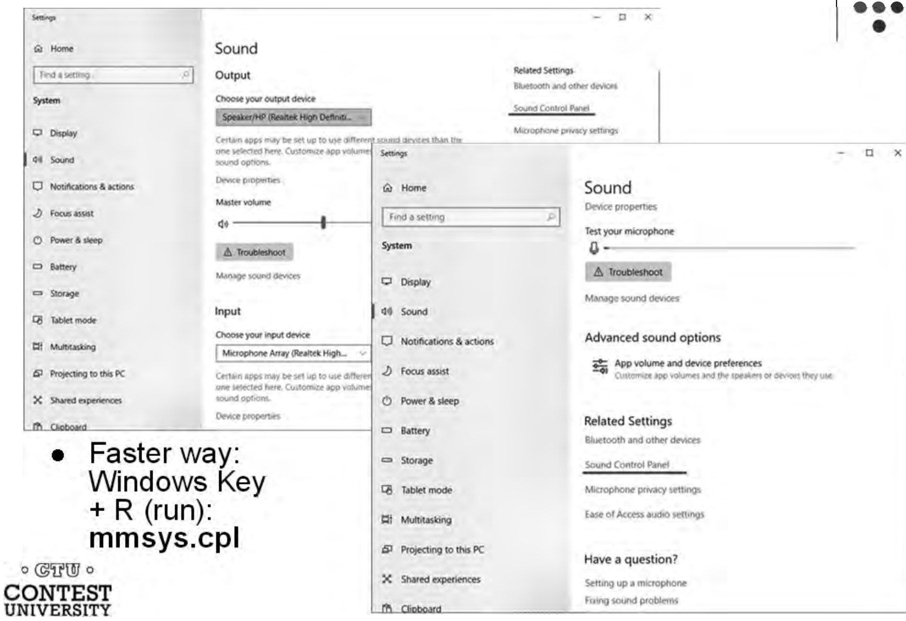
Click Sound Control Panel



- Faster way: Windows Key + R (run): **mmsys.cpl**

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77

77

Windows Sound Control Panel, Recording Tab

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In Sound Control Panel, which sound card is my radio?

- Watch **USB AUDIO CODEC** devices
- A device will disappear and reappear when you disconnect and reconnect the USB cable from the back of the radio
- Select that device, then click **Properties** button
- Label both the **Recording** and **Playback** tabs with name of device, click **Apply**

79

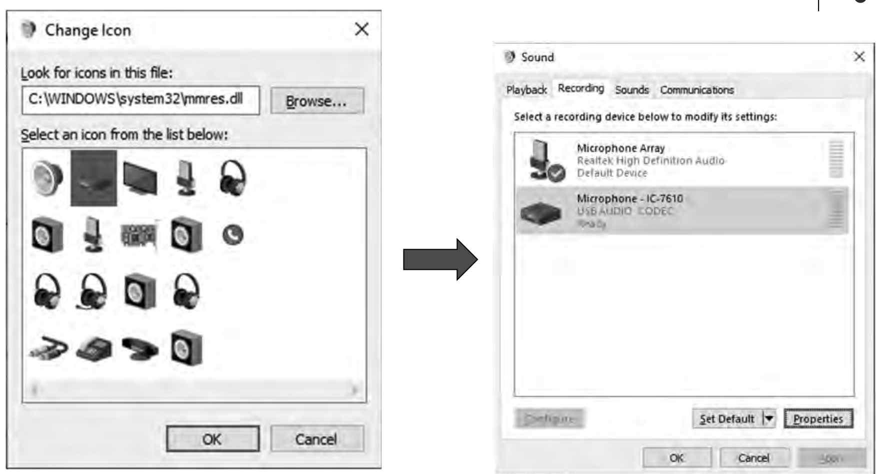
79

Change Label and Icon of USB Audio CODEC

80

80

Change Icon of USB Audio CODEC Device



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81

Key Points to Remember

- Use the Windows Device Manager to manage and renumber COM ports
- Always uninstall Prolific devices and drivers
- Always change the FTDI Default Options
- Consider labeling COM ports using Registry Editor
- Try CW, FSK and PTT via serial port pins
- Use DTR for CW/FSK, RTS for PTT
- Understand serial port conflicts and sharing
- Label your USB Audio CODEC devices

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82

References

- http://www.qrz.com/db/n6tv - Links to this and other presentations
- https://www.nirsoft.net/utils/usb_devices_view.html - USB Deview
- https://docs.microsoft.com/en-us/sysinternals/downloads/process-explorer - Windows Process Explorer
- https://bit.ly/S-BOX - The “Serial Box” by N6TV
- n6tv@arrl.net

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Questions?

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ICOM 84

84

1

Who Am I

- Licensed in 1967, CW traffic handler in high school years
- Contest bug bit hard in college
- Started in engineering, switched to economics
- Career in academics, research
- Married with two adult children, four grandkids
- One of seven siblings – I am the only one who owns a socket set

2

An Economist is Going to Tell You How to Build Something?

- Plenty of expertise out there on antenna design, propagation, terrain analysis, and a host of other technical topics
- But there is something missing: how to turn designs into reality
- Some hams build contest stations wherever they go
- Many contesters never build stations
- Sharing my story might inspire you to do better

3

My Contest Station Building History: 1972-74

WA8SWM (now W7WM), Michigan

- First guyed tower (80 feet of Rohn 25) at WA8SWM's parent's house
- Monobanders on 20/15/10 better than anything we'd ever used
- Too many stupid and unsafe things to ever remember them all
- Won the WW CW for W8 with a score of 629,000 points!!
- Lessons learned:

  - You need a 40 meter beam
  - 160? What's 160?

4

My Contest Station Building History: 1975-84

NA8V (then WA8TBQ), Michigan

- Great countryside location at NA8V's parent's house in rural Michigan
- Many failed iterations for the first five years
- Eventually built a large station with four towers
- Some good contest scores as WA8YVR (#2 in WW CW 1982)
- Lessons learned:

  - bury feedlines!
  - competitive antennas for 80/160 needed

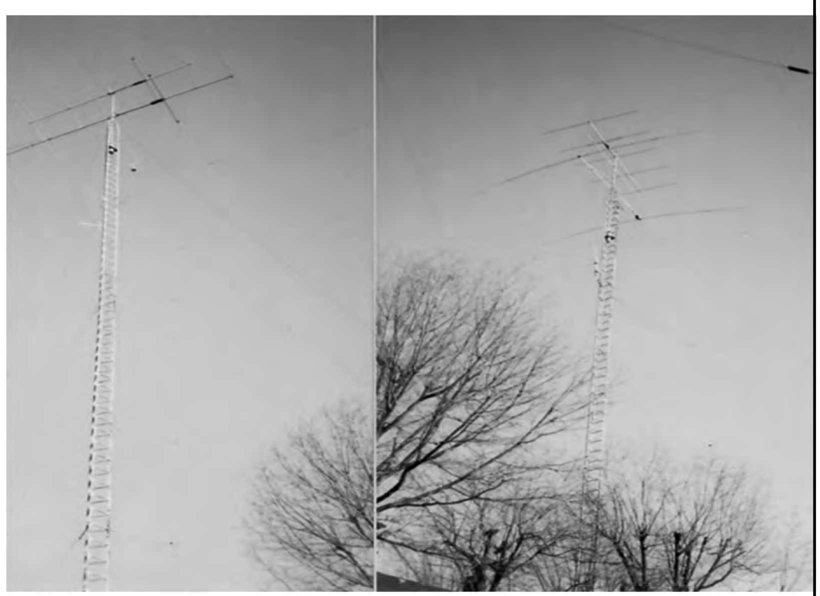
5

My Contest Station Building History: 1990-93

WA8YVR in Columbus, Ohio

- First home station since high school
- Acquired a two tower station, was in the process of installing two new towers when QSY'd to W9
- Lessons learned:

  - Towers and neighbors can work
  - Prop pitch rotors are nice
  - Stacks matter



6

My Contest Station Building History: 1994-2007 N9RV in Indiana

- First green field station of my own – 30 acres
- No temporary antennas! Full plan was executed from the outset
- Third tower went up in 2001, fourth was 2/3 done when QSY'd to W7
- External building built for shack and workshop

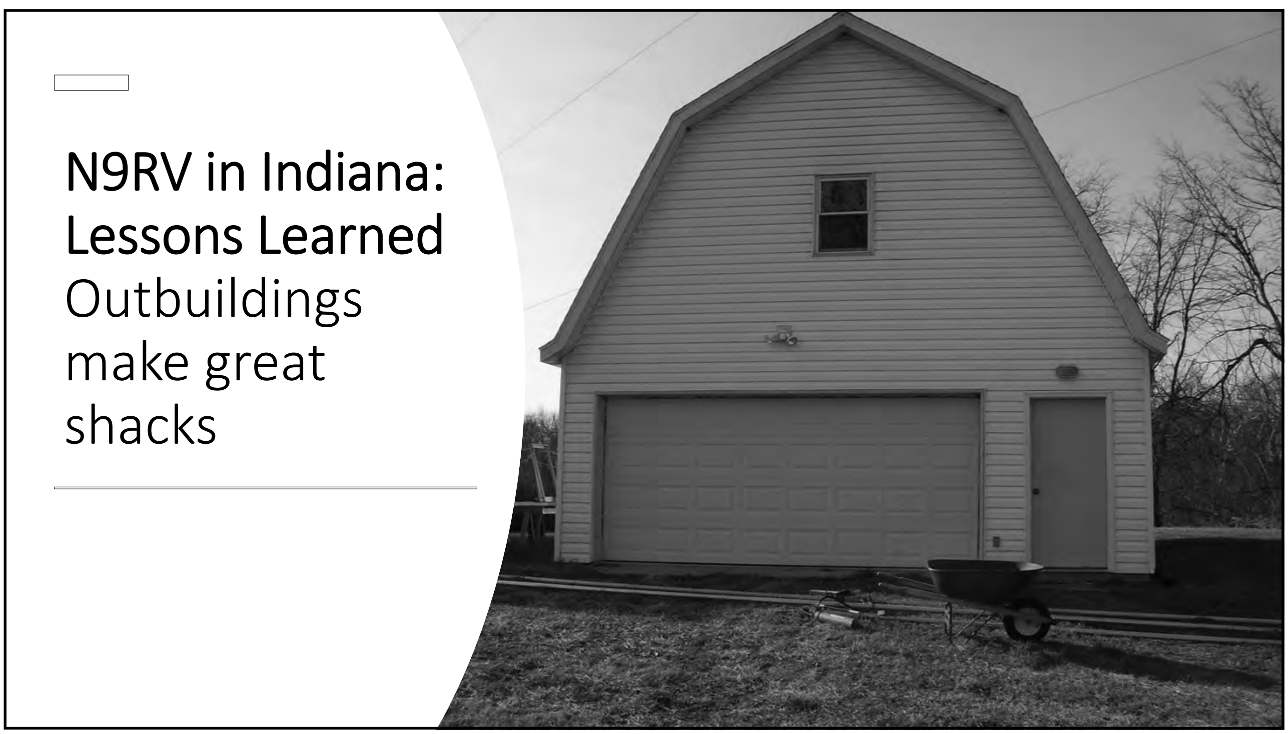
7

N9RV in Indiana: Lessons Learned
Make sure your antennas are insured

8


N9RV in Indiana: Lessons Learned
Don’t put up towers you don’t like to work on

9

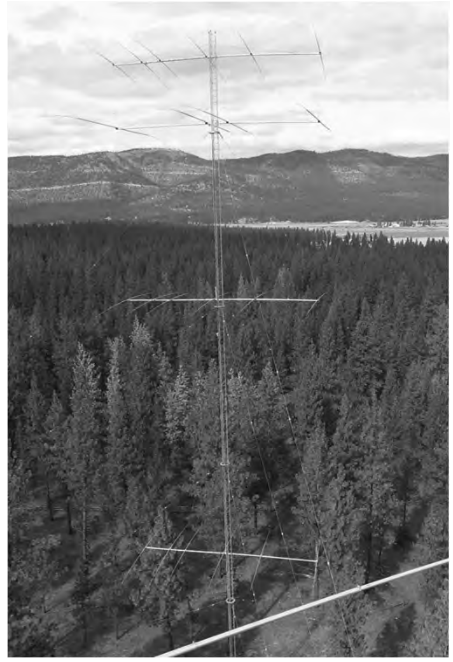

N9RV in Indiana: Lessons Learned
Outbuildings make great shacks

10

My Contest Station Building History: Since 2007
N9RV in Montana

- Totally different environment (trees/mountains)
- No chance to be competitive in DX contests – but SS?
- Moved only the antennas and towers I planned on using

Rotating 180' of Rohn 55 with 6/6/6 on 20 meters and 4 el OWA 40 meter yagi



11

40 meter yagi being launched

Rotating R55 tower with 10 and 15m stacks & 2 el 40

12

Transported tower 1,700 miles from Indiana!

Pirod tower with independent rotary yagis for 20/15/10

13

80 meter Four Square

14

160 vertical – base insulated Rohn 25 tower

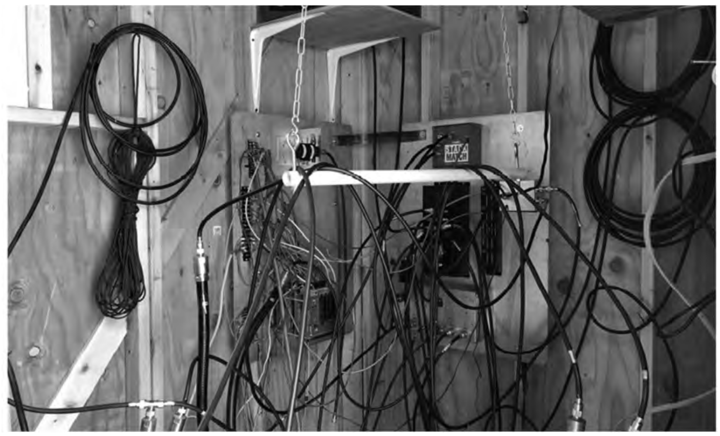
Parasitic reflector/director wires for 160m

15

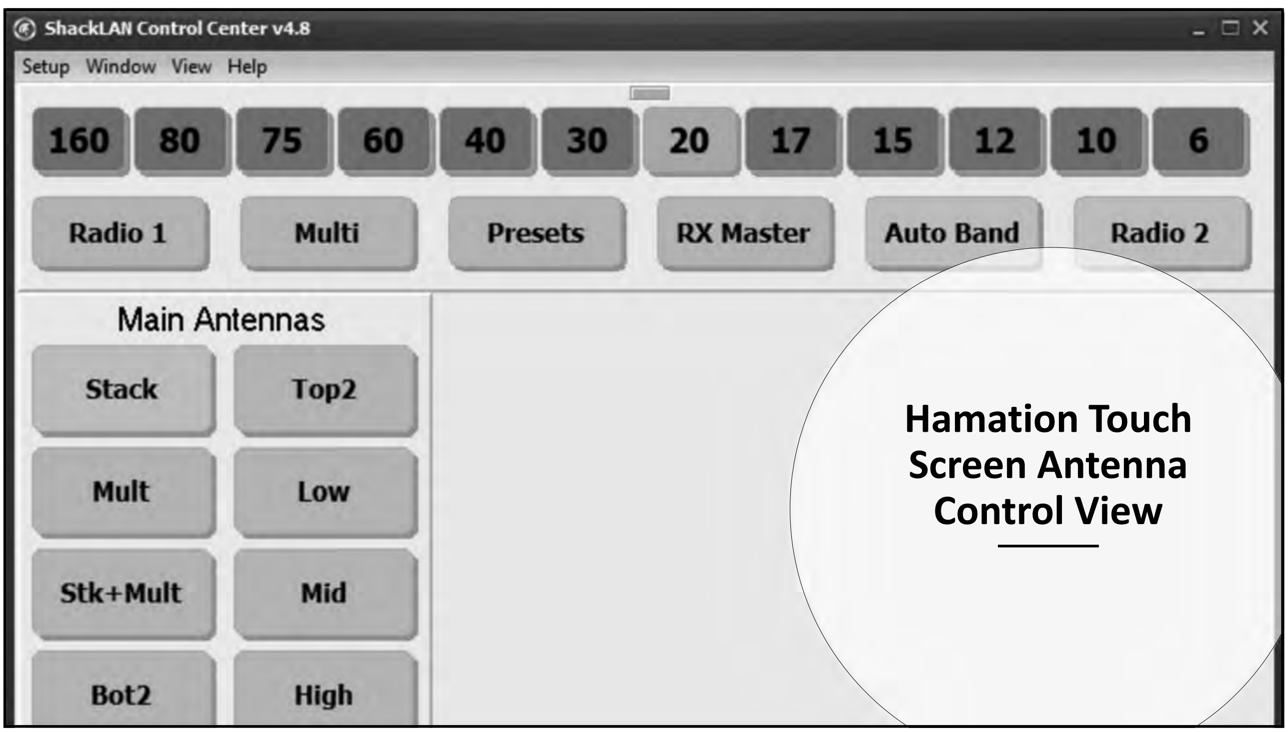
Current N9RV Operating Position

16

Remote Switch Hut is Central Node for RF Switching/Stubs



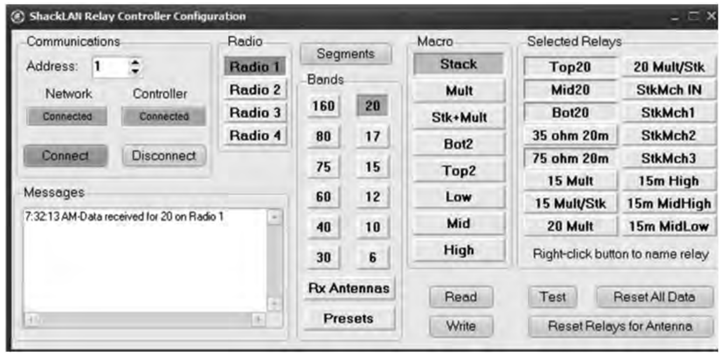
17



Hamation Touch Screen Antenna Control View

18

Hamation Configuration Screen



19

Lessons learned: Moving is a great time to downsize!

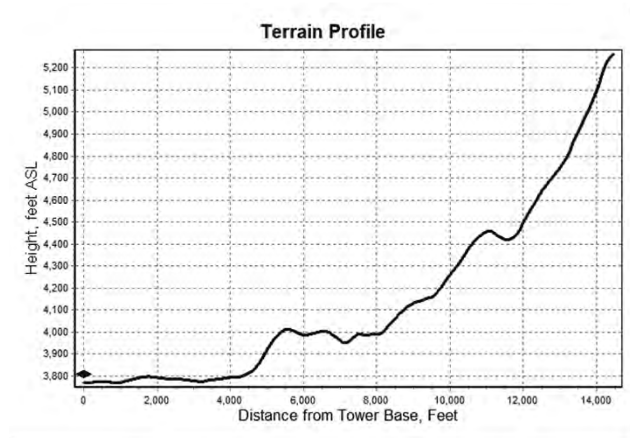
240’ of Riverview Tower, trailer headed to recycler

Antennas, Rohn tower, prop pitch rotors heading to MT

20

Lessons Learned:
All Property Decisions Involve Compromises

- Lot size of 5.5 acres was adequate, but smaller
- House did not have a ham room
- Terrain to the south blocked by a mountain



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Contest Station Building: So Many Questions

- Should I build a station?
- What kind of station should I build?
- What are the basic steps?
- How can I build a station that is (i) affordable? (ii) reliable? (iii) effective? (iv) safe?

22

Should I Build a Contest Station?

- Some people just like to operate
- Some people enjoy being weak
- Contest stations require time, resources, and the willingness to make compromises
- And an understanding family!
- And who likes fixing stuff?
- But you don't have to be an engineer …

- Without contest stations there would be no contests
- Having your own station is the best way to operate a lot
- Planning and executing a plan to build a station is tremendously satisfying (but sometimes frustrating)
- Adding and building to your station keeps the buzz going

23

Operating from C6A

N5AU in 1981

24

What Kind of Station Should I Build?
It depends on who/where you are and what are your goals

- Coastal Maine or northern North Dakota?
- Dxers only need to be loud in one direction
- All band capability is a must for most of us
- The definition of “big” keeps changing

25

What Kind of Station Should I Build?
It depends on who/where you are and what are your goals

- Tower mounted yagi(s) for 20/15/10 is basic
- Ability to spread RF in multiple directions is useful
- Monobanders and stacked yagis are the “ticket to the dance” for DX contests competitiveness

26

N9RV Station Objectives

- To be "the guy to beat" in DX contests from my area
- Needed to be 2-radio capable
- Multi-op possible, but not a priority
- Phone and SSB capable, other modes not important
- Stacks on 20/15/10, full sized yagi on 40, gain antenna on 80

- Copied many ideas from other stations
- K3TUP: Stack, fixed SE antenna, and independent rotary yagi for 20/15/10
- KC1XX: Switch hut for RF away from main shack
- W9RE: North stop rotor for multiplier antennas

27

- **The Basic Steps of Contest Station Building**
  Step 1: Get a QTH

- Most contesters never get past this step
- You don't need to solve the nation's problems of HOAs and Zoning Restrictions. You just need to find a place you can set up.
- The objective of contest station building is to be loud into Europe. It is not necessarily to be the most popular person in your neighborhood.
- QTH selection involves tradeoffs and compromises. Some (commute time) may be easier than others (K12 school quality).
- Talk to people who have done it in your area, don't dwell on the stories of those with attic antennas.

28

K9RS/3
Perkasie, PA

Built this very effective one tower contest station in EPA. Spent six months persistently seeking a building permit after moving in.

29

30

- **The Basic Steps of Contest Station Building**
  Step 2: Acquire your "stuff"

- Another stumbling block for many – contest hardware is expensive!
- But many of the things you need for a contest station do not have to ordered from a catalog.
- The art of the deal: with time, ingenuity, energy and maybe a two axle trailer, you can get a lot of things you need.
- Learn what is worth having and what is junk
- Some things are too important to buy used (especially when they impact safety)

31

Opportunities for Contest Station Builders
Teardowns of Existing Stations

- Contesters/DXers move, downsize, go SK
- Taking down towers/antennas, done safely, can yield "core" items like towers, and many "extra" and "throw in" items
- Sell off stuff you don't use
- Rusted Spaulding tower, old TH6's – NO
- Rohn tower, rotating rings, even Philly or guy wires – YES
- You can adapt your plans based on what you acquire within reason
- All N9RV towers and rotors are teardowns

32

Opportunities for Contest Station Builders

Building your own antennas

- Monoband antennas are easy and fun to construct
- Aluminum bulk purchasing prices fall with the size of the order, sometimes substantially
- May need to utilize multiple vendors to get best prices
- Collaboration with other station builders can reap rewards when combining orders
- The same is true for muffler clamps – which can be galvanized
- McMasterCarr is an absolutely amazing resource

33

Random Notes on Station Construction

- Rotors are another costly item that are failure points in many stations
- Prop pitches need not be expensive, and are fun to refurbish
- Guyed towers are preferred, Rohn 45/55 is the best
- Absolutely do not compromise on guy anchors, guy hardware, bases and other safety related items
- If you are doing something different than the Rohn book recommends, don't!

- Your recycling facilities can sometimes be fertile ground for scrounging
- CATV coax used to be a great option for feedlines
- Use of cranes for tower and antenna installation is sometimes cheaper than you think
- Rotating towers are addictive

34

Perspectives and Observations

- I remain surprised at how many contesters do not have stations
- My stories of building my stations may have no relevance for your situation
- But the satisfaction of contesting with the station that you have yourself built is tremendous
- Some of these lessons might apply to you
- Persistence – you are pursuing your passion
- Flexibility and willingness to compromise
- Ingenuity and resourcefulness in assembling your hardware and executing your plan
- Next year we will talk about maintaining it all!

35

Teamwork and Multi-Operator Innovations

CTU Presents

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1

Who is ND7K?

- A brand-new station in Central Arizona built to push the limits of Western United States contesting

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2

Accomplishments

- CQ WW SSB 2020 M2 #1 North America
- SS CW 2020 MS #1 (Missed record by 1 Qso)
- SS Phone 2020 MS #1
- CQ WPX SSB 2021 M/M #1 North America
- CQ WPX CW 2021 M/M #1 North America
- IARU SO CW HP 2021 #1 US/Canada
- CQ WPX SSB 2022 M2 #1 North America (claimed)

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3

Questions you might have:

- Who the heck are you?
- How did you do this?
- ***Wait, you're not in Maine?!***

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4

About me:

- Tim Coker, N6WIN
- Licensed in 1989
- Had a modest station on 1/8 acre in a Los Angeles suburb
- Retired Firearms Instructor (not an engineer)
- ***Didn't initially plan on building a superstation***
- ***Definitely didn't think these results were even possible from Arizona***

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5

This guy:

- Dan Craig, N6MJ / ZF2MJ (when he's not at TI7W)
- Occasionally wins contests
- Manages to convince me that perhaps I could "go big" and build a competitive station at my new QTH
- "People would travel from all over the place to operate your station…" he says
- "… you just need the following 50 antennas, radios, amplifiers, and a bunch of other stuff." Recruits several others to cheer me on.

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6

Today’s Talk

- We could spend hours on how the station came to be, the antennas, the design decisions, the construction, the neighbors, the permits.
  - *All very important, great topics for another talk*
- *But what can I tell you in 30 minutes about*
  - *Teamwork?*
  - *Operator Scheduling?*
  - *Shack Technology?*

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7

Teamwork

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8

Recruiting

- N6MJ solicits team members
- Each contest in mind
- Desired category
- Teamwork abilities
- Personal traits

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9

Schedule

- Based on category
- Operator strengths & weaknesses
- Run and inband listed
- Previous logs studied
- Expected conditions considered
- * on inband slots that are ok to miss (rest)

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10

Station Boot Camp

- Friday morning start
- Antenna walk
- Team Captain briefing
- Try to break stuff
- Train inband

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11

Technology

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12

K6AM Skunkworkz

- Small, simple, purpose-built black boxes perfected by K6AM at W6YI, ZF1A, and other locations
  - Audio sharing
  - Interlocked radios
  - Transfer switches
- No microcontrollers or software (completely reliable)
- Works with almost any radio

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13

K6AM Skunkworkz Audio Box

- 2BSIQ Mode
  - Both
  - Left
  - Right
- Manual Mode
  - Multi's
  - Weak signals
  - One radio

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14

K6AM Skunkworkz Lockout Box

- **PTT Lockout**
  - **3 Radio**
  - **Partner Mode**

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15

K6AM Skunkworkz Xfer Switch

- **Transfer Switch**
  - **Run**
  - **Mult (out of band)**

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16

Inband RX Antennas

- RX Verticals 600’ East
- Beverages 580’ length
- Coax buried & choked
- Preamps only if needed

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17

MOAS / K9AY Receive Switching

- Mother Of All Switches (K1XM)
- RX antenna selection at every operating position
- Band-Pass Filters for 40/80/160M
- DX Engineering RX Guards

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18

Green Heron Engineering

- GH Everywhere
- Per-band menu selection of TX antennas
- Available at every operating position
- With so many antennas, very intimidating to new operators

19

What's Next? Simplification

- Streamdecks
- MOAS for TX & RX

20

Post Contest Dinner

Comaraderie

Relive the contest

Tradition

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21

Tower Safety

Tim Jellison W3YQ/KL7WV

1

Safety procedures

- First – check for power lines
- Use a proper harness and lanyards
- 100% Tie-off. NO FREE CLIMBING
- EVERYONE wears a hardhat
- Never "EVER" ride a rope, capstan, hoist

2

A full-body harness aids in rescuing you from the tower should that become necessary.

3

If using a fall arrest lanyard, the tie-off point is critical. Don't trust Rohn cross braces. They're not strong enough.

4

Snap around the tower leg instead

5

6

Plus, you can get a harness with a seat strap. These are the best!!!

7

Be careful at the top of the tower. Don't let the lanyard slip over the top.

8

- If hiring a tower crew, use only certified climbers
- Consider becoming a certified climber yourself
- www.comtrainusa.com
  www.citca4training.com

9

Open forum and discussion.

10

And above all, when climbing follow all safety rules!

NO SK's

11

Glossary – by Patrick Barkey, N9RV

10-minute rule

The 10 minute rule restricts band changes for some multi-operator categories for certain contests. The implementation of the rule depends on the contest -- in some cases it has been replaced by a band change rule. The rule was designed to prevent the interleaving of QSO's on different bands for "single" transmitter categories by stations which actually have multiple transmitters on different bands.

Categories: contest specific concept, operating classification,

See Also: Band change rule, MS, M2, rubber clocking

175 mile radius

A geographic requirement for groups of stations jointly submitting their scores as part of the club competition in ARRL contests. In the “unlimited” category of club competition, stations submitting their scores as part of a club for the club competition must either be within a single ARRL section, or within a 175 mile radius of a centroid, to be eligible to contribute their score to the club total.

Categories: contest specific concept, log checking and reporting

See Also:

2BSIQ

Two Band Synchronized Interleaved QSOs. Dual-CQing in a SO2R environment, where a CQ is called alternatively on each radio (typically on separate bands). See Dual-CQ.

Categories: operating technique, operating software/hardware,

See Also: Dual-CQ

3830

The frequency on the 75 meter band where stations congregate at the end of a contest to exchange scores informally. In actual practice, most of this now takes place on internet. The listserv, or reflector, where much of this takes place is called the 3830 reflector. It is hosted by contesting.com. A separate site, 3830scores.com, has comprehensive summaries of (unverified) contest scores reported by participants.

Categories: log checking and reporting

See Also:

4-square

An increasingly common array of four vertical antennas arranged in a square that is electronically steered in four, switchable directions using torroidal or coaxial delay lines. Once used mostly as transmit antennas, particularly on lower frequencies where yagis are not practicable, these arrays are also becoming common as receive antennas. 4-square controllers, which perform the switching, are both homebrew and commercially available.

Categories: station hardware

See Also: Receive antennas

ADIF

Amateur Data Interchange Format. A transport format for contest logs used for inporting/exporting files between different logging software and other programs. Similar in function to Cabrillo.

Categories: operating software/hardware

See Also:

AFSK

Audio Frequency Shift Keying is a RTTY mode where two audio tones are fed into the Mic or auxiliary audio input to the SSB transmitter to create the two RTTY RF frequencies.

Categories: general

See Also:

Assisted

Assisted is an "overlay" category that is interpreted in most contests as meaning that use of spotting information delivered from internet or packet radio based networks which give real-time information on frequencies and call signs of stations in the contest is allowed. It is a single operator overlay -- most multi-operator categories already allow spotting assistance.

Categories: operating classification

See Also: SOA, unassisted

Band change rule

A rule which restricts band changes for certain multi-operator categories in some contests. A band change rule says that a station can, say, only make 8 band changes per hour. Note that moving to a band to work something, and then returning counts as two band changes.

Categories: contest specific concept

See Also: 10-minute rule, MS, M2

Band Decoder

A band decoder either operates through hardware or software to switch station hardware (e.g., antennas, filters) based upon the band selection of the radio. They are a fundamental part of most top tier stations.

Categories: station hardware

See Also:

Band Edge

The band edge generally refers to the lowest (or highest) frequency in the band where one can legally operate within the limits of his/her license. For US operators, for example, this would be approximately 21200.4, say, for 15 (USB), but

would be about 7127 or so for 40 (LSB). The reverse is true for the upper band edge – e.g., on USB on 15 meters the practical limit for transmit frequency is approximately 21448. The lower band edge is sometimes desirable for US operators who are running since QRM from other W stations can only be on one side of your signal.

Categories: operating technique, ethics,

See Also:

Band Map

A graphical, real time display of stations arranged by frequency presented by most popular contest software. The map is either populated by telnet/packet spots from clusters and skimmers, and/or may be filled in using data entered by the user. Most software allows users to then click on stations on the map to be taken directly to the frequency the station is reported to be on. Stations listed on the map are color coded – with new multipliers distinctly noted. (Stations previously worked may not be listed at all). The accuracy of these maps is only as good as the data used to construct it – errors in callsigns are frequently encountered. Use of band maps (or packet/telnet and skimmer spots) are not permitted for Single Operator Unassisted categories.

Categories: operating software/hardware

See Also:

Beacon

Fixed, automated transmitters which transmit signals (typically CW) continuously to allow operators to check propagation. These transmitters are located around the globe and on HF are mostly found on bands such as 10 meters above 28.1 mHz. They typically use low power and omni-directional antennas. It can be good operating strategy to tune to these stations during contests to learn when propagation might support QSO’s even if activity and thus stations in the contest are not heard

Categories: operating techniques

See Also: RBN

Bip/Bop

A hardware switching arrangement for stacked yagis or other all driven antenna arrays that allows the operator to select both in phase (BIP) or both out of phase (BOP) operation. The latter can be dramatically better for very high angles of radiation..

Categories: station hardware

See Also: Stack, yagi, phasing

Blind skimmer

A mode of operation for a CW skimmer that disables the decoding of callsigns as well as the integration with internet spots. In this blind mode, the operator only sees (potentially) a waterfall display showing recent historical activity across the band as with a panadaptor. Blind mode is legal for single operator, unassisted entrants in most major contests.

Categories: contesting hardware/software

See Also: Skimmer, panadapater, spots, SOAB, SOA

Breakdown

The disaggregation of one's contest score into QSO's and multipliers worked, usually separately tallied for each band (or even additionally, for each hour).

Categories: log checking and reporting

See Also:

Buffers

To account for latency and jitter, most systems allow for an amount of ‘buffering’ or ‘storing up’ packets as they arrive, so that a momentary big swing in either latency or jitter won’t interrupt the flow of conversation. Too many buffers introduces extra time and can make transmit / turnaround times grow to be an annoyance in contest situations

Categories: remote radio

See Also: Latency, jitter

Bust

A bust is a QSO that is incorrect in some way -- the callsign or exchange was inaccurately recorded. May also refer to spots which are incorrect.

Categories: log checking and reporting, ethics,

See Also: Spot

Cabrillo

Cabrillo is a very flexible and generalized computer file format that is supported for score reporting by all modern contest software. Most contests have moved to require that electronic log submissions provide contest logs in this format. In most cases contest software will do this automatically.

Categories: log checking and reporting

See Also:

Category

A contest category is the classification defined by the contest rules that you choose to enter when you run the contest. Specific category definitions depend on the rules of the contest, but common examples would be single operator all band or multi-operator (with one or more transmitters).

Categories: operating classification, log checking and reporting

See Also: Category shopping

Category Shopping

The practice of deciding which category to submit your contest score in after the contest is over, and after information on (claimed) scores of potential competitors is public. The purpose of category shopping is to attempt to win a plaque or other recognition in a category that was less competitive than the category that was actually selected in advance. This could be done, say, by claiming SOA when no assistance was used, or even by claiming multi-operator when only one operator was present. This practice is unethical and contrary to the spirit of competition.

Categories: ethics, log checking and reporting

See Also: SOA

Check

A two digit number that corresponds to the first year that you obtained your ham radio license. The check is part of the exchange in the ARRL SS contest. Multi-operator stations use the same check regardless of who is operating.

Categories: contest specific concept

See Also: Exchange

Cheerleading

Describes the practice of a station or group of stations actively supporting the operation of a specific competitor. This could be by, say, spotting the competitor's CQs on spotting networks, coordinating to find and call the station (as a group) to attempt to enhance their score, or passing along multiplier information, etc. Such practices are unethical and, in many cases, cause for disqualification. They have been known to occur in WRTC events and constitute a serious threat to the integrity of those competitions.

Categories: ethics

See Also: Spot, WRTC

Check Log

A category for log submissions which removes the entrant from any competition or score listing. Instead, the log information is submitted solely for log checking purposes by the contest sponsor.

Categories: operating classification

See Also:

Claimed Score

The contest score that is computed before any deductions for incorrectly logged information (conducted after the contestant submits the log to the contest sponsor) take place.

Categories: log checking and reporting

See Also:

Cluster

A legacy term that once referred to the packet radio networks that supported the exchange of real-time spotting information (announcements of calls on specific frequencies). Since the software that made this possible was PacketCluster, written by AK1A, the use of any spotting network is still call using the “cluster,” even though the software and the use of packet radio are no longer used.

Categories: operating software/hardware, operating technique

See Also: assisted, RBN

CODEC

CODE then DECODE. This is the software that puts audio from an analog form into a digital form, and reverses the process on the other end of a link. It is how we send audio over the internet. Without this, VOIP would not be possible.

Categories: remote radio

See Also: VO IP

Cty.dat

Cty.dat, or sometimes wl_cty.dat, also known as a "country file." is the computer file containing the lookup information that translates prefixes of callsigns into country and/or zone multipliers. Software would use this file, say, to tell you that N9RV counts as a W, and is in CQ zone 4 (or ITU zone 6). Since worldwide prefixes are frequently in a state of flux, an up-to-date country file is always desirable. More recent country files also contain data that may help determine a station’szone. Such information can be inaccurate and in all cases operators should gather such information from the contest exchanges themselves.

Categories: operating software/hardware

See Also: Mult, Exchange

Deadline

The latest day that logs can be submitted to the contest sponsor to be included in the competition.

Categories: log checking and reporting

See Also:

Digital Voice Keyer

Hardware which digitally records one’s voice for CQ’s, contest exchanges and other frequently spoken information. The recording is played back using keystrokes defined by software (or by pushing a button for a stand alone box), thus saving the operator the fatigue of doing it manually. Most modern software uses computer sound cards for this purpose. Older software used specially designed cards (e.g., the DVP by K1EA, the W9XT card) or even a stand alone box.

Categories: operating software/hardware

See Also:

Distributed Multiop

A multi-operator (and often multi-transmitter) category where the stations and antennas are physically distant from each other, linked by internet, competing as a single entry using a single call sign. This category has been allowed for headquarters stations in the IARU contest for many years – otherwise it is generally against contest rules that require all antennas/radios to be in one location. Social distancing and Covid have persuaded more contesting sponsors to allow it.

Categories: operating classification

See Also: M2, MS, MM, Headquarters Station

DNS

Domain Name Service or Server. Since humans find it easier to remember names rather than a 12 digit number, we have created names for addresses. The Domain Name Servers keep track of the mapping of names to IP Addresses and provide the number when you put in a 'name', i.e. www.google.com

Categories: remote radio

See Also: IP address, dynamic DNS

DQ

Disqualifaction (DQ) is the disallowal of a contest entry by the sponsor of the contest, for serious rule violations. DQ is a serious step, which can have ramifications for WRTC eligibility and participation in future contests.

Categories: log checking and reporting

See Also: Red card, yellow card

Dual-CQ

Dual-Cqing (or dueling CQ's) is supported by some contest software in a SO2R environment, where a CQ is called alternatively on each radio (typically on separate bands). It adds complexity, but can increase your transmitted presence and has led to significant score increases for some top competitors.. Some have labelled this operating technique with the more complicated moniker "2BSIQ," which stands for Two Band Synchronized Interleaved QSOs.

Categories: operating technique, operating software/hardware,

See Also: 2BSIQ

Dummy CQ

A dummy CQ is a CQ sent out by a SO2R station as a means of holding a frequency (e.g., discouraging others who might start Cqing themselves). Although it sounds just like any ordinary CQ, in a dummy CQ scenario the SO2R station is not prepared to answer responding stations until his/her QSO on the other radio is completed.

Categories: operating technique, operating software/hardware,

See Also: SO2R, dual-CQ

Dupe

A dupe is a second contact with a station that does not count for additional points. Most contest software will inform you whether or not a station is a "dupe" so you don't waste time working it.

Categories: log checking and reporting

See Also:

Dynamic DNS service

This is a service provided to keep track of your current Dynamic IP address. Since your IP address can change at any time, it's easiest to come up with a name, then have the system keep track of your current IP number. The largest is www.dyn.com – and your router will have an option to communicate with it.

Categories: remote radio

See Also: IP address, router, DNS

Dynamic IP address

Your ISP provides your IP Address on a random basis. As the pool of numbers is limited, they recycle them. This number is assigned to your internet Modem or Router.

Categories: remote radio

See Also: ISP, IP address, router, fixed IP address

ESM Mode

Enter Sends Message mode. A concept for logging software that uses the Enter key on the keyboard to accomplish multiple tasks, depending on the context. While this is implemented differently in specific software, the general concept allows the user to press the Enter key at different stages to, say, start a CQ message, respond to a call by sending the exchange, or send one's own call, depending on the context in which the key is pressed. If a program does not enable ESM mode, then pressing a specific key always produces the same result.

Categories: operating software/hardware

See Also:

Exchange

The information that is passed between stations in a contest (in addition to the call sign). In the CQ WW, for example, the exchange is RST and the two digit CQ zone number.

Categories: contest specific concept, operating software/hardware,

See Also:

Firmware

Computer code that controls a device. The code is generally resident in a chip, and can be updated using whatever communications protocols are set up for this purpose. Many contesting devices are now microprocessor controlled, and the ability to update firmware (generally made available by the manufacturer but sometimes customizable by the user) can greatly add to the capabilities and functionality of the device. The Elecraft K3 tranceiver, for example, has a rich and vibrant community developing new firmware to improve its operation.

Categories: station hardware

See Also:

Fishing Boats

Refers to the SSB QRM found in the CW segment of the HF bands (especially 40 meters) caused by the unlicensed, illegal activity centered in southeast Asia thought to be prevalent among fishing boats in the region.

Categories: general

See Also:

Fixed IP Address

For an extra fee, you may be able to have your IP Address not change. This makes connecting to your device easier since it's number never changes.

Categories: remote radio

See Also: IP address

Flutter

A propagation phenomenon that is characterized by very rapid QSB (fading signal strength), often accompanied by Doppler shift in frequency, which can produce a warbling tone on CW. Signals displaying flutter are most often associated with paths that travel close to or through the auroral zones around each pole of the globe, but during periods of high auroral disturbances flutter can affect almost all signals. For this reason the presence of flutter on a signal gives a useful clue for the callsign of a (possibly weak) station.

Categories: general, operating technique

See Also:

FSK

Frequency Shift Keying is a RTTY mode where the transmitter is keyed directly, similar to CW.

Categories: general

See Also:

FT8

One of the more recently developed (and rapidly evolving) digital communications modes that have exploded in popularity for both HF and VHF. While not yet a contest mode, its increasing use makes it only a matter of time before competition is implemented. Has its origins in the extremely weak signal mode WSJT originally designed by Joe Taylor, K1JT, for use with exotic propagation modes such as moonbounce. Has the ability to "read" – the human ear is not involved – signals at lower signal to noise ratios than many humans can detect using CW or SSB.

Categories: general

See Also:

Gab

Gab is a feature of many contest software packages that allows computers setup at different operating positions in a multi-operator station to send and receive messages at the keyboard to/from each other.

Categories: operating software/hardware

See Also:

Gab file

Gab file is the record of gab messages recorded by the software during the contest.

Categories: operating software/hardware

See Also:

Gas

A derogatory term that refers to running more transmitter power than is allowed by the terms of your radio license. Some contests (e.g., the CQ WW) limit transmitter power to a maximum of 1500W output no matter what the rules for one's country say. Similes include soup, smoke, or "active" antenna tuners.

Categories: ethics

See Also:

Golden Log

A log which survives the contest sponsor's log checking process with zero errors and no change to its claimed score. A golden log is the mark of a careful and skillful operator.

Categories: log checking and reporting

See Also:

Gray Line

The gray line, or daylight/darkness terminator, is a constantly moving circle around the earth where a daylight/darkness transition is taking place. When this circle is over your QTH, potentially enhanced propagation along the terminator is possible, especially on lower frequencies. The timing and potential for gray line propagation depend on a number of predictable (season of the year) and unpredictable (solar conditions) factors. Gray line QSO's can produce new multipliers and/or memorable contest experiences.

Categories: general, operating technique

See Also: Long path

Grid Square

An alphanumeric geographical coordinate system, based on the Maidenhead Locator System developed by VHF enthusiasts in 1980, in which the entire globe is divided into equal-sized rectangles which are denoted by alphanumeric codes. E.g., the four digit grid square for N9RV (western Montana) is DN36. Four (or more) digit grid squares have found increasing popularity as contest exchanges, particularly for VHF contests, as they offer both an increased challenge for successfully completing contest QSOs with accuracy, as well as giving universal location information for all countries/states.

Categories: contest specific concept

See Also: Exchange, http://en.wikipedia.org/wiki/Maidenhead_Locator_System

Great Circle

The bearing between two points on the globe which minimizes the physical distance is known as a great circle bearing. Thus the great circle bearing for working, say, India from the central U.S. is approximately due north. Great circle bearings can vary considerably from what might be suggested from the Mercator projection maps posted in most grade schools. During most openings on HF, great circle bearings are optimal for directional antennas. Long path (180 degrees different) or skew path (aiming towards the equator) are less frequent, but sometimes better, strategies for aiming antennas.

Categories: general

See Also:

Headquarters Station

A special designation in the IARU contest held in July that involves IARU member societies in each country fielding multi-operator, multi-transmitter operations that often involve special calls and multiple station locations (as a distributed multiop). They are especially popular in Europe, where competition between each country's HQ stations is intense. HQ stations count as multipliers in the contest itself, which increases the interest in their operations.

Categories: operating category

See Also: Distributed multiop, mult

IP address

The Internet Protocol uses numbers as addresses to find machines on the internet. It is analogous to a telephone number

Categories: remote radio

See Also: UDP, IP address

ISP

Internet Service Provider. This is the company that provides your connection to the internet.

Categories: remote radio

See Also: IP address

Jitter

This is the change of the latency over time. It is a particular problem on radio remote control, as the difference in latency can make it difficult to adjust the system which has settings to account for latency. If it changes a lot, you will probably experience some audio dropouts.

Categories: remote radio

See Also: Latency

K3

A popular HF transceiver available from Elecraft that is used by many contesters.

Categories: station hardware

See Also:

Key Clicks

W8JI defines keyclicks as “off-frequency sidebands heard when there is no trace of tone (w8ji.com)”. They effectively, and illegally, increase the frequency footprint of a CW signal, since the tone-less clicks of the signal will desense receivers and make copying on adjacent frequencies difficult. Many modern radios continue to be produced that exhibit unacceptable levels of key clicks.

Categories: operating software/hardware

See Also: SO2R

Keyboard focus

An attribute of contest software that controls more than one radio at a time. Keyboard focus is the particular radio that your keyboard is entering information for. This is the “active radio” for purposes of logging. If the software is well designed, keyboard focus will flow naturally between radios as the situation requires. In a two radio situation where radio 1 is on 40 meters and radio 2 is on 20 meters, while your radio 2 is CQing your keyboard focus should probably be on radio 1, and vice versa.

Categories: operating software/hardware

See Also: SO2R

LAN

Local Area Network. This refers to any device that is attached to your router, in your home system. Via wired or wireless connections, that is your local network

Categories: remote radio

See Also: Router, WAN

Latency

All of this travel between 2 machines over the internet takes time, and the time delay in internet parlance is referred to as latency

Categories: remote radio

See Also: WAN

LCR

An acronym for Log Checking Report. A report from the contest sponsor to each individual competitor that details the scoring adjustments to their submitted contest log, reflecting dupes, busted calls, NIL’s and other errors. The LCR is very useful as a means of improving your accuracy in future contests.

Categories: general, ethics,

See Also: Bust, dupe, NIL

Lid

A lid, generally, is someone whose operating behavior shows a lack of awareness, competence or consideration for other amateurs.

Categories: general, ethics,

See Also:

Lockout

A means of preventing two transmitters from keying or transmitting simultaneously. A hardware lockout accomplishes this task by inhibiting the transmit/key line on the different radios with a lockout circuit. A software lockout does the same thing using software. This prevents the station from violating the rules of the contest. E.g., it could prevent a multi/multi station from having more than one transmitted signal on the same band, or it might prevent a single operator station from transmitting simultaneously on multiple bands.

Categories: operating software/hardware, ethics

See Also:

Long Path

A situation where HF propagation exists between two stations in the inverse direction of the great circle heading. “Beaming long path” means pointing your antenna 180 degrees different from the “short path,” or great circle heading, for a particular station. Long path propagation, for example, might allow a North Carolina station to work a station in Hong Kong on 10 meters in the morning by beaming southeast. Depending on the season of the year and the propagation on any particular day, this can be an extremely effective event in a DX contest, allowing for long distance QSOs not possible during short path openings. Gray line QSOs, for instance, are frequently long path. Learning and checking the long path openings, in terms of times, bands and geographies, from your QTH can be very valuable for increasing your multipliers and contest scores in DX contests.

Categories: general, operating technique

See Also: Gray line, skew path

M2

Shorthand for the multi-operator, two-transmitter category offered in some contests. This is a relatively new category that was intended to allow greater flexibility that older single transmitter categories, but with less hardware requirements than the open ended multi transmitter category.

Categories: operating classification

See Also: MS, MM

Master.dta

The master.dta, or "master database" file is a collection of so-called "known good calls" -- e.g., call signs of stations that have been worked in previous contests. It can be used as an operating aid with most contest software to suggest complete calls when only partial information is copied over the air.

Categories: operating software/hardware

See Also:

MOAS

The “mother of all switches” is a project by K1XM and others in theYankee Clipper Contest Club to produce a flexible and powerful switching board to handle a variety of layouts of multiple radios, transmitting antennas, receiving antennas and amplifier interconnections.

Categories: operating software/hardware

See Also:

MM

The multi-operator, multi-transmitter category involves an unlimited number of operators and transmitters, with only one transmitted signal allowed per band.

Categories: operating classification

See Also: M2, MS

Morse Runner

Contest simulation software developed by VE3NEA that faithfully presents users with many aspects of actual CW contesting, including pileups, QRM and band noise.

Categories: operating software/hardware

See Also: Pileup

Moving Multipliers

An operating technique where one asks over the air for a station who is a multiplier (e.g., a new country, state or section) to move (QSY) to a different band so that an additional multiplier can be added to one's score. To be done successfully, there must be propagation between the stations on the new band, and the asking station must be able to move quickly. It is not good contest etiquette to ask a CQ-ing station with a pileup to move bands, but even rare DX that comes back to your own CQ's is fair game for this technique. For contests like SS and WPX that only count multipliers once (instead of once per band) this does not apply.

Categories: operating technique

See Also:

MS

The multi-operator, single-transmitter category found in many contests has evolved to have different definitions in individual contests. Once understood as a "one transmitted signal" category, its exceptions and specific band change rules make it among the most complex, yet most popular, categories.

Categories: operating classification

See Also: 10-minute rule, band change rule

Mult

Most, but not all, contests compute the final score as the product of (i) QSO points and (ii) a tally of zones, countries, prefixes or other unique characteristics. Since they impact the score multiplicatively, this second item is called the multiplier. For example, in the SS contest, the multiplier is the number of unique ARRL sections worked (maximum of 80). Thus when a new (e.g., unique) section is worked, it has a greater impact on the final

Categories: contest specific concept, operating technique,

See Also:

Mult station

The station in a multi-transmitter environment that is working only mulitpliers -- new countries, zones, or prefixes, depending on the contest. This usually entails tuning and answering others who are calling CQ.

Categories: contest specific concept

See Also: S&P, Run station

Multiplier

See the discussion under mult above.

Multiplier Bell

A frequently used motivational device for multioperator contests. The sound of a bell going off in a room of operators when a new multiplier is worked by one of them manning different radios is familiar to many successful multi-operator stations.

Categories: operating technique

See Also:

NCJ

National Contest Journal. A bi-monthly magazine devoted to contesting published by the ARRL. NCJ was originally begun by a group of independent contesters (the first editor was K0TO) in the 1970s, and is responsible for the introduction and growth of the popular Sprint and North American QSO Party contests.

Categories: general

See Also: Sprint

NIL

Not-in-log. A deduction made by the contest sponsor that refers to the situation where a contact claimed by one station is not confirmed by a record in the second station's log. In most cases an NIL results for you when there is nothing even "close" to your call in the other station's log at the time you claimed the contact.

Categories: log checking and reporting

See Also:

Off-by-1

A "one off" call is a call that differs by one character -- W9RV, N7RV, and N9RE are all one off calls for N9RV.

Categories: log checking and reporting

See Also: SCP

Over the Horizon (OTH) Radar

High power radar systems deployed in the HF spectrum that can cause broadband, intense interference to contest and other communications. Recently OTH radar QRM has been particularly bad on 40 meters, and occurs when there is propagation over the north pole.

Categories: general

See Also:

Off-time

Off-time is the amount of time during the contest period that a station is off the air -- no listening or transmitting taking place. Some contests (e.g., Worked All Europe, ARRL SS) require that single operator entrants take a minimum amount of off time. Off time lengths are usually restricted to a minimum block size (30 minutes in SS, for example).

Categories: contest specific concept, operating technique,

See Also: Rubber clocking

Online scoreboard

A web site that delivers real-time score information of participants in a contest, such as those at cqcontest.net . In most cases these scoreboards are designed to seamlessly interface with contest software at participating stations so that one can see at a glance the relative standings of the competitors in any category. Participation in live scoreboards is gaining popularity, but some have questioned whether or not the use of such information during a contest is consistent with unassisted operation.

Categories: operating hardware/software

See Also: Unassisted

Overlay categories

Refers to contest classifications that co-exist with, or overlay, other classifications. Examples might be the "rookie" overlay that is restricted to new contesters, or restricted time overlays (e.g., 24 or 12 hours). A contest overlay category creates a subcategory within a "base" category (which is usually a single operator category). In the CQ WPX contest, for example, one might enter the "tribander/wires" or "youth" overlay category and thus compete for plaques and certificates within that subcategory. Not all contests offer overlay categories, see the rules for the specific contest.

Categories: operating classification

See Also: Single operator

Packet

Packet originally referred to packet radio spotting networks, which were an application of (typically) VHF packet radio networks that were created in the late 1980's as a means of exchanging real-time spot information during contests. The rise of high speed internet since that time has caused almost all of these networks to migrate to the net, greatly increasing their speed and scope. Although no real connection to packet radio networks still exists, the term "packet" has survived, referring to spotting networks in general

Categories: operating software/hardware, operating technique

See Also: spot

Panadaptor

A band scope that displays signals on a band visually, usually as a line or area graph, allowing for a view of activity across an entire band at once. The display show signal strength on the vertical axis and frequency on the horizontal, and is sometimes combined with a waterfall display which presents a brief historical view of activity on a frequency instead of an instantaneous view. This can be a stand alone piece of hardware, integrated into a radio, or software produced by a product like a skimmer.

Categories: contesting hardware/software

See Also: Skimmer

Partial

Partial calls are bits and pieces of full callsigns. They contain valuable information but cannot be logged until they are complete.

Categories: operating software/hardware, operating technique,

See Also: SCP, Super Check

Pass

Passing is an action where a station worked on one band is requested to QSY to a second band, typically in order to obtain additional multiplier credit. Proper contest etiquette holds that only stations who respond to your CQ can be passed -- it is not good manners to ask a station who has established his or her own running frequency to QSY to another band.

Categories: operating technique, operating software/hardware,

See Also:

Penalty

Penalties are additional deductions made for unverified or inaccurate information submitted as part of one's claimed score. For example, a NIL in the ARRL SS contest results in the loss of the claimed QSO as well as an additional penalty QSO deducted. Penalties and other score reductions are incurred by all contest competitors, both new and experienced, and are generally nothing to be ashamed or fearful of. Part of contest competition is acquiring operating habits that minimize these deductions.

Categories: log checking and reporting

See Also:

Phasing

Refers to the relationship between the waveforms of two signals, typically of equal frequency. In-phase, or zero degree phasing, refers to waveforms that are exactly coincident. Out-of-phase, or 180 degree phasing is where the high point of one signal occurs at the low point of a second signal's cycle. Used as a verb, this generally refers to methods or hardware of adjusting the phase, often with transmit or receive antenna systems. "Phased" verticals, for instance, are antennas that use delay lines or other methods to adjust the phase relationship between the antennas to optimize their directivity and performance.

Categories: station hardware

See Also: Stack, yagi, receive antenna

Pileup

Multiple stations calling a CQing station at the same time. Modest pileups are concentrated on a single frequency. Rare DX might result in a pileup that is spread out across multiple frequencies. The skill of picking calls out of a pileup, or alternatively, successfully breaking through a pileup to get a CQing station to respond to your call, is a critical contest skill.

Categories: operating technique

See Also:

Poaching

Poaching is when a third station strays onto the frequency of a station who is running in order to make contact with one of the responding stations. If N9RV is running stations on 14024, say, and you attempt to call one of the stations that he has just worked, you are poaching. As the term implies, this is aggressive and unethical contest.

Categories: operating technique, operating software/hardware, ethics

See Also:

Point and shoot

Also known as point and click. A refinement of the search and pounce operating method which is supported by most major logging software programs. With this method, the operator clicks on calls presented in a window on the monitor, so that the frequency of the radio is immediately changed to the frequency of the call which is listed. Thus one may quickly hop around the band, each time landing on the frequency of a CQing station who can be called. The technique is only allowed for operating categories which allow access to packet/internet spotting networks. The technique, while very attractive, has two major difficulties: (i) calls which are spotted may be incorrect – unless one independently verifies the call one runs a very high risk of incurring penalties for busted QSOs, and (ii) when dozens or hundreds of stations in a contest use this technique simultaneously, it results in big pileups calling on exactly the same frequency, which are hard for CQing stations to disentangle.

Categories: operating technique, operating hardware/software

See Also: S&P, spot, bust, skimmer

Points per q

The number of QSO points that any particular contest contact contributes. In some contests, for example the NA Sprint or ARRL SS, the points per QSO is constant. Most DX contests employ points per q rules that give more credit for contacts outside your continent. Some give zero points for contacts within your own country.

Categories: contest specific concept, operating technique,

See Also:

Prec

Part of the exchange in the ARRL SS contest. It consists of a single letter, once soley based upon your transmitter power: Q = 5 watts or lower, A = 5-100 watts, B = more than 100 watts. Recently additional Prec's were added for multi-operator and assisted categories. See rules for ARRL SS contest.

Categories: contest specific concept

See Also: Exchange

Port

All internet traffic travels to the IP address of your home, which all comes to your router. Once it arrives, it has to ‘announce’ what type of service it is for… some is for a Web Page, another type is for VOIP, or control of a device such as a remote radio setup. Each type of service has been assigned a ‘number’ which gets sent to the device that is handling the particular service of the packet. The word ‘port’ has been given to this ‘service type’.

Categories: remote radio

See Also: IP address, Router, VOIP

Port forwarding

Once a piece of traffic arrives at your router, it may or may not need to be ‘forwarded’ to a particular device on your LAN, the devices in your home. For REMOTE CONTROL, this will be a particular PC or Device, such as a RemoteRig box. The router needs instructions on where to send a ‘packet’ depending on which device on your LAN is handlng that ‘Port’.

Categories: remote radio

See Also: Router, LAN, TCP/IP, Port

Prefill

Prefill refers to the features of some software packages which automatically fill in exchange information based upon information obtained either before or during the contest. Prefill software might enter "Pat" in the name field for the NA Sprint, for example, if you work N9RV, either based upon previous contests, or based on working N9RV on a different band in the current contest. If the prefill information is different from what the station actually changes, of course, it is up to the operator to manually correct it.

Categories: operating software/hardware, operating technique,

See Also: Exchange

Prefix

The portion of a callsign that contains the beginning of the all, up to, and including, the number. The prefix of N9RV is N9. The prefix of 3DA0X is 3DA0. Prefixes count as multipliers in some contests – e.g,, the WPX contest. In most cases, prefixes also reveal the geographical location of the station as well.

Categories: general

See Also: mult

QRP

QRP in contesting is generally where one's maximum output power is no more than 5 watts. In many contests, power is an overlay category. E.g., you can be QRP and SOAB.

Categories: operating classification

See Also: Category, overlay category

Q-signals

A three letter code beginning with the letter Q. In theory, each code has a slighly different meaning when used with a ? appended. ARRL and other groups publish the codes and their text meaning. In contesting only a few of these codes are used, sometimes in ways that have evolved from their "official" meaning.

Categories: general

See Also:

Qso b4

QSO b4 is the CW message sent to tell responding stations that they have been worked for point credit previously in the contest and no second QSO is necessary/desirable.

Categories: operating technique

See Also: Dupe

Rate

Rate refers to the speed of making contest QSOs. It is typically measured in QSOs per hour, even when the time span referred to is longer or shorter than 60 minutes. E.g., if N9RV's 10 minute rate is 70.4, it means that if he continued to make QSOs at the same rate for 60 minutes as he just made in the last 10, he would have 70.4 QSOs in the log. The rate statistics provided by most contest software give valuable information on operating

Categories: operating technique, operating software/hardware,

See Also:

RBN

Reverse Beacon Network is a internet-based network of dedicated wide band receivers around the world which decode CW signals in real time and generate “spots” which contain frequency, signal strength and other information. The effect is that of a traditional beacon in reverse – instead of checking propagation by tuning one’s receiver to a transmitting beacon at a particular frequency, one merely transmits (usually by calling CQ on CW) while connected to a RBN to see which of the receivers on the network hears you.

Categories: operating software/hardware

See Also: Spot, skimmer, skimmer network, beacon

RDF

Receiving Directivity Factor is a measure of receiving antenna performance which compares the forward gain of an antenna at the desired azimuth and elevation grade to its average gain over the entire hemisphere (thanks W3LPL for this definition).

Categories: station hardware

See Also: Receive antenna, receive diversity

Receive Antenna

Generally refers to an antenna that is used for receive purposes only – e.g., not the same as the transmitting antenna. These include specialized antennas, such as loops, short verticals, pennants or beverages. Receive antennas can be used singly or in combination – e.g., fed into separate receivers simultaneously – the latter is used for what is known as diversity reception. Most modern receivers allow for this. Receive antennas are often non-resonant, and are of particular advantage on lower frequencies to improve directivity and the signal to noise ratio.

Categories: station hardware

See Also: 4-square

Receive Diversity

The practice of using two antennas, each feeding a separate receiver locked onto the same frequency, to better capture a weak signal. This frequently is an advantage due to the differences in polarization, wave angle, noise susceptibility and other characteristics of propagation at any time. Receive diversity is especially important on the low bands where signal to noise ratios are low. Common practice feeds the audio from each receiver into a separate ear.

Categories: station hardware

See Also: Receive antenna, RDF

Reflector

When referring to an antenna, or specifically, a yagi or quad antenna, the reflector is the parasitic (e.g., not fed with coax) element of the antenna that lies behind (opposite the side of maximum radition) the driven element (the one that receives power directly from the transmitter). The reflector can also refer to an internet-based repository of contest-related postings that contesters have used for decades to exchange information and stories. When people refer to the “contest reflector,” they generally refer to the service hosted at the web site www.contesting.com. The term reflector is used because email from contributors is “reflected” to the many subscribers by software at the site.

Categories: station hardware, ethics

See Also: Remote receiver

Remote Operation

This generally describes a situation where the physical location of the transmitter/receiver is different from that of the controlling operator. This can be supported by software that allows receiver audio and other information to be sent to a remote computer (possibly located thousands of miles away) that also controls transmit, rotor, and other station functions. Contest and DX rules are still evolving on the validity of this configuration. Most seem to allow remote operation as long as the transmitters and antennas are in a single physical location.

Categories: station hardware, ethics

See Also: Remote receiver

Remote Receiver

A receiver that is remote (e.g., not at the physical location of the station/transmitter) that is accessed using the internet. The ease with which remote receivers can be accessed (many are open to the public) has grown rapidly, creating opportunities for both entertainment ("I wonder what I sound like in Europe") as well as cheating ("it would be nice to be able to figure out who's calling me"). Remote receivers are not allowed in most contests. Exceptions are certain categories of the Stew Perry and CQ 160 contests, which place limits on how far away they can be located from the main station.

Categories: station hardware, ethics

See Also: Remote operation

Robot

The contest robot, or simply "robot," refers to the automated process that examines contest logs that are submitted to contest sponsors (either via email or a web page) for proper syntax and formatting. Most contest robots will "bounce," or reject with error messages, logs which fail to conform to the proper Cabrillo format, fail to include required information, or which contain other errors.

Categories: log checking and reporting

See Also: Cabrillo

Router

The internet works by sending 'packets' across the house or around the world using 'routes'. It hands off a packet with a destination address to its nearest 'neighbor' router, and it then has instructions of how to reach the destination. Sometimes there can be a dozen or more 'routers' involved in reaching the ultimate destination.

Categories: remote radio

See Also: WAN, TCP/IP

Rover

A rover is a mobile station that travels during a contest to activate multiple geographic locations (typically grid squares) during the course of a contest. Rover stations are especially common in VHF contests, and often involve sophisticated setups that can activate multiple bands as well as high profile (elevation) locations. Rovers can make the contest more fun for everyone by making more multipliers available and thus adding to contest scores. The so-called "captive" rover refers to a rover whose express purpose is to work only a single competitor. The ethics of this variant to the rover concept is dubious at best.

Categories: operating classification, ethics

See Also:

Rubber Clocking

A slang term used to refer to the adjusting of times in the contest log to make QSOs appear to conform to the rules of a category and contest. This includes, for example, to make reported off-times in time-limited contests such as the ARRL SS conform to rules that require them to be at least 30 minutes in length, or making times of QSOs appear to obey the 10-minute rule for multi-operator categories in DX contests. Such changes are unethical and not allowed by contest rules and are grounds for disqualification.

Categories: ethics, log checking and reporting, contest specific concept

See Also: DQ, 10-minute rule

Run

Running refers to staying on one frequency and calling CQ to solicit new contacts. Running may, or may not, be the fastest way to make QSOs and/or build your score at any given time. Whether or not to run is a fundamental decision made during the entire duration of a contest.

Categories: operating technique

See Also: Run station

Run station

The station in a multi-transmitter environment that is "running" stations -- e.g., calling CQ and taking all who respond

Categories: contest specific concept

See Also: Running

S&P

Search & Pounce is the operating method where one tunes a band and responds to other stations who are running (e.g., calling CQ). The "traditional" tuning by spinning the receiver knob has been augmented by contest software that allows one to jump instantly to a spot frequency (for categories which allow this) and more recently through the use of panadaptors and other visual displays that allow operators to jump to a frequency based on visual

Categories: operating technique

See Also: Spot, point and shoot

Schedule

Schedules are advance arrangements to make QSO's with specific stations at specific frequencies and times. Schedules are often made during a contest to try to work additional multipliers on times and frequencies when propagation is favorable. E.g., N9RV may work NH2T on 15 meters at 0100z and set up a schedule for 40 meters on 7030 kHz at 0700z. When 0700z rolls around, if NH2T and N9RV remember to go to 7030 kHz and they hear each other, a new QSO (which may be a new multiplier for one or both) can be made. Schedules made on the air during the contest can be an important and effective contest tactic. Schedules made via non-amateur means (e.g, email) and/or schedules made before the contest starts are not allowed by most contest rules. Even if rules do not explicitly forbid it, such practices are not considered ethical and should be avoided.

Categories: operating technique, ethics

See Also: mult

Sec

Abbreviation for ARRL section. Loosely corresponds to US states and Canadian provinces, but larger entities (e.g., NY or California) are divided, resulting in a total of 80 sections. Sections count as multipliers for some ARRL contests.

Categories: contest specific concept

See Also: Mult

SDR

Software Defined Receiver. An SDR performs many of the basic functions of a receiver (e.g., mixing, filtering, demodulation) in the digital realm using a personal computer or other dedicated microprocessor device, instead of the analog, special purpose hardware built into conventional receivers. Commercial SDR receivers, both sophisticated and simple/inexpensive, have been available commercially for many years, and their popularity has grown.

Categories: station hardware

See Also:

Self Spotting

The practice of using internet spotting networks or other means to spot yourself – e.g., to announce what frequency you are CQ-ing on in an attempt to attract others to call you. This has always been considered unethical behavior and is generally banned by contest rules, but there are exceptions. In ARRL VHF contests self-spotting has been permitted since 2015. The ARRL has announced that self-spotting will be allowed beginning in 2023 for the ARRL DX contests, but this remains controversial and may be reconsidered.

Categories: operating technique, ethics

See Also: Spot

Serial Number

A counter that begins at 1 for the first contest QSO, and increments by 1 for each successive contact. The serial number is part of the exchange for some contests (e.g., the CQ WPX, the Worked All Europe contest).

Categories: contest specific concept

See Also: Exchange

Single-Band

Competitors in the single band categories restrict their competitive efforts to one frequency band (e.g., 40 or 20). In some contests they are allowed to make contacts on other bands, but only their "single" band QSOs count towards their score.

Categories: operating classification

See Also:

Single Operator

A contest category where one person performs all operating and logging during the contest. It is frequently abbreviated SO, forming the root for acronyms such as SOAB (single operator all band) and SOA (single operator assisted).

Categories: category

See Also: SOA

Six-Pack

A six pack is a relay controlled matrix coax switch with two inputs and six outputs. It is used by many stations who use SO2R as a means of allowing either station to have access to any antenna. Newer variants of matrix switches allow for more than six outputs, but the term has stuck.

Categories: station hardware

See Also:

Skew Path

A propagation phenomenon where the ionosphere does not support direct-line propagation (along a great circle heading) between two stations, but contacts can be made by aiming closer to the equator (due east or west) so that the path is skewed, so that the first hops travelling in a more southerly direction (for northern hemisphere stations). For a North American station, for example, a skew path opening to Japan might make signals peak due west or even south of west. Skew path openings can take place at frequencies below the MUF, or maximum usable frequency, between two points on the globe, which is often the case under poor propagation conditions. Turning your antenna to explore skew path propagation is a very useful technique that can make a previously inaudible signal suddenly appear and make a QSO possible.

Categories: general, operating technique

See Also:

Skimmer

A CW Skimmer is a product developed by VE3NEA which combines a CW code reader with a broadband receiver, providing real time spotting information without the use of a spotting network.

Categories: station hardware, operating software/hardware, ethics

See Also: Skimmer network

Skimmer Network

The global network of internet-connected skimmer stations which continuously copy and post call sign, frequency information and signal strength data for ever station they decode (CW and digital modes). The data stream can be used in real time by a variety of applications and contest programs to allow “point and shoot” operating during contests. Note that unassisted categories are not allowed to access skimmer networks.

Categories: station hardware, operating software/hardware, operating technique, ethics

See Also: Skimmer, point and shoot

SO1R

Single operator single radio is not a formal category in most contests, but describes the less complex hardware/software setup where the operator tunes and transmits on one radio at a time.

Categories: operating classification, operating technique,

See Also:

Snow/rain static

QRN caused by electrically charged precipitation hitting antennas. Low antennas and quads are usually less susceptible than high yagis.

Categories: general

See Also:

SO2R

Single operator two radio operation involves using audio feeds from two radios simultaneously (but with only one transmitted signal at a time allowed), which enables an operator to tune and listen on a second radio (usually on a second band) while the primary radio is transmitting.

Categories: operating classification, operating technique,

See Also: Dual-CQ, Dummy CQ

SO2R Controller

A homebrew or commercially made accessory which automates the switching of station peripherals (e.g., headphone audio, key paddle input, microphone) between two radios to enable more effective and efficient two radio operation. These accessories typically integrate with contest software to manage two radio operation as seamlessly as possible.

Categories: station hardware, operating software/hardware

See Also: SO2R

SOA

Single operator assisted is a single operator category where packet/internet spotting assistance is allowed (see Assisted).

Categories: operating classification

See Also: Single operator, assisted

SOAB

Single operator all band is an operating category common to most contests. In most contests, packet/internet spotting assistance is not allowed, but the WAE and some other contests allow it. Due to the popularity of internet assistance, and the difficulty in detecting the (intentional or unintentional) use of this assistance by contest sponsors judging the results, this situation is changing. This category is sometimes referred to as "SOAB Classic" to reflect its legacy to the pre-spotting era. In all cases a single person is responsible for all operating and logging during the contest.

Categories: operating classification

See Also:

SOHP

Single operator high power refers to a SOAB, SOA, or SOSB station that runs more than 100 watts output from the transmitter.

Categories: operating classification

See Also:

SOLP

Single operator low power is a single operator who runs a maximum of 100 watts output.

Categories: operating classification

See Also:

SOQRP

Single operator QRP stations run a maximum of 5 watts from the transmitter.

Categories: operating classification

See Also:

SOSB

Single operator single band is a single operator station who operates a single band. It also may mean unassisted, although this is ambiguous.

Categories: operating classification

See Also:

SOU

Single operator unlimited is used interchangeably with single operator assisted as described above. Unfortunately, both terms "unlimited" and "assisted" have connotations (especially when translated frorm English) that are inconsistent with their intended meaning. They both are supposed to denote a single operator who receives spotting assistance via packet radio or internet.

Categories: operating classification

See Also: SOA, Assisted

SPG

Single point ground is a lightning protection practice that physically binds all of the entry wiring into a house/shack to a single ground -- e.g., RF, AC power, water pipes, telephone.

Categories: station hardware

See Also:

Split

Describes the situation where a CQing station is listening on a frequency that is different from his/her transmit frequency.

Categories: operating classification, operating technique,

See Also:

Sporadic E

Propagation that utilizes the E layer of the ionosphere. Since this layer is inconsistently ionized and is lower than the F layers that support more reliable HF propagation, such propagation is more rare. When it occurs (usually in the summer months) it can support long distance QSOs especially on 10 and 6 meters.

Categories: general

See Also:

Spot

A spot generally refers to a posting of information on the frequency and callsign of a station in the contest, usually received from an internet or packet radio network.

Categories: operating software/hardware, operating technique,

See Also: Assisted

Spot filtering

The process of screening spots to restrict them to the desired geography, frequency range, operating mode or other criteria. This can be accomplished in different ways – either by configuring the RBN node you connect to to receive spots (preferred) to restrict what is sent to you, or by configuring your contest software to only display spots that you wish to see. Spot filtering is useful as a way of showing only the information that is relevant.

Categories: operating software/hardware, operating technique,

See Also: Assisted

Sprint

A short contest that emphasizes frequency agility. The original Sprint contest is the North American Sprint, held in February and September of each year, sponsored by the National Contest Journal. The most unique aspect of Sprint contests is the QSY rule – when a CQing station receives a response, they must QSY and leave the frequency to the calling station at the end of the QSO. Thus sprint contests do not allow the "running" of stations on a single frequency that is characteristic of most other contests.

Categories: operating classification, operating technique,

See Also:

Stack

A stack generally refers to two or more yagi antennas which are pointed in the same direction, aligned vertically on a tower or mast, and fed (typically) in phase to increase gain and better control the take-off angle of the antenna system's forward lobe.

Categories: station hardware

See Also: Bip/Bop

SteppIR

A commercially manufacturer yagi which works on multiple bands. The antenna elements consist of hollow fiberglass tubes which support a conductive ribbon that is adjusted in length with microprocessor controlled motors.

Categories: station hardware

See Also Yagi

Stub

Coaxial stubs are specific lengths of coax (generally, but not always, integer multiple of a quarter wavelength on the design frequency) which are used as impedance transformers for matching, attenuation, or other purposes. In a multi-transmitter environment, stubs are frequently used to reduce inter-station interference by nulling harmonics or other kinds of frequency passing/rejection.

Categories: station hardware

See Also:

Super Check Partial

A legacy term from the original K1EA contest software, abbreviated SCP. When SCP is active in contest software, typing a few characters in the callsign entry field brings up a list of known contest calls from a database that match what is typed. The "super" in the term refers to the use of an external database – check partial checks the partial in the existing log. Most software now extends the concept to offer callsigns that are "one off" of the callsign typed.

Categories: operating software/hardware

See Also: Partial, unique+1

SWL

A station that only listens and does not transmit. This may be because the operator is not licensed to transmit. There is a long tradition of short wave listening (SWL) enthusiasts who compete for awards in a manner very much like amateur radio.

Categories: general

See Also:

TCP/IP

Transmission Control Protocol / Internet Protocol. This is how the internet does what it does. Developed by the Department of Defense in the 1970's to communicate between defense sites, it has grown into what we call The Internet. It delivers 'packets' of information, using an address, from one point on the network to another, which is now worldwide.

Categories: remote radio

See Also: UDP, IP address

UBN

An acronym for "unique, bad, not-in-log" which became slang for a log checking report.

Categories: log checking and reporting

See Also: LCR

UDP

Uniform Datagram Packet. The type of packet used to control a remote radio and send audio. These provide the fastest transmission time between 2 points. No error correction and highest priority. The other type you will see in nomenclature is TCP. This is an 'error corrected' packet, and one which can take a 'back seat' to other VIP packets. Not good for 'real time' applications.

Categories: remote radio

See Also: TCP/IP

Unassisted

Unassisted is the opposite of assisted, in that the use of spotting information delivered from internet or packet radio networks that is allowed in the latter is not allowed. It is a single operator overlay -- most multi-operator categories already allow spotting assistance.

Categories: operating classification

See Also: Assisted, SOA

Unique

A claimed contact that is unique to all of the submitted logs in a particular contest. Such calls are much more likely to have been incorrectly copied.

Categories: log checking and reporting

See Also:

Unique+1

A unique+1 is a call that is (i) "one off" from a unique call and (ii) is a call of someone who was active in the contest. If you claimed contact with N9RU, and no one else in the contest worked N9RU, it is a unique. If N9RV was active in the contest, that is a unique+1. (N9RD might also be a U+1 if he was active).

Categories: log checking and reporting

See Also:

Unlimited

Unlimited means the same as assisted -- e.g., spotting network assistance is allowed.

Categories: operating classification

See Also: Assisted, SOA, SOU

VOIP

Voice Over Internet Protocol. Audio travels over the internet using this technique.

Categories: remote radio

See Also: TCP/IP, IP address

WAN

Wide Area Network. This refers to the network beyond your router, outside of your home. In general, this can be called the internet.

Categories: remote radio

See Also: Router

Waterfall Display

A useful mode of a panadaptor which gives an animated depiction of band activity over the chosen frequency range. In a waterfall display, received signals show up as solid points at a spot on a horizontal display that indicates their frequency. The pattern of the points gives visual information about what kind of signal it is – e.g., a carrier, a station sending CW or some other mode.

Categories: station hardware

See Also: Panadaptor

WRTC

World Radio Team Championship. Begun in 1990 at the World Cup Games in Seattle, the WRTC is a unique competition that occurs approximately every four years in July coincident with the IARU contest. WRTC assembles the competitors – two-person teams drawn from the top operators worldwide – in a single physical area, using identical antennas and power levels, to present a more level playing field in the competition. WRTC's have been held on three continents and in five different countries. WRTC 2023 will be held in Italy.

Categories: general

See Also:

WWROF

The World Wide Radio Operators Foundation is an independent organization committed to supporting radio contesting worldwide.

Categories: general

See Also:

WWYC

Worldwide Young Contesters. An international, internet-based club of young contesters established in 1999 by a group of young European contesters, which is (sadly) rather dormant at the moment.

Categories: general

See Also:

Yagi

A directional antenna typically consisting of a dipole element that is directly fed by the transmitter and a number of closely spaced "parasitic," or indirectly energized, elements which re-radiate RF energy to produce a directional pattern.

Categories: station hardware

See Also: reflector

Zero Beat

When one CW signal is on exactly the same frequency as another they are said to be zero beat. In CW pileups, signals that are zero beat can be difficult to distinguish. Such pileups often occur when those calling have clicked on spots from skimmers or other packet announcements, thus all landing on the exact same frequency and creating a zero beat pileup. It is often a good strategy to call slightly above or below the spotted frequency for this reason.

Categories: operating technique

See Also: spot, skimmer, pileup

The primary mission of the Northern California DX Foundation (NCDXF) is to provide necessary financial support for well-organized DXpeditions to the rarest, most difficult, most expensive DXCC entities. We do this with funds contributed by DXers worldwide.

Beginning in 2013, NCDXF made a decision to use some of our funds to help bring younger DXers and Contesters into our hobby, by providing full-tuition scholarships for hams less than 25 years of age at Contest University sessions held in Dayton each year.

Why? Because becoming a **skilled contester** is a great stepping-stone to becoming an excellent **DXpedition operator**. There is a strong relationship between the two.

- Skill development: optimize on-air technique for clear & efficient communication
- Pileup Management: ability to quickly and accurately pick out callsigns from other countries while effectively controlling a pileup
- Time Management: optimizing on-air time to maximize # of contacts
- Good Preparation: both mental and physical
- Cross-Mode Operation: becoming comfortable with CW, SSB, Digital (RTTY, FT8, etc.)
- Ethics: obeying the rules, and displaying good on-air behavior
- Maximizing the Fun Factor of ham radio

We hope that all younger hams will take full advantage of the scholarship program to improve your skills by learning from some of the best DXers and Contesters on the air today at CTU.

We want to support you as you work toward DXCC, your first DXpedition, a contest award, or to just become a better operator. Best of luck!

73
John Miller, K6MM
President, NCDXF

Notes

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