CTU
CONTEST UNIVERSITY

Dayton Contest University

May 16, 2024

Hope Hotel

Dayton, Ohio

Youth On The Air
There is youth in ham radio!

YouthOnTheAir.org

Visit Us at Booth 4304 at Hamvention!

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 hemisphere. In addition, we participate in December YOTA month and the YOTA contest, and sponsor a summer camp for ages 15-25.

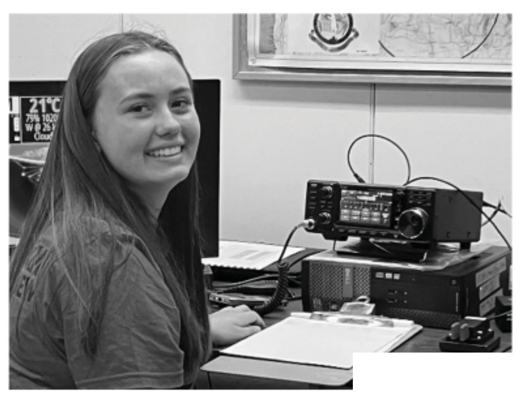
Listen for **VE1YOTA** on the air July 7-12, 2024 from Halifax, Nova Scotia at our next regional camp!

Future regional camps include:

July, 2025 Western USA
June, 2026 Midwestern USA
July, 2027 Southeastern USA

Tentative subregional camps include:

2025 Canada
2025 Kids On the Air (KOTA) USA (under age 15)
Midwestern USA



WWROF

WORLD WIDE RADIO OPERATORS FOUNDATION

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
Philipp Springer, DK6SP, Director
Teri Grizer, K8MNJ, Executive Administrator

Donate

Can you imagine contesting without electronic logs? Sophisticated log checking software? Online certificates? 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

• CTU •

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Dayton, Ohio USA

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First Edition

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Welcome!

On behalf of the CTU Board of Directors K1DG, N9JA, K1AR, CTU Chief Coordinator K8MNJ and the CTU Professors of Dayton Contest University 2024 we are pleased you are here, and we extend a warm welcome to you!

There have been more than 28 CTU's held in the past seventeen years. CTU's have been held here in Dayton, Chicago (mini CTU), Brazil, England, Germany, Finland, Italy, Australia, and Puerto Rico.

Over 20 presentations are available here at Dayton Contest University 2024. They are the work product of many hours of effort by your Professors and the CTU staff (thank you again to K8MNJ, KC3UCJ, N8AMY, N9RV, DL1QQ, W5JDX and K1SO for all they do to make CTU happen). Continuing with our attention to youth in ham radio we are proud to have two youth professors this year. Katie, KE8LQR and Grace, KE8RJU.

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, ARRL, YASME and NCDXF. They all have contributed their help and guidance in making this CTU the best ever. Please support those 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 what you see here at CTU would not be possible without her dedication.

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

Very 73!

Tim Duffy K3LR – Founder and Chairman

"Contesting affords all of us worldwide a 48-hour escape to this fantasyland where politics, economics, misery, injustice, and all other suffering seem briefly distant and abstract. Sport is an escape from the burdens of everyday life. Contesting is our sport and I'm grateful for this sport – contesting – and the friendships and fellowship and escape it brings us. In these brief hours yes, all seems right with the world".

Author: Geoff Howard, WØCG, 2024

2024 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 2024 – K3LR, W8CI & N9JA – ALL – 10 minutes
8:10 ALL ROOMS – It's our Radiosport Game – Let's Play Fair – K5ZD - ALL – 40 minutes

9:00 CONTEST TOPIC SESSION #1 – attend ONE of 4 sessions – 60 minutes
ROOM 1 – Optimizing the Use of Waterfall Displays for Contesting – N6TV
ROOM 2 – HF Propagation Tips to Improve your Competitiveness in Contests – W3LPL
ROOM 3 – Feeding and Detuning Towers – NØAX
ROOM 4 – Contesting Fun on That "Other Mode" RTTY – WØYK

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

10:15 CONTEST TOPIC SESSION #2 – attend ONE of 4 sessions – 60 minutes
ROOM 1 – How to Integrate Youth Operators in Multiop Contesting – KE8LQR and KE8RJU
ROOM 2 – Station Improvements to Improve your Competitiveness in Contests – W3LPL
ROOM 3 – Success Strategies for Remote & Hybrid Multiop Contesting – W1VE
ROOM 4 – Contesting Fun on That "Really Other Mode" FT8/FT4 – WØYK

11:20 CONTEST TOPIC SESSION #3 – attend ONE of 4 sessions – 55 minutes
ROOM 1 – Next Level Contesting; Making the Move to SO2R – K5ZD
ROOM 2 – Antenna Improvements to Improve your Competitiveness in Contests – W3LPL
ROOM 3 – Using Automation in Your Contest Station – Techniques and Recommendations – N6TV
ROOM 4 – Busting Contesting Myths to Get Started in RadioSport – K8ZT

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

12:50 ALL ROOMS – 2024 Eye Ball Sprint Contest "LIVE" – ALL – 10 minutes – K1DG
1:00-1:35 ALL ROOMS – The Road to WRTC2026 in the United Kingdom – MØDXR

***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 – The World of QRP Contesting – K8ZT
ROOM 2 – Feeding and Detuning Towers – NØAX
ROOM 3 – Remote Station Ideas and Q&A – W1VE
ROOM 4 – Tower Safety – W3YQ

3:15 CONTEST OPEN DISCUSSION Q&A GROUPs Attend ONE of 4 sessions – 30 minutes
ROOM 1 – SO2R and Station Design Q&A – K5ZD
ROOM 2 – How to Improve Your Station – Better Contest Results – W3LPL
ROOM 3 – Digital and RTTY Contesting – WØYK
ROOM 4 – Antenna/Tower Reliability – W3YQ

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

4:00 ALL ROOMS – Are you Considering a New Radio? Is My TX Clean? – NCØB – ALL – 50 minutes
4:50 ALL ROOMS – 2024 CTU Survey & Eyeball Sprint Results – K3LR & K1DG – 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 Bios

Katie Campbell, KE8LQR
Katie is 16 years old and resides in northeast Ohio. She was originally licensed at age 10 and got her extra 3 months later at age 11. Her favorite mode is CW and she enjoys contesting, teaching kids morse code classes for the Long Island CW Club, and helping out with her school's amateur radio club, K8LPS. She is also a member of the YACHT (Young Amateurs Communication Ham Team) group. Katie has been a Carole Perry youth presenter at Hamvention in Dayton and Hamcation in Florida, the YLRL speaker at Hamvention and SeaPac, as well being the Great Lakes division young ham of the year. She has also attended YOTA region 2 summer camps in 2022 and 2023 and is on the planning committee and PR team for the YOTA group.

Frank Donovan, W3LPL

Frank's contesting career began as a twelve-year-old at the Providence Radio Assn. 1959 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 $1/10^{th}$ acre in a densely populated urban neighborhood.

Frank's ham radio story began 100 years ago when his grandfather collected parts and built one tube radios for friends and family during the early days of AM broadcasting. His 1923 parts and expertise were eight year old Frank's introduction to radio and antenna construction during the mid-1950s.

While in high school at age 17, he finished first place USA in the 1964 ARRL CW DX Contest low power category. In 1968 he was the leader of the W1OP/1 Field Day that finished first place in the 4A category from a former World War II FCC Radio Intelligence Division direction finding and signals intelligence collection site in Scituate, RI. Immediately after college, he was commissioned in the US Air Force as a 2nd lieutenant where he worked as an engineer under PVRC member W3GN and as a colleague of one of PVRC's great multi-multi station builders, W4BVV.

Frank and his teams finished first place U.S.A in more than 75 of the 200 CQ Worldwide and ARRL DX Contest categories they've entered since 1964. Frank finished first place USA single operator in four CQ Worldwide CW and four ARRL CW DX contests from 1973 to 1978. His first multi-multi experience was as a member of the world high scoring 1974 PJ9JT CQWW CW team. His multi-operator teams have completed more than one million DX QSOs and achieved more than 50 first place USA finishes out of 180 multi-operator entries in the CQ Worldwide and ARRL DX Contests since their 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, a few months before multi-multi great W2PV became a silent key.

Frank was inducted into the CQ Contest Hall of Fame in 1999 and is a regular presenter at Contest University and to radio clubs and conventions around the world. He retired 13 years ago as a Chief Engineer at General Dynamics Corporation after a 45 year career in electronics research, development, engineering and operations of military spaceborne, terrestrial, subterranean, seaborn and subsea electronic systems.

Tim Duffy, K3LR

Tim has been an active amateur radio operator for over 52 years – starting as WN3SZX in 1972. He has hosted over 175 different ham radio operators from around the world as part of the K3LR Multi operator Multi transmitter radio sport contest efforts since 1992. K3LR has built a 14 tower station with 11 operating positions. He was the ARRL Atlantic Division Technical Achievement award winner in 1998. Tim has been the moderator of the Hamvention Antenna forum for 40 years. K3LR serves as chairman of Contest University (15 years), the Dayton Contest Dinner (29 years), chairman of the Top Band Dinner – as well as co-coordinator of the Contest Super Suite (37 years) in Dayton during the yearly Dayton Hamvention. He is founder and moderator of the popular RFI Reflector (RFI@contesting.com) since 1999. K3LR serves on the WRTC2026 Advisory Board. Tim serves on the board of directors of the World Wide Radio Operators Foundation (WWROF) as Chairman and is President Emeritus of the Radio Club of America (RCA). Tim is multiyear President of the Mercer County Amateur Radio Club (W3LIF/W3JTV). K3LR is Vice President of the North Coast Contesters. Tim serves on the electrical engineering advisory board for Grove City College. Tim was elected to the CQ Contest Hall of Fame in 2006. He was honored with the prestigious Barry Goldwater Amateur Radio service award by the RCA in 2010. Tim was honored in 2016 with the YASME Excellence award. K3LR was also honored as Hamvention Amateur of the Year in 2015 by the Dayton Amateur Radio Association. Tim is the Chief Executive Officer of DX Engineering. He is a graduate of Pennsylvania State University.

Doug Grant, K1DG

K1DG was licensed in 1967 and has been active on HF, mostly in contesting, continuously since then. He has won numerous HF contests and holds a few contest records from his own station and as a member of multiop teams in the U.S. and overseas. He is, or has been, a member of the ARRL Contest Advisory Committee, CQWW Contest Committee, president of the Yankee Clipper Contest Club, a founding director of the WorldWide Radio Operators Foundation (WWROF), Vice-president of Contest University, and chair of the Dayton Hamvention Contest Forum. He was a competitor in WRTC seven times and has won a gold and two bronze medals. He also was Chairman of the WRTC2014 Organizing Committee in Boston and is a member of the CQ Contest Hall of Fame. Doug wrote the ARRL's "Amateur Radio Contesting for Beginners" book and was managing editor of the CQ Amateur Radio Almanac. Dabbling in chasing DX between contests, he has worked all current DXCC entities, achieved DXCC on all bands from 160 through 6, and has a DXCC Challenge score over 2700. He has built and maintains two stations, one at his home in New Hampshire, and one primarily for contesting on a small Maine coastal island.

Mark Haynes, MØDXR

Married to M6YGL and have 4 children. Avid HF and VHF contester for the past 27 years. Holder of many country records in CQWW. Mark is a CQWW contest committee member and chairman of WRTC UK 2026. Mark has operated from 40 DXCCs DXpedition and Contest style including from Comoros, Maldives, Kerguelen, Cyprus and Costa Rica. Member of K3LR Contest Team and FOC. Personal contest call is G9W.

Gerry Hull, W1VE

Gerry began his contesting career a year after receiving his first license in 1975, participating in ARRL SS as WA4UUX. Hailing from Nova Scotia, Canada, he returned to the Maritimes for college. Originally operating as VE1BXC, later as VE1CER then VE1RM, he began a life-long love for multi-operator contesting, operating with the winning VE1DXC crew at Bob Biling's. VE1YX's QTH. After college, he worked in broadcasting, and then returned to the US, joining ARRL HQ as a Lab Technician, moving on to become an Assistant Technical Editor under the tutelage of Doug DeMaw, W1FB. W1FB suggested Gerry head up to Mt. Greylock to see what was up in V/U/uW contesting and technology, leading to a 30+ year amazing relationship with the W2SZ/1 crew, the so-called "Mount Greylock Expeditionary Force". The Greylock gang is an amazing group of engineers, builders and operators, who continue to dominate VHF multi-op contesting. While at HQ, he joined Murphy's Marauders, then on to the Yankee Clipper Contest Club. From 1982 to 1985, he organized and participated in three DXpeditions, to Canada's St. Paul Island (VE1SPI/'82, CYØSP/'83) and to Sable Island (CYØSAB/'85). More recently, Gerry operated with the 2024 AA7JV-lead VP6A and E51 DXpeditions, as remote operator, and helping to improve the remote CW capabilities of the operations, which generated over 400,000 remote CW QSO's using a diverse group of remote operators from around the world. Continuing his passion for Multi-Operator contesting, he has spent the better part of 46 years in the hobby operating from powerhouse stations K1ZZ, K1TTT/KY1H, K1IR, K1LZ, K2LE, P40LE, VY2SS, HP3SS, 6Y1V, ZF5T, LO5D and many others. Gerry is proud of the scores generated by these multi-op teams, typically in the top 10, including top NA wins in ARRL DX CW and SSB, and multiple world wins in ARRL DX CW M/S from P40LE and ZF5T. Gerry enjoys mixing his avocation with his vocation, which has been software development for many decades. In September 2007 he built getscores.org, the first real-time score reporting system for the World Wide Web. Controversial at first, this concept has bloomed into another fun aspect of the game. Over the years, he has developed many applications for ham radio contesting. A lifelong passion for ARRL SS led Gerry to a bucket-list quest: operate from as many different sections as possible in his lifetime. VY1 was a very interesting QYH, but the expense of travel vs the chance of poor propagation led to a multi-year relationship with J, VY1JA – operating the station via internet remote. This has been very successful, and VY1AAA, the internet-remote club call at J's place, has provided the rare multiplier to many of the deserving. Gerry introduced remote contesting to many in the contest community at WRTC 2014 in Boston, organizing six remote stations at the HQ Hotel. SK3W, K2LE, VY1AAA, PR1T RHR Blueberry Hill and N3AD were activated remotely. Gerry was a referee at WRTC 2018 in Germany, and again setup VY1AAA and K2LE for remote activation by guest ops from Germany. Gerry was also a referee at WRTC 2022 in Bologna, Italy in 2023. He is planning a similar setup for WRTC 2025 in the United Kingdom. Gerry continues to educate the contesting and general Amateur population on Remote operation, through his blog at blog.radiosport.network and his new site, easyhamradiroemote.info

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/Competent 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.

Anthony Luscre, K8ZT

First licensed in 1981 as KA8NRC, Anthony has been a QRP operator from his very first QSO (no one told him Novices should not start with a 2-watt QRP rig). He changed his callsign to K8ZT in June 2000 after updating to an Extra Class License.

Anthony enjoys sharing his Amateur Radio interests with others by maintaining websites, including www.k8zt.com, writing articles for a variety of publications, developing an online course for the ARRL and doing hundreds of club presentations both virtually and in person. He also serves as ARRL Ohio Section Youth Coordinator.

He is active in a variety of Amateur Radio activities, but his favorite activity is operating! Whether it is contesting, DXing, rag chewing, satellites, etc. CW, phone or digital, the QRP contacts have added up and are now top 115,000. First drawn to contesting by his love of working DX, he has consistently finished in the top ten of various major contests and finished first in the World and US in both CQ Worldwide Phone and CW QRP categories multiple times. As a bonus, his QRP DXCC total recently topped the 328 mark, and he has completed 11-band WAS QRP.

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 Roundup, 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 is the log checker for the 2024 ARRL RTTY Roundup. 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 seventeenth year at CTU delivering the two Digital Contesting presentations and Q&A.

Grace Papay, KE8RJU

Grace KE8RJU is a 3rd generation, 18-year-old amateur radio operator from Holland, Michigan. Grace was licensed in 2021 and holds an Amateur Extra class license. She enjoys communicating via amateur satellites and has so far achieved via satellite DXCC, VUCC, WAS, and WAZ. She is actively working towards the AMSAT GridMaster Award. One of Grace's most memorable contacts was with Dr. Kjell Lindgren while he was aboard the ISS operating as NA1SS. Grace has participated in many contests both as a Single Op, Multioperator, and Multi-Multi. Her first contest was the Rookie Roundup SSB in 2021. Since then Grace has participated in many major contests including WAE SSB, Sweepstakes, and several CQ WW contests. Grace was a member of the 2023 K3LR CQWW Phone team. She is a member of the AMSAT, ARRL, Grand Rapids Amateur Radio Association (W8DC), Holland Amateur Radio Club (K8DAA), Young Amateurs Communications Ham Team (Y.A.C.H.T), and the West Chester Amateur Radio Association (WC8VOA

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 & 2023 I spoke at ARRL Hamcon in Wyoming. Also I gave two presentations at the Duke City Hamfest in Albuquerque, NM, and Winterfest in Collinsville, IL.

Contest University 2024 will be my 17th annual presentation at this great event.

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

Seventeen years ago, my XYL encouraged me to build my dream contest station on 20 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.

In the fall of 2023 I installed a north east terminated Beverage 425 feet long and suspended 5 feet above ground for 160m. The feed point is located 800 feet north of the house using a DX Engineering transformer, and common mode chokes on each end wound on a ferrite type 43 2.4 inch core with RG-174 coax.

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 of 38 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 when we were at sun spot minimum. That is not possible with the current near sun spot maximum.

Ward Silver, NØAX

For the past twenty years Ward has been the Lead Editor of the ARRL Handbook and the ARRL Antenna Book, and a primary author of all three ARRL License Manuals and study guides until his retirement. He wrote the well-received "Grounding and Bonding for the Radio Amateur" (now in its 2nd edition) and "Ham Radio for Dummies". (now in its 4th edition) An electrical engineer, he designed microprocessor-based products and medical devices for twenty years before beginning a second career as a teacher and writer. Licensed since 1972, he is a co-founder of the World Radiosport Team Championships, was inducted into the CQ Contest Hall of Fame in 2015 and is President of the Yasme Foundation:
(https://protect-us.mimecast.com/s/3D3LCYExWVupjjMGT0hvMN?domain=yasme.org).

Randy Thompson, K5ZD

Randy has been licensed and active in contesting since 1973 at age 13. He is an accomplished operator, having multiple single-operator wins in the ARRL Sweepstakes, CQ World Wide DX Contest, and the CQ WPX Contest, among others. Randy is a past editor of the "National Contest Journal" and a co-founder of the eHam.net website. He was the Director of the CQ WPX Contest 2008-2013, the Director of the CQ World Wide DX Contest 2013-2016, and is a member of the CQ Magazine Contest Hall of Fame. He has competed in six World Radiosport Team Championships and was a co-chair of the organizing committee for WRTC2014 in Boston. When not in front of a radio, Randy works in technical sales of a global system integrator.

Bob Wilson, N6TV

TV Bob" is an active CW contester, ham accessory provider, Win-Test supporter, and Elecraft K4 volunteer Field Tester. He also provides consulting assistance to users of various transceivers, amplifiers, antenna controllers, and the Reverse Beacon Network. Licensed for 52 years, Bob competed at WRTC in San Francisco (1996), Slovenia (2000), and Moscow (2010). He finished first in the 2013 and 2019 ARRL November CW Sweepstakes CW from at W7RN, and first in the September 2014 CW NA Sprint, from home. In 2017, he was inducted into the CQ Contest Hall of Fame.

2024 Contesting Related Events

May 15th – 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) North Coast Contesters (NCC), and Kansas City DX Club (KCDXC).

7:00 PM to 9:00 PM Dayton Contest University 2024 Registration at the Hope Hotel

10:30 PM Pizza Party at the Hope Hotel sponsored by Dayton Contest University 2024. http://www.contestsupersuite.com.

May 16th – Thursday daytime

7:00 AM Dayton Contest University 2024 Registration opens at the Hope Hotel. Must sign up in advance – http://www.contestuniversity.com.

8:00 AM – 5:00 PM Dayton Contest University 2024 at the Hope Hotel.

May 16th – Thursday night

6:30 pm Digital Contest Dinner – at the Hope Hotel in the Mustang Room. Speakers are Ron and Trina Koenig (WV4P and NJ4P). Tickets from Ed@w0yk.com

7:00 PM Contest Super Suite at the Hope Hotel hosted by the Mad River Radio Club (MRRC), Frankford Radio Club (FRC) North Coast Contesters (NCC), and Kansas City DX Club (KCDXC).

10:30 PM Pizza Party at the Hope Hotel sponsored by the Society of Midwest Contesters (SMC). http://www.contestsupersuite.com

May 17th – Friday daytime

7:00 AM - First Bus Pickup from the Hope Hotel to the Fairgrounds. (Bus runs on a continuous loop between the hotel and the fairgrounds). Friday and Saturday only.

9:15 – 10:35 AM Digital Contest Forum at Hamvention in Xenia, Ohio, Room 4 Moderator: Ed Muns, WØYK
“Thursday Night Fun with WRT,” Tim Shoppa, N3QE
“Thursday Night Fun with FT NCCC Sprint,” Dennis Egan, W1UE
“SO4R with Rig Select PRO,” Courtney Krehbiel, KD6X, Ed Muns, WØYK

2:00 PM – 5:00 PM Antenna Forum at Hamvention in Xenia, Ohio, Room 1 Moderator: Tim Duffy, K3LR.
“First Results of the 2023-2024 HamSCI Festivals of Eclipse Ionospheric Science,” Dr. Nathaniel Frissell, W2NAF
“160 Meters RF Loss, 5/16 Wave Single Wire Folded Counterpoise and Some Antennas,” Guy Olinger, K2AV
“AutoEZ: A Revolution in the Evolution of Antenna Modeling,” Greg Ordy, W8WWV

5:00 PM - Final Bus Pickup from the Fairgrounds to the Hope Hotel.

May 17th – Friday night

7:00 PM Contest Super Suite at the Hope Hotel hosted by the Mad River Radio Club (MRRC), Frankford Radio Club (FRC) North Coast Contesters (NCC), and Kansas City DX Club (KCDXC).

7:00 PM 33rd Annual Top Band Dinner at the Hope Hotel. Speaker is David Raymond, WØFLS. Tickets in advance from http://www.topbanddinner.com.

11:00 PM Pizza Party at the Hope Hotel sponsored by the Potomac Valley Radio Club (PVRC). http://www.contestsupersuite.com

May 18th – Saturday daytime

7:00 AM - First Bus Pickup from the Hope Hotel to the Fairgrounds. (Bus runs on a continuous loop between the hotel and the fairgrounds). Friday and Saturday only.

2:00 PM – 3:50 PM Contest Forum at Hamvention in Xenia, OH, Room 1 Moderator: Doug Grant, K1DG.
"VP2VMM – A Low-Power Effort With Big Results,” Mike Wetzel, W9RE and Mark Bailey, KD4D
"WRTC2026 Update,” Mark Haynes, MØDXR
"Contest Antiques Roadshow,” Rus Healy, K2UA
"The Evolution of Contesting in the 21st Century,” John Dorr, K1AR, Paul Bourque, N1SFE, and Bart Jahnke, W9JJ

5:00 PM - Final Bus Pickup from the Fairgrounds to the Hope Hotel.

May 18th – Saturday evening

6:30 PM 30th Annual Dayton Contest Dinner hosted by North Coast Contesters at the Hope Hotel. Dinner speaker is Tim Duffy, K3LR. 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) North Coast Contesters (NCC), and Kansas City DX Club (KCDXC).

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 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.

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CTU Presents

It’s our Radiosport Game – Let’s Play Fair

Randy Thompson, K5ZD

CTU CONTEST UNIVERSITY

ICOM

“Contesting affords all of us worldwide a 48-hour escape to this fantasyland where politics, economics, misery, injustice, and all other suffering seem briefly distant and abstract.

Sport is escape from the burdens of everyday life. Contesting is our sport. And I’m most grateful for this sport – contesting – and the friendships and fellowship and escape it brings us.”

Geoff Howard, W0CG/PJ2DX

Source: PJ2T score report for ARRL DX SSB 2024
https://www.3830scores.com/showrumor.php?arg=RvYizV7YJnxL0U

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Purpose of this Session

- Discussion of why ethical behavior is important in radio contesting
- Understand the impact of unethical behavior
- Encourage YOU to take ownership of your behavior and encourage others to do the same

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What do we mean … Ethics?

Ethics:

“the discipline of dealing with what is good and bad, and with moral duty and obligation”

Ethics are… knowing the difference between right and wrong and choosing to do what is right.

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Why do ethics matter?

Lance Armstrong

No longer the winner of 7 Tour de France titles

Another Example

Brian Davis
2010 Verizon Heritage Tournament
Sudden death playoff
Called a two-stroke penalty on himself.
2nd place…$400k less than #1

"(Brian Davis') honor, character, and integrity were of much higher standard than most, not allowing him to accept anything less than truly 'winning' the tournament." – *Golf blog*

"What Davis lost on the course will be regained in his reputation for his honorable act" – *Tournament director*

Why do you operate contests?

I am here today to learn, so I can…

1. ____________________________

2. ____________________________

3. ____________________________

Sources of Motivation

- FUN !!!
- Self Improvement
- Personal Satisfaction
- ~~Financial Rewards~~

Internal

- "Fame"
- Peer Recognition
- Winning

External

The Four Stages of Contesting

- Starting out
- Getting hooked on the game
- Trying to win
  - The right way (playing by the rules, having fun)
  - The wrong way (bending or breaking the rules)
- Passing it along

Peer Recognition

- You are recognized by your achievements and how you went about achieving those results
- Your reputation is strongly influenced by what other people say about you

Negative Peer Recognition

- "Mark uses his amp and claims low power"
- "Bill operates remote from East Coast but tells people he is in California"
- "Joe uses packet but claims unassisted"
- "Larry's signal is always wide"
- "I hate to be in a pileup with XXXX, he never stops calling."

While some of these examples might be hearsay – they do influence how others may see you.

High Scores Fame Reputation	≠	Respect

Respect is earned through your actions and behavior

Let's face it:
Contesting is not a Fair Game

- Geographic advantages
- Local terrain advantages
- Rareness advantages
- A small station in the Black Hole has a big disadvantage when compared to a mega-station in Maine

If the game is *that* important to you…

- Neutralize the competition's advantages *(within the rules!)*
- Change QTH or guest-op
- Use a remote station
- Put up better antennas
- Practice, practice, practice

At some point, you must decide

Play by the rules

- Work on improving skills/station
- Use power consistent with class
- Don't use cluster when not allowed
- Submit log when contest ends

Make your own rules

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

How do we know what to do?

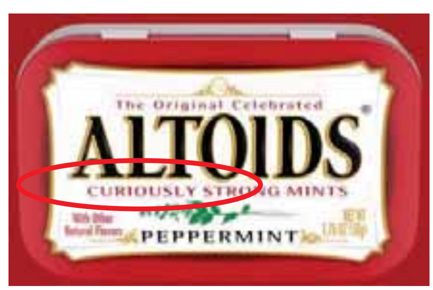
- Written Rules
  - Specified in the contest rules
  - Black and white
- Unwritten "Rules"
  - Interpreted norms
  - Gray

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."
- "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."

Excessive Power

- Do not exceed power limits for your category
- Just because the knobs go to 11…
- Applies to ALL power categories
- People know if you are in "Altoids" mode



Essence of Unwritten Rules

- Just because it's not specifically prohibited in the written rules doesn't mean you can do it!
- Keep the contest on the radio and within the contest period
- Don't give or take unfair advantage

Examples of Unwritten "Rules"

- **Do not** make pre-arranged schedules
- **Do** identify frequently
- **Do not** ask friends to work you … only
- **Do** encourage club members to work everyone
- **Do not** work friends with multiple calls
- **Do** work and spot stations equally
- **Do not** let others "help" your single-op effort

Examples of Unwritten "Rules"

- **Do not** telephone or text message multipliers
- **Do** try to help casual callers enjoy the contest and make a contact
- **Do not** plop down 100 Hertz away from your competitor to intentionally disrupt their run
- **Do not** leave CQ on auto repeat while you run down the hall…

See the ARRL's *"HF Contesting - Good Practices, Interpretations & Suggestions"*

No log washing

When the contest is over, put your pencil down.

Do not

- Use QRZ.com, Spot history, 3830 reports, LoTW to "correct" QSOs
- Use utilities to analyze and correct the log
- Record the contest and replay it to change log entries
- Ask others who they worked or if a callsign is correct
- Email stations you think you worked

“All the guys at the top are cheating”

No, they are not

- There are a few bad apples – this is true in any sport
- They don’t last long

This belief is the primary reason for cheating - in virtually every sport studied!

Why people cheat

- Desire to be a “hero” on the field of competition
- Achieve immortality via community legend, fame, and lasting peer recognition
- Seeking current community “stardom”
- Prove superiority over others
- A means to prove self-worth

These are powerful forces!

Rationalizations for cheating

- Everybody is doing it
  - (#1 Reason, and provably false)
- Nobody was hurt
  - (Except those you beat)
- Nobody was watching
  - (Maybe not in the shack…)
- Overcome unfair disadvantages
  - (Life is not fair)
- Rules apply to others, not me/us

"I'm not a big gun…it doesn't matter if I cut corners a bit"

Yes, it does!

- Bad habits early on become seriously bad habits later
- Your reputation is established early
- Dealing with temptation is hard…"It's easy to just give in! And it keeps getting easier."

Cheating is stealing

- If you beat someone by cheating, you have stolen his award/recognition
- In nearly every culture, stealing violates the Golden Rule

Honor Code

- 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

The RIGHT way to do contesting

- Play fair
  - Obey the rules, remember this presentation
- Try to do better next time
  - No ‘excuses’
  - Improve your skills, station
- Make your enjoyment of contesting be about the journey, not the destination

Will you commit to the Code?

- 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 (see dx-code.org).
- I will yield my frequency to any emergency communications activity.
- I will operate my transmitter with sufficient signal quality to minimize interference to others.

Signed ________________________ Date __________

Who is the final judge ?

- The person in the mirror

- Your peers

  “Yeah, I know that guy. He cheats.”
  - *Anonymous Contester*

We learned it in grade school – just follow the Golden Rule

Please play fair!

The sport of contesting depends on your integrity.

Randy Thompson, K5ZD

Acknowledgments

This presentation draws on material developed by

Ken Adams, K5KA (SK)

Doug Grant K1DG

Larry Tyree N6TR

Ward Silver NØAX

Dave McCarty K5GN

Kirk Pickering K4RO

Optimizing the Use of Waterfall Displays for Contesting

Presented by N6TV
n6tv@arrl.net

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Presentation Overview

- Spectrum display limitations
- Waterfall displays in Modern Rigs
- Waterfall display advantages & disadvantages
- Optimum waterfall settings and adjustments
- Q & A

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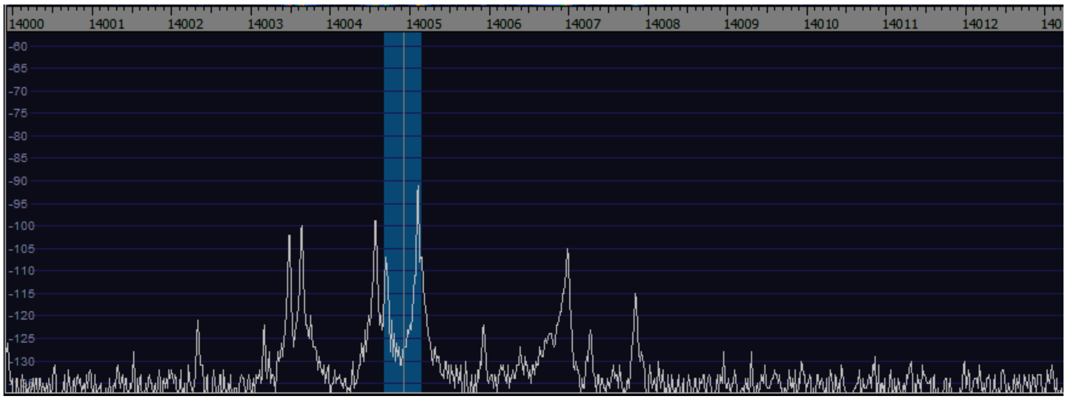
ICOM 2

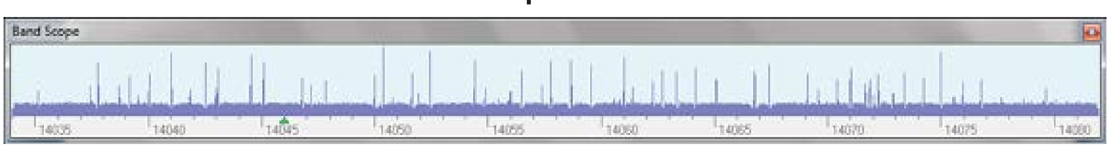
Spectrum-Only Displays, aka "Panadapters"



- No history – weak signals are covered up

CW Skimmer's Band Scope

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

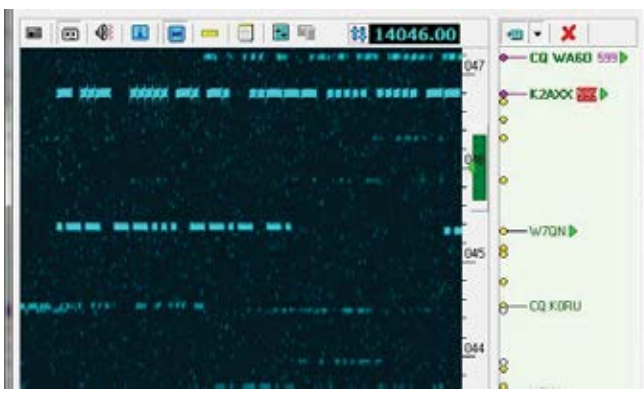


- Much better resolution, but display is very jumpy
- No history or "peak signal" memory
- Not useful on SSB

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
- Display jumpy, distracting
  - Signal peak or averaging helps, but it also hides things

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

Better Waterfall Displays

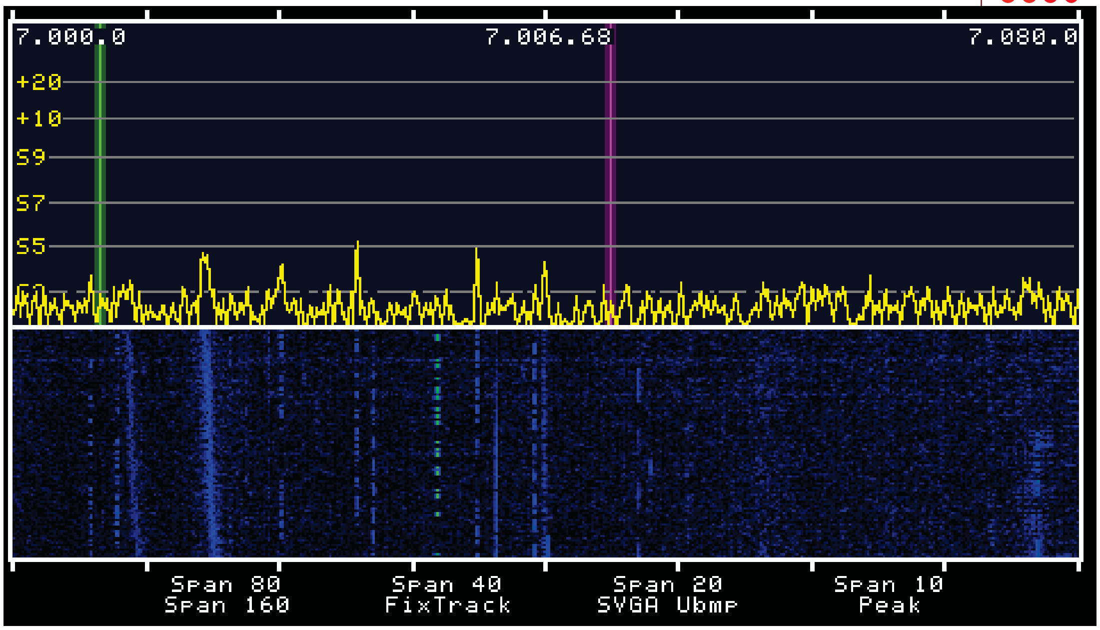
- The Elecraft P3 Panadapter

- Now seems obsolete

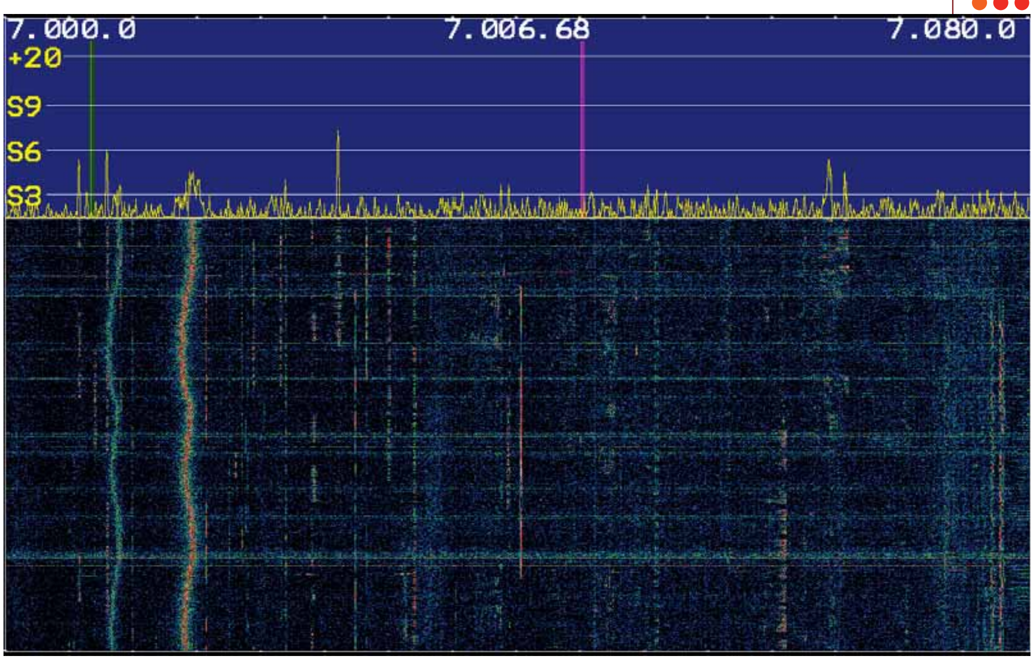
Elecraft P3 + P3SVGA Option

- 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

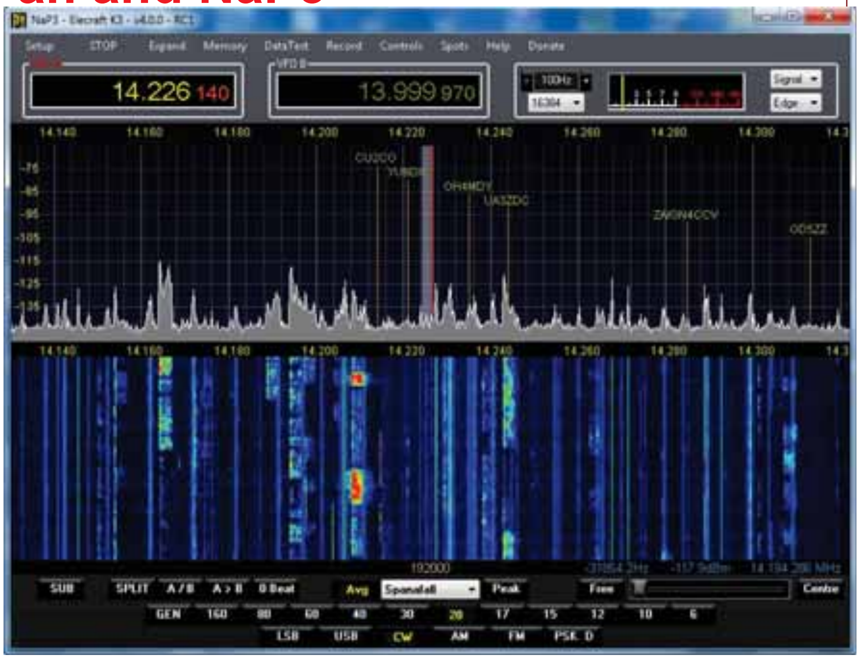
P3 Built-in Display at 480 x 272



P3SVGA at 1440 x 900



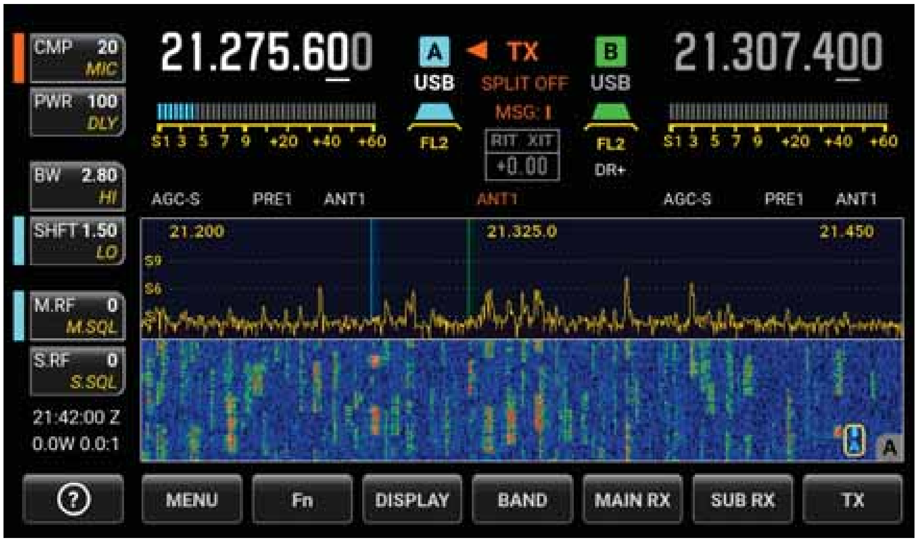
LP-Pan and NaP3



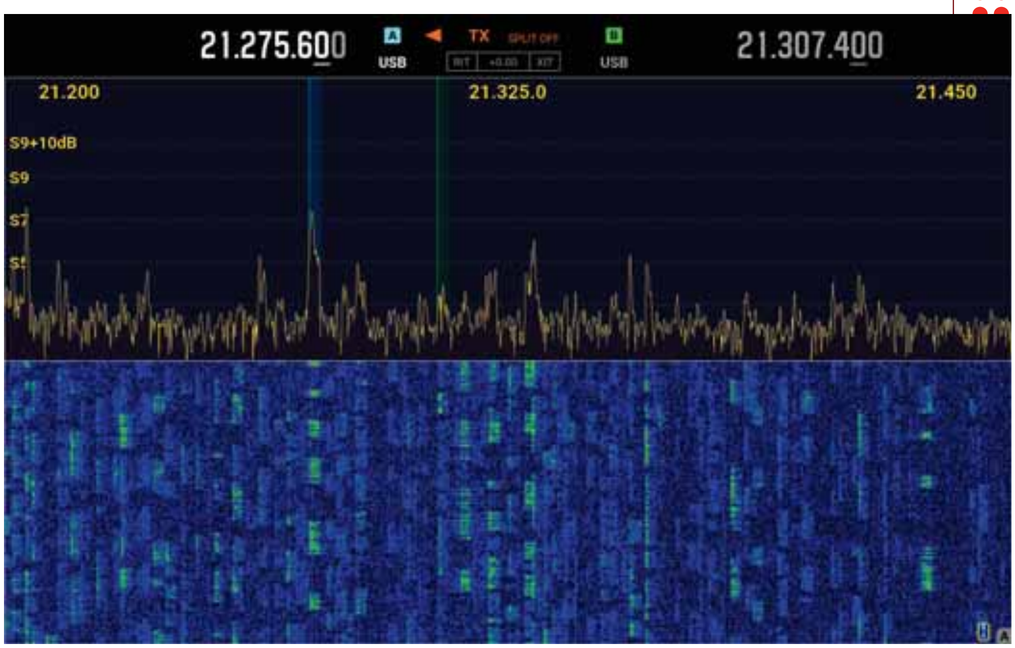
Elecraft K4

- 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

Elecraft K4 Built-in Display at 1024 x 600



Elecraft K4 Ext. Monitor at 1920 x 1200



IC-7850 / 7851

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

IC-7300 “Spectrum Scope”

- With touch screen

IC-7610 with dual band waterfall

Kenwood TS-890S

Yaesu FTdx101D

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ICOM 19

FlexRadio FLEX-6700™

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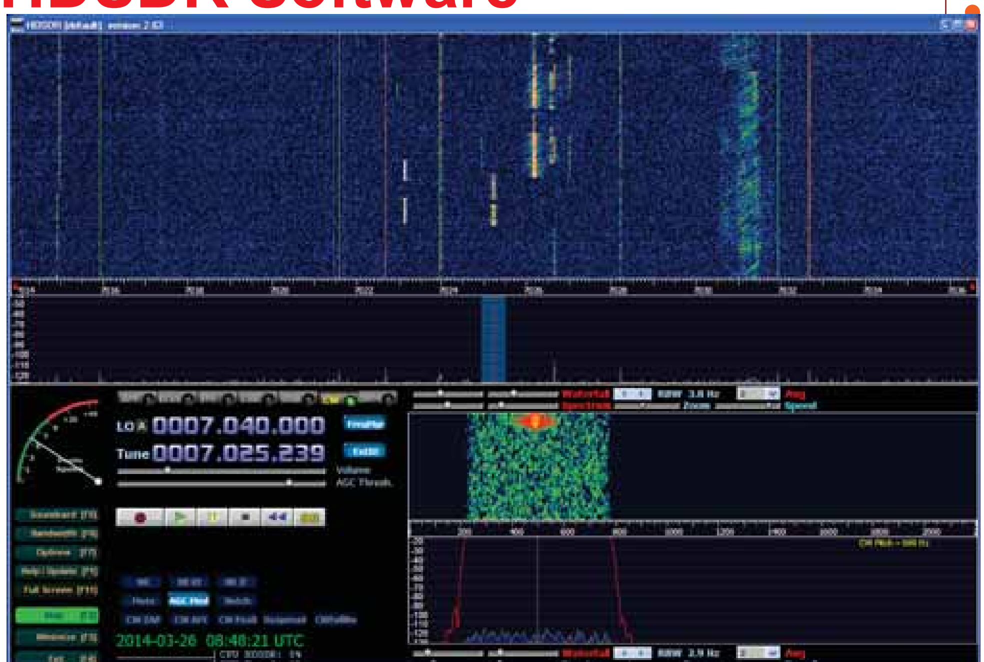
ICOM 20

FlexRadio Systems® SmartSDR

HDSDR Software



SDR-Radio.com SDRCconsole (V2) by HB9DRV

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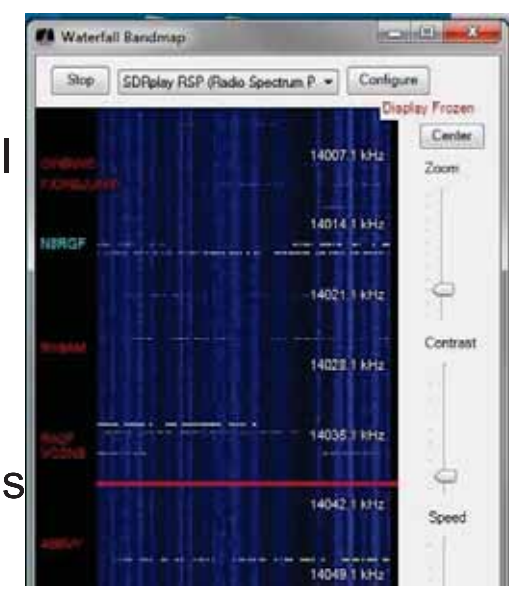
Waterfall Bandmap by N2IC (for N1MM+)

- 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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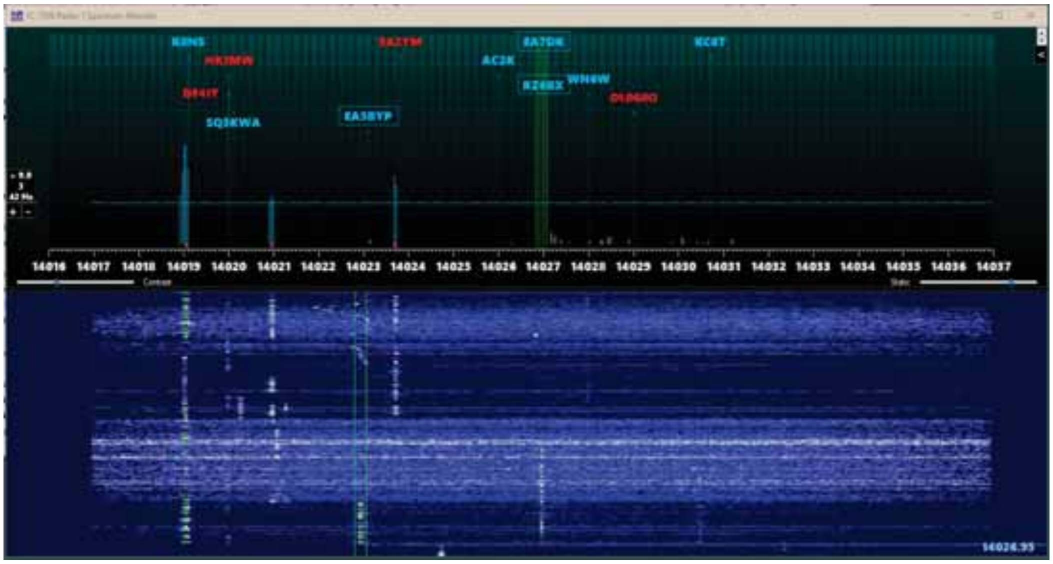
N1MM+ Spectrum Display Window



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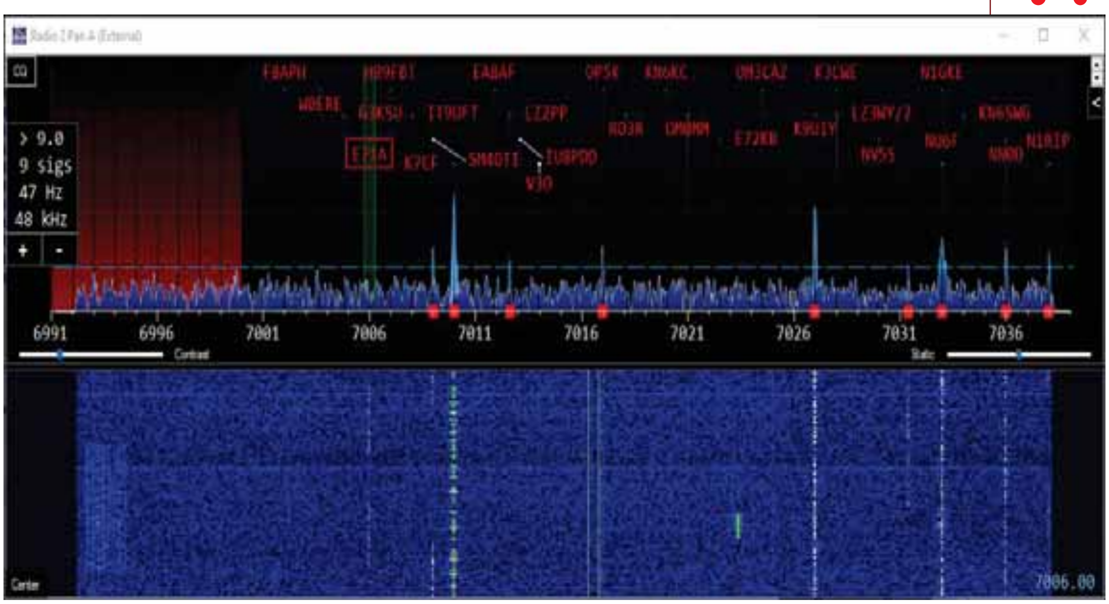
ICOM 25

N1MM+ Spectrum Display Window



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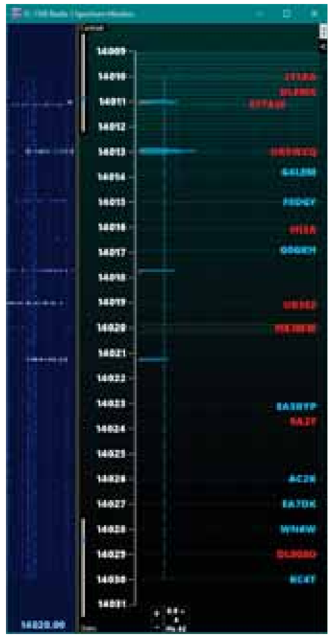
ICOM 26

N1MM+ Vertical Spectrum Display Window



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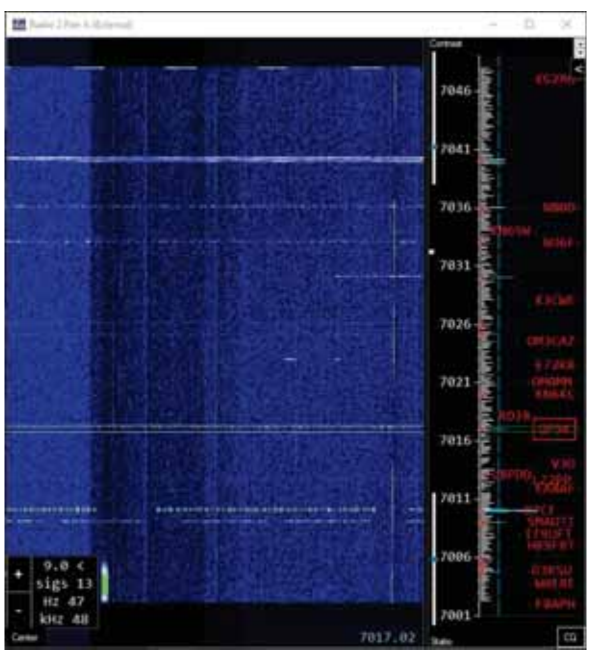
ICOM 27

N1MM+ Vertical Spectrum Display Window



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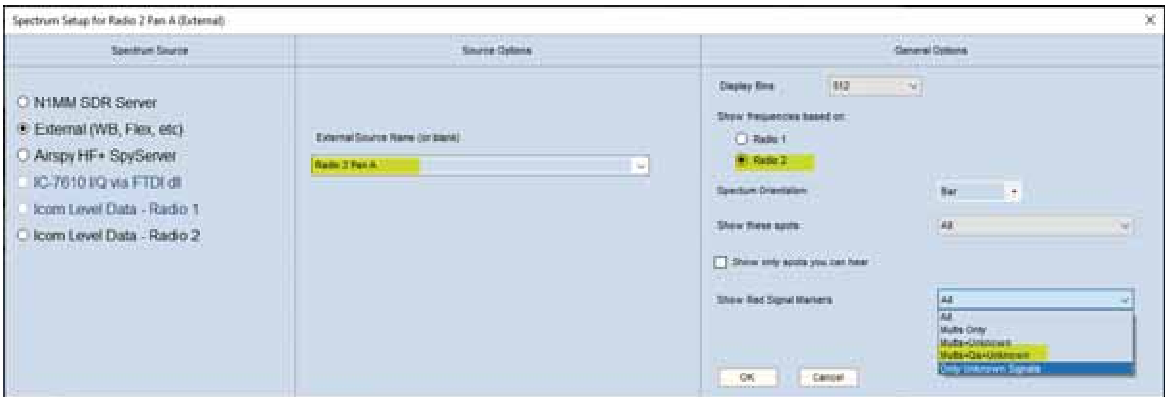
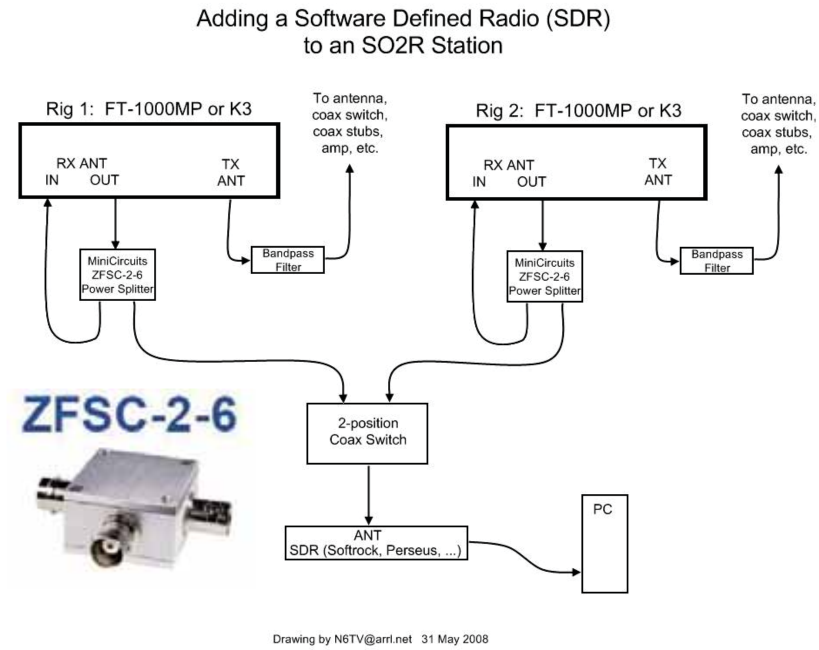
N1MM+ Spectrum Display Options

- For Elecraft K4, connect via to K4 via TCP
- Click Window > Spectrum Display
- Click “<“ Arrow, top right corner

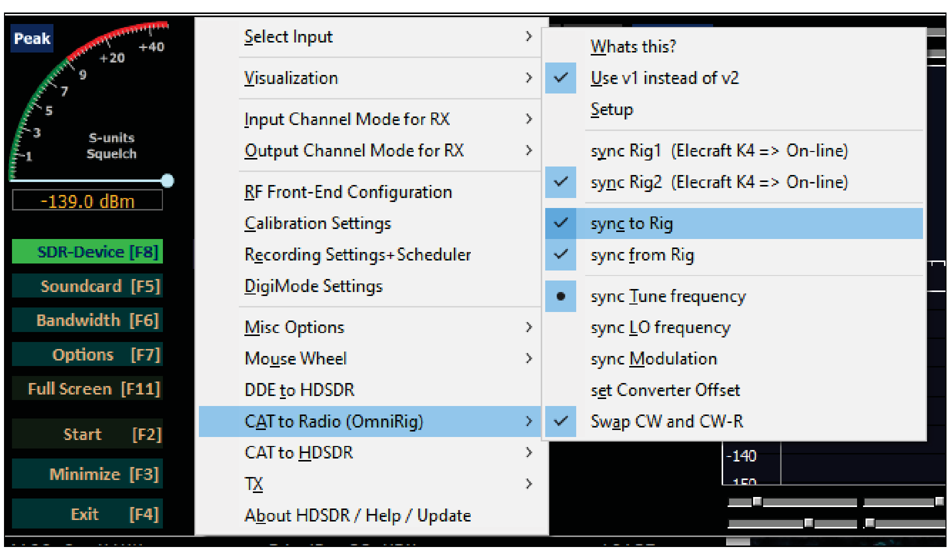


N1MM+ with Spectrum Display

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



Use OmniRig support in HDSDR to sync freq. with any transceiver



Waterfall Display Advantages

- Many zoom levels: 5, 10, 30, 60, …, 800 KHz+
  - Monitor an entire band, or a small slice
- Jump to Next Signal (N1MM+ Spectrum Display)
- Find "fresh meat" (unlabeled signals)
- Weak signals easy to spot (faint traces)
- Find new run frequencies *fast*
- Spot big pileups, or gaps in "Listening Up" DX pileups
- Find who the DX just worked, *fast*
- "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)

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More Waterfall Advantages

- 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 or the 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 in separate program
- 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, and adjust properly
- 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 CW, or running
- Use wider 40 -100 kHz span for Phone
- 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 https://bit.ly/wtscripts - Win-Test Scripts P3scripts.zip, IcomScripts.zip, includes source code

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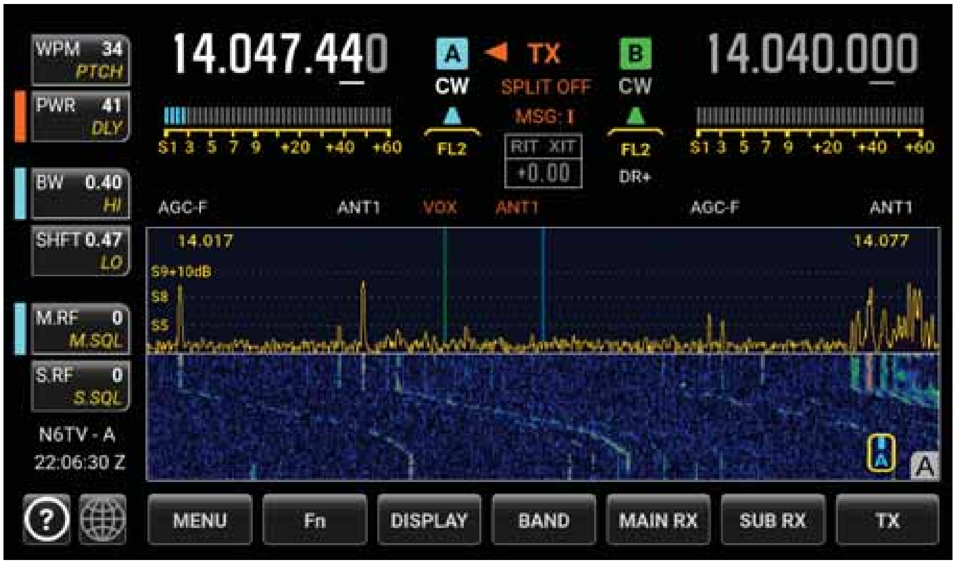
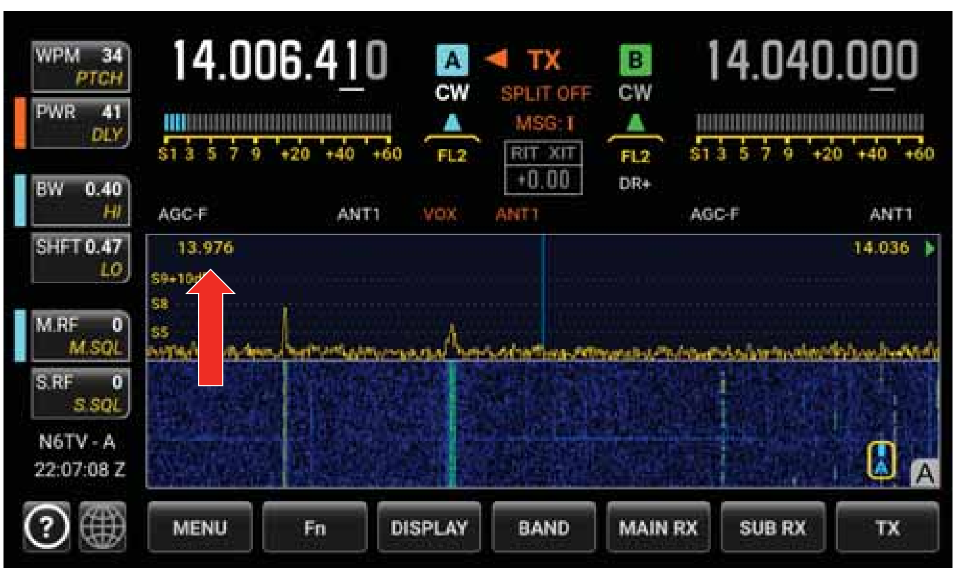
What's Wrong with this picture?



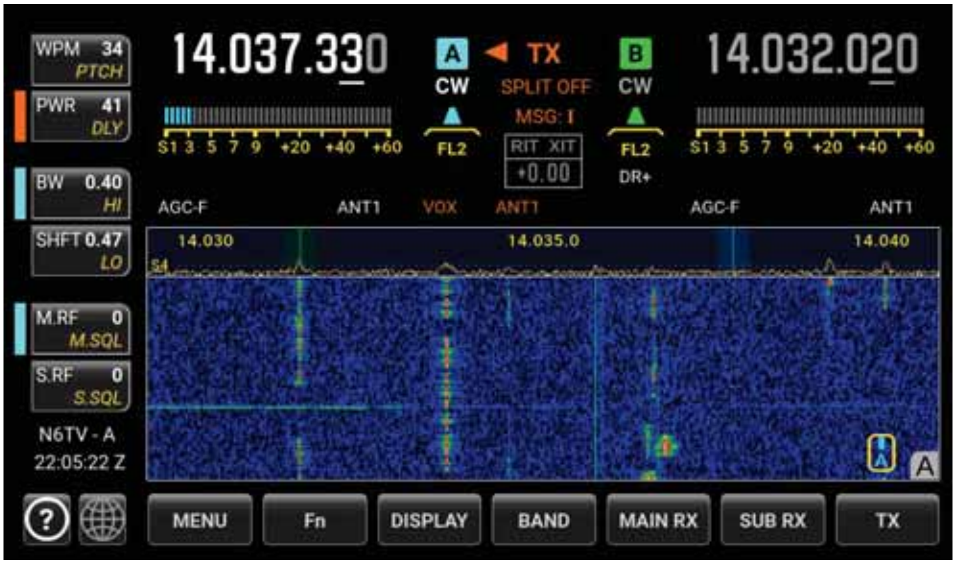
- **TRACK or CENTER mode causes waterfall smearing**

What's Wrong with this picture?



- **CENTER mode causes wasted space "Out of Band"**

What’s Wrong with this picture?

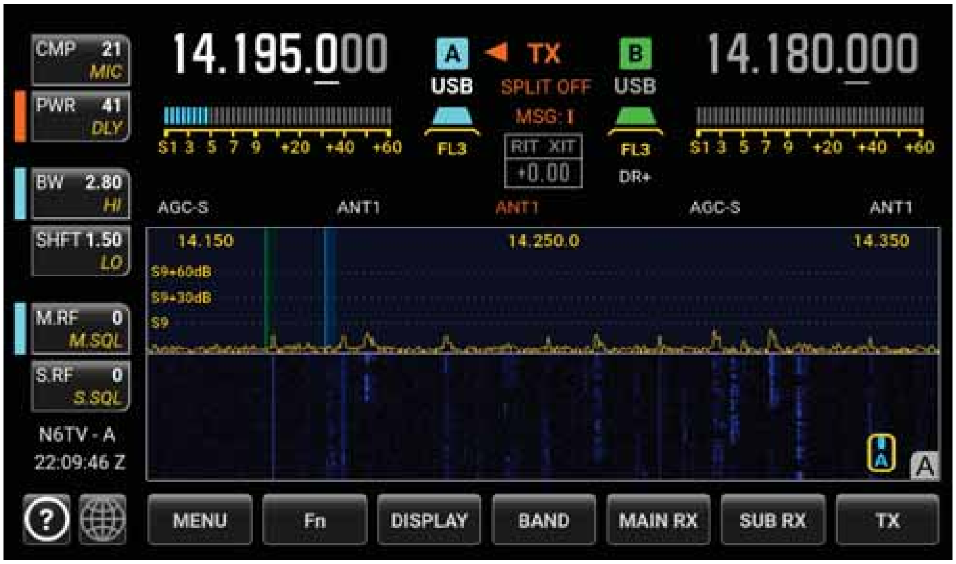


- Waterfall Height is set too high

What’s Wrong with this picture?

- Waterfall Height set too low

What's Wrong with this picture?



- Reference Level (bottom edge) is set too high (S-8)

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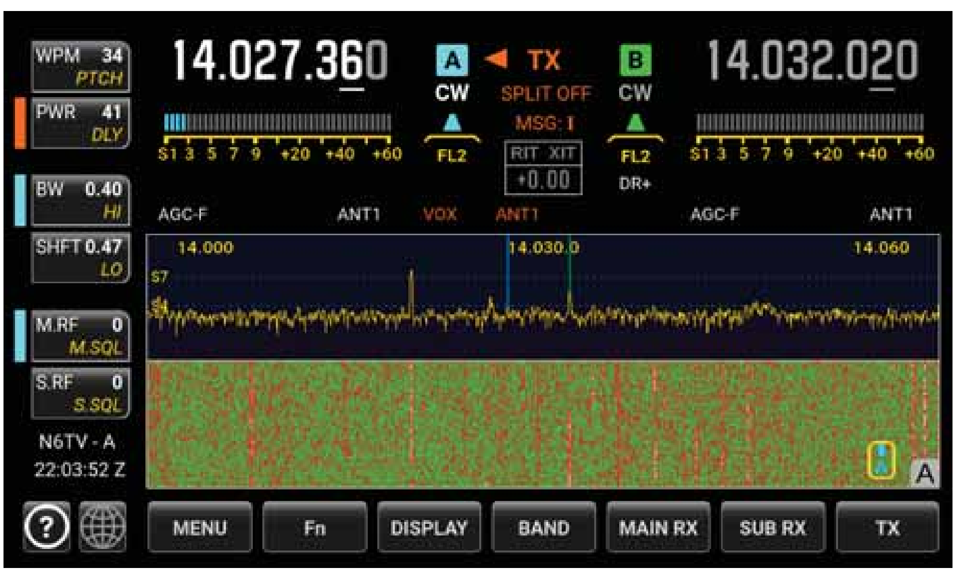
What's Wrong with this picture?



- Reference Level (bottom edge) is set too low

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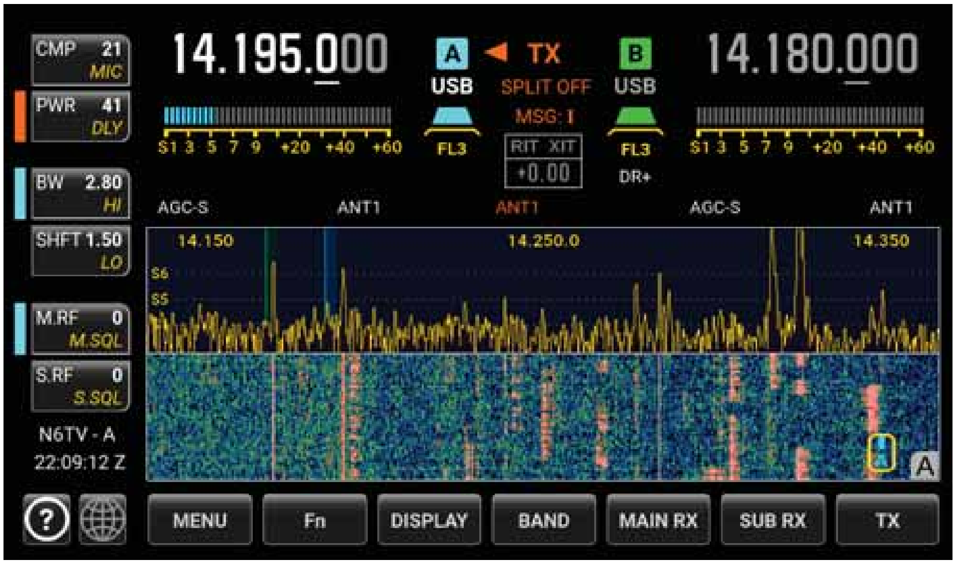
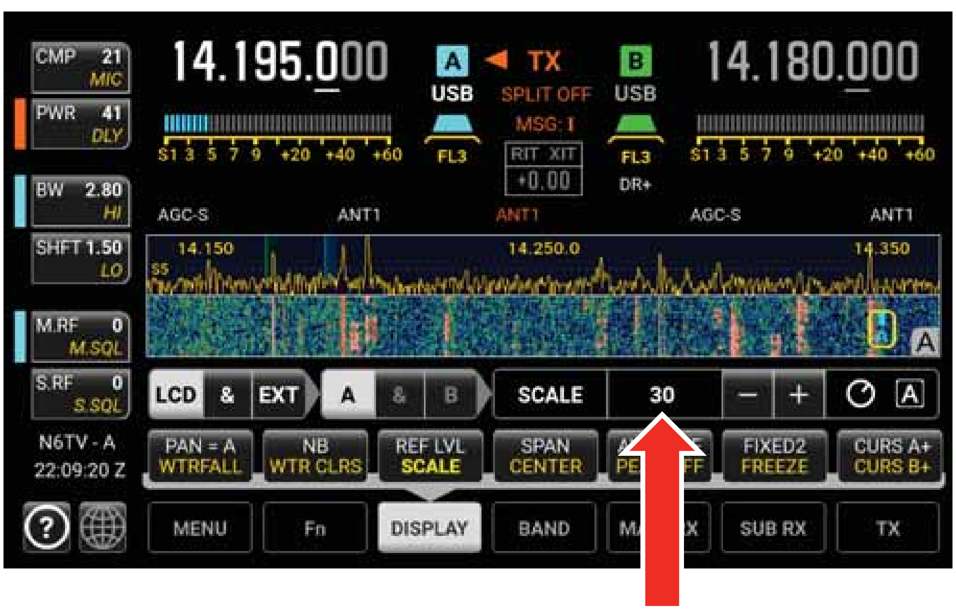
ICOM 42

What's Wrong with this picture?

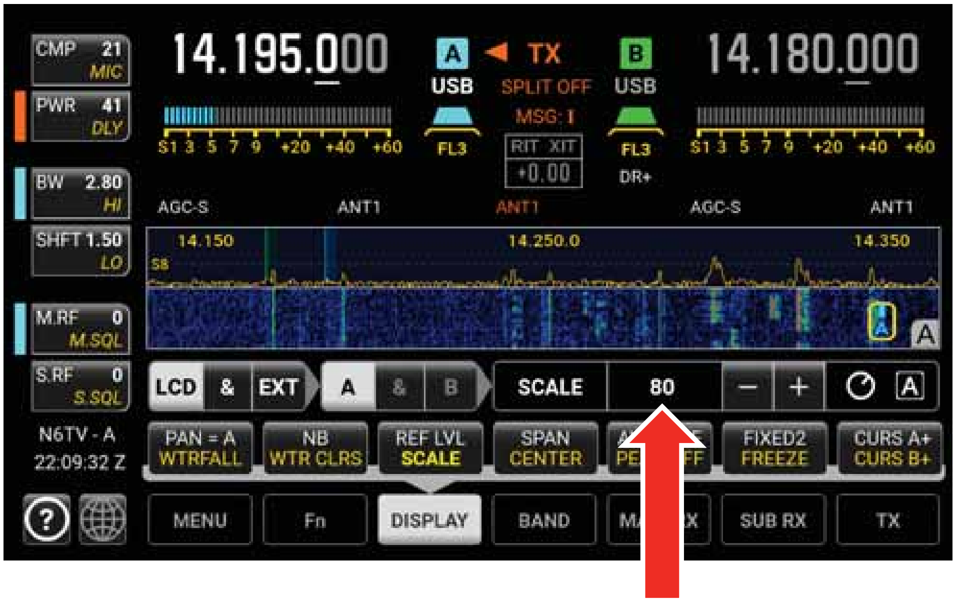


- **Vertical SCALE is set too low**

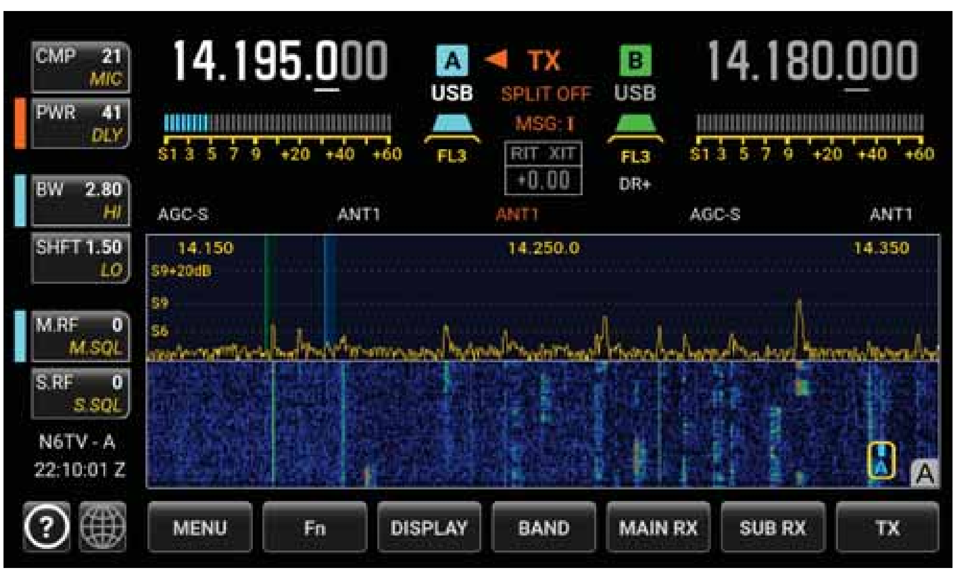
SCALE (height) is too low (only 30 dB)



Corrected to 80 dB of vertical scale



Proper Scale, Reference Level, Height



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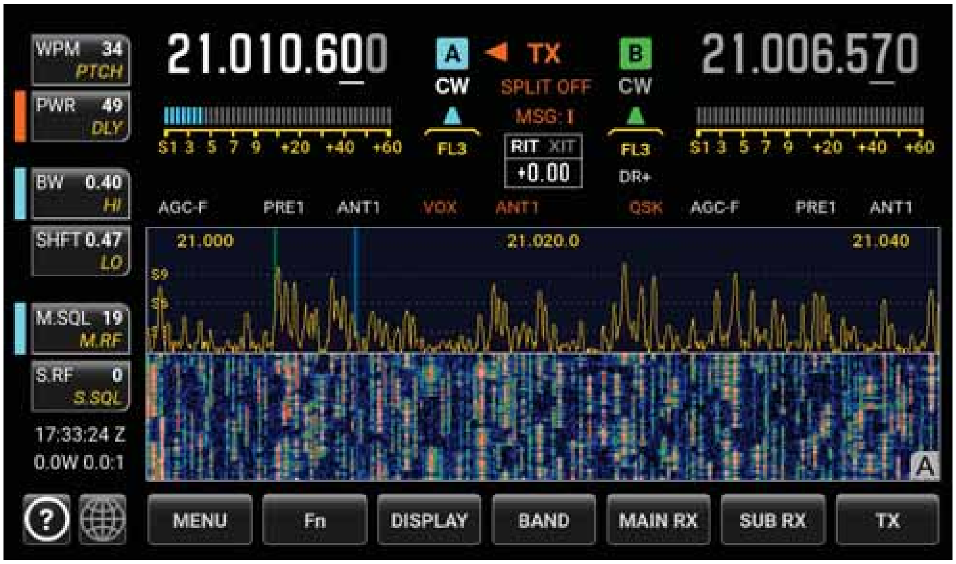
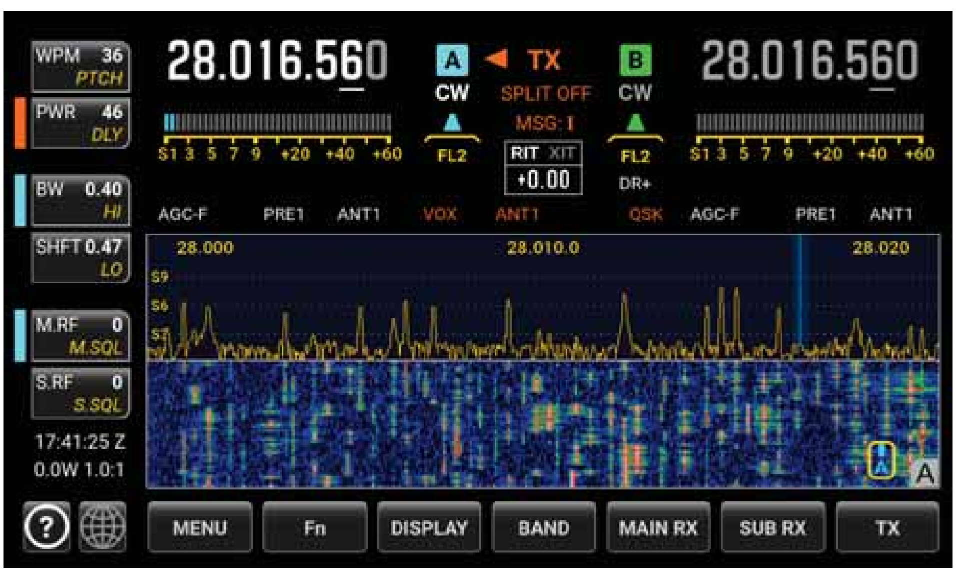
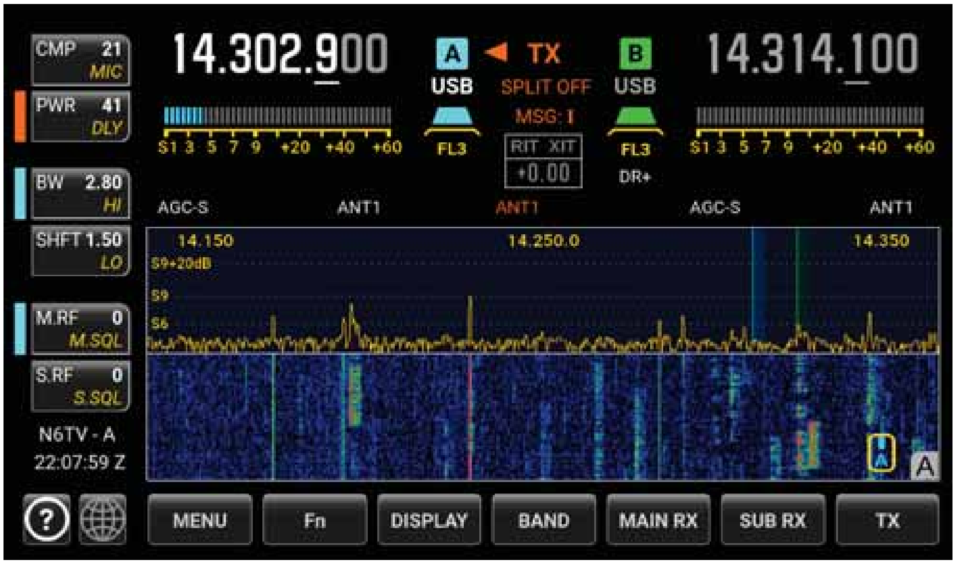


- Too many signals, SPAN too wide (40 kHz)

Try 20 kHz SPAN for Crowded CW Bands



What's Wrong with this picture?



- 200 kHz SPAN too wide for Phone contests

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Try 100 kHz SPAN for Phone Bands

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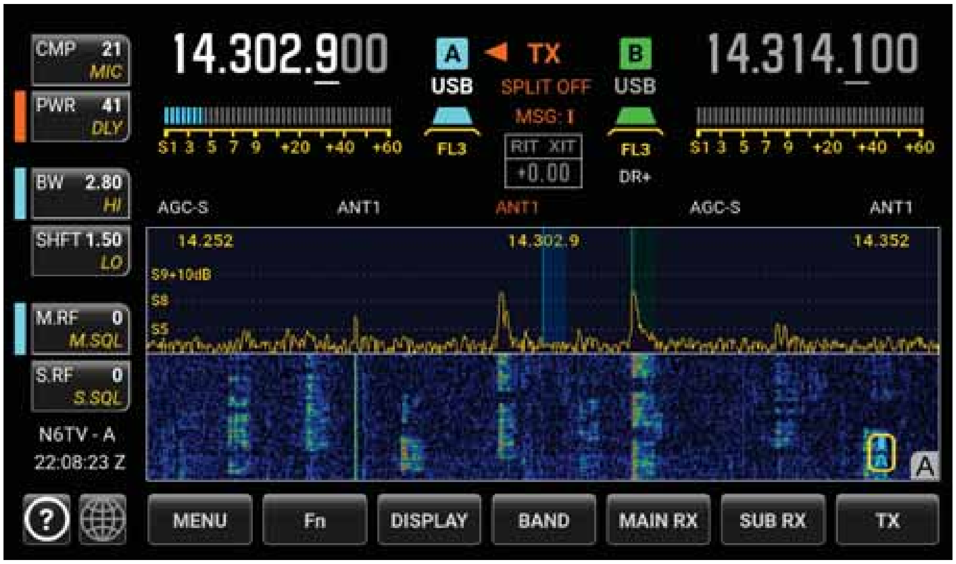
A 100 kHz SPAN is good for Phone Contests



Summary of Recommendations

- Always enable a waterfall display when contesting
- Set up the waterfall scope for good visibility of weak signals, but low visual noise
- Adjust horizontal SPAN throughout contest
- Avoid CENTER or TRACK mode to avoid smearing and wasted space on “out of band” frequencies
- Try the N1MM Spectrum Display with DX Cluster spots

Questions?

- http://www.qrz.com/db/n6tv - Links to this and other presentations
- https://n1mmwp.hamdocs.com/n1mm-manual/windows/#16-the-spectrum-display-window – N1MM+ Spectrum Display Setup
- http://http://www.hdsdr.de/ - HDSDR software
- http://sdr-radio.com/Software - SDRConsole
- https://n1mmwp.hamdocs.com/n1mm-manual/windows/#16-the-spectrum-display-window – N1MM+ Spectrum Display

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HF Propagation Knowledge to Improve Your Competitiveness in Contests

Frank Donovan
W3LPL
donovanf@erols.com

• CTU •
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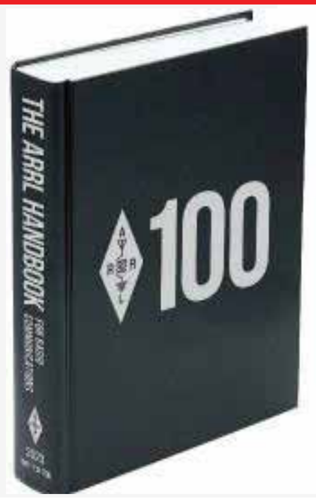
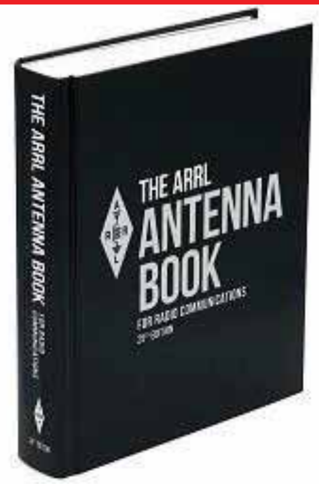
Frank Donovan W3LPL

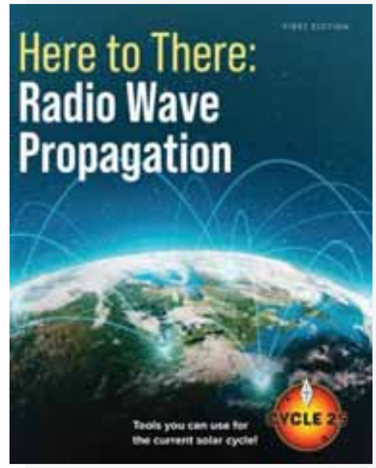
May 2023 QST

arrl.org/qst

The Three Most Valuable Investments to Greatly Improve Your Detailed Knowledge of Antennas and Propagation







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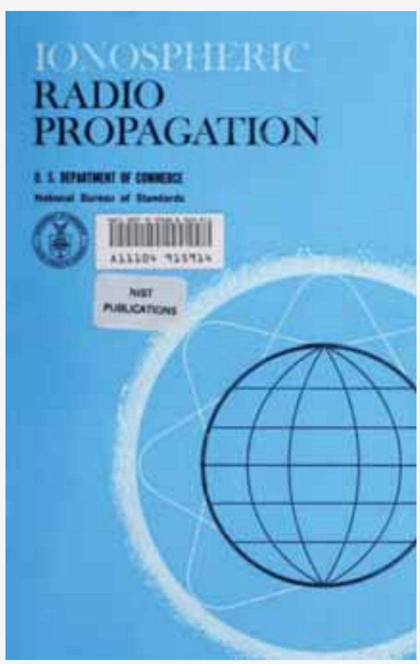
An Excellent Free Technical Reference for Scientifically Inclined Amateurs



nvlpubs.nist.gov/nistpubs/Legacy/MONO/nbsmonograph80.pdf

All HF Propagation Originates on the Sun

Magnetic Field: creates the corona and IMF
Corona: Superheated magnetized plasma
Active Regions: sunspots, solar flares, CMEs
Sunspots: concentrated closed magnetic fields
Solar Cycle: rising, maximum, declining, minimum
Solar Wind: megatons/sec of magnetized plasma
Coronal Holes: source of high speed solar wind
CMEs: powerful explosions of magnetized plasma
Solar Flares: intense X-ray and proton radiation

Key Features of the Sun-Earth System

every HF contester should understand these basic concepts

Sunspots and Active Regions Intense closed magnetic fields emerge from the Sun to form sunspots and their surrounding active regions. Ionizing extreme ultraviolet radiation and disturbances from solar flares, hard x-rays, energetic protons and CMEs originate in active regions

Solar Cycles usually 11 years, as short as 9 years, as long as 14 years. Some cycles have a long lasting and more energetic solar maximum. Some cycles have a long lasting and less energetic solar minimum.

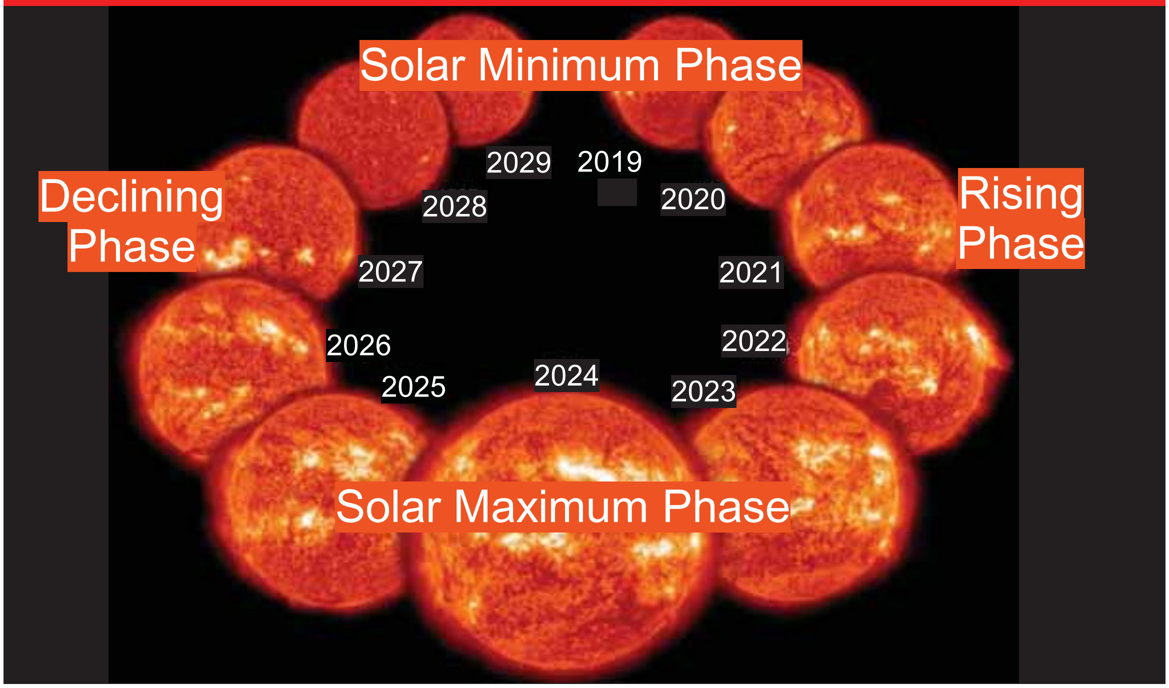
Ionizing Radiation Ten times more ionizing extreme ultraviolet radiation during solar maximum improves HF propagation especially during fall, winter and spring. Highly energetic x-rays from solar flares can suddenly black out daytime HF propagation for up to two hours with no warning

Geomagnetic Disturbances HF propagation is often degraded by the enhanced hypersonic flow of magnetized plasma in the solar wind

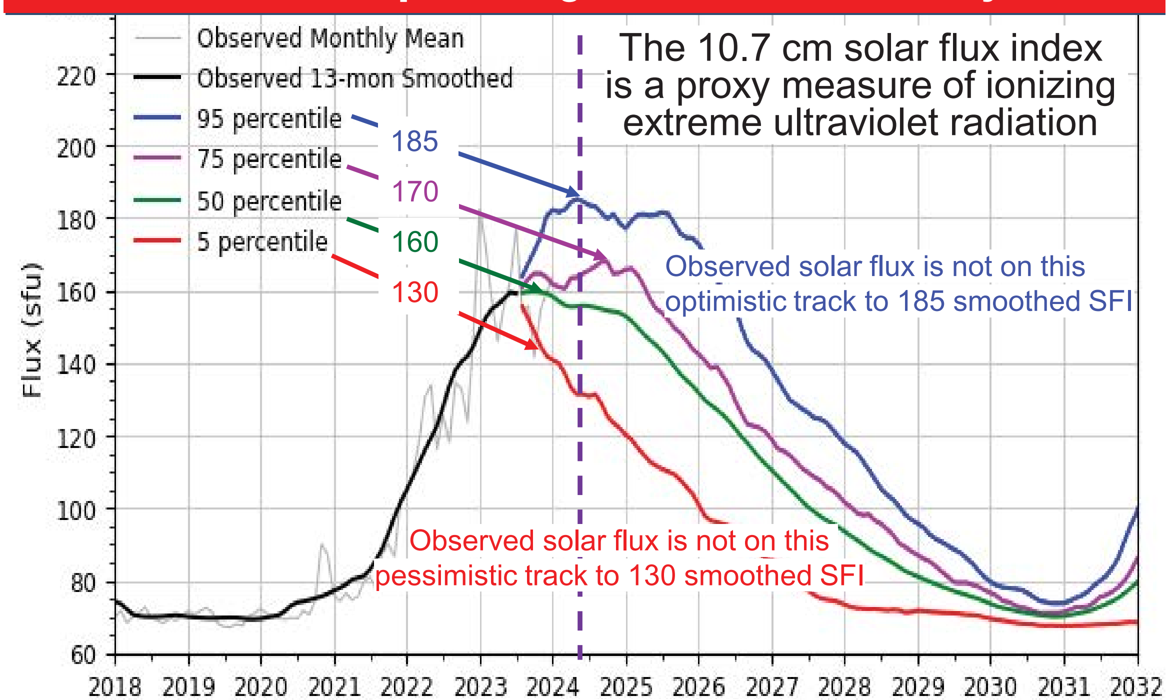
27 Day Solar Rotation 27 day periods of enhancement and disturbance

Seasonal Variability Earth's 23.5º tilted axis increases ionizing EUV radiation intensity at mid and high latitudes during summer and decreases it during winter. Earth's tilted axis also reduces the intensity and frequency of disturbed HF propagation during summer and winter

Enhanced Ionizing Extreme Ultraviolet Radiation Through 2026 Produces Greatly Improved 40 to 10 Meter Propagation



Solar Cycle 25 Solar Flux Index Forecast
NASA Marshall Space Flight Center - February 2024



www.nasa.gov/msfcsolar

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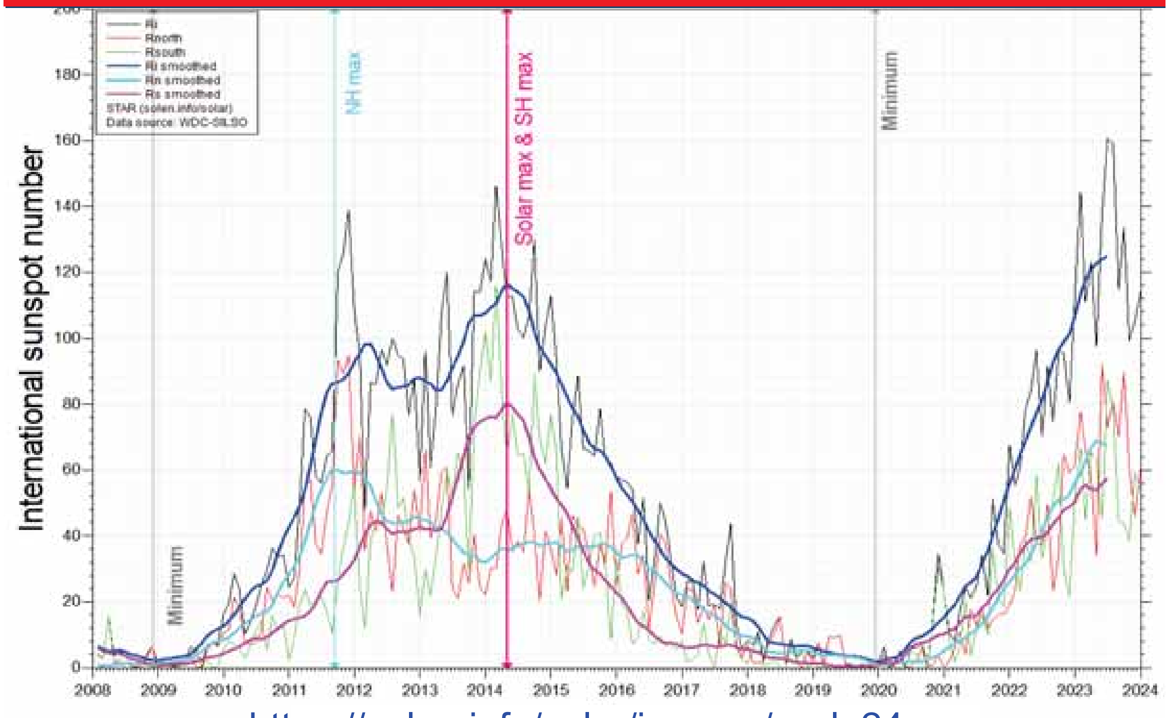
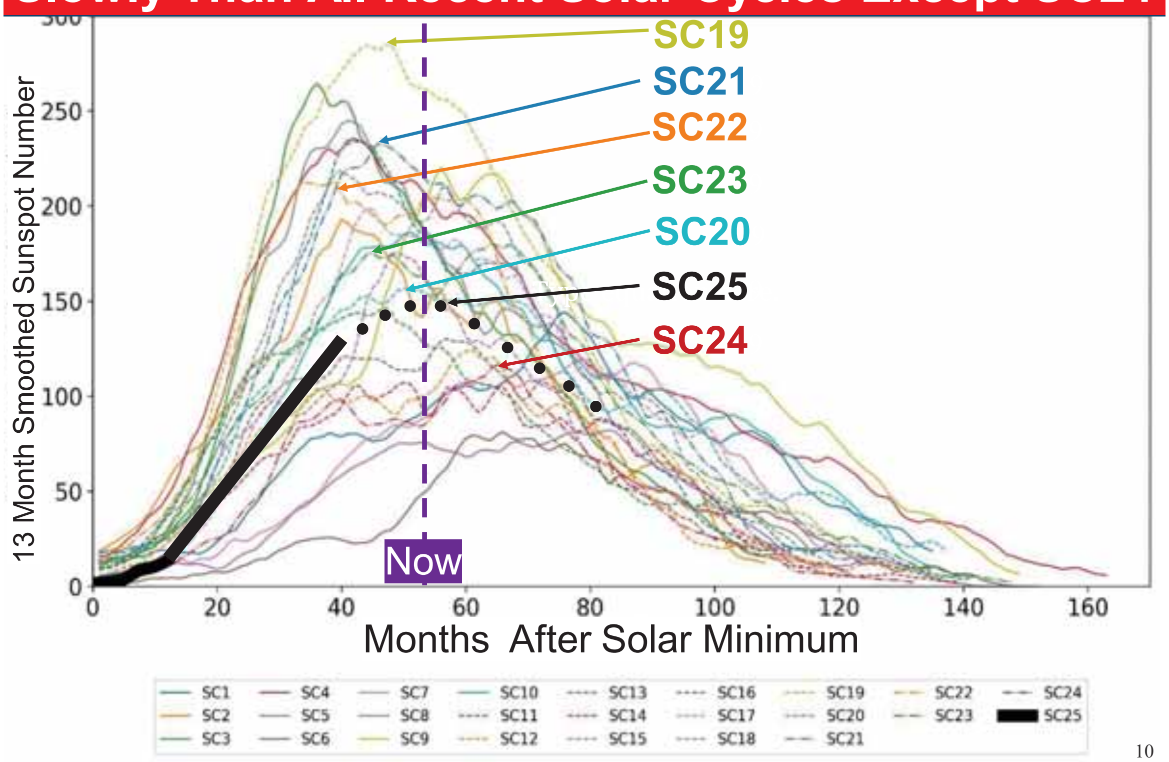
Solar Cycle 25 Progress vs Solar Cycle 24



https://solen.info/solar/images/cycle24.png

9

Solar Cycle 25 Sunspot Activity Increased More Slowly Than All Recent Solar Cycles Except SC24

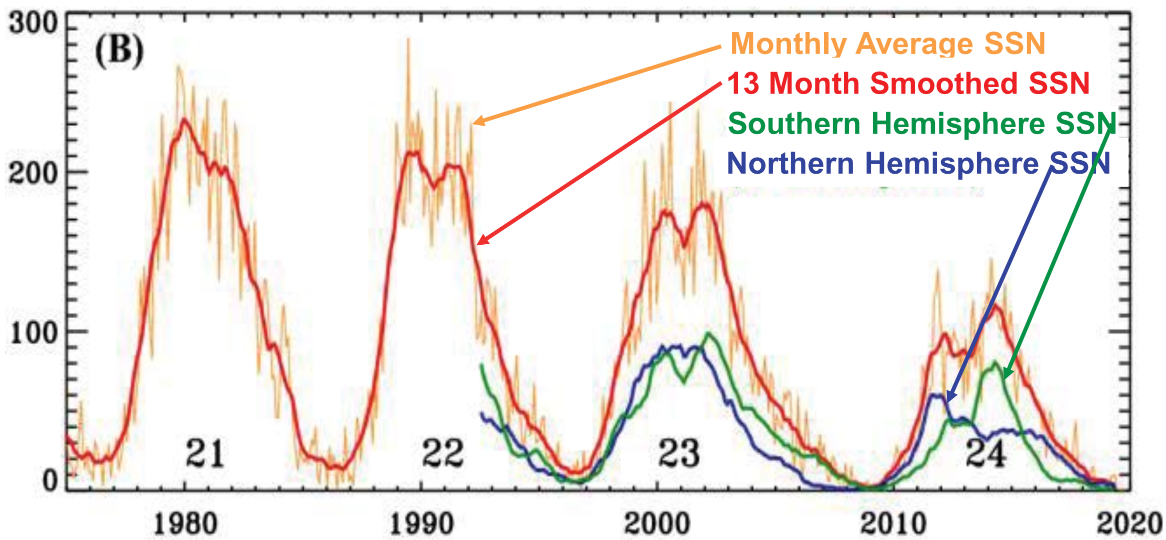


10

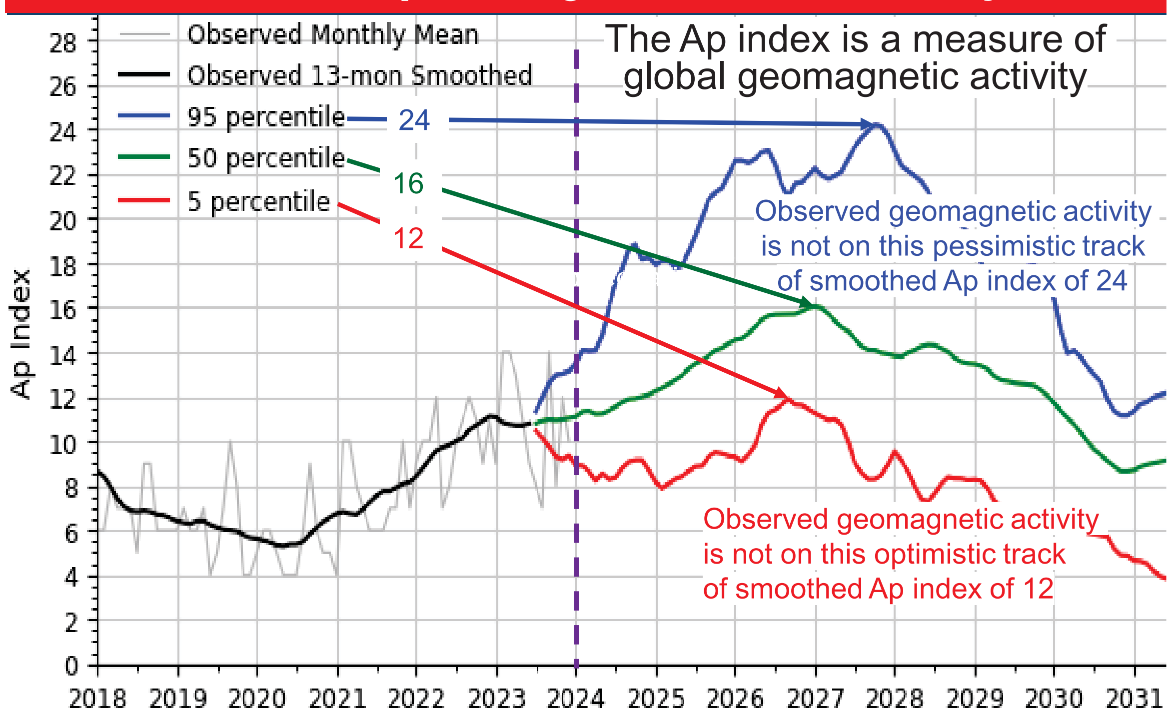
The Sun's Northern and Southern Hemisphere Solar Cycles Can be Offset by Up to Two Years

Solar cycle duration varies from 8 to more than 14 years

Propagation models use the 13 month smoothed SSN



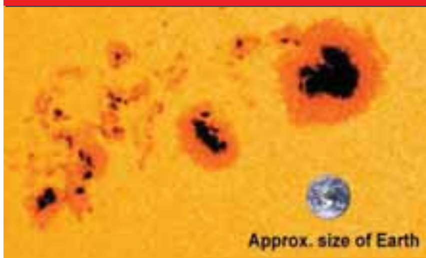
Solar Cycle 25 Geomagnetic Ap Index Forecast
NASA Marshall Space Flight Center - February 2024



www.nasa.gov/msfcsolar

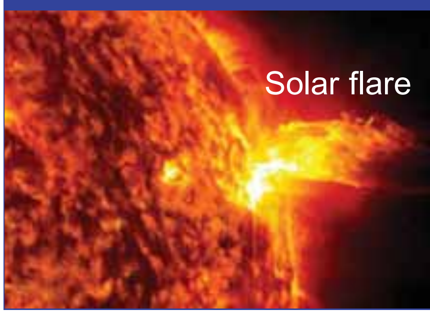
12

More Frequent, More Energetic Active Regions Produce Many More Sunspots, Solar Flares and Coronal Mass Ejections



One of the largest sunspots ever seen

Coronal mass ejection

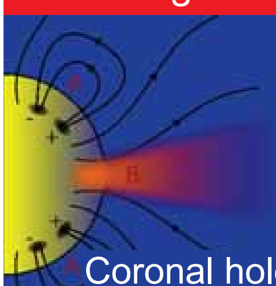


During solar maximum active regions radiate:

- Stronger ionizing extreme ultraviolet radiation enhancing HF propagation on upper HF bands
- Highly energetic magnetized plasma from fast interplanetary CMEs causing more frequent strong geomagnetic storms
- Highly energetic hard x-rays from solar flares cause more frequent daytime radio blackouts

Coronal Hole High Speed Streams

Unlike the closed magnetic fields of sunspots, the open magnetic fields of coronal holes allow the corona's magnetized plasma to escape forming the solar wind



Coronal hole high speed streams are the most frequent source of minor geomagnetic storms throughout the solar cycle but most frequently during the declining four years of each solar cycle

Coronal hole high speed streams interact with the slow ambient solar wind often causing minor geomagnetic storms that develop <u>gradually</u> over several hours most frequently during the declining four years of each solar cycle

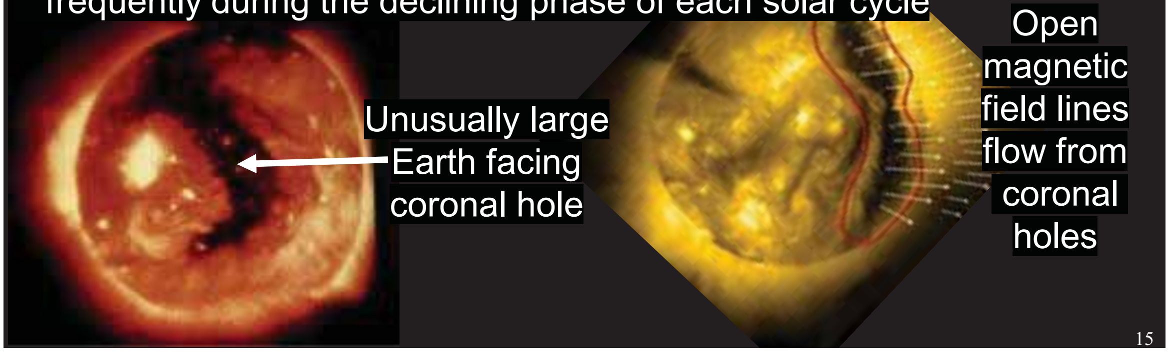
Conversely, <u>fast CMEs</u> originating in active regions sometimes cause <u>strong</u> and rare <u>extreme</u> geomagnetic storms that develop <u>suddenly</u> mostly during the four years near solar maximum

Disturbed Geomagnetic Conditions
Caused by Coronal Hole High Speed Stream Effects

Open magnetic fields flowing from small coronal holes at low solar latitudes allow magnetized plasma to escape the Sun's gravity forming the ambient solar wind and the interplanetary magnetic field

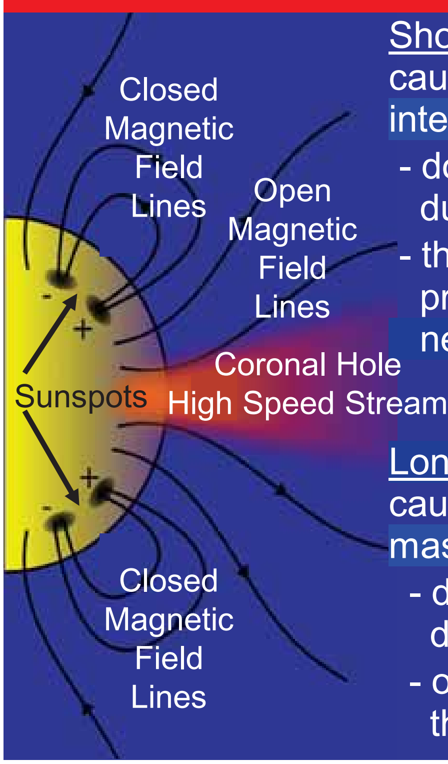
Coronal hole high speed streams originating from large Earth facing low latitude coronal holes cause frequent unsettled to active geomagnetic disturbances and occasional minor geomagnetic storms

Disturbed geomagnetic activity and minor geomagnetic storms caused by coronal hole high speed stream effects occur most frequently during the declining phase of each solar cycle



15

Short and Long Duration Minor Geomagnetic Storms



<u>Short duration</u> minor geomagnetic storms are caused by coronal hole <u>high speed stream</u> interactions with the ambient slow solar wind

- do not significantly degrade HF propagation during the four years near solar maximum
- the most frequent cause of degraded HF propagation during the four years near solar minimum

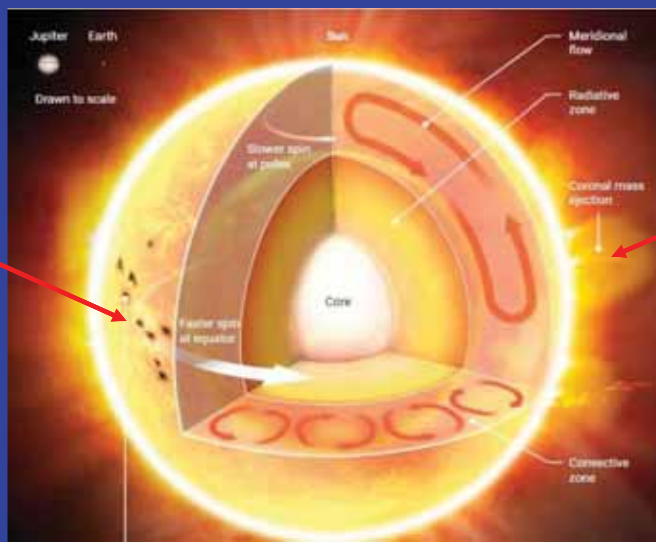
<u>Long duration</u> minor geomagnetic storms are caused by <u>geoeffective</u> interplanetary coronal mass ejections

- do not significantly degrade HF propagation during the four years near solar maximum
- occur about twice as frequently during the declining years of each solar cycle

16

The Sun's Twisting Magnetic Field Produces Active Regions and their Sunspots, Solar Flares and Coronal Mass Ejections

Differential rotation in the convective zone stretches, twists, tangles and strengthens the powerful submerged magnetic field which produces sunspots, solar flares and coronal mass ejections



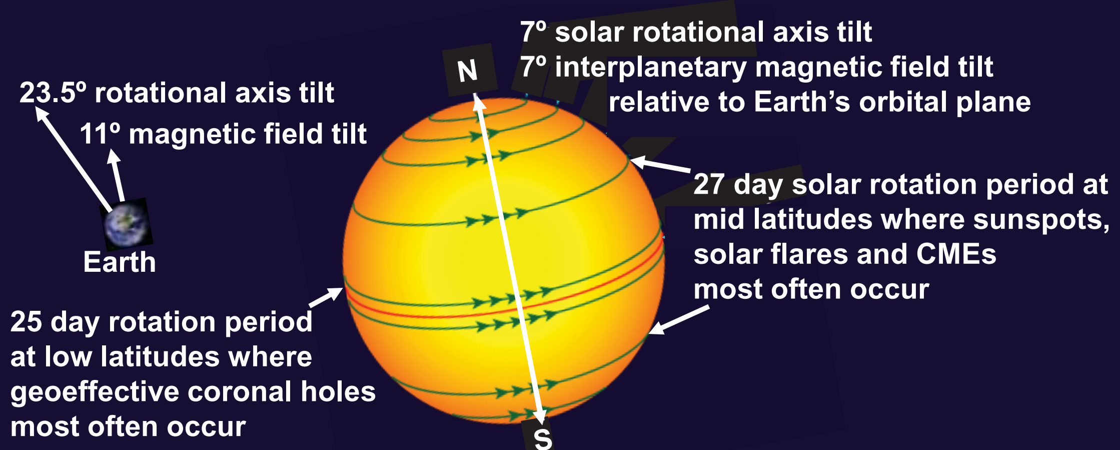
Sunspots

Coronal Mass Ejection

27 Day Recurrent Large Active Regions and 25 Day Recurrent Large Coronal Holes

Enhanced HF propagation can repeat about every 27 days as large sunspots rise on the east solar limb and set on the west limb

Geomagnetic disturbances can repeat about every 27 days when large active regions are +/- 30º latitude from the central meridian



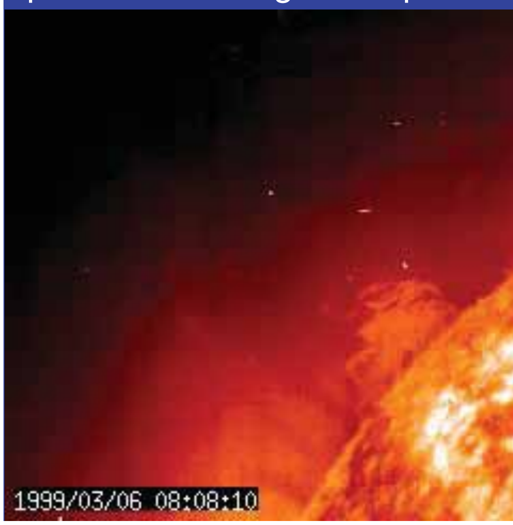
27 day solar rotation period where large active regions most often occur
25 day solar rotation period where geoeffective coronal holes often occur

Solar Flares and their Associated CMEs

Massive explosions of X-rays and plasma from active regions

95% of solar flares occur when the solar flux index is 90 or greater during the four years of greatest solar activity near solar maximum

In just a few minutes coronal mass ejections often associated with solar flares can release as much as ten billion tons of magnetized plasma travelling to the planets from 700 to more than 1000 km/second

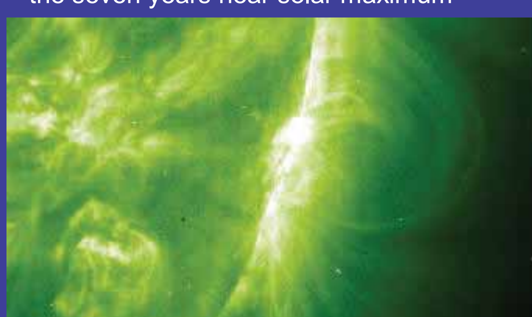


X-Class Major and Extreme Solar Flares Severely Impact HF Ionospheric Propagation

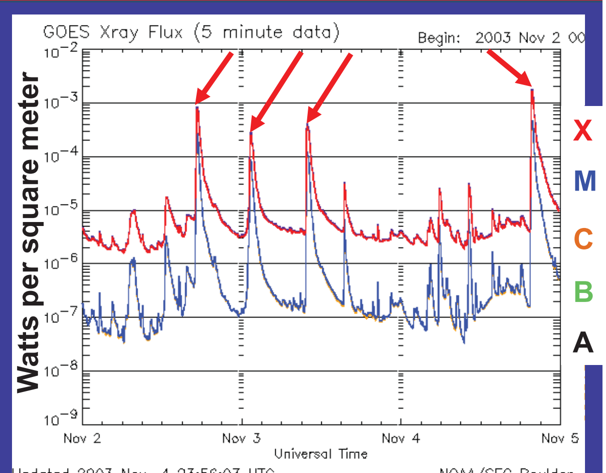
Extreme X10-Class produce long duration hemisphere-wide radio blackouts

Major X-Class produce hemisphere-wide radio blackouts and severe geomagnetic storms especially during the four years near solar maximum

Strong M-Class – medium flares produce less severely degrade HF ionospheric propagation mostly at high latitudes during the seven years near solar maximum



X28 solar flare the largest ever recorded November 4, 2003



Four Major X-Class flares
2 to 4 November 2003

Flares are classified on a logarithmic scale according to their X-ray strength

20

Moderate to Severe Daytime HF Radio Blackouts Caused by X-ray Radiation from X-Class Major Solar Flares During the Four Years Near Solar Maximum

X-rays propagating at the speed of light arrive on Earth in 8 minutes
- causing radio blackouts due to extreme D region absorption
- radio blackouts begin suddenly and with no warning

Radio blackouts affect *only* propagation crossing daylight regions

Disrupts HF propagation at lower frequencies for a longer duration and with significantly more D region absorption than higher frequencies

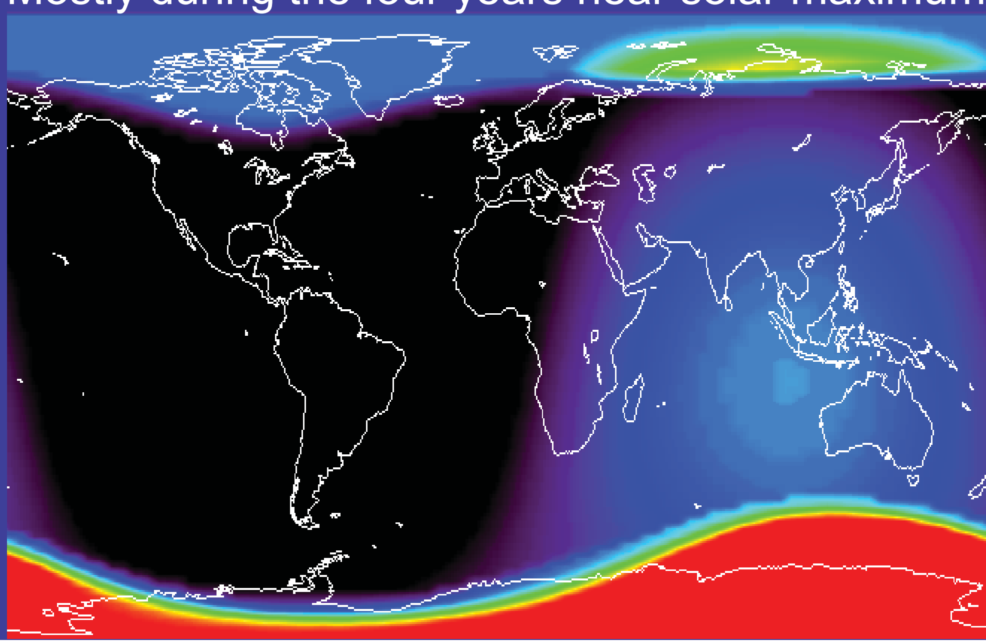
HF ionospheric propagation gradually returns to near pre-blackout conditions about an hour or two after the onset of radio blackouts

Propagation on the higher frequency HF bands returns to near pre-blackout conditions more quickly than the lower frequencies

21

S2-Class Strong Polar Cap Absorption Events

Typically about 25 S2-Class strong PCAs per solar cycle
PCAs usually last for a few days, sometimes longer
Mostly during the four years near solar maximum



22

S2-Class Strong Polar Cap Absorption Events

PCA events are caused by Solar Energetic Proton (SEP) radiation from X-Class major solar flares

PCAs absorb (but usually do not black out) HF propagation crossing the polar regions

Energetic protons arrive at Earth 10-12 hours after a solar flare
- typically propagate through the interplanetary magnetic field at more than 10 million MPH

Polar cap absorption is much less severe:
- when Earth's winter polar region is tilted away from the sun
- during nighttime hours

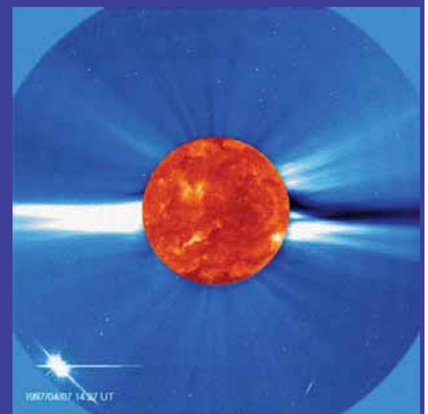
23

More Frequent Fast Coronal Mass Ejections Through 2026

Fast interplanetary CMEs cause more frequent and longer lasting moderate and severe geomagnetic storms

Fast Coronal Mass Ejections (CMEs) The Dominant Cause of Strong to Severe Geomagnetic Storms

Fast CMEs from solar active regions are the dominant cause of moderate to severe HF propagation disturbances caused by geomagnetic storms



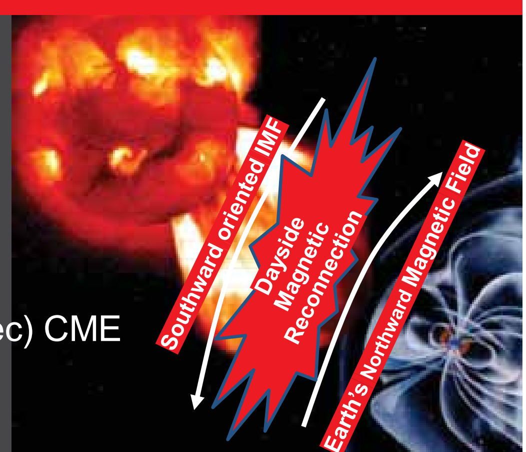
Fast CME impacts are greatly magnified when the interplanetary magnetic field (IMF) persists in a southward orientation -- opposite to Earth's magnetic field -- for more than a few hours

25

Strong to Severe Geomagnetic Storms

Always Caused by Persistent Southward IMF Orientation

Persistent Southward Oriented Interplanetary Magnetic Field (IMF)
causes strong to severe geomagnetic storms
when the IMF persists in a southward orientation for at least several hours
when enhanced by a fast (>500 km/sec) CME



Fast CMEs occur most frequently during the seven most active years of the solar cycle

The most severe geomagnetic storms occur most often:

- when they occur within a few weeks of the equinoxes on Earth, and
- when directed toward the Earth from 30º solar latitude or lower, and
- when directed from +/- 30º longitude from the Sun's central meridian

26

High Level Overview of Solar Maximum HF Propagation Through 2026

- Solar maximum propagation conditions began in Dec 2022 and continue for about four years through late 2026
- Frequent 10 meter DX propagation will continue through 2026
- 10 and especially 15 meter worldwide propagation will persist later into the night through 2026
- 20 and 40 meter DX propagation throughout the night will continue frequently through 2026
- Geomagnetic disturbances will gradually become more frequent as low latitude geoeffective large coronal holes become increasingly more frequent through 2026
- Sunspot activity will steadily decline after 2026 until solar minimum propagation conditions begin in about 2029

What HF Bands Should I Use for DX Contesting Through 2026?

- Each band has its unique advantages and disadvantages
- 15 and 10 meters provide reliable daytime worldwide propagation from mid-September through May
  - but not during summer months
- 20 meters provides reliable daytime and nighttime worldwide propagation throughout the year
  - but not during midday hours during summer months
- 40 meters provides reliable nighttime worldwide propagation throughout the year
- 80 meters often provides good nighttime worldwide propagation from October through April

28

How Solar Maximum Affects 10 Meter Worldwide Propagation Through 2026

- Worldwide propagation improved dramatically since late 2022
  - almost every day from mid-September through April
  - excellent propagation to Europe from sunrise through early afternoon
  - excellent propagation to Japan and Asia after 2130Z sometimes continuing for as long as three or four hours
  - is likely to continue through 2016
- Worldwide sporadic-E propagation between northern hemisphere locations will continue during many days from May through August
  – Sporadic-E is the dominant May to mid-August propagation

How Solar Maximum Affects 15 Meter Worldwide Propagation Through 2027

- Worldwide propagation improved dramatically since 2022
  – almost every day from September through May
  – Excellent propagation to Europe from before sunrise to mid-afternoon
  – excellent propagation to Japan and Asia after 2130Z sometimes for four hours or more
- Worldwide propagation between northern hemisphere locations begins later and is shorter in duration from June to August
  – Sporadic-E is sometimes the dominant propagation mode from May through August

How Solar Maximum Affects 20 Meter Worldwide Propagation Through 2027

- Nighttime worldwide propagation improved dramatically since 2022
  - almost 24 hours per day worldwide propagation
    - but not during summer mid-day hours
  - excellent nighttime propagation to Europe from 0700-0900Z
  - excellent propagation to Europe resumes before our sunrise
  - DX activity switches to 15 and 10 meters shortly after our sunrise
- Propagation to Japan and east Asia is strongest for three or four hours after 2130Z, somewhat weaker throughout the night then improves for several hours after local sunrise in the USA
- Midday 20 meter DX propagation is always very poor from June through August

How Solar Maximum Affects 40 Meter Worldwide Propagation Through 2027

- Worldwide propagation throughout the night became much more reliable and more long lasting since 2022
  - propagation to Europe starts about an hour before sunset
  - continues throughout the night until a few hours after European sunrise when European activity shifts to higher frequency bands
  - the best European propagation and activity is often around European sunrise (0600-0800Z)
- Mid-afternoon propagation to Europe is weaker since 2022
  - most DX activity is still on the higher bands
- Propagation from the east coast to Japan and east Asia is more reliable since 2022 starting at sunset in Japan (0830Z) until about 30 minutes after local sunrise in the USA

How Solar Maximum Affects 80 Meter Worldwide Propagation Through 2026

- 80 meter DX propagation is often shorter duration since 2022
  - weak and less reliable DX propagation begins at USA sunset
  - stronger European propagation usually starts a few hours after local USA sunset
  - the best European activity is often during the hours before their sunrise
    - continuing until just after European sunrise (0600-0800Z) when most Europeans shift their operating to the higher frequency bands
- 80 meter worldwide propagation will begin to steadily improve after 2026

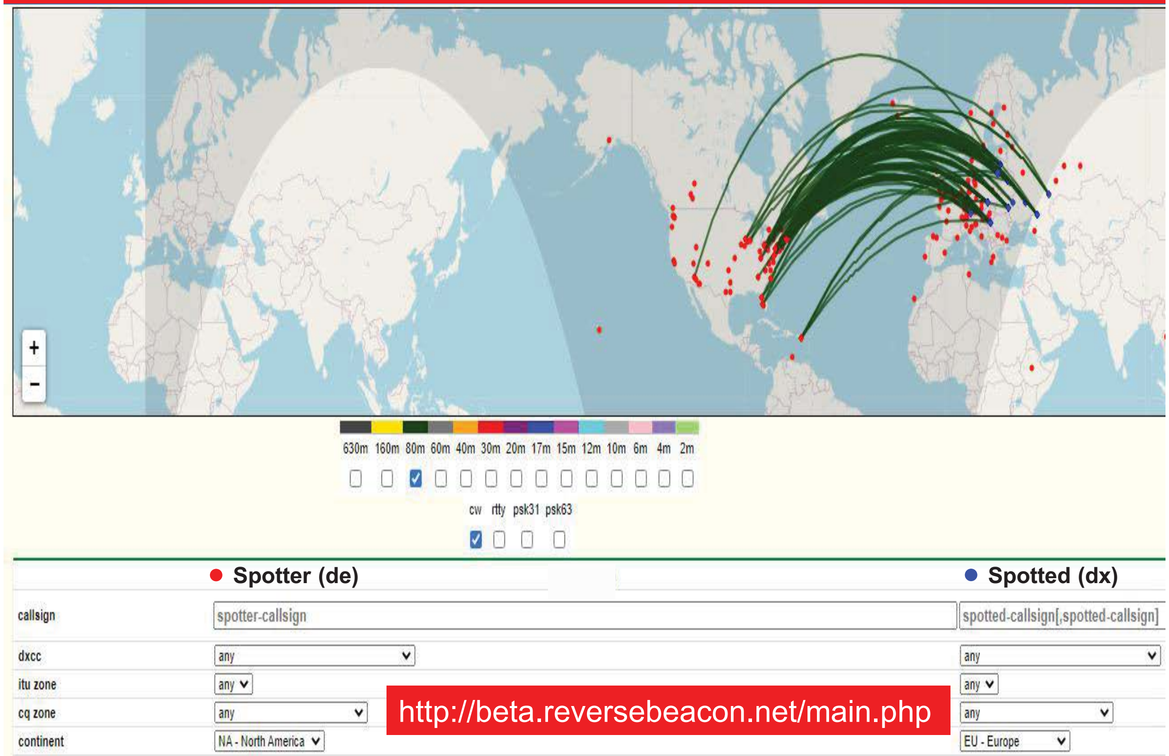
One of the largest sunspots ever seen

How Solar Maximum Affects 160 Meter Worldwide Propagation Through 2026

- 160 meter DX propagation is very unreliable since 2022
  - weak unreliable DX propagation begins after sunset
  - propagation to Europe sometimes improves around midnight for just a few hours and sometimes much less
- 160 meter DX propagation will begin to slowly improve after 2026

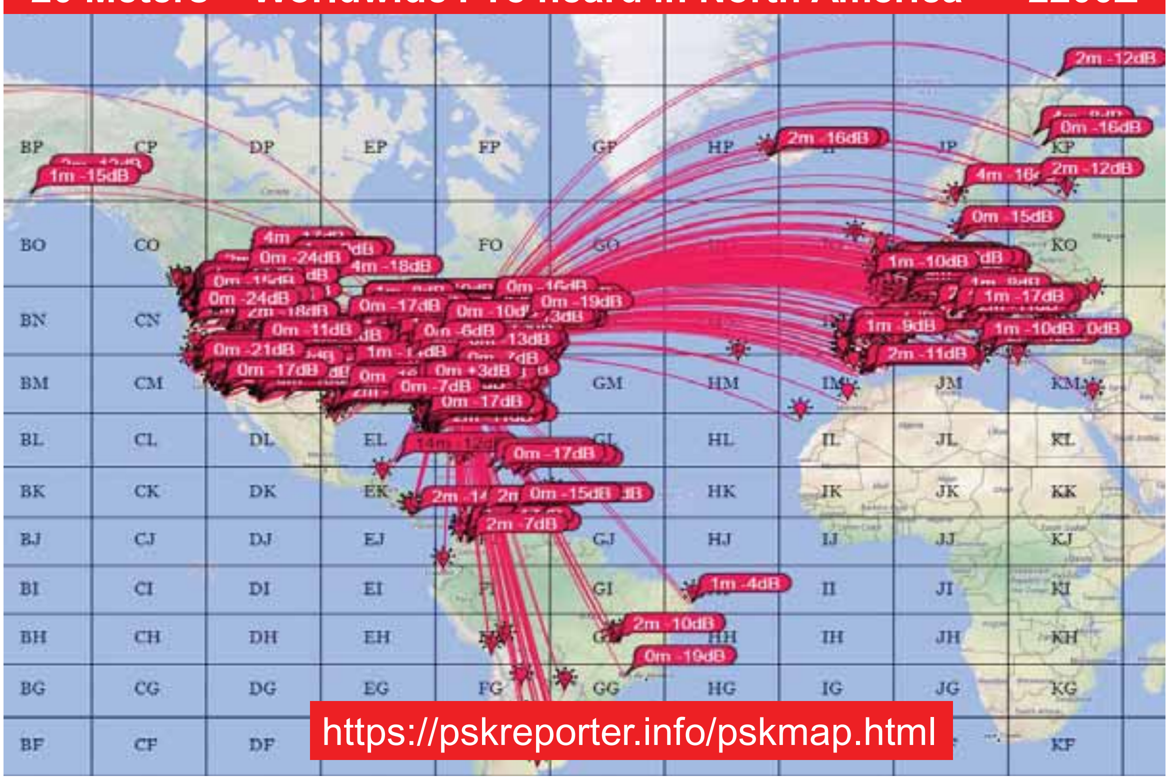
Nowcasting using the Reverse Beacon Network

80 Meters European CW CQs heard in North America 0500Z



Nowcasting using PSK Reporter

20 Meters Worldwide FT8 heard in North America 2200Z



Daily Propagation Forecast
Published by W3LPL in *The Daily DX*
72 hours Before the 2024 ARRL CW DX Contest

The best ARRL CW DX Contest propagation in more than 20 years is likely this weekend

- high sunspot activity
- quiet geomagnetic activity
- quiescent solar wind, and
- low polar cap absorption

CTU Presents

Feeding and Detuning Towers

Ward Silver, NØAX

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Overview

- Towers as Antennas – the Basics
- Ground Systems
- Base-feeding Towers
- Shunt-feeding Towers
- Detuning Towers
- Q&A

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Towers As Antennas

- You might already have one!
- Verticals or "monopoles"
- Used on 160 through 40 meters
  - 1/8th - ½ λ are the most useful electrical heights
  - Any tower 30 feet or higher will work
- Beams and wires lengthen the tower
  - Mast "stingers" can extend the tower
- Highly empirical – experimenting required!

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Ground System

- Most important part of the antenna!
- Ground loss cannot be made up in gain
- Keep RF out of the dirt!
- Many dB to be gained from loss reduction
- Most important area around tower base
- See *Antenna Book*, Chapter 3
  - Effects of Ground

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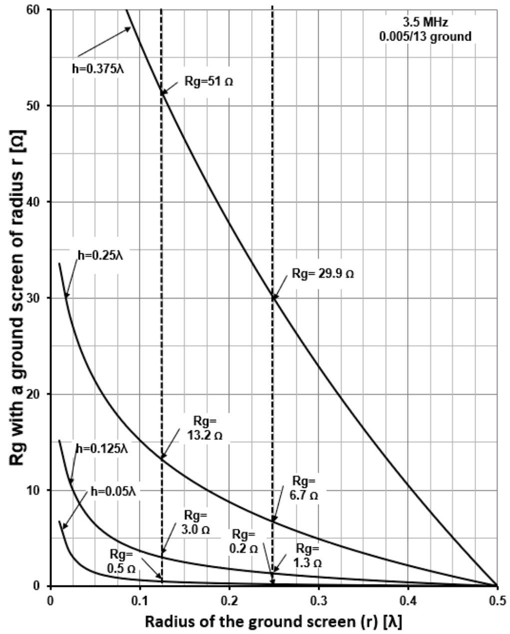
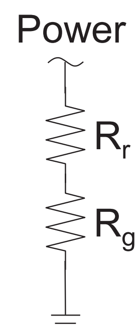
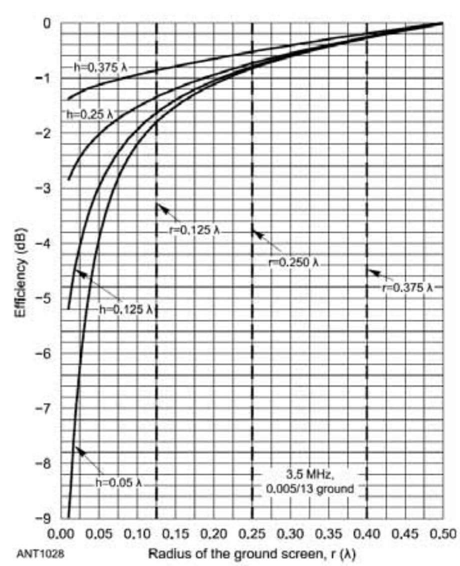
Ground System - Loss





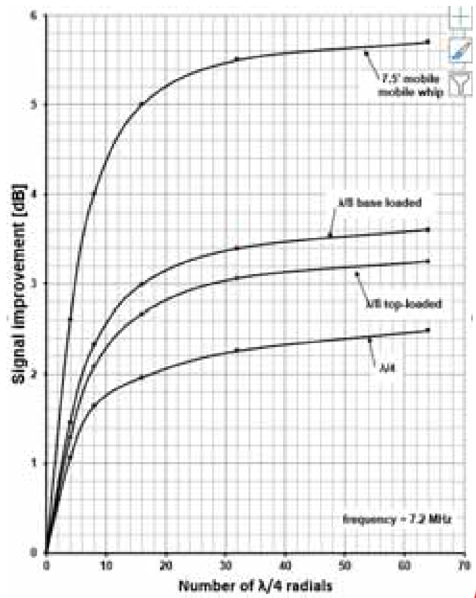
Ground System - Loss

The change in efficiency for an 80 meter vertical as the radius of the ground screen is increased. Even for electrically short verticals (h represents antenna height in wavelengths), most of the improvement is obtained for a radius of 1/8 wavelength. (Graphic from the *ARRL Antenna Book*, 24th edition, courtesy of the ARRL)



Ground System - Screen

- The Bottom Line



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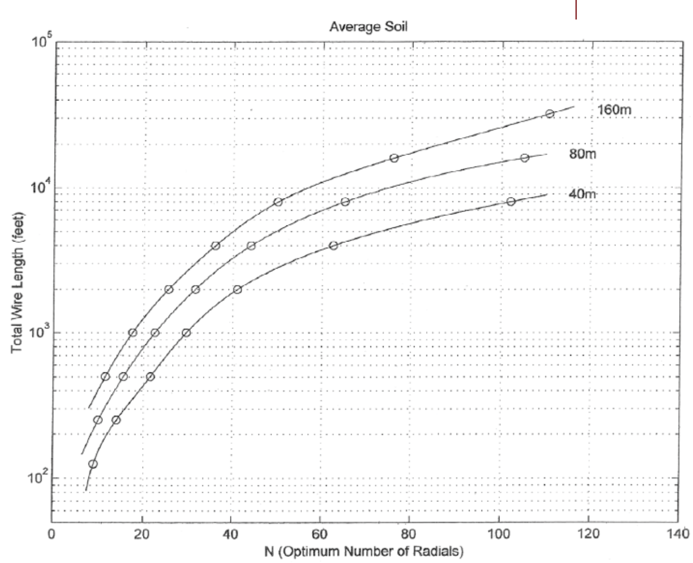
Ground System - Screen

- K3LC, *NCJ* Mar 2004
- Optimum Use of Available Wire



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Ground System - Screen

- Mesh
  - Galvanized, avoid bare aluminum
  - Fencing, hardware cloth, chicken wire
- Diameter
  - Concentrate on 1/8th wavelength around base
  - Supplement with longer radials
- Elevated Radials

Base-Feeding Towers

- Insulating the base
  - Three-leg or pier
  - Types of insulators
  - Spark gaps
- Decide *before* putting up the tower!

WBØW.com

Homemade

Base-Feeding Towers

- Loading effects of guys
  - Suggest insulator close to tower
- Cables and feed lines
  - Run *inside* the tower
  - Bond shields at top and bottom
  - Bring out at ground level

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Base-Feeding Towers

- L-network or series-C
- Determine base impedance with analyzer
  - $Z = R + jX$
- Use online calculator to design L-network
  - Z close to 50 Ω allows best bandwidth
- Lengthen or load tower for R close to 50 Ω
  - Allows simple series-C match

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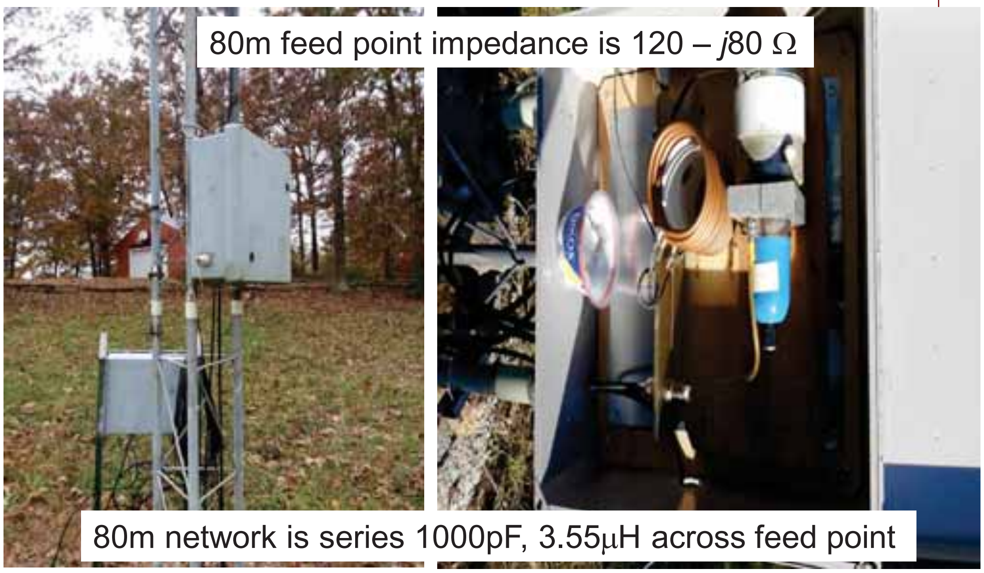
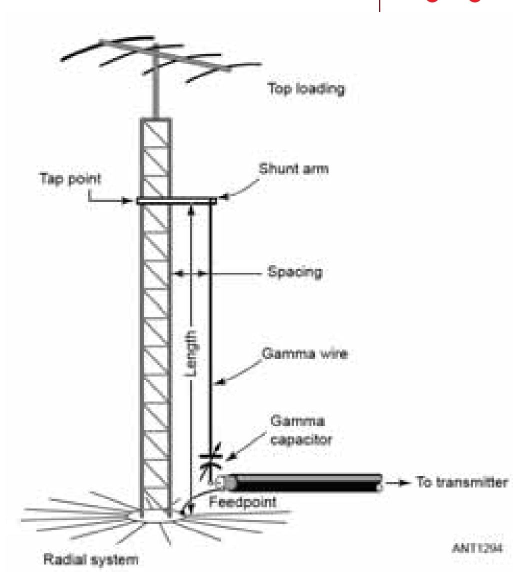
Base-Feeding Towers



Shunt-Feeding Towers

- Base is grounded
- See new material in *ARRL Antenna Book*
  - Chap 11 – Gen'l Purpose MF/HF Antennas
- Cables and feed lines go *inside* the tower in shunt-feed portion



Shunt-Feeding Towers

- Designing the gamma match
  - Model base impedance, use N6MW calculator
  - Charts from ON4UN *Low-Band DXing*
  - Empirical
    - Try a convenient shunt-arm length
    - Attach at top, measure feed point impedance
    - Move shunt-arm length and position
  - Experiment to find impedance closest to 50 Ω

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Shunt-Feeding Towers

- Adjusting the shunt-arm and gamma-wire
  - Moving shunt-arm up increases R
  - Increasing gamma-wire spacing
    - Increases R and decreases X_L
- Adjust C to cancel X_L
- Increasing gamma-wire diameter increases SWR bandwidth
- Omega match if R < 50 Ω

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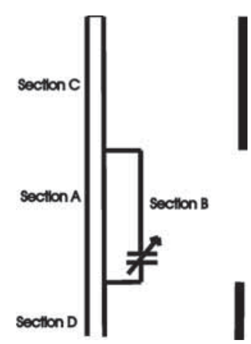
Detuning Towers

- Why is detuning necessary?
- Interaction
  - Affects impedance of other antennas
  - Distorts antenna patterns
  - Couples noise into receive antennas
  - Conducts more RF into the ground

Detuning Towers

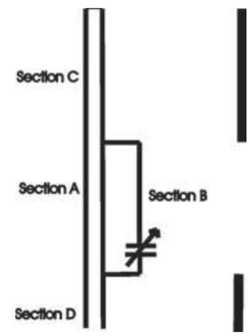
- Creates a “trap” in middle of tower
- Loop of tower plus arms and vertical wire
- Adjustable capacitor at the bottom
- Heavy-duty components and connections – carry full QRO
- May create other resonances in the tower



From w8ji.com

Detuning Towers

- Tune for <u>*maximum*</u> current in the loop – can be substantial
- Adjust from *below* the loop
- Don't touch the loop while tuning
- All cables must run inside the tower, bonded above and below the trap



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Resources

- General Antenna Design Resources
  - ON4UN Low-Band DXing
  - ARRL Antenna Book
- Matching Network Design
  - home.sandiego.edu/~ekim/e194rfs01/jwmatcher/matcher2.html (16 different networks)
- Inductor Design Calculator
  - k7mem.com/Ind_Coil_Ind_Calc.html (Use calculator #2 for large diameter wire

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Resources

- Ground Systems
  - *ARRL Antenna Book* – Chapter 3 "Effects of Ground"
  - Rudy Severns, N6LF: www.antennasbyn6lf.com/
    - Lots of antenna design material
  - Tom Rauch, W8JI: w8ji.com/Antenna%20grounds.htm
  - *Grounding and Bonding for the Radio Amateur*, 2nd edition

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Resources

- Shunt-feed design
  - *ARRL Antenna Book* – Chap 11.2.5 "Shunt-Feeding Towers"
  - *ON4UN Low-Band DXing*
  - *GAMMAMW9a* spreadsheet at n6mw.jimdofree.com/antenna-matching
  - "How to Shunt-Feed Your Tower" by VE6WZ youtube.com/watch?v=cHIc5MTGTFM&ab_channel=ve6wz

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Detuning Towers

- Tom Rauch, W8JI: w8ji.com/detuning_towers.htm
- Ron Schwartz, VE3VN: ve3vn.blogspot.com/2014/03/detuning-tower-from-vertically.html
  - Lots of modeling information
- "How To Detune a Tower" by WXØB ncjweb.com/bonus-content/novdec05feat.pdf

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THANK YOU!

QUESTIONS?

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CTU Presents

Contesting Fun on That *Other* Mode (RTTY)

Ed Muns, W0YK / P49X

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Digital Contesting Is Fun!

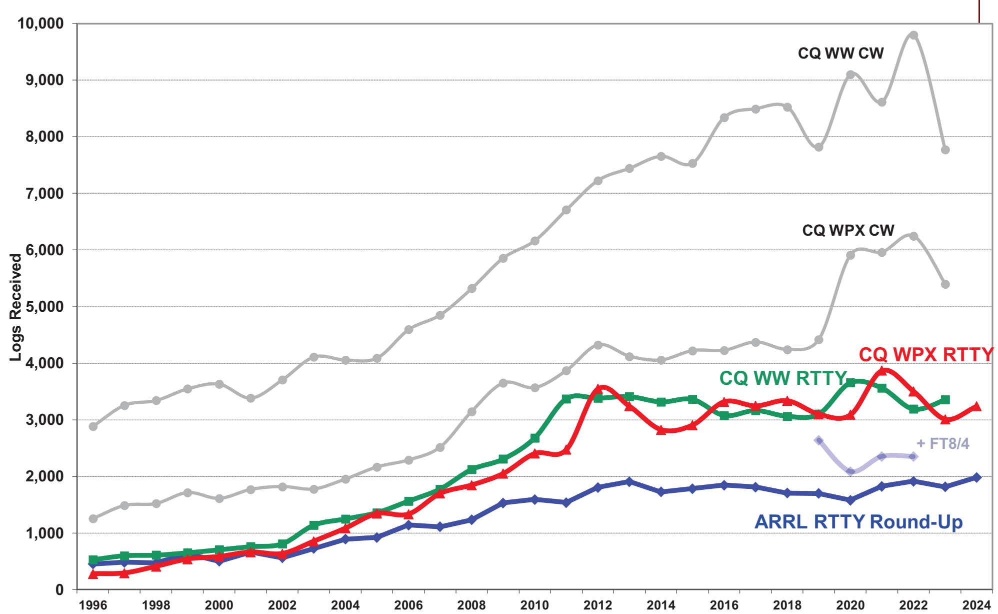
- Operating RTTY
  - RTTY contesting (4)
  - What is RTTY? (9)
  - Basics (10)
  - RX & TX bandwidth (7)
  - UOS and hyphen (2)
  - Multiple decoders (9)
  - Call sign stacking (6)
  - SO2V & SO2R (6)
- Setting Up RTTY (40)
- 2nd session: "*Contesting Fun on That Really Other Mode (FT8)*"

Lots of RTTY Contests

~ 2/mo.

- **Biggies (3)**
  - ARRL RTTY Roundup (1st weekend in Jan)
  - CQ WPX RTTY (2nd weekend in Feb)
  - CQ WW RTTY (last weekend in Sep)
- **NCJ contests (4)**
  - NAQP RTTY (3rd Sat in Feb, 2nd Sat in Jul)
  - Sprint RTTY (2nd Sat in Mar & Oct)
- **Other popular RTTY contests (8)**
  - BARTG:
    - Sprint (3rd weekend Jan)
    - HF RTTY (3rd weekend Mar)
    - 75 Baud (3rd weekend Apr)
  - WAE RTTY (2nd weekend in Nov)
  - JARTS, Makrothen, SARTG (3)
- **WRT (52 - every Thursday evening)**

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
   a. Auto-decode frees operator time … use it to do things difficult with CW & SSB, e.g., SO3R!
   b. Speed is ~2x CW
4. Applies learning back to CW & SSB

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) ***Baudet*** code • constant 60 wpm *(or 45.45 Baud)*

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	"	

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	"	

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

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

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.

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)*

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 *(legacy)*	• 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*

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!

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!

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

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

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

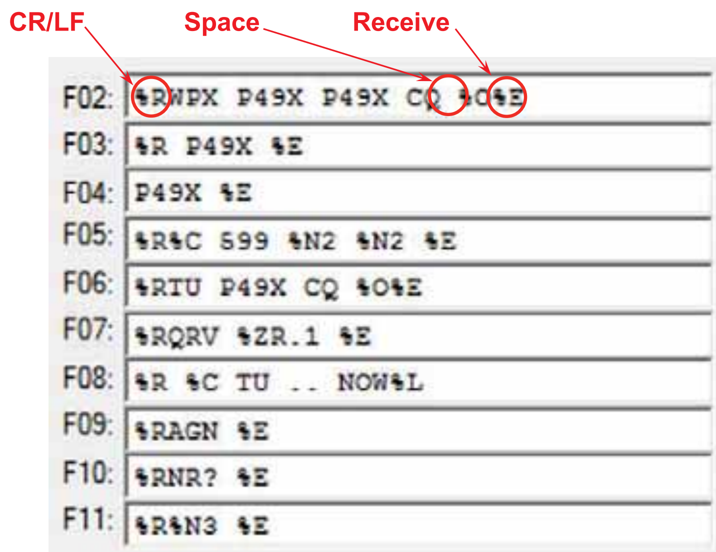
www.rttycontesting.com/tutorials/messages

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

RTTY Messages

formatting



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

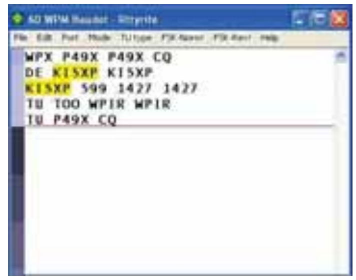
N1MM Logger

- Use main SCP from CW/SSB/RTTY contests
  - RTTY SCP is a subset, so use full file

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)



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

More Tips

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

RTTY Operating Basics

summary

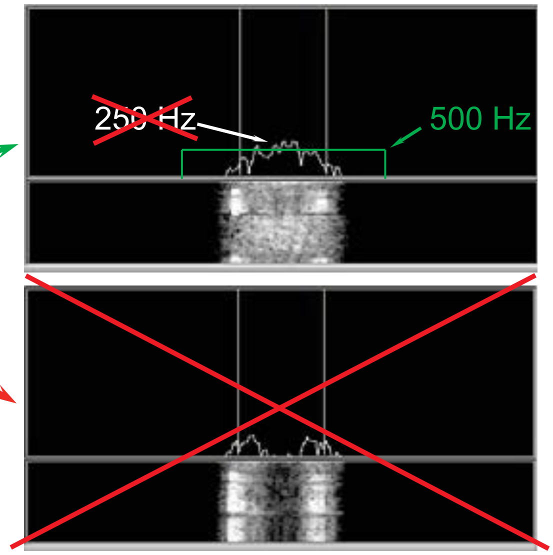
- Many casual RTTY contest participants
- RTTY sub-bands; 10-80 only; avoid audio-digital & beacons
- 500 Hz receive filtering; USOS on
- Messages ("macros")
  - Short, ~~5NN~~, unique exchange twice, Space delimiter
- Common problems
  - "Upside-down" (reversed Space/Mark or LSB vs. USB)
  - Figures 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

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



RTTY Transmit Bandwidth

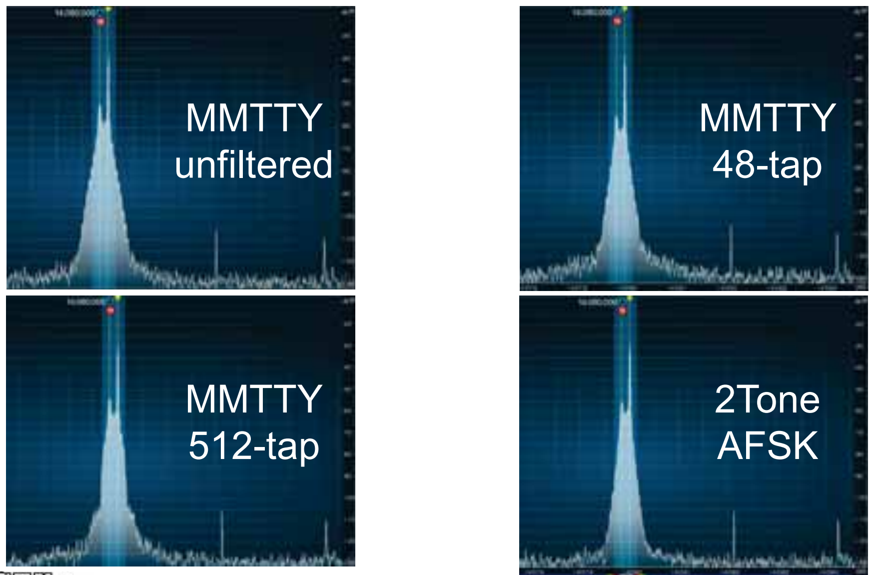
unnecessary QRM

- 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?

RTTY Transmit Bandwidth

AFSK

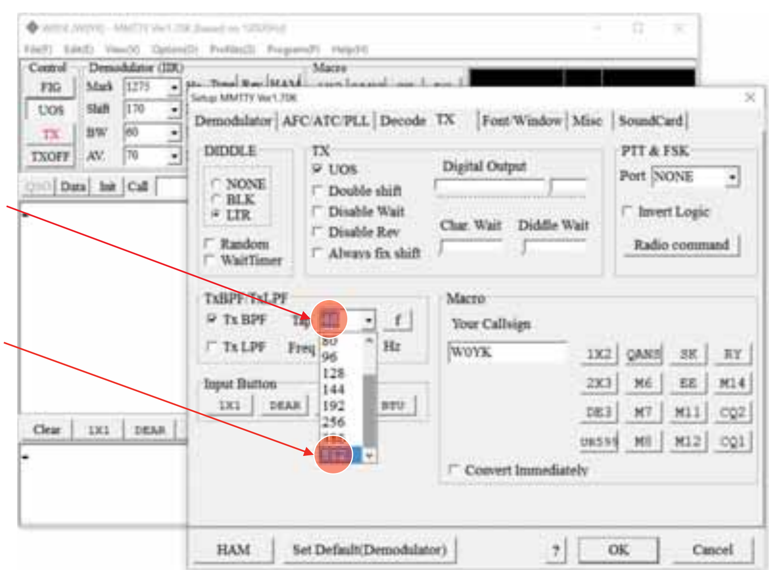


Tx BPF Setting

MMTTY

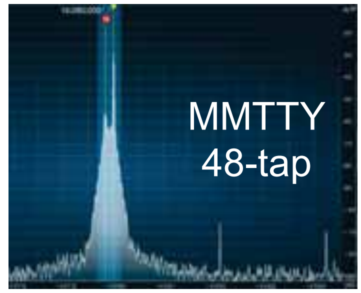
default 48

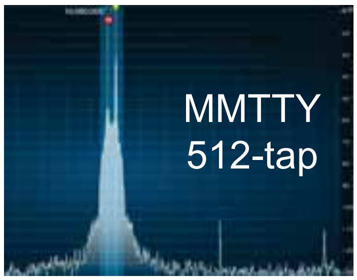
select 512

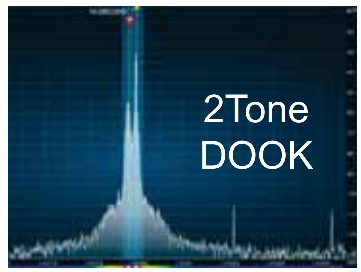


RTTY Transmit Bandwidth

AFSK – 2Tone DOOK

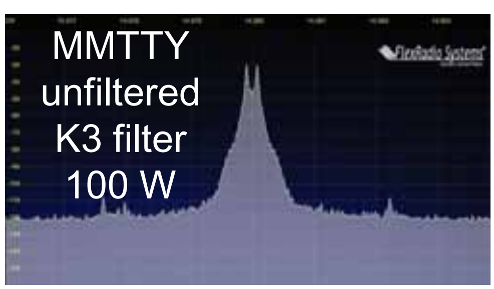






RTTY Transmit Bandwidth

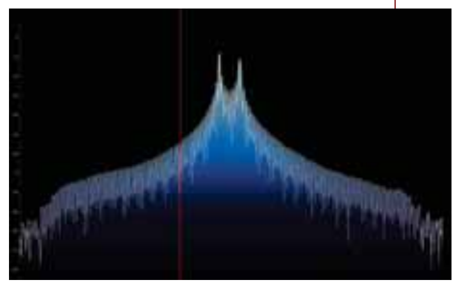
AFSK - *PA IMD effect*



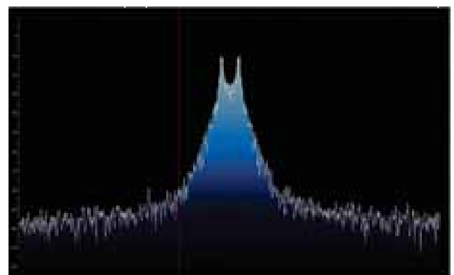
RTTY Transmit Bandwidth

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



UOS

(Unshift-On-Space)

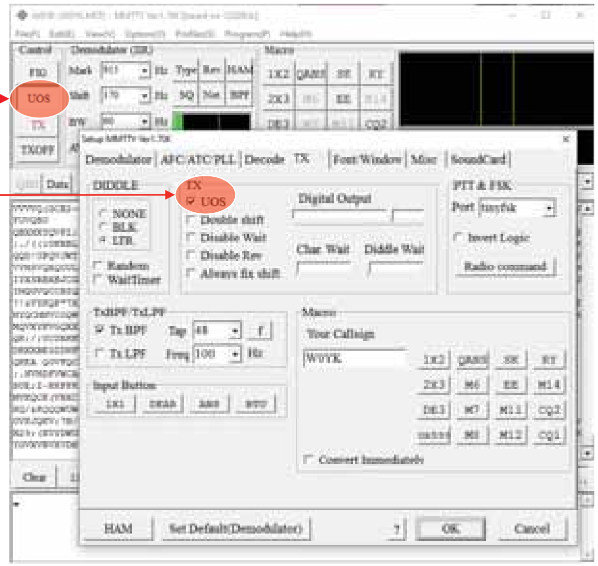
- Receive UOS:
  - Space character forces a shift to the Letters set
  - Increases noise immunity for alpha text
- Transmit UOS:
  - Sends FIGS character after Space, before numeric "word"
- Contest exchanges are alpha and numeric
  - Should UOS be on ~~or off~~?
  - Should Space ~~or Hyphen~~ delimit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

UOS

MMTTY

RX

TX

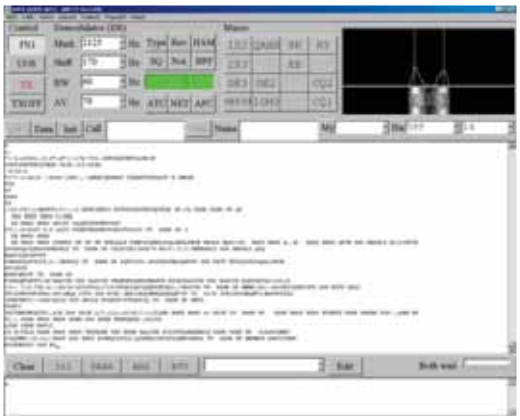


Multiple Decoders

- 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

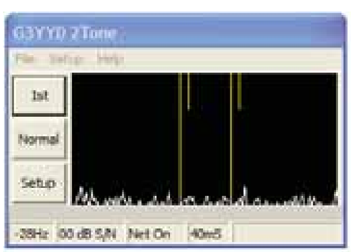
MMTTY

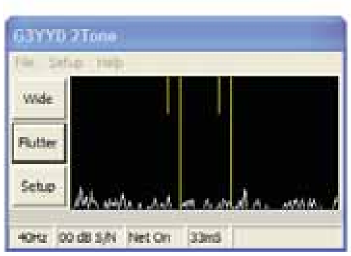


- Dominant SC MODEM
- Standalone, or …
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced June 2000
- Mako Mori, JE3HHT

Multiple Decoders

2Tone

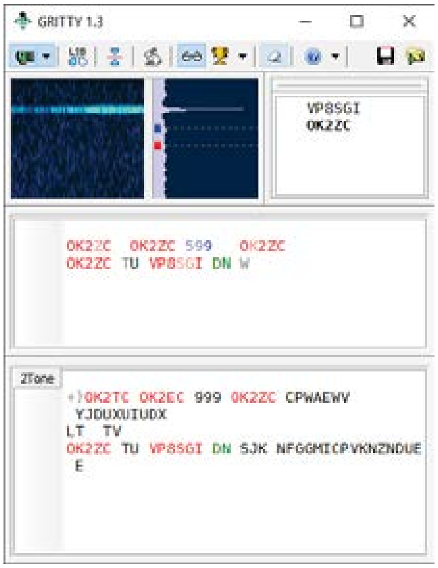




- Outperforms MMTTY ?
- Uses less CPU cycles
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced late 2012
- David Wicks, G3YYD

Multiple Decoders

GRITTY

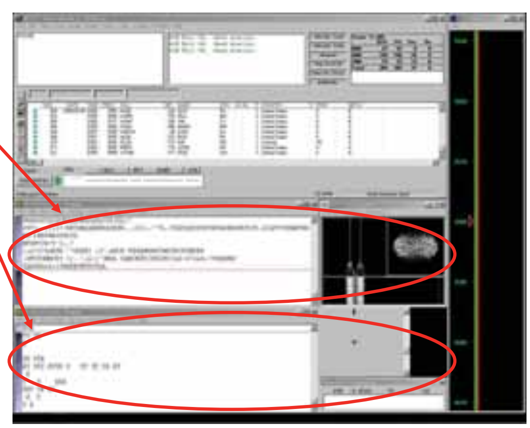


- Best accuracy ?
- Bayesian statistics
- Standalone, or …
- Contest loggers:
  - N1MM Logger+ only
- Introduced late 2015
- Alex Shovkoplyas, VE3NEA

Multiple Decoders

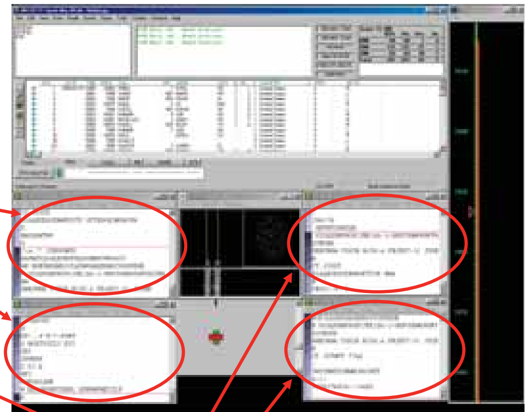
MMTTY & DXP38

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



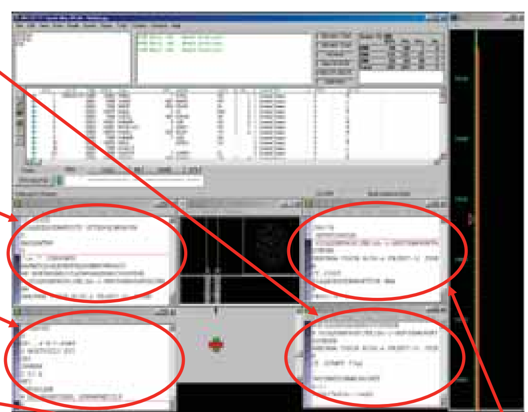
Multiple Decoders
multiple MMTTY profiles

- 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

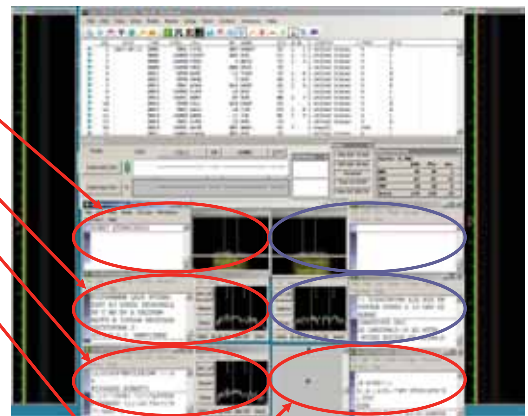
- Narrow IF filtering (main RX)
  - Hardware modem, i.e. DXP38
  - MMTTY profiles:
    - Standard
    - Fluttered signals
    - Fluttered signals (FIR)
    - Multi-path
    - hyper sensitive
    - EU1SA
- Wide IF filtering (sub RX)
  - MMTTY profile:
    - AA6YQ-FIR-512
      - Dual Peak Filter
    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



Multiple Decoders

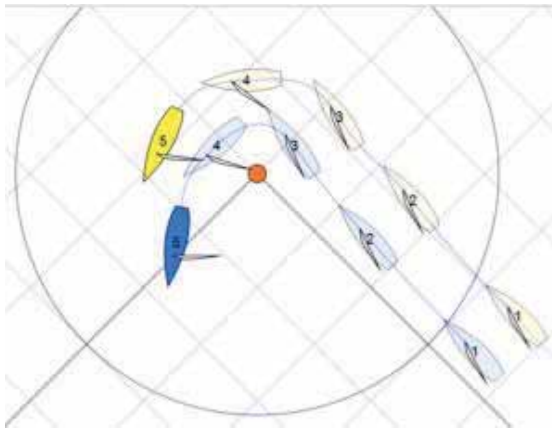
Tone choices for monitoring

- 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)

Sailboat Buoy Racing

mark rounding

Yellow falls behind by keeping up with Blue



Call Sign Stacking

"Slow Down to Win"

- Sailboat racing analogy:
  - Pinwheel effect at mark-rounding→slow down
- Let pile-up continue a "beat" after getting the first call sign
  - Increase chance for another call sign or two
  - Increase chance for QSO-phase-skip
- Apply same tactic for tail-enders … pause ½-second before sending TU/CQ message

Call Sign Stacking

The 4 Phases of a QSO

Normal Run mode flow:

1. CQ msg
   - repeat
   - AGN?
2. pile-up
3. Exchange msg
   - Send fill(s)
4. receive his Exchange
   - AGN? or NR? or QTH? or NAME?

1. TU/CQ msg (logs QSO)

Normal S&P mode flow:

1. CQ
2. <mycall> msg
   - repeat
3. receive his Exchange
   - AGN? or NR? or QTH? or NAME?
4. Exchange msg
   - send fill(s)

1. find next CQ

transmit
receive

Call Sign Stacking

Pileup

Normal	***Shortened***
1. *WPX P49X P49X CQ, or TU P49X CQ*	1. (skip CQ)
2. *K3LR K3LR K5ZD K5ZD*	2. (skip pileup)
3. *K3LR 599 2419 2419*	3. *K3LR TU NW K5ZD 599 2420 2420*
4. *TU 599 842 842*	4. *TU 599 1134 1134*

transmit
receive

Call Sign Stacking

Tail-end

Normal	**Shortened**
1. *WPX P49X P49X CQ, or TU P49X CQ*	1. (skip CQ)
2. *K3LR K3LR*	2. (skip pileup)
3. *K3LR 599 2419 2419 K5ZD (tail-end)*	3. *K3LR TU NW K5ZD 599 2420 2420*
4. *TU 599 842 842*	4. *TU 599 1134 1134*

transmit
receive

Call Sign Stacking

summary

- Efficiently work:
  - multiple callers in a pile-up, and
  - tail-enders to a completing QSO
- Calls pushed onto the stack as they arrive
- Message parameter pops call off of the stack into the Entry window
- Eliminates 2 of 4 QSO phases, which doubles short-term rate

SO2V

2 VFOs

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

1BSIQ

interleaved QSO phases

- Receive on one VFO, while transmitting on the other.
- VFOs must be interlocked to guarantee only one signal at a time.
- 1BSIQ=One Band Synchronized Interleaved QSOs

SO2R

optionally 2BSIQ

- 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!

SO2R

Multi-2 configuration

Left-hand Trackball

Right-hand Trackball

Right-sized Keyboards

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!

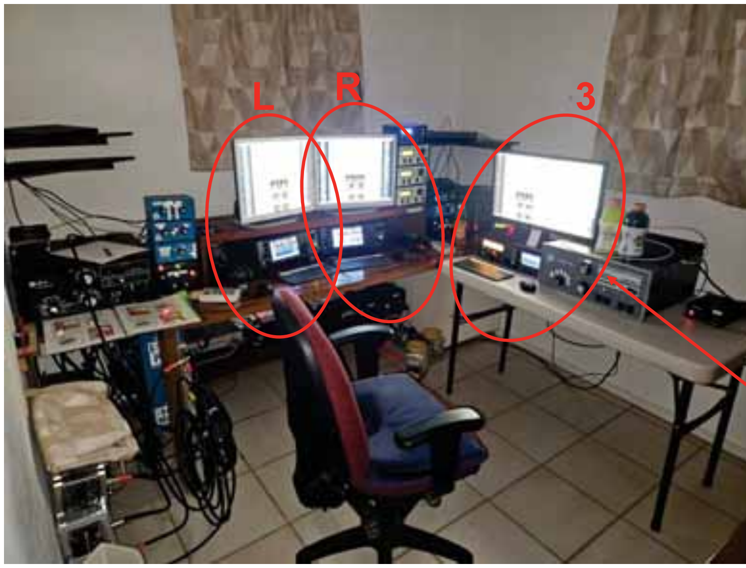
SOnR

> 2 radios

- Simplify antenna/filter band-decoding:
  - Dedicate a band/antenna to the 3rd (and 4th) radio
- Networked PC/radio simplifies configuration
- RTTY (vs. CW or SSB) easier to operate
  - 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
  - RigSelect to instantly select 2 of 4 radios for main SO2R operation

SO3R

Multi-Multi configuration



dedicated to 10 or 80 meters

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!

How Do I Set it Up?

overview

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

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

How Do I Set it Up?

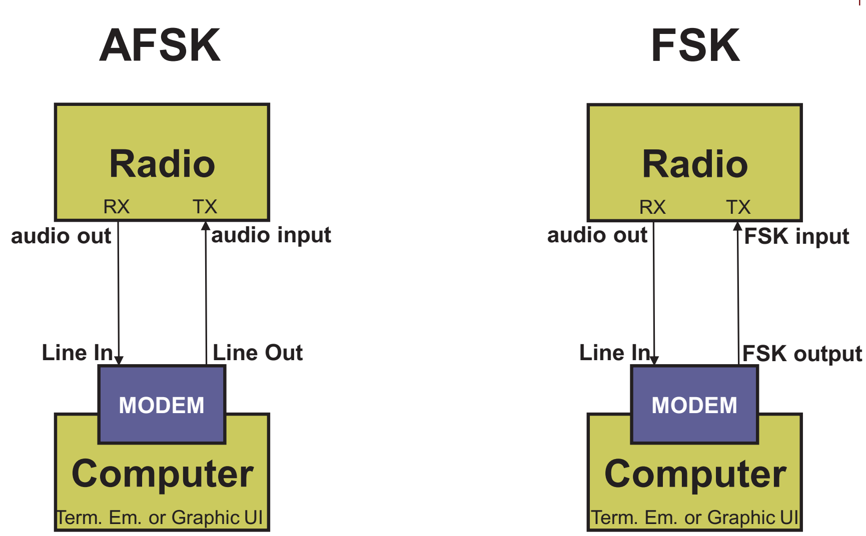
RTTY decoder/encoder

- 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

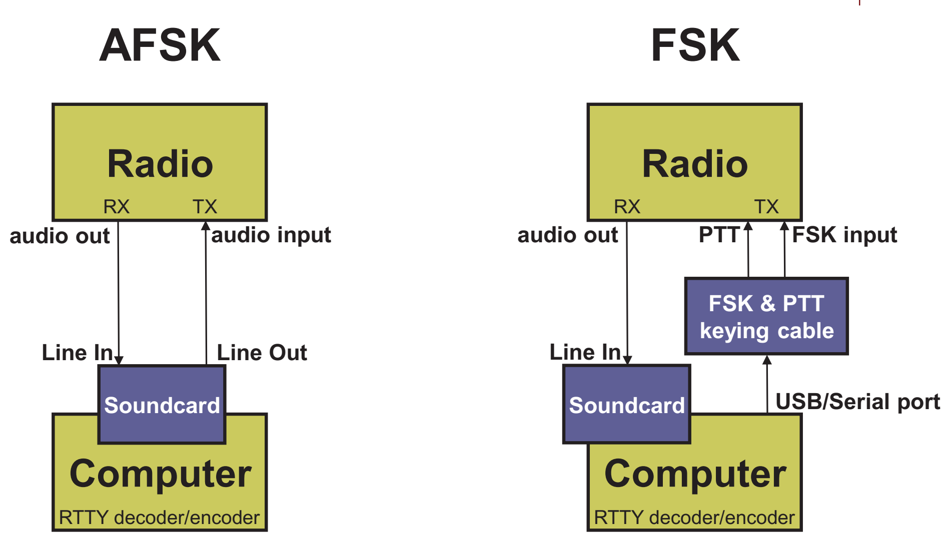
- The RTTY ***transmit encoder*** and ***receive decoder*** is sometimes referred to as a MODEM or a TNC:
  - MODEM = <u>MO</u>dulator <u>DEM</u>odulator
  - TNC = <u>T</u>erminal <u>N</u>ode <u>C</u>ontroller
- MODEMs can be:
  - a hardware box, or
  - a software application driving a PC soundcard

How Do I Set It Up?
hardware MODEM



How Do I Set It Up?
hardware MODEM

How Do I Set It Up?
software application & soundcard



How Do I Set it UP?

cables

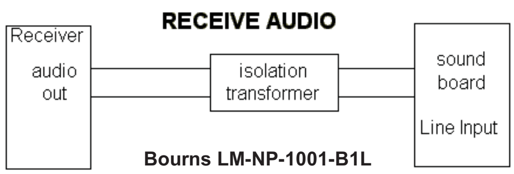
- Receive:
  - RX audio out to soundcard
  - ***Optional DSP filter***
  - 1:1 isolation transformer
  - ***JPS NIR-12, or …***
- Transmit:
  - AFSK: TX audio in from soundcard, ***or***
  - FSK: FSK/PTT keying
  - 1:1 isolation transformer, ***or***
  - Keying interface

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)

How Do I Set It Up?
homebrew audio isolation



$1.78

-90 dBc 3rd order IMD

How Do I Set It Up?
ground loop isolators

Amazon $7.99

Radio Shack $19.49 or eBay $6.99

-64 dBc 3rd order IMD

eBay $5.50

eBay $7.45

How Do I Set It Up?

SDR digital audio isolation

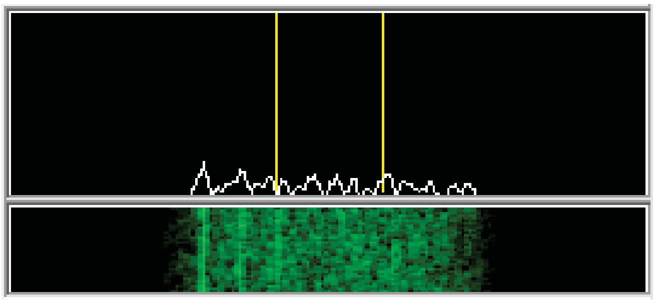
K3S { digital: CODEC (soundcard)
analog: IN – LINE – OUT

How Do I Set It Up?

legacy 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?
maximize RX dynamic range



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

How Do I Set It Up?
adjust AFSK audio

Insure SSB processor (compression) is Off.

- Adjust:
  - the *Windows* Playback Volume control, and/or
  - the Mic level (or auxiliary audio input)
- such that:
  - full power output is attained, but no more.
- Back off a bit to avoid overdrive.

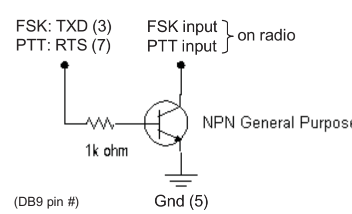
How Do I Set It Up?

PTT vs. VOX

- AFSK uses VOX (rarely 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

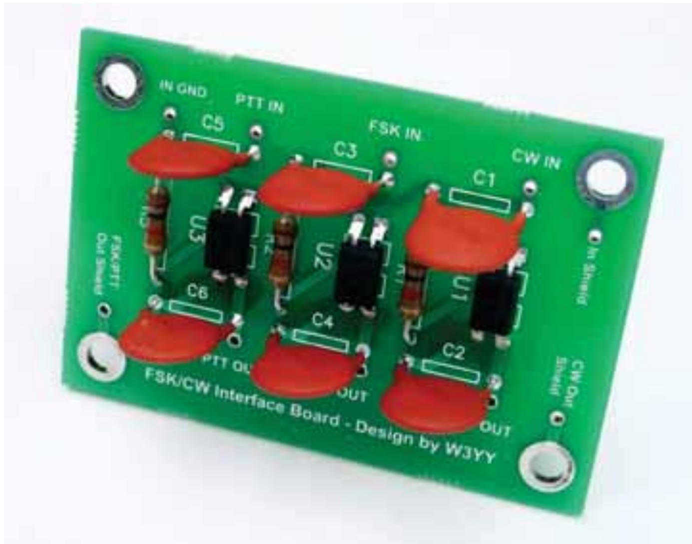
How Do I Set It Up?

homebrew FSK & PTT keying cable



How Do I Set It Up?

W3YY *FSK & PTT keying cable*



How Do I Set It Up?

Morrty

How Do I Set It Up?

commercial interfaces

RASCAL


How Do I Set It Up?

RigExpert Interfaces


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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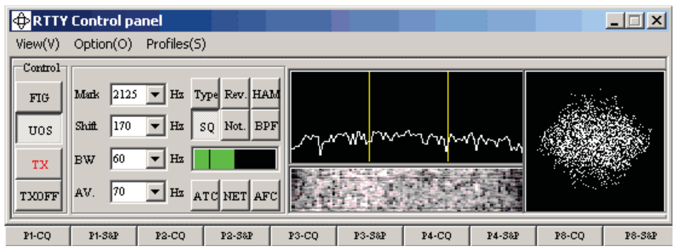
Decoders

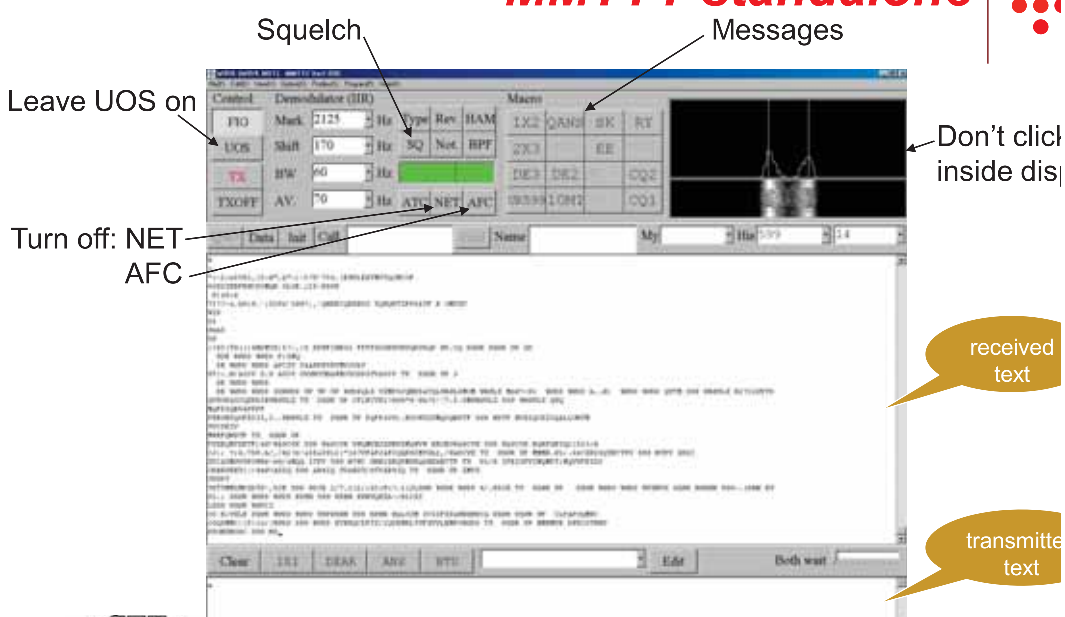
MMTTY



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

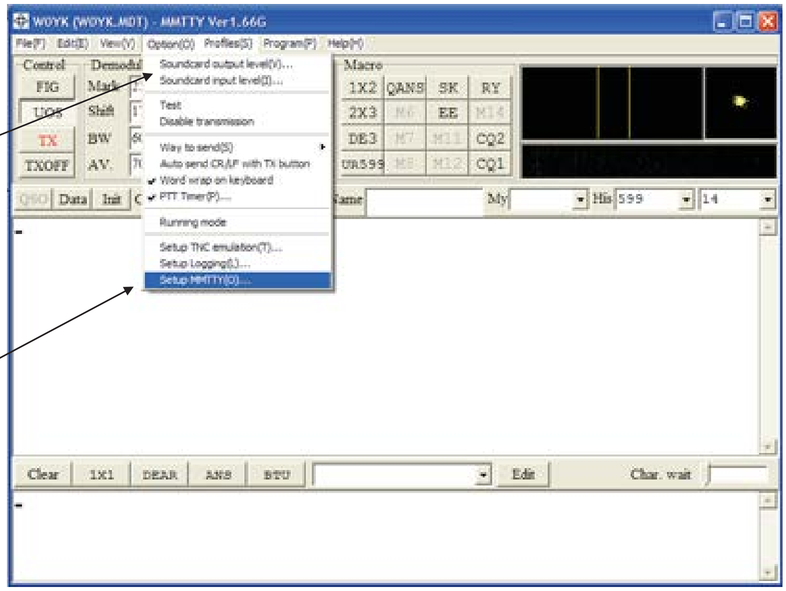
How Do I Set It Up?

MMTTY standalone



How Do I Set It Up?

MMTTY Option menu

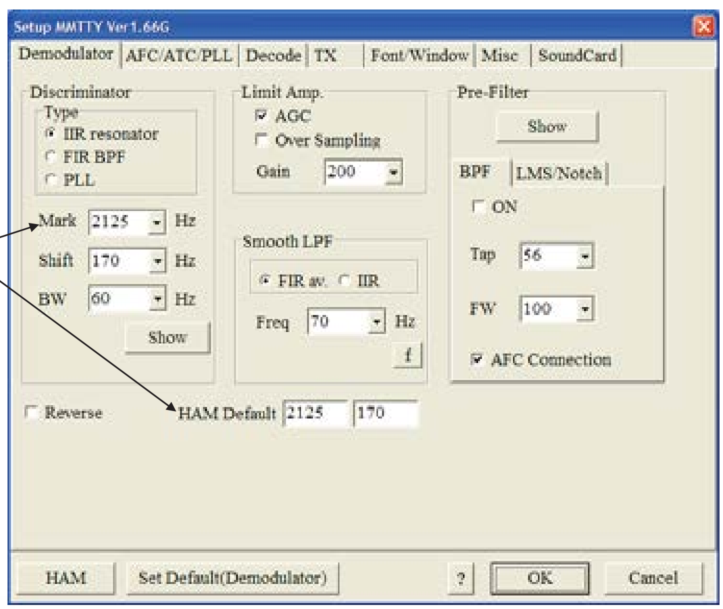


Soundcard levels

MMTTY setup

How Do I Set It Up?

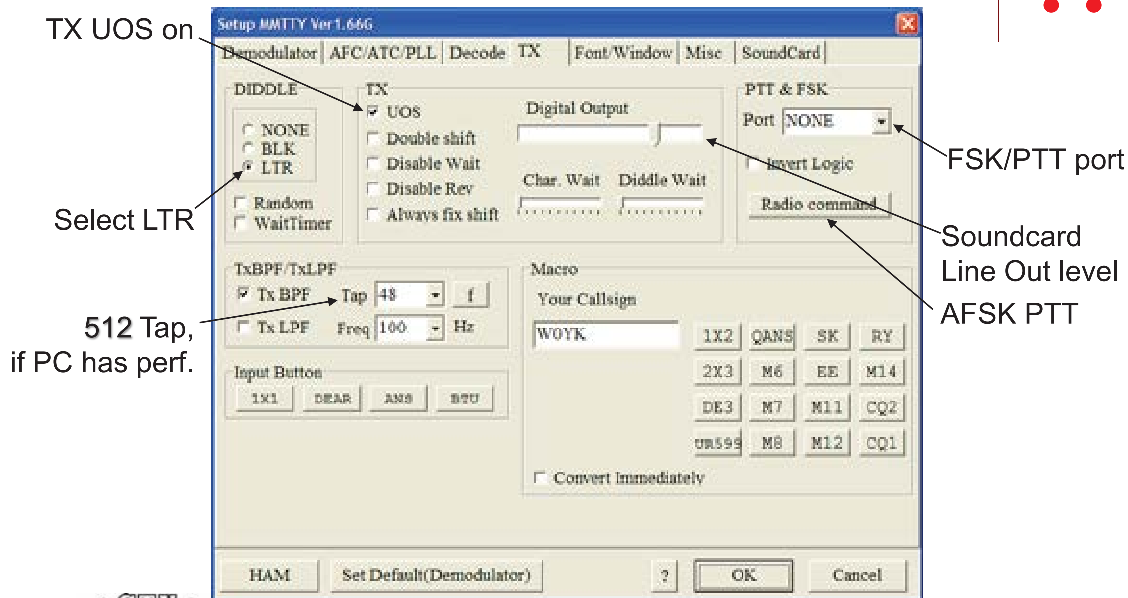
MMTTY Option/Setup/Demodulator



Set tones (radio same)

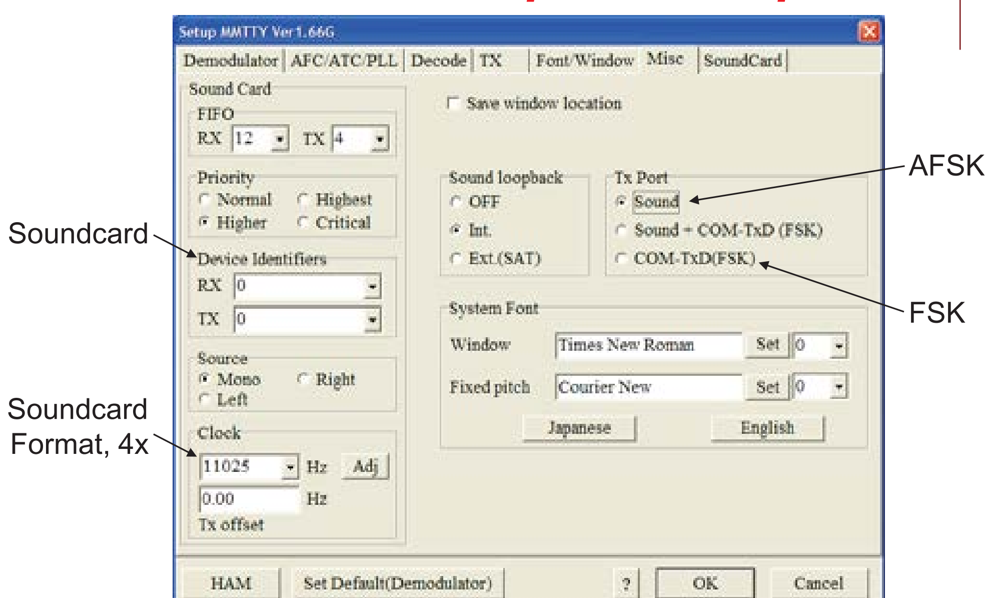
How Do I Set It Up?

MMTTY Option/Setup/TX



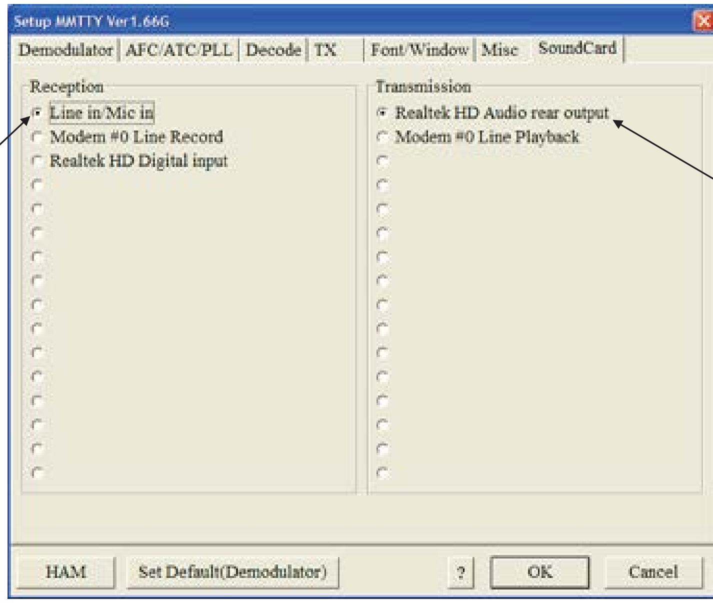
How Do I Set It Up?

MMTTY Option/Setup/Misc



How Do I Set It Up?

MMTTY Option/Setup/SoundCard

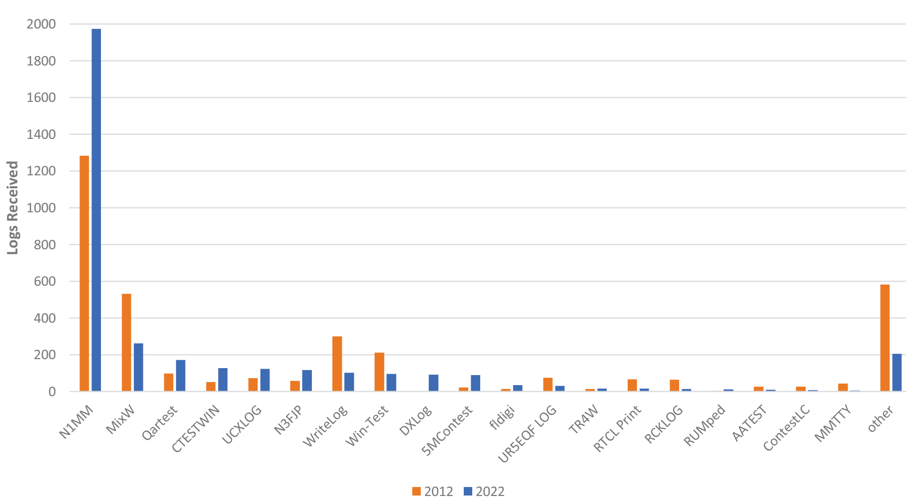


Select receive Soundcard

Select transmit Soundcard (AFSK only)

CQ WPX RTTY

logs received: 2022 vs. 2012



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.

A Blizzard of Details!

this is fun??

Start Simple, then Enhance

- Standalone 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 alternative decoder
  - Higher capability interface *(DIY or commercial)*
  - Advanced setup: multiple decoders, SO2V, SO2R, SO3R, ...

Resources

- www.rttycontesting.com premier website
  - Tutorials and resources (beginner to expert)
  - WriteLog, N1MM Logger+, MMTTY and 2Tone
- rtty@groups.io & rttydigital@groups.io Email reflectors
  - RTTY contester networking
  - Real-time 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)

How to Integrate Youth Operators in Multiop Contesting

KE8LQR & KE8RJU

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Katie KE8LQR

- 16 Years Old
- Licensed March 2019
- Amateur Extra
- CW!
- Contesting

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Grace KE8RJU

- 18 Years Old
- Licensed March 2021
- Amateur Extra
- Amateur Satellite
- Contesting

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Rookie Roundup SSB - April 2021

ROOKIE ROUNDUP
Certificate of Achievement
This certifies that
K8DP (Ops: K8CLP, KE8RJU)
has participated in the April 2021
ARRL Rookie Roundup - SSB
1,870 points
3rd Place - Multi Op
ARRL AMATEUR RADIO

ROOKIE ROUNDUP
Certificate of Achievement
This certifies that
Katherine Campbell, KE8LQR
has participated in the April 2021
ARRL Rookie Roundup - SSB
972 points
5th Place - Single Op, Call Area W8
ARRL AMATEUR RADIO

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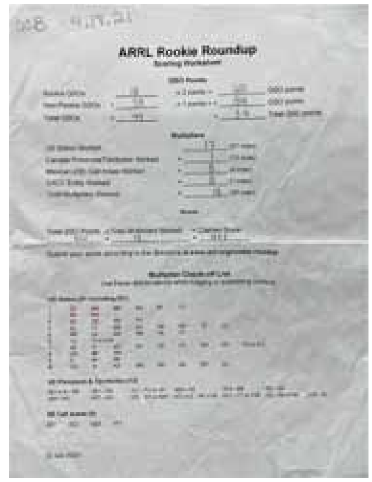
How we met!

KE8RJU

KE8LQR



ARRL Rookie Roundup

Scoring Worksheet

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Who is youth?

- Most major contests define youth as anyone 25 years old or younger.

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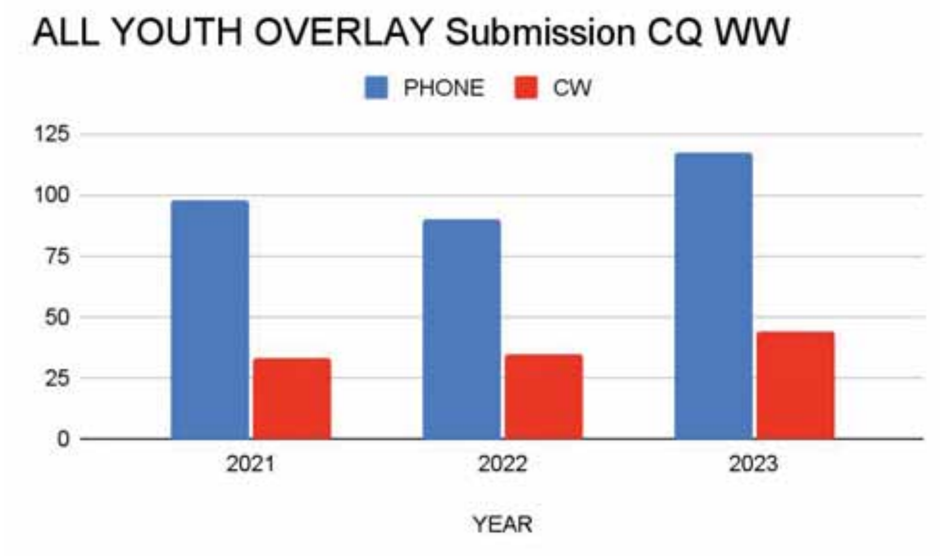
Youth CQ WW Statistics



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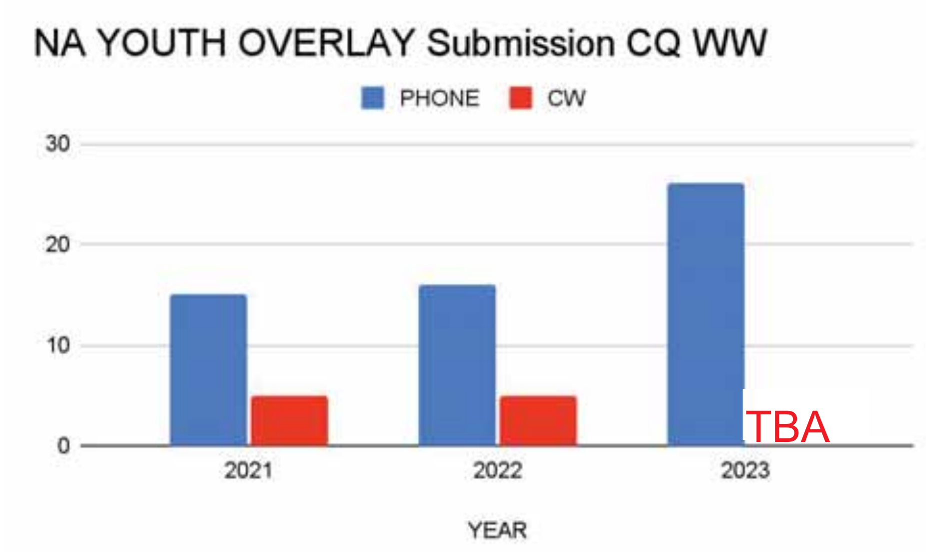
Youth CQ WW Statistics



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Multi op stations hosting youth

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History of YDXA

- Started in 2010
- Operate as DX
- 12-17 and Parent

Costa Rica (TI), Curacao (PJ2), and Saba & Saint Eustatius (PJ6)

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YDXA 2023 W3Y @ K3LR

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L-R Youth: Katie KE8LQR, Grace KE8RJU, Agnes AD8IR, Ben AD8FQ

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DX ENGINEERING

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RSGB IOTA Contest W3Y M/M

BAND	QSO	DUP	IOTA	POINTS	AVG
80	12	0	0	24	2.00
40	501	8	1	1013	2.02
20	973	32	21	2477	2.55
15	559	6	24	2028	3.63
10	188	2	5	532	2.83
TOTAL	2233	48	51	6074	2.72

TOTAL SCORE : 309 774

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W3Y
By band – All modes
QSOs (with dupes) – By time

Hr	80	40	20	15	10	Total
10						
11						
12	2	21	19	6		48
13	10	71	110	66		257
14		73	132	85	15	305
15		60	102	60	11	233
16		45	134	41	17	237
17		40	115	77	24	256
18		66	102	68	32	268
19		47	113	62	32	254
20		51	74	55	36	216
21		35	104	45	23	207
	12	509	1005	565	190	2281

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2023 YDXA Sponsors

Dayton Amateur Radio Association, Sponsor of Dayton Hamvention, W8BI, est 1928

Huber Heights Amateur Radio Club, HHARC

DX Engineering

K3LR Multi Multi Contest Station

Portage County Amateur Radio Service

Spunky Threads

Xenia Weather Amateur Radio Net, XWARN, 147.165 / 443.100

Pikes Peak Radio Amateur Association

Metro DX Club

SWODXA

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Elmering in a multi-op setting

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CQ WW SSB 2023 KE8RJU @ K3LR

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CQ 160 CW 2024 KE8LQR @ K3LR

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CQ 160 CW 2024 KE8LQR @ K3LR

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Multi-op Experiences

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Multi-op Experiences

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Multi-op Experiences

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Impacts of multi-op

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Youth contesting community

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Encouraged to Contest More

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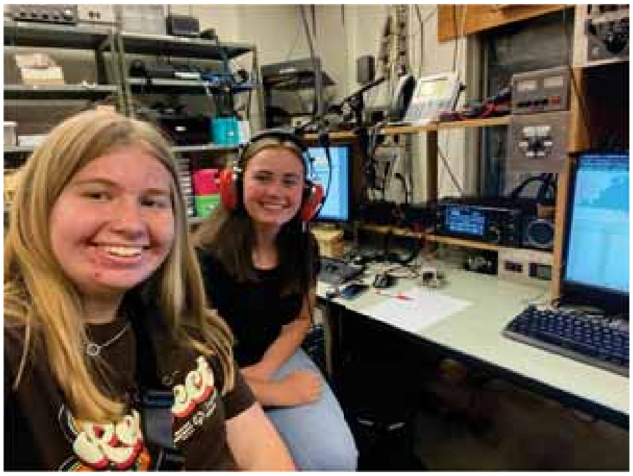
What can you do?



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Station Improvements to Improve Your Competitiveness in Contests

Frank Donovan
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Computer Monitor Height

You should not be constantly moving your neck up and down or left and right

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Antenna Switching Desktop Keypads

Immediately Adjacent to Logging Keyboards
No Slow, Awkward Fumbling with a Mouse
No Reaching for Antenna Switches

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160 Meter Antenna Switching

4-Square, 8-Circle and Beverages
Desktop Antenna Control Keypads

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160 Meter 8-Circle Receiving Array
Desktop Direction Control Keypad

160 Meter 4-Square Transmit Antenna
Desktop Direction Control Keypad

Stacked Yagis on Two Towers

Desktop Stacked Yagi Control Keypad

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First Steps in Identifying Candidate Improvements to Your Station

- Identify realistic <u>time phased</u> personal contest goals for your 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 your peer competitors
- 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 or improved station equipment
  - annual funds available to support improvements
- Achieve a balance between your goals and constraints

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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
  - all aspects of your station environment that limit operator performance
    - identify all ergonomic and operator comfort weaknesses
  - antenna switching flexibility, ergonomics and hot switching protection
  - transceiver performance -- focusing on receiver performance
  - amplifier reliability and digital monitoring of output power and VSWR
  - audio and CW keying quality. Eliminate undesired CW VOX delay
  - computers, software and their internal and external computer networks
  - internal and external RFI and inter-station RFI
  - all aspects of station equipment and interconnection 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 station improvement opportunities

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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 with your peer competitors
- Identify every aspect your station's performance that was not competitive with your peer competitors
- Identify improvements that your peer competitors can't match
- Identify every opportunity to improve your station 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 station improvement
  - practicality of achieving each improvement
  - impediments to achieving each improvement
  - expense to achieve each improvement

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Station Performance and Reliability Improvement Ideas

- Transceiver performance (sensitivity, dynamic range, filters)
- Amplifier output power and reliability
- Digital wattmeters to monitor power output and antenna VSWR
- Operator environment
  - noise, chair, ventilation, desk height, computer monitor
  - you should not be constantly looking up/down or left/right
  - equipment placement, keyboard placement, desktop space
- Keyers and paddles and transmitted CW quality **– no keyclicks!**
- Microphones and transmitted audio quality
- Dedicated computers, keyboards and larger monitors
- Antenna switching close to computer keyboard with no reaching
- DX spotting network displays and alarms
- Propagation map displays from the Reverse Beacon Network
- Wrench tighten all PL-259s, verify tightness at least annually
- Verify center pin mating force of all SO-239 mating connectors

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Single Operator 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 all 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 digital wattmeter allows you to monitor transmitter power output and antenna VSWR during the contest

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SO2R Station Improvement Ideas

- 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 close to each other
- Triband antennas can cause problemativ cross-band interference
- Many SO2R operators find it more effective to use two networked computers and two keyboards
- Identify and correct internal/external RFI and cross-band RFI
- 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 harmonics

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Execute Your Proof of Station Performance Checklist Before Every Competition

- Prove that everything in your station is in performing properly
  - improve and update your checklist regularly
  - record all antenna VSWR 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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CTU Presents

Success Strategies for Remote & Hybrid Multiop Contesting
Gerry Hull, W1VE

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Success Strategies for Remote & Hybrid Multiop Contesting
Gerry Hull, W1VE

- **Definitions**
  - Remote
  - Hybrid Remote
- **MultiOperator Station Challenges**
  - Staffing
  - Technology
  - Strategy

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Success Strategies for Remote & Hybrid Multiop Contesting
Gerry Hull, W1VE

- **Attacking the Challenges**
  - Remote Methodologies
  - Example/Best practices that work
  - The challenge of “Remote Challenged” operators
  - “What About? …”

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Success Strategies for Remote & Hybrid Multiop Contesting
Gerry Hull, W1VE

Definitions

- **What is “Remote” Multiop contesting?**
  - Simply put, using the internet, connecting one or more operators to a station, in order to operate a contest.
- **What is “Hybrid” Multiop contesting?**
  - In the Hybrid scenario, at-station operators are supplemented with operators located elsewhere.

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MultiOperator Station Challenges

- **Staffing**
  - Operators are aging out. There are simply not as many operators able to come and staff a multi-op station.
  - Health Concerns: Covid and related communicable health conditions remain pervasive.
  - Great stations may be located far from population centers, so travel may be prohibitive due to cost or other barriers.
  - Hosting Costs/XYL Support: Bringing a big team over to the QTH for a weekend is not a problem for some, but a huge barrier for others.

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MultiOperator Station Challenges

- **Technology**
  - Your well-equipped multi-op station has all manual controls for antenna/filter switching and amplifier control.
  - Internet access and speed. Not enough bandwidth. Too much latency.
  - All technology at the station, with a simple interface for remote ops, or, the “full experience” for the remote ops?
  - You see a sea of remote technology out there, and it seems just too expensive.
  - You are not sure how to start

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MultiOperator Challenges

- **Strategy**
  - Multiplier station or In-Band? Will these work on a remote?
  - Team Competency and Roles: Run vs In-Band/Multiplier hunting
  - Team Cohesiveness: Does everyone agree on the goal, and how?
  - Team Communication: vital for all multiops, critical for remote or hybrid scenarios.
  - Team Staffing on Remote: license issues, Internet quality at an operator's location.

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Attacking Challenges – Remote Technologies

- Internet Access
  - Use Fiber-To-The-Home, Cable Modem, Starlink Satellite or 4GLTE connections
  - Stay away from Wireless Internet Service Providers – they have excessive latency and jitter.
  - Latency is typically not an issue these days. In most of the world, latencies are 140mS or less point to point: a single character at 40 wpm takes 135 mS. It is not noticeable.
  - Different remote implementations have specific Internet Service Provider requirements.

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Attacking Challenges – Remote Technologies

- Remote Implementations:
  - "Being There" Remote Operators using the Microbit RRC boxes:
    - Full Radio interface via 2nd Rig or Control Panel (K3/0), or Yaesu/Kenwood/Elecraft twins.
    - VFO knobs and the whole radio at the Remote Ops location
    - Requires port forwarding, possible DDNS for RRC Server box. Will not work with a 4GLTE station-side endpoint without a bunch of technology (VPN, etc). Some Starlink plans offer Dynamic IPv4 Public addresses and RRCs work fine.
    - The "Cadillac" of remote technologies, but also quite expensive for boxes and Radios if a lot of remote ops, which limit your operator pool.
    - CW Paddle remote.

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Attacking Challenges – Remote Technologies

- Remote Implementations:
  - Manufacturer Specific Remote Solutions:
    - Yaesu SCULan10 box and software offers nice remote UI with spectrum scope and front panel like the radio, but offers zero support for CW. Nothing special required on operator PC. Requires port forwarding or a VPN.
    - Icom RS-BA1 also offers the full control panel of the radio, including the spectrum scope. Overly complex to configure, and very hard to debug.
    - Flex Systems is natively remote, as it uses Desktop software connected via IP. However, it uses a proprietary VPN that has had reliability issues, and the remote provides no sidetone for CW operation. There are work arounds to not use the proprietary VPN. Quite Popular.

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Attacking Challenges – Remote Technologies

- Remote Implementations:
  - Off-the-shelf Custom Do-It-Yourself Remote:
    - Use Remote Desktop Technologies (Anydesk, RustDesk, TeamViewer) to connect to a station desktop. On the desktop is every piece of station automation software you want. The complexity of implementing remote is no more complex that what you have done without remote.
    - For High Quality Audio, use a low-latency centralized Mumble Server, and Mumble clients at the station and operator locations.
    - All of this software is free. See the URLs at the end of my presentation.
    - This is a start-simple solution that works incredibly well, and is a contest-winning remote strategy.
    - CW via keyboard only.

Attacking Challenges – Remote Technologies

- Antenna Switching and Other Controls
  - No matter the remote choice, you will still have antennas to switch, Rotators to turn, and amplifiers to control.
    - Use Remote Desktop Technologies (Anydesk, RustDesk, TeamViewer) to connect to a station desktop. You'll have access to the automation provided by the devices you use.
    - If your station has all manual antenna switching, start off as a hybrid remote. Operators at the station can do antenna switching and rotation chores.
    - If the station is not to be occupied, then a remote AC Power Switch is pretty much mandatory.

Success Strategies for Remote & Hybrid Multiop Contesting
Gerry Hull, W1VE

Attacking Challenges – Strategy

- In-Band is a hot trend in Multi-Single and Multi/2 these days.
  - If you have bandpass filters, and a second antenna (gain or vertical) with enough separation, in-band can provide a significant advantage.
  - At band-opening times, there are many multipliers available in the same band. Having a single operator leave the run frequency is not as efficient as having a 2nd radio running down all those mults (and extra QSOs) while the run rate is pretty much not effected.
  - If you are not sharing a second antenna with the run radio, you can build a simple lockout using the INHIBIT inputs available on most all modern radios. Give the In-Band guy priority – when he transmits, the run station is inhibited. If antennas are shared, then additional relay logic should be in place to route antennas appropriately.
  - In-Band is TOTALLY compatible with remote operation, as I'll explain ahead.

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Attacking Challenges – Strategy

- Build the right TEAM:
  - There are typical rate jockeys, multiplier mutants, and, well, typically much slower (typically newer) guys. They are ALL key to your operation. Put the right people in the right roles. New guys are GREAT on an In-band radio, as they can typically add 30% more QSOs to a band. Misplacing a person in the wrong role can lead to a very poor showing, and, even worse, an operator who might not come back.
  - Set GOALS and talk about a strategy with the team. This is especially important if your team is all remote or partially remote.
  - Communicate EFFECTIVELY. Doing well in multiop includes communication off of the radio. This is especially important with remote operators. Without effective communication, they are stranded on an island and don't understand the flow of the contest. Use the chat window in the logger, out-of-band apps like WhatsApp or Slack, and, if you are using Mumble (as I will talk about in the new few slides), use an "Operator Chat" channel to talk about the contest (even to BS with other ops – it is a social sport.)
  - Do not put a technology-phobic operator at a remote position.

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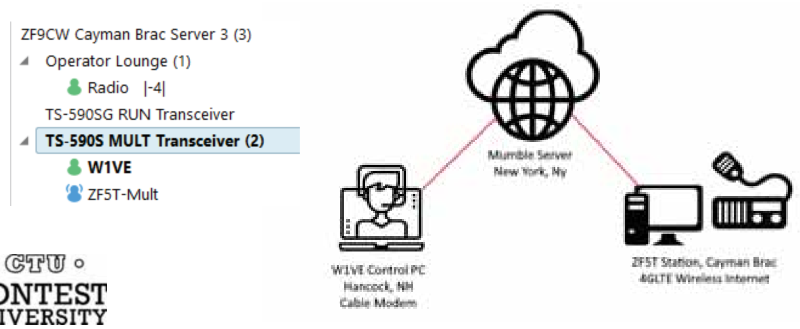
A MultiOp Remote Hybrid Example

- K5GO Built ZF5T in the Cayman Islands
  - Stan has many years of experience building great stations. The station is setup for Mutli-Single, With two radios, Two towers, two homebrew triband yagis, an In-Band Vertical, a 40m vertical, loaded towers for 160 and 80, a YCCC 9-Circle receive array, Green Heron antenna switching, and a homebrew interlock mechanism for In-Band lockout. Pretty slick.
  - **However, Stan could not use the station when he was back home in AR.**



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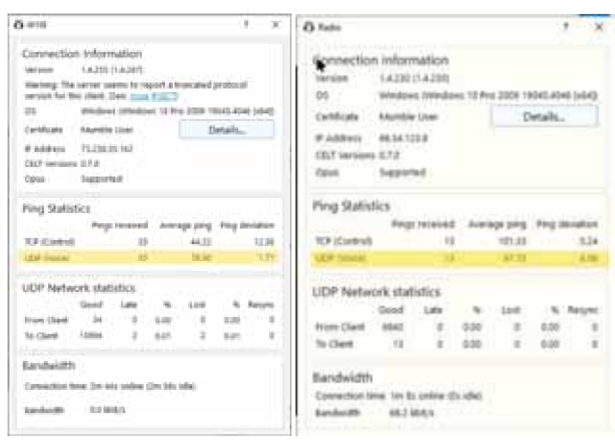
A MultiOp Remote Hybrid Example

- Remoting ZF5T:
  - Anydesk is the Remote Desktop application of choice, but we have RustDesk and TeamViewer as backups.
  - Mumble is used as the audio server. We use a central, cloud-hosted Mumble server that provides very low latency and stability to both NH and the Cayman Islands.



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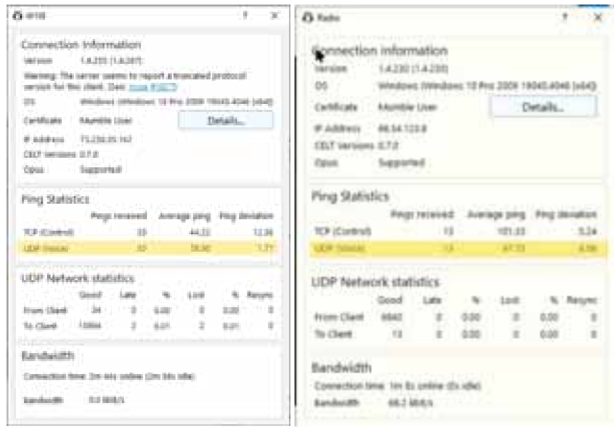
A MultiOp Remote Hybrid Example

- Remoting ZF5T:
  - Notice the overall latency is 127ms between W1VE and ZF5T.
  - The duration of a single dot in Morse code when sending at 40 words per minute (wpm) is 30 milliseconds (ms). Therefore, the average duration of a Morse code character, assuming an average character length of 3.5 dots/dashes plus a space between elements of the same character, is approximately 135 ms.
  - With a total delay of 127 mS between W1VE, in Hancock NH, the central Mumble server in NYC, and the ZF5T station in Cayman Brac, the delay is less than one morse character.



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A MultiOp Remote Hybrid Example

- Remoting ZF5T:
  - The run station consists of an ICOM 7610, with Win4Icom Suite as the radio control software for remote ops.
  - The rather-busy screen has everything the remote op needs:
    - Rig Control
    - Antenna Control
    - Rotator Control
    - N1MM Networking info: CW sending was done using N1MM Macros, and the Key indicator in the Network Status window would tell you what the other station is doing (InBand vs Run)

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A MultiOp Remote Hybrid Example

- Remoting ZF5T:
  - **The second (InBand/Otherband) station** at ZFT5 is available by another Anydesk session. This Allows the remote operator to switch radios quickly.
  - This is a Kenwood TS-590s, using the free Kenwood remote software.
  - The same controls are available as the run station.

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Success Strategies for Remote & Hybrid Multiop Contesting
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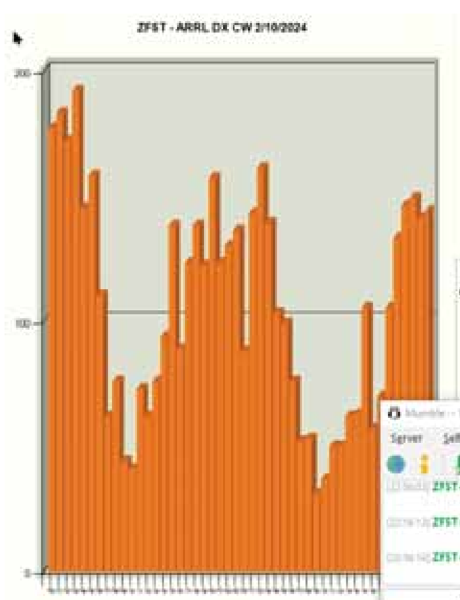
A MultiOp Remote Hybrid Example

- ZF5T ARRL DX CW 2024 M/S LP
  - K5GO, W5SJ, KO8SS on-site, with W1VE Remote
  - No difference noticeable between remote run rate and local.
  - We used "N1MM Pair Mode" with the Remote Op and Local op entering callsigns. Surprisingly, sometimes the Remote Op would get the callsign entered first. No discernable difference.
  - We used Mumble for both the radio and the interop communication. Our second coms path was WhatsApp.
  - Results: #1 LP M/S World, claimed. We won world last year using the exact same configuration. It was a tight fight with V3T! This was a mid-contest capture:

V3T	3,579,180
ZF5T	3,579,180



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A MultiOp Remote Hybrid Example

- ZF5T Bottom Line:
  - Remote was implemented with essentially Zero cost.
  - The internet connection at ZF5T is fixed cellular 4GLTE. It provides more than enough bandwidth.
  - Remote does not hinder the performance of the operators.

  - This same Do-It-Yourself Remote Strategy has been implemented/is being implemented by VY1AAA@VY1JAK, VE1JS, W4LT, VE7KW, K3WW, K3AJ, AG2J any many others.

Success Strategies for Remote & Hybrid Multiop Contesting
Gerry Hull, W1VE

A MultiOp Remote Hybrid Example

- Follow Ups, further reading
  - My previous articles in NCJ
  - My blog on remote operation at http://blog.radiosport.network
  - gerry@w1ve.com
  - What About?... Any Questions?

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CTU Presents

Contesting Fun on That *Really Other* Mode (FT8)

Ed Muns, W0YK / P49X

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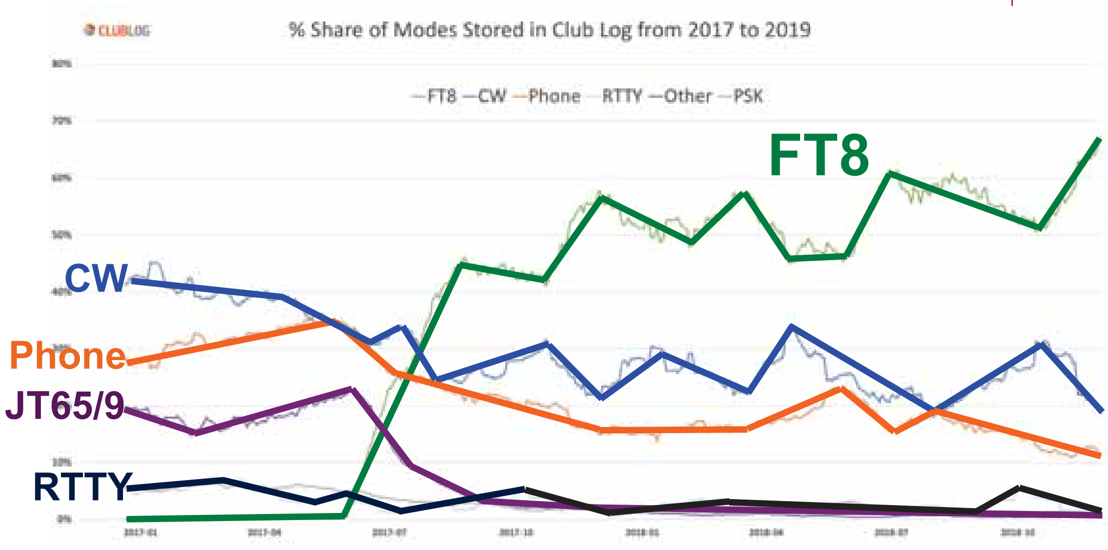
Digital Contesting is Fun!

- FT8 Explosion
- WSJT-X History
- FT8 Contests
- WSJT-X & FT8 QSOs
- Setup
- Optimizing WSJT-X
- Superfluous 73 and NILs
- FT8 vs. FT4

Clublog QSOs: 2017-2018



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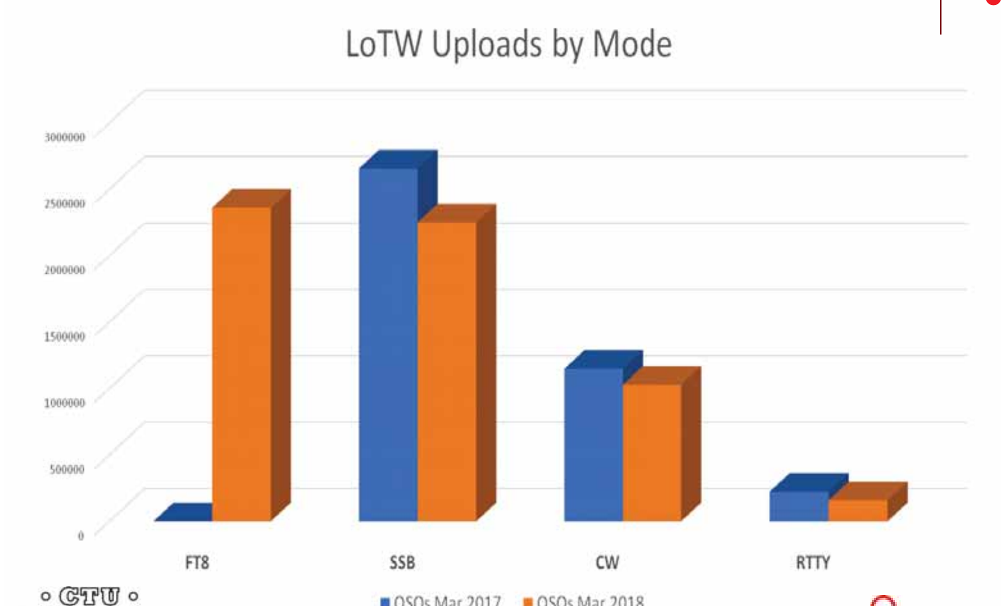
The FT8 Explosion



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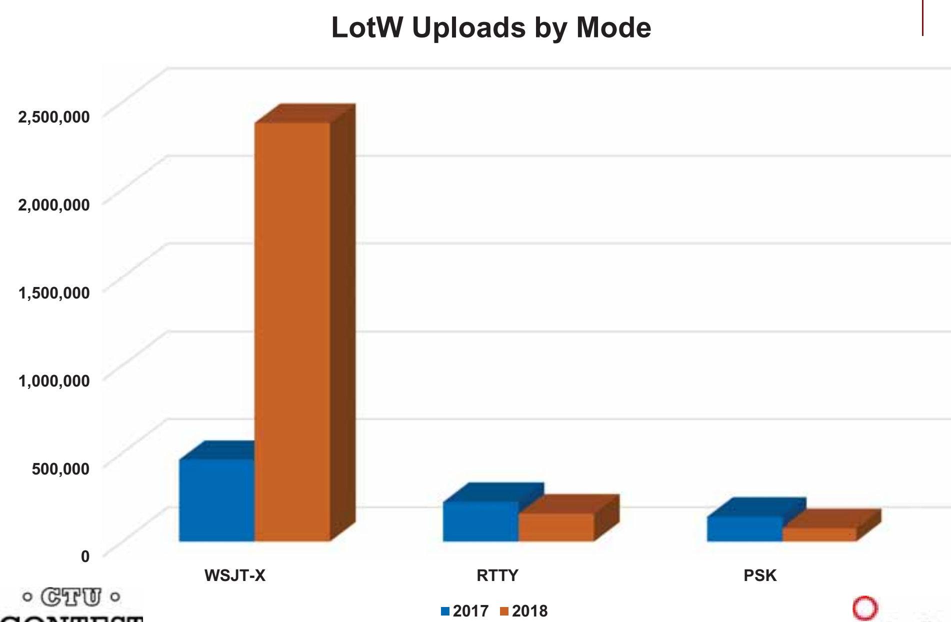
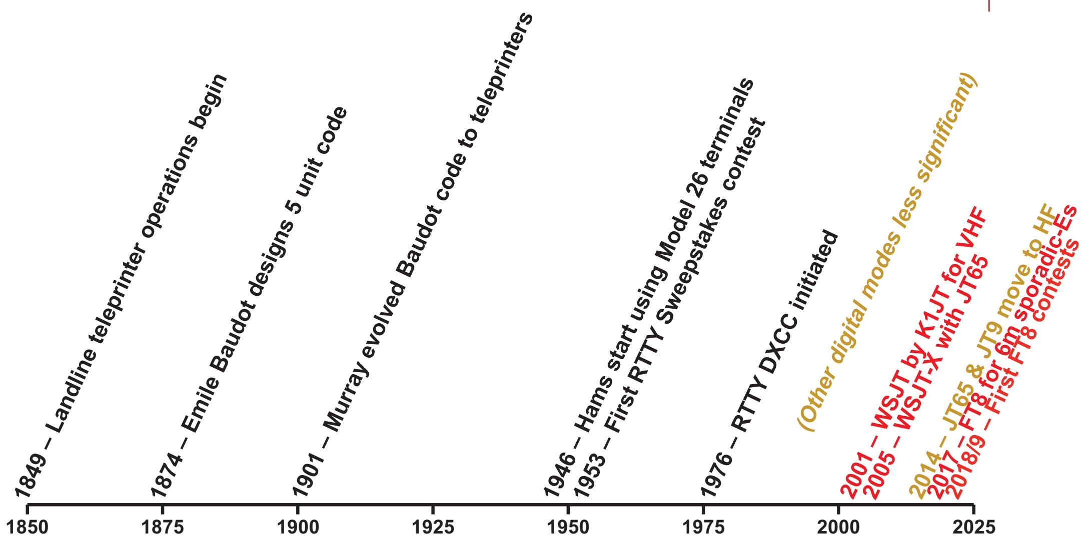
Digital Mode Trends



FT8 Software

- WSJT-X
- Derivatives:
  - WSJT-X Improved
  - JTDX
  - MSHV
  - DigiRite (WriteLog only)
  - WSJT-Z
  - JS8Call (conversational; non-contest)

RTTY & WSJT Timeline



WSJT & WSJT-X History

- 2001: WSJT (Weak Signal communication by Joe Taylor)
  - 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
- 2005: WSJT-X (-eXperimental)
  - Developed for EME; adapted by HF
  - Several modes (JT65, JT9, FT8, etc.)
  - TX/RX cycles synchronous with time servers
- 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
- Apr 2019: FT4 for “contesting”
  - 90 Hz bandwidth; 7.5 second transmission

WSJT-X Contest History

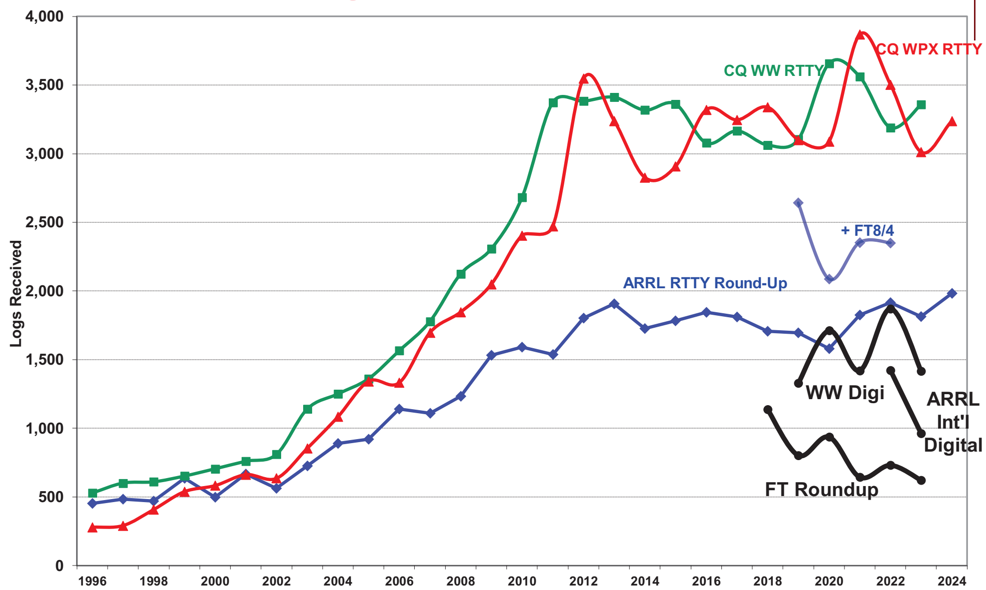
- 2005: WSJT-X
- Jun 2017: FT8 for 6m Es & HF
  - 50 Hz bandwidth; 15 second transmission
- May 2018: Baker Is. DXpedition > 11,000 FT8 HF QSOs
- *Dec 2018: FT8 Roundup (first WSJT-X HF contest)*
- *Jan 2019: ARRL RTTY Roundup (FT8 permitted)*
- *Apr 2019: FT8 DX Contest*
- Apr 2019: FT4 for "contesting"
  - 90 Hz bandwidth; 7.5 second transmission
- *Sep 2019: SCC RTTY Championship → WW Digi*
- *Jun 2022: ARRL International Digital*
- *Jan 2023: ARRL RTTY Roundup becomes RTTY-only*

Three 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

1. ARRL International Digital [1st weekend in Jun]
   - Distance-based scoring
2. WW Digi DX Contest [last weekend in Aug]
   - Same as ARRL Int'l Digital
     - plus Grid multipliers
     - minus 160m and 6m
3. FT Roundup [1st weekend in Dec]
   - RTTY Roundup rules →*New Format*

Three Largest FT4/8 Contests



FT4 NS (NCCC Sprint)

- https://www.ncccsprint.com/ft4ns.html
- Weekly practice
- Based on VE7AB's QSO rate increase
- Tim N3QE presentation in Digital Contest Forum Friday morning, Room 3, Xenia

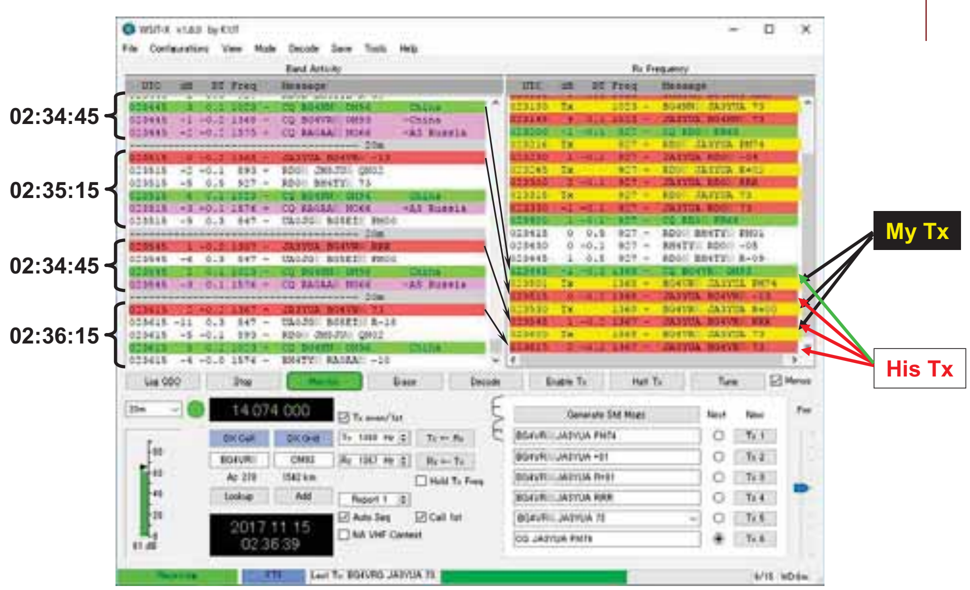
WSJT-X Overview

+ 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=90 Hz)
+ “Perfect” copy (Super Check Partial is irrelevant)

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

FT8 Multi-Channel Reception

Run vs. S&P is irrelevant



75-90 sec./QSO

FT8 Standard QSO

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

60 sec./QSO

FT8 Short-Cycle QSO

- CQ K1AB FN42
- K1AB W9XY -09 (Tx2, not Tx1)
- W9XY K1AB R-11
- K1AB W9XY RR73, *and* K1AB N5DEF -01
- CQ K1AB FN42, *or* N5DEF K1AB R-07

30 sec. rolling QSOs

FT8 DXpedition QSO

75 sec./QSO
60 sec./5 QSOs
(Fox/Hound)

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

WW Digi QSO

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

QSO period 1
QSO period 2
QSO period 3

- CQ WW K1ABC FN42
- K1ABC W9XYZ EM05
- W9XYZ K1ABC R-FN42
  (implicit "CQ" for others)
- K1ABC W9XYZ RR73
  K1ABC W0YK CM97
- W0YK K1ABC R-FN42
  (implicit "2nd QSL" for W9XYZ)
  (implicit "CQ" for others)
- K1ABC W0YK RR73
  K1ABC P49X FK52
- P49X K1ABC R-FN42
  (implicit "2nd QSL" for W0YK)
- K1ABC P49X RR73
- P49X K1ABC 73
  (superfluous 2nd QSL)

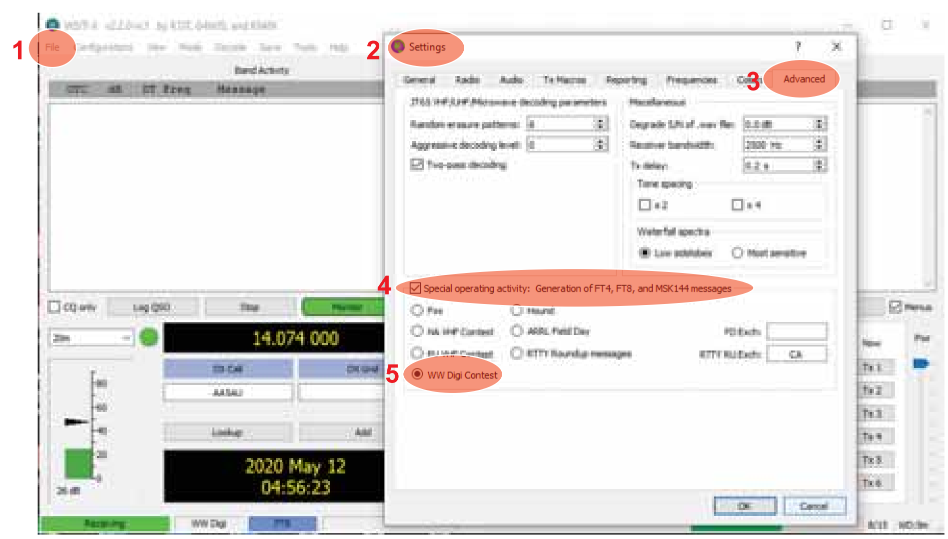
WW Digi QSO

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

QSO period 1
QSO period 2
QSO period 3

- CQ WW K1ABC FN42
- K1ABC W9XYZ EM05
- W9XYZ K1ABC R-FN42
  (implicit "CQ" for others)
- K1ABC W9XYZ RR73
  K1ABC W0YK CM97
- W0YK K1ABC R-FN42
  (implicit "2nd QSL" for W9XYZ) ← W9XYZ may want 73
  (implicit "CQ" for others)
- K1ABC W0YK RR73 ← *repeat* K1ABC W9XYZ RR73
  K1ABC P49X FK52
- P49X K1ABC R-FN42
  (implicit "2nd QSL" for W0YK) ← W0YK may want 73
- K1ABC P49X RR73 ← *repeat* K1ABC W0YK RR73
- P49X K1ABC 73
  (superfluous 2nd QSL)

WW Digi DX Contest



Setting Up for FT8

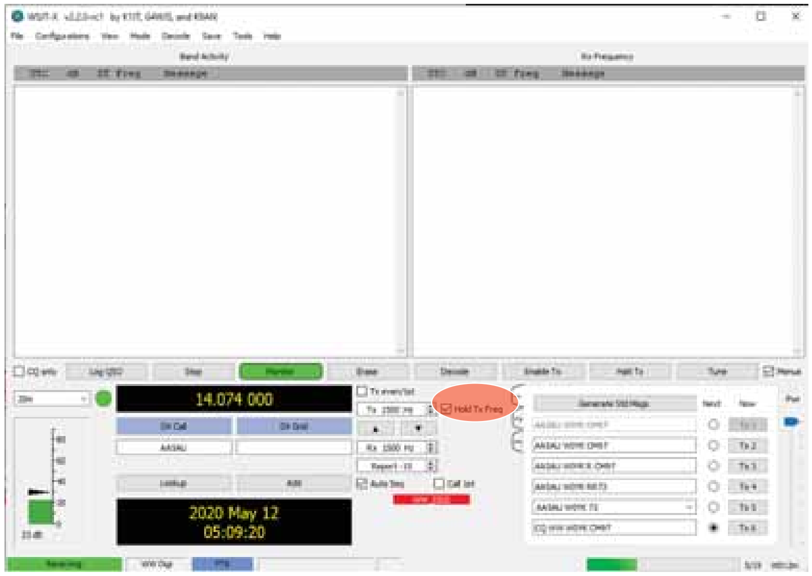
- Download/install WSJT-X
  - Alternatively one of the derivatives
- Hardware (radio and PC) same as AFSK
- Study the:
  - Quick Start Guide to WSJT-X 2.0, and
  - the WSJT-X User Guide

Time Synchronization

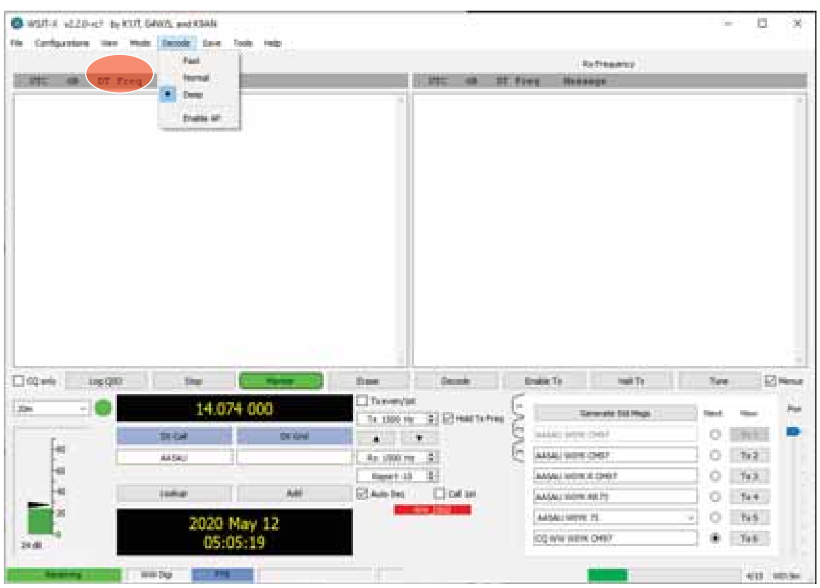
mandatory for reliable QSOs

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

Split Transmit



Deep Decode

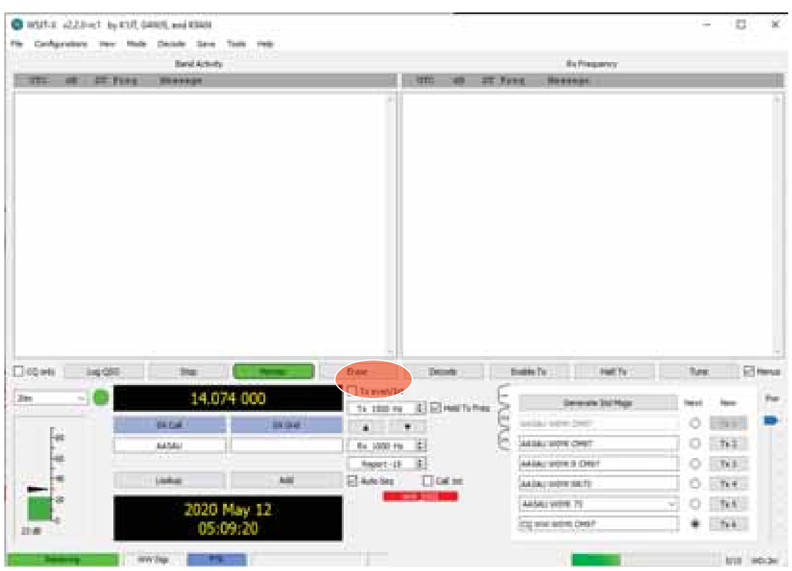


Sub-Band Choices

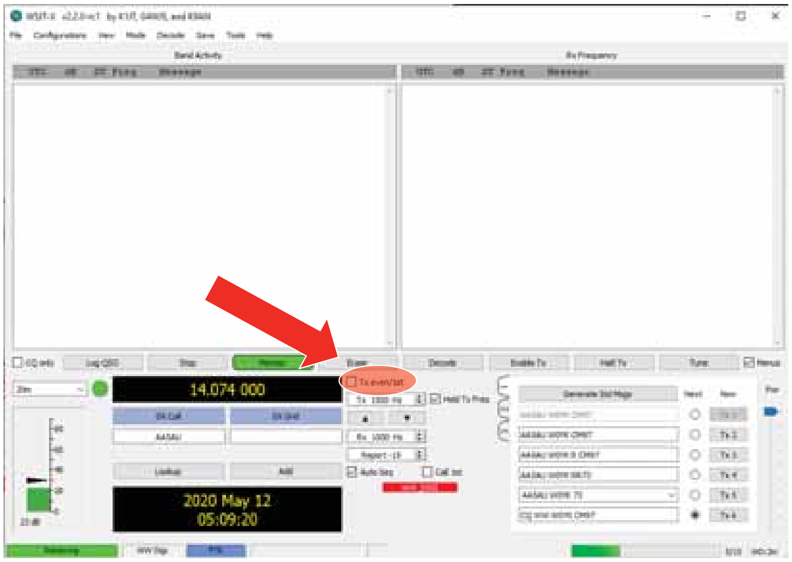
Int'l Digi, WW Digi, FT RU

- **Suppressed-Carrier dial frequency**
  - **FT4: 14080** ***(now also the daily default)***
  - **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**

Utilize Odd/Even Cycles



Rotate Odd/Even Cycles



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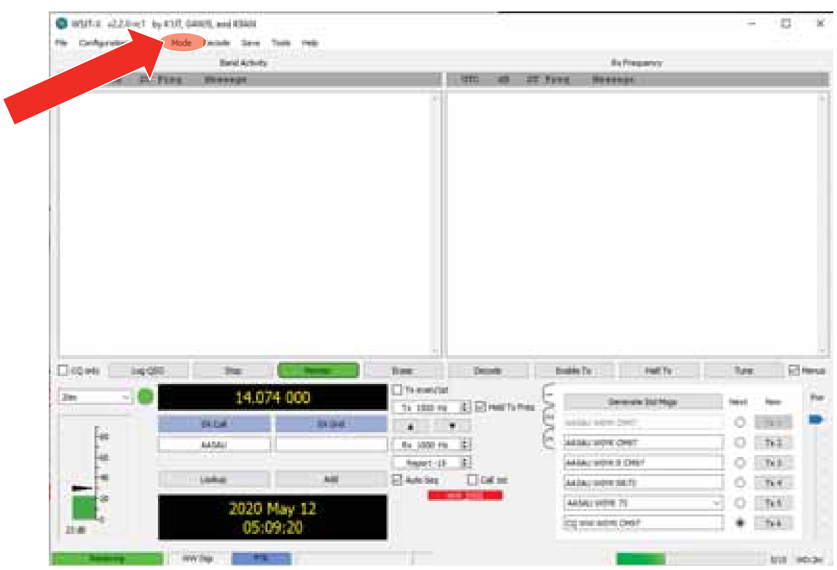
Rotate FT4/FT8 Modes



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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*

Working Non-Contesters

- Depends on contest
  - SNR (no contests yet)
  - Grid Square exchange (S&P only)
  - 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*

Minimizing NILs

e.g. WW Digi

- FT contest NILs are high
  - RTTY is 1-2%, FT is 5-6%
- 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?*

Minimizing NILs

QSO Requirements

- Each QSO partner sends:
  - Call sign
  - Exchange
  - QSL

WW Digi QSO

CQ W0YK CM97 ← *W0YK call*
W0YK AA5AU EL92 ← *AA5AU call & exch*
AA5AU W0YK R CM97 ← *W0YK QSL & 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*

Two Generals Problem [1,2]

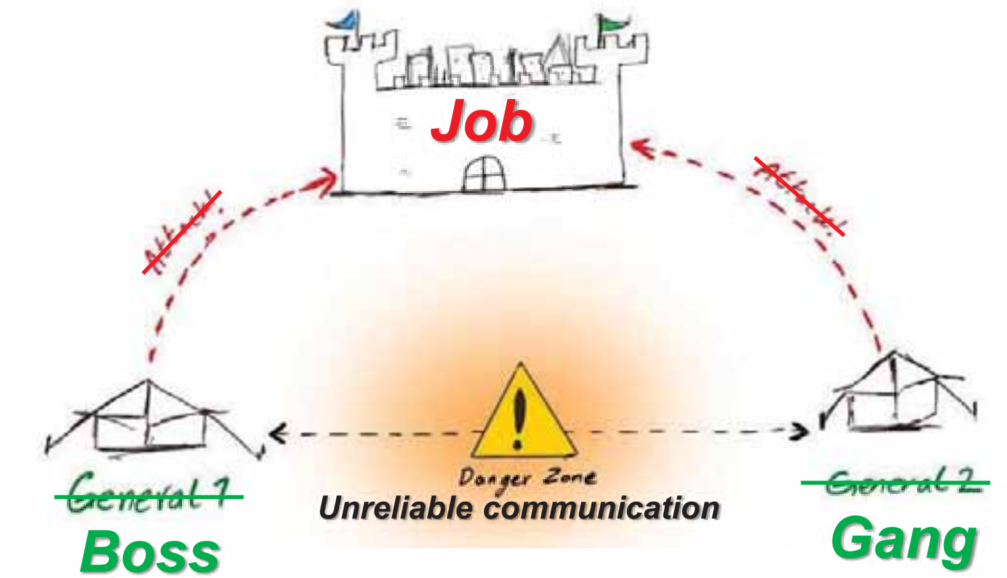
unreliable communication

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

[1] E. A. Akkoyunlu, K. Ekanadham, and R. V. Huber, 1975 "Some Constraints and Trade-offs in the Design of Network Communications", page 73
[2] Jim Gray, 1978 "Notes on Data Base Operating Systems", page 465

The Gangsters Paradox

~~Two Generals Problem~~



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

FT4 & FT8

- 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 = 5-6%

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.

Minimizing NILs

Recommendation #2

- Give in!
  - Send the superfluous 73, but
  - Don't require it from your QSO partner
- Yes, it's unnecessarily slower, but
  - FT contesting is currently slow enough to absorb it

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:
    - the highest QSO rate, or
    - the most multipliers
- New stations & multipliers in each mode

Resources

- Thursday night practice
  - https://www.ncccsprint.com/ft4ns.html
- 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
- 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)

CTU Presents

Next Level Contesting; Making the Move to SO2R

Randy Thompson, K5ZD

What is SO2R?

- Single Operator
  - One human doing all operating
- Two (or more) Radios
  - Only one transmitted signal at any time

- Technique has been around since 1960's
- Became a competitive necessity in late 80's

My History with SO2R

K5TM – SS CW 1980

N5AU – SS CW 1984

K5ZD/3 – SS CW 1990

K5ZD/1 – May 1996

Why Use Two Radios?

- Maximize productivity – boost score
- Make better decisions – boost score
- Reduce boredom – boost score
- Increase the fun – boost score

- Be more competitive (WIN!)

Why Does SO2R Help?

Enables better use of time

Use transmitting time to listen
and line up QSOs

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How Does SO2R Help?

- Winning requires…
  - Working the most guys who "aren't in the contest" – they answer CQs
  - Working the most rare multipliers – they answer CQs

ABC
Always Be CQing

- Paradox
  - You must also work everyone else who is calling CQ!

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SO2R or 2BSIQ?

- 2BSIQ* – Name given by CT1BOH to the concept of interleaving CQs on two bands
- Same infrastructure as SO2R
- Can greatly increase rates on CW and RTTY
- SO2R is a prerequisite to doing 2BSIQ

*2BSIQ - Two Bands Synchronized Interleaved QSOs

See https://www.contestuniversity.com/wp-content/uploads/2019/05/3-N6MJ-2BSIQ-and-SO3R_-Riding-the-edge-of-Human-Capabilities.pdf or https://wwrof.org/wp-content/uploads/2017/04/2BSIQ-20170331.pdf

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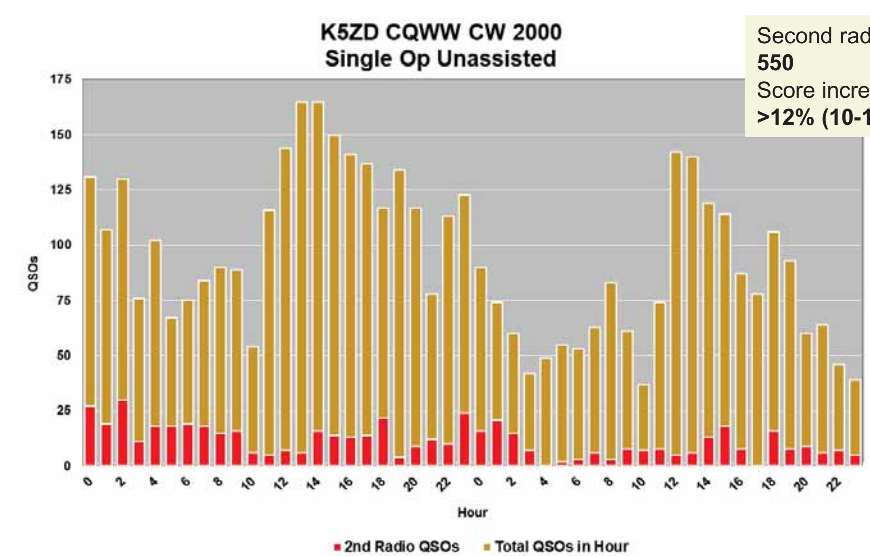
How Much is SO2R Worth?



Second radio QSOs
550
Score increase
>12% (10-15% is typical)

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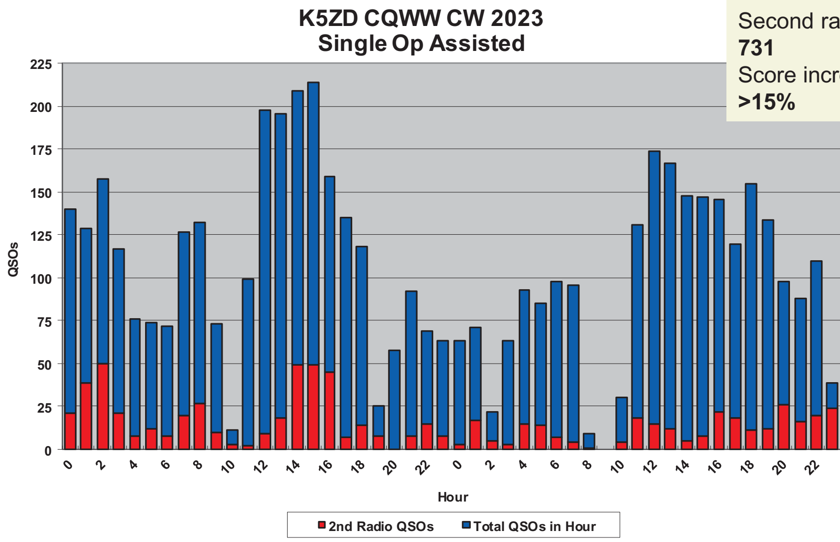
How Much is SO2R Worth?



Second radio QSOs
731
Score increase
>15%

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When is SO2R Most Effective?

- Best when you have:
  - Ergonomic station design (easy to use)
    - Efficient (and automated) audio switching
    - Minimal self-interference
  - Low to moderate QSO rates
    - Less than 80/hour
    - Especially helpful for low power or QRP
- Least effective when:
  - Very high noise situations
  - You're unable to hold a good run frequency

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How Do You Do It?

- *Call CQ!*
- When transmitting, dial the second rig's VFO!
  - Look for multipliers
  - Look for QSOs (best use of time in low-rate situations)
  - Check for band openings

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What Does it Sound Like?

- Listen to one radio at a time into both ears
- Listen with one radio in each ear
- Listen to one rig whenever you're transmitting on the other
- Do both
  - Split audio, but never be more than a keystroke away from putting both ears on the radio of interest

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How Do You Get Started?

- Add a second radio!
- Minimal setup:
  - Two inexpensive radios, two multiband antennas
  - Manually switch the key/mic line and RX audio between rigs
  - Ensure that you cannot transmit on both rigs at the same time; this is illegal in almost all contests
  - Protect the receiver front end!

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The Challenges of SO2R

- Achieving zero interstation interference
  - You must be able to hear while transmitting
- Efficient switching
  - Minimize complexity of using two radios
- Learning the skills
  - Requires practice!

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Minimizing Interference

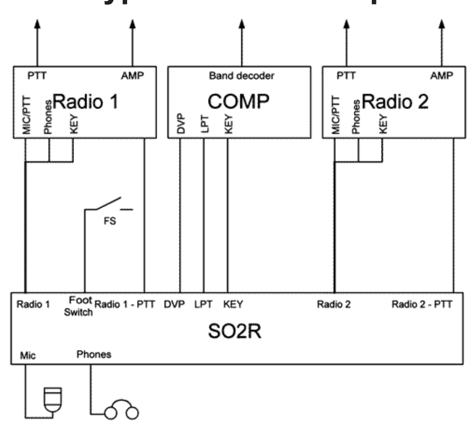
- Antennas
  - As far apart as possible — difficult for most of us
  - Avoid tribanders or multi-band antennas if possible — less rejection of other bands
- Radio Protection
  - Coaxial stubs — good, especially with monobanders
  - Band-pass filters — better
  - Receiver protection circuit

Managing Interstation Interference by W2VJN
https://www.vibroplex.com/techdocs/INRAD/MII_W2VJN.pdf

Efficient Switching

- The SO2R controller needs to deal with
  - Receiver audio
  - CW key line and/or mic audio
  - PTT
- Station switching deals with
  - Antenna feedlines
  - Associated band-pass filters or coax stubs

Typical SO2R Setup



Source: http://www.ok1rr.com/view.php?cisloclanku=2004122505

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My First SO2R “Controller”

Front View

Rear View

Inside View

This simple box won many contests!

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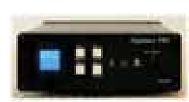
SO2R Controllers

- Ham Radio Solutions, EZMaster, $600+
- microHAM MK2R, $800+
- Top Ten DX Doubler, $200+
- RigSelect, new in beta
- Array Solutions SO2R Master, no longer avail
- Home-brew solution, <$100 depending on features and parts used.



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Computers and Software

- Interface rigs to PC
  - Frequency control (serial/USB interface)
- Use all the control outputs available to you
  - CW output (serial or parallel) and paddles (parallel)
  - PTT output to key radio(s)
  - Radio A/B select output for switching receiver audio/CW/voice
- Software
  - All of the major contest loggers support SO2R
    - WriteLog
    - N1MM+
    - Dxlog
    - WinTest
    - TRlog
  - Two logging windows
  - Multi-keyboard support
  - Switching and Automation

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One Keyboard or Two?

One keyboard

- Keep hands on one keyboard
- Requires good keyboarding skills to change radios quickly
- Less equipment

Two keyboards/computers

- Requires more physical movement (less ergonomic)
- Enables data entry on either radio without impacting the other
- Requires more room on the operating desk

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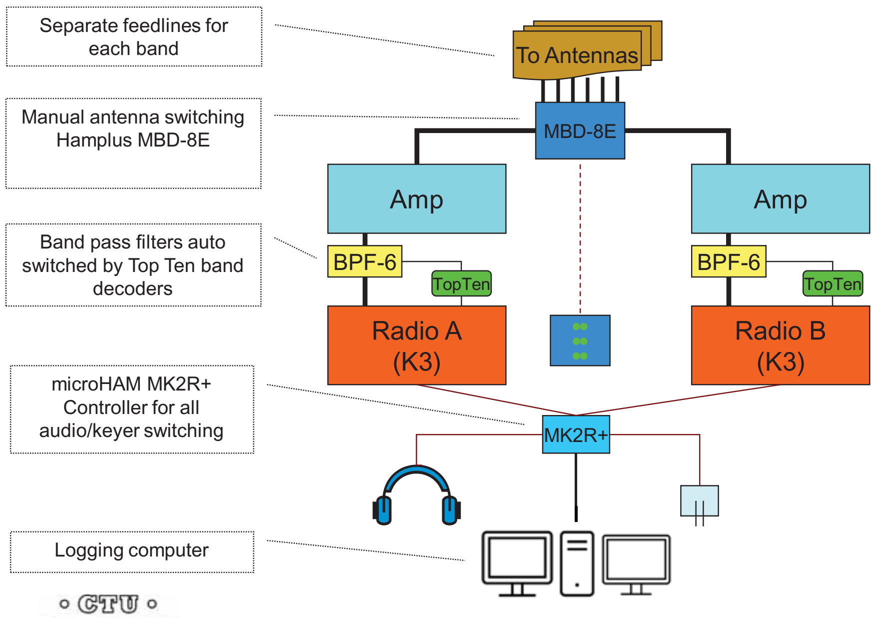
K5ZD SO2R Station Diagram



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K5ZD Station Layout

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What About Low Power/QRP?

- SO2R is very effective with a small lot and close spaced antennas for LP/QRP entrants
  - You can get by with less filtering or antenna separation
- You can do well with simple antennas
  - Tribander for the CQ rig
  - Wires, such as parallel dipoles with single feed point, for second radio
- It's possible to double your rate, especially during slow times
  - Call CQ whenever possible
  - Use tune second radio while waiting your turn in a pileup

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Please…

Don't attempt doing two radios until you have mastered using one very well

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You are ready for SO2R when..

- You are operating one radio and find yourself wanting to
  - watch TV
  - read a book
  - look at your phone

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Caution

- Learning takes time…
  - Prepare for a few contests where score may not improve

- Example: Driving a car
  - Had to think about everything at first
  - With experience, able to focus on other things

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SO2R Skills

- Know the “flow”
  - Contest QSOs have a rhythm and sequence
  - Use timing to know when you can make it work
- Keyboarding skills
  - Know your software
- Practice until it is automatic

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How to Practice SO2R?

- Operate RTTY contests
  - You can focus just on the “flow” and switching
  - Transmissions are very long
  - Computer does the copying
- Any contest with activity on 2 or more bands
  - Call CQ on one band while S&P on the other
  - Try S&P on two bands at same time
- Listen to two audio streams
  - W4AN would turn on both radios in shack and try to follow two QSOs on CW while doing other things

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Technique Differences for SSB?

- SSB is more difficult
  - Transmissions are shorter
  - More QRM, harder to hold CQ frequency
  - Computer doesn't do all the talking
- Tips
  - Use voice keyer to CQ
  - Voice keyer to call stations and send exchange on second radio
  - Focus on "easy" QSOs or multipliers only

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Final Advice

- The purpose of SO2R is to increase your efficiency
  - Don't lose your run frequency!
  - Make smart decisions about who you call on the second radio
    - Snappy operators with good signals are best
    - Be loud enough to work whomever you call
- Don't be an SO2R lid
  - Use frequencies wisely and be courteous
  - Anyone listening to you on the air should not be able to tell that you're doing SO2R

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SO2R Resources

- Hear and watch SO2R operation
  - KA1IOR YouTube video series
    - *http://www.youtube.com/watch?v=kHCveAeju_A*
- Lots of station photos
  - K8ND SO2R Resources
    - *http://www.k8nd.com/Radio/SO2R/K8ND_SO2R.htm*
- Article about one contester's experience
  - ZS6AA A Simple SO2R Contest Station
    - *http://zs6aa.files.wordpress.com/2008/02/a-simple-so2r-contest-station.pdf*
- Tips on advanced SO2R techniques
  - N2NT Presentation at CTU 2016
    - *https://www.contestuniversity.com/wp-content/uploads/2021/03/8.-N2NT-CTU-2016-Improving-Single-Operator-2-Radio-SO2R-Techniques.pdf*

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Questions?

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Web: k5zd.com

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Antenna Improvements to Improve Your Competitiveness in Contests

Frank Donovan
W3LPL
donovanf@erols.com

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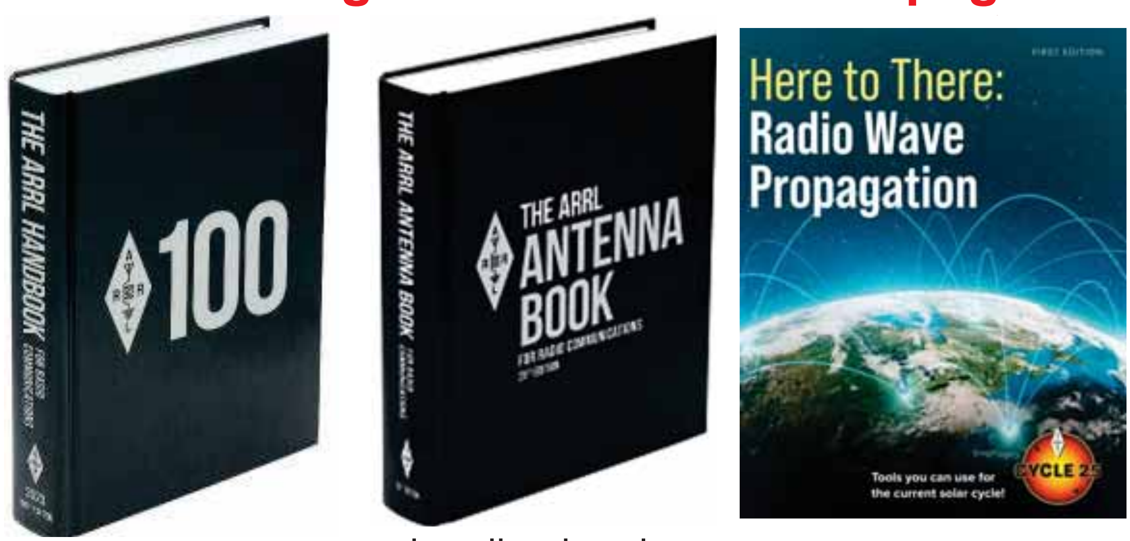
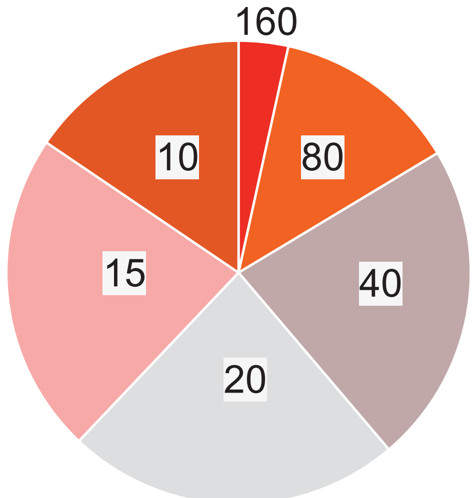
The Three Most Valuable Investments to Greatly Improve Your Understanding of Antennas and Propagation



handbook.arrl.org
home.arrl.org/action/Store/Product-Details/productId/2012451093
home.arrl.org/action/Store/Product-Details/productId/2010547491

CW DX Contest QSOs Per Band Near Solar Maximum



10 and 15 meter QSOs are much more important near solar maximum
80 meter QSOs and 160 multipliers continue to be very important

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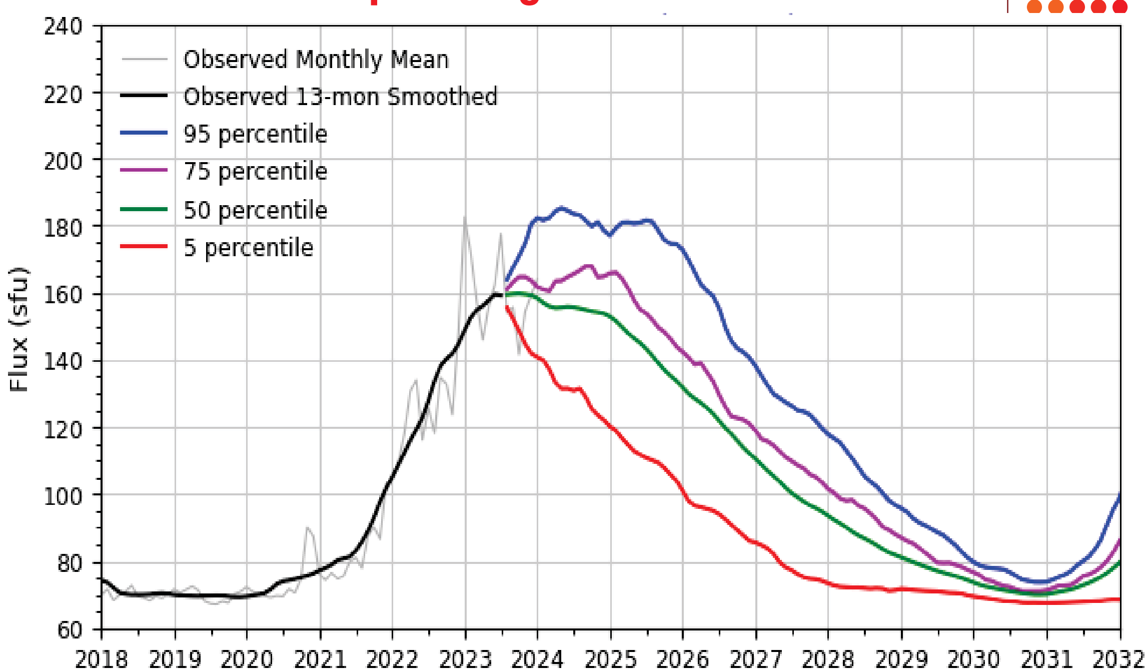
Solar Cycle 25 Solar Flux Index Forecast
NASA Marshall Space Flight Center – 6 Feb 2024



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nasa.gov/msfcsolar

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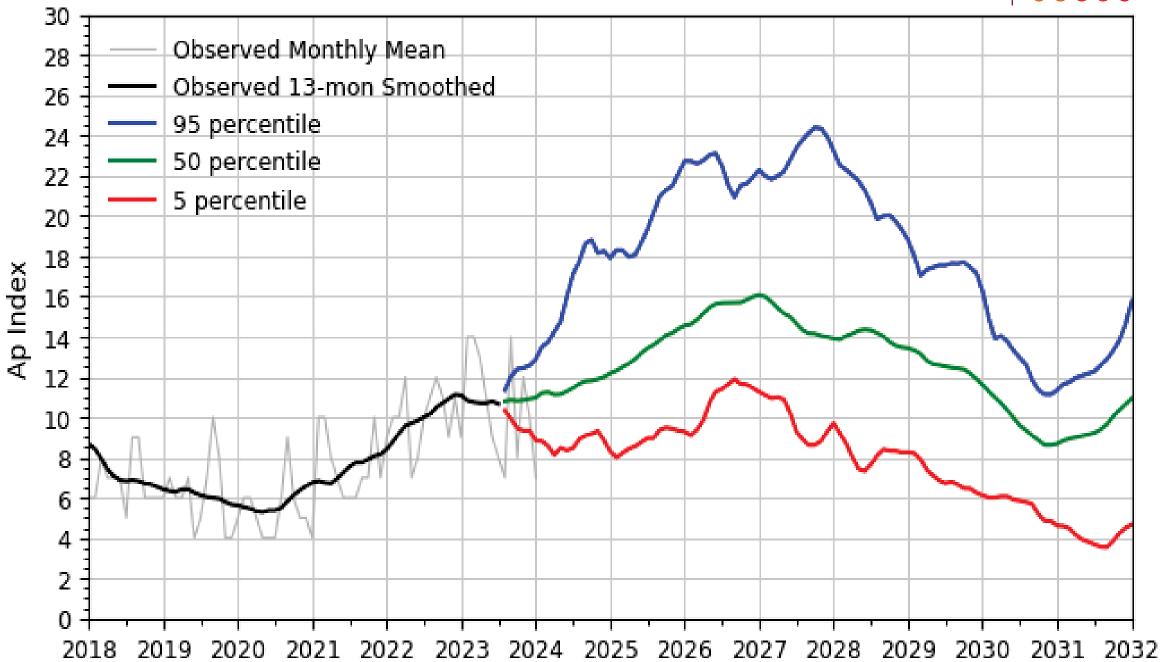
Solar Cycle 25 Ap Index Forecast
NASA Marshall Space Flight Center – 6 Feb 2024



nasa.gov/msfcsolar

HF Propagation Trends Through Solar Minimum in 2031

- Solar maximum propagation conditions began in Dec 2022
- Solar maximum is likely to occur during 2024
  - but solar maximum propagation continues through 2026
- More frequent disturbed propagation conditions will begin during 2024
  - will slowly become less frequent after 2026
- Excellent 10 meter worldwide propagation through 2026
  - will begin to decline after 2026
- Excellent, reliable 15 meter worldwide propagation
  - will begin to decline after 2027
- The slow decline to solar minimum will begin by 2027
- Solar minimum propagation is likely to begin by about 2029

Identify and Prioritize Antenna Improvement Goals to Improve Your Competitiveness

- Identify your realistic achievable personal goals for your selected contests, entry categories and competition region
  - first place regional, national or world winner, or
  - consistently placing among the top three competitors, or
  - consistently placing among the top ten competitors, or
  - consistently improving your scores relative to your peers
- Understand your realistic constraints that limit your achievable antenna improvements
  - available physical space for towers and antennas
  - available time for achieving your goals
  - available funds for achieving your goals
- Achieve a balance between your goals and constraints
- Prioritize your goals in order of improving your competitiveness

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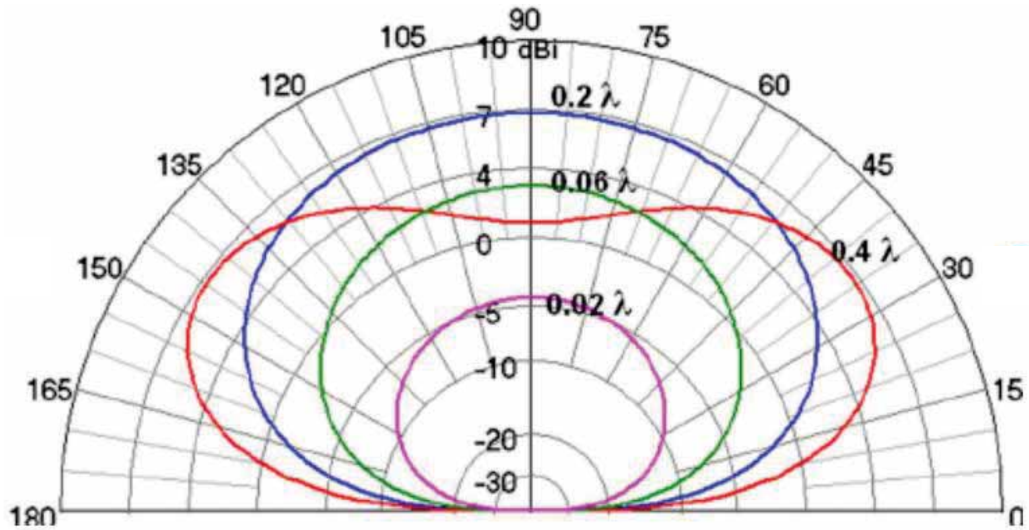
During and After Every Contest Prepare Notes Documenting Your Antenna Strengths and Weaknesses Compared to Your Peer Competitors

- Identify every aspect of antenna performance and reliability that was a competitive strength compared to your peers
- Identify every aspect antenna performance and reliability that was a competitive weakness compared to your peers
- Identify improvements that your peer competitors can't match
- Identify every opportunity for antenna improvement that would have improved your score in this contest, in priority order by:
  - estimated score improvement 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

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



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

6 dB of "Free" Ground Gain

- Horizontally polarized dipoles, Yagis or quads
  - easily produce 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
  - *nearby antennas for the same band and tribanders can destroy ground gain, antenna gain and directivity*
- Vertically polarized antennas can achieve nearly 6 dB of ground gain
  - but only over highly conductive soil such as a salt marsh W1KM K3ZM
- Competitive DX contest stations require high horizontally polarized 40 through 10 meter antennas especially during solar minimum
- Stacked Yagis provide additional gain by suppressing unwanted high angle radiation and redistributing power into useful lower angles
  - *if installed at proper heights and spacings to obtain useful stacking gain*
  - a Stackmatch allows selection of the optimum elevation angle

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

Antenna Elevation Angles and Heights Near Solar Maximum

- **10 meters** - early morning through sunset world wide DX band
  - most DX propagation is at **5 to 10 degree** elevation angles **50 to 100 ft**
  - marginal DX paths require angles **well below 5 degrees** **above 100 ft**
- **15 meters** - sunrise to early evening worldwide DX band
  - most DX propagation is at **5 to 15 degree** elevation angles **50 to 120 ft**
  - marginal DX paths require angles **well below 5 degrees** **above 120 ft**
- **20 meters** - 24 hour very crowded competitive worldwide DX band
  - most DX propagation is at **5 to 20 degree** elevation angles **50 to 180 ft**
  - marginal DX paths require angles **below 5 degrees** **above 180 ft**
- **40 meters** - evening and night very crowded competitive DX band
  - most DX propagation is at **10 to 25 degree** elevation angles **70 to 200 ft**
  - marginal DX paths require angles **below 10 degrees** **200 ft**
- **80 meters** - less reliable and weaker DX signals than recent years
  - use efficient antennas covering angles from **10 to 25 degrees** **100 to 200 ft**
- **160 meters** - less reliable and weaker DX signals than recent years
  - **vertical antennas** almost always provide ***much better*** 160 meter performance

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Increased sunspot activity requires competitive 15 and 10 meter antennas

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Competitive 160 Meter Antennas are Almost Always Vertically Polarized

- 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

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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 more than 4) elevated 125 foot radials
      - but only if 30 to 60 shallow buried 125 foot radials are not possible
    - the K2AV folded counterpoise is a good alternative for small lots
- Inverted-L, T and umbrella verticals are good alternatives
  - 50 feet or higher (as short as 35 feet with degraded performance)
  - supported by a tower, mast or trees
- or a corner fed delta loop or corner fed inverted-U antenna

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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 but only if shallow buried radials are not possible
  - ***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 corner fed delta loop or corner fed inverted-U

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80 Meter 4-Square Vertical Array

very competitive high performing alternative to a high 80 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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Horizontal Polarization on 80 Meters Easily Achieves 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
  - ***verticals 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 under each vertical

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High Performance 40M Antennas

- Horizontal dipole at least 70 feet high
  - 13 to 45 degree elevation pattern half power (-3 dB) beamwidth
  - 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 half power (-3 dB) beamwidth
  - 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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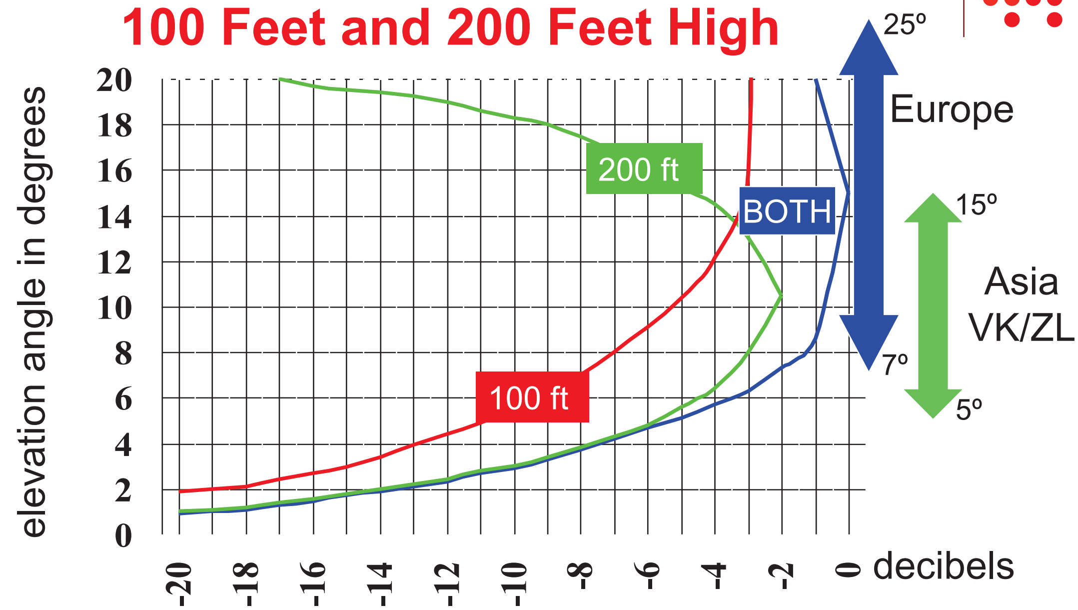
Stacked 3 Element 40 Meter Yagis
48 Foot Booms
100 Feet and 200 Feet High



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Elevation angles from 10º to 25º are needed

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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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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

Stacked 40 Meter 4 Element OWA Yagis at K9CT

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 *always* 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

Elevation angles from 5º to 20º are needed

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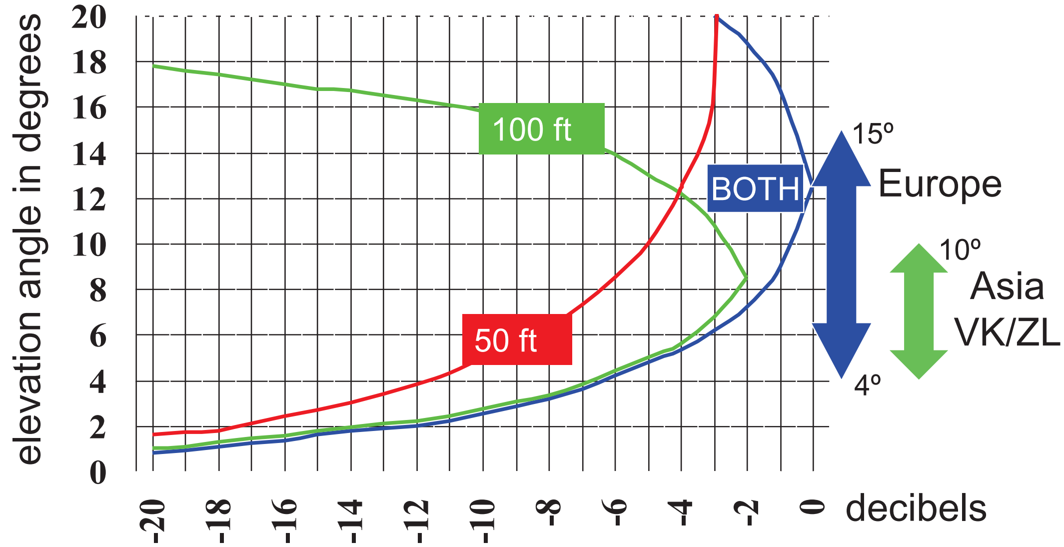
Stacked 5 Element 20 Meter Yagis
48 Foot Booms
50 and 100 Feet High



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Elevation angles from 5º to 15º are needed

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Array Solutions Stack Match

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The Stackmatch revolutionized the performance and flexibility of stacked Yagi antennas

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High Performance 15M Antennas

- A horizontal Yagi or quad is *always* 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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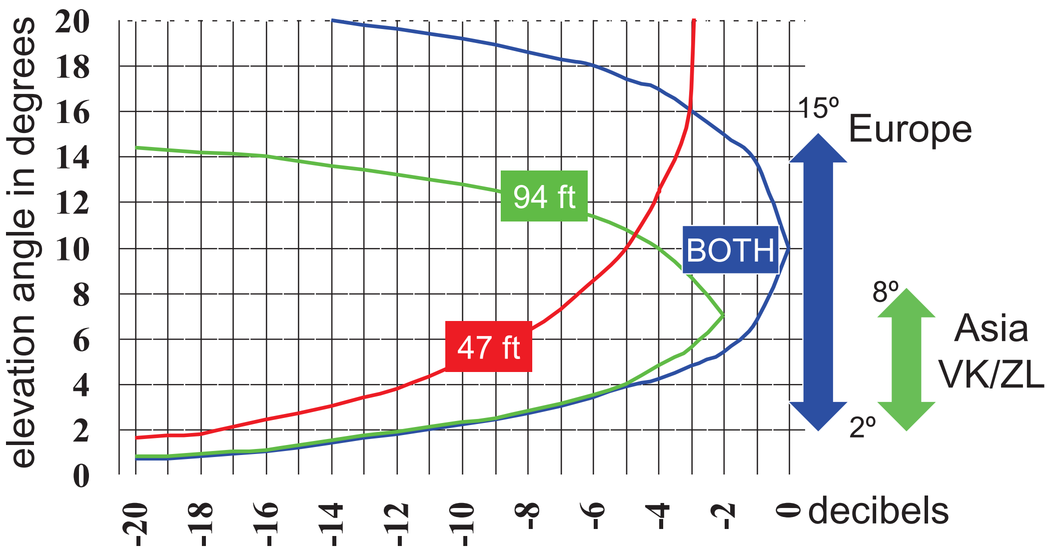
Elevation angles from 5º to 15º are needed

ICOM

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

ICOM

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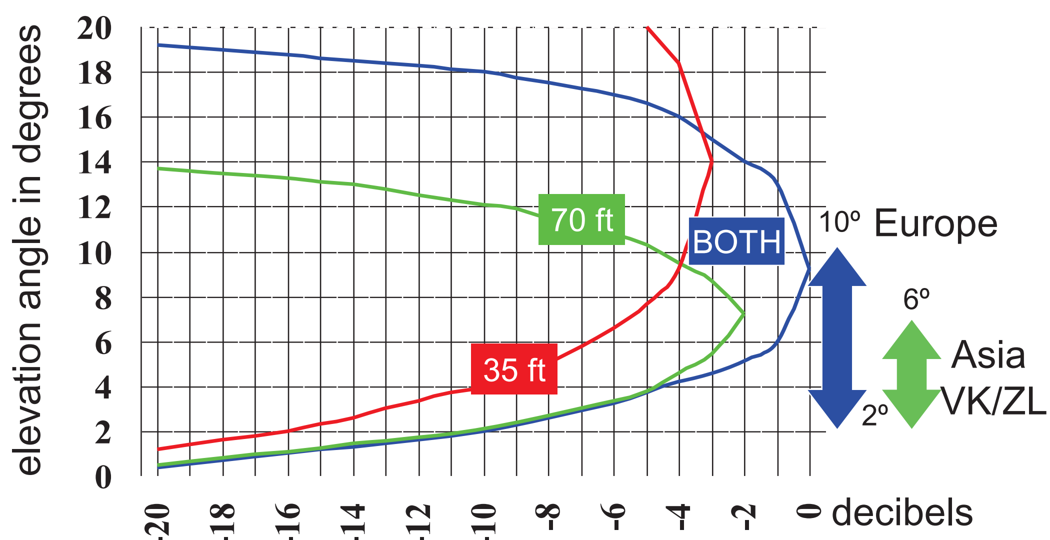
Stacked 6 Element 10 Meter Yagis
36 Foot Booms
35 and 70 Feet High



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Elevation angles from 5º to 10º are needed

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Competitive Single Tower Stations for the Years Near Solar Maximum

- 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
  - stacked monoband Yagis such as the HyGain LJ series on ring rotators
  - 80 meter dipole and a 160 meter inverted-L

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High Performing Single Tower Station K9RS

JK 402
120 ft

JK Mid-Tri
110 ft

JK Mid-Tri
75 ft

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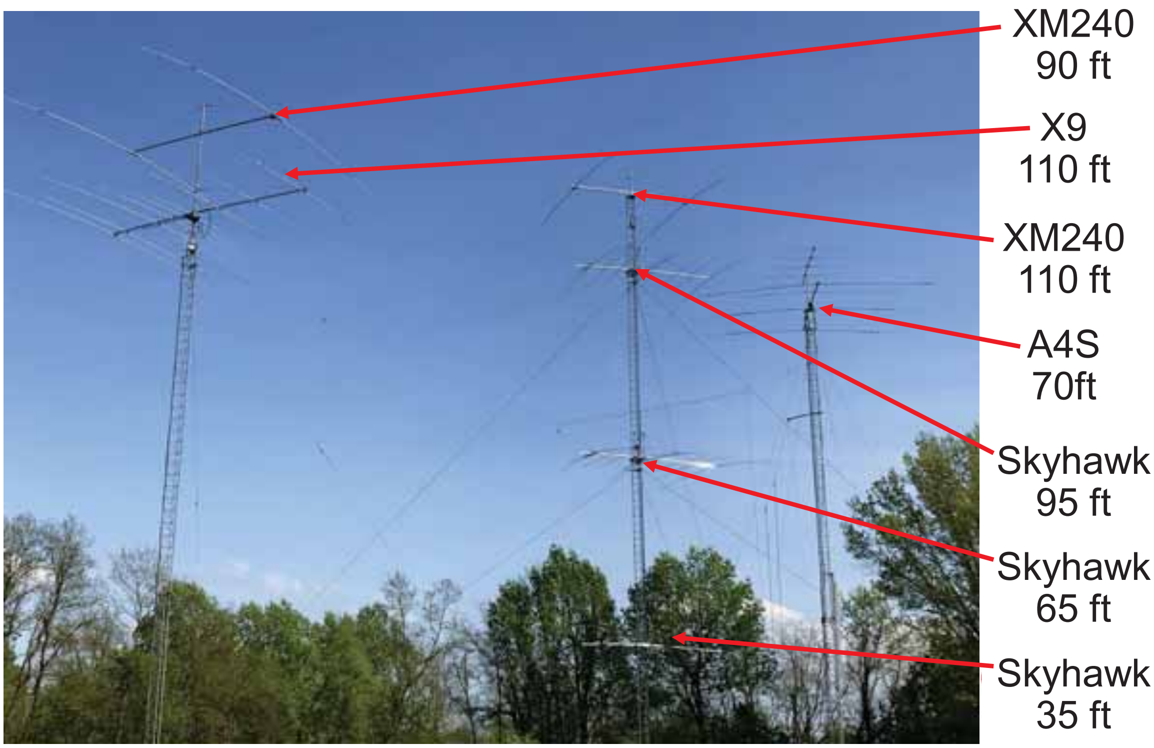
Multi-Tower Antenna Systems

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

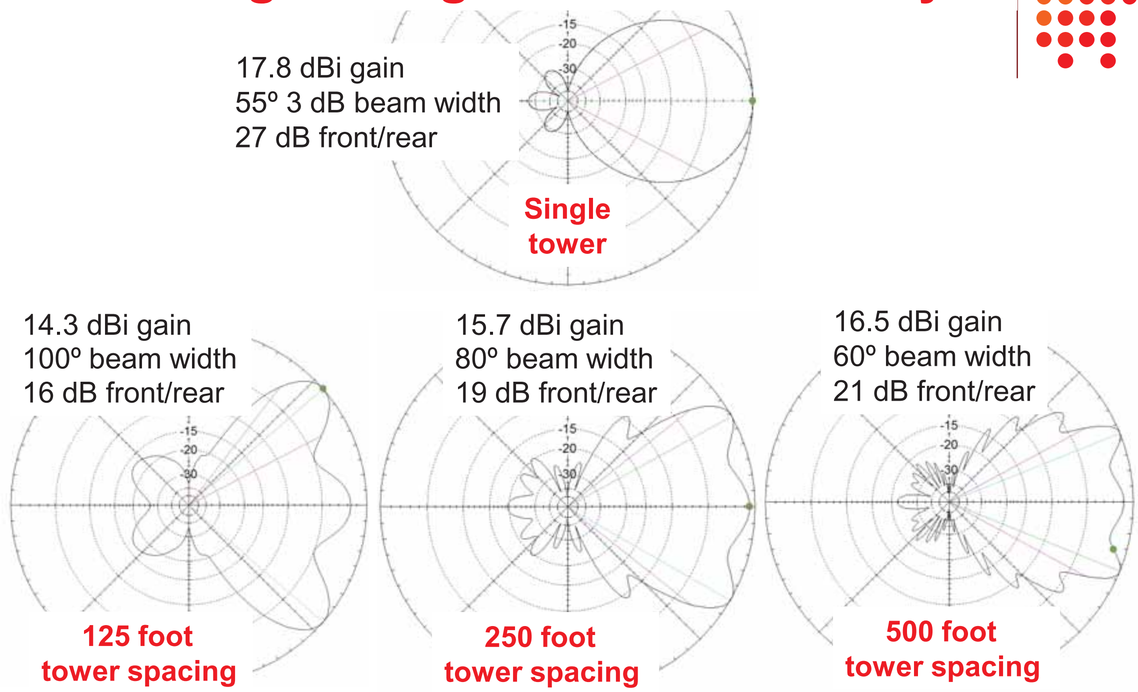
- Placement of Yagis and the relative location of the towers to minimize degradation is critical to achieving high performance
  - in most cases multiple *Triband Yagis* and multiple Yagis for the same band should be installed *on only one tower*
  - placing Yagis covering the same band *on multiple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

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

High Performing Three Tower Station AA3B



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



Single Operator Antenna Improvement Ideas for the Years Near Solar Maximum

- Antenna improvements are almost always more effective and less expensive than any other station improvement
- Improved antennas can significantly improve both transmitting and receiving performance
- Receiving antennas make a big improvement on 160 and 80 meters
- A digital wattmeter allows you to monitor transmitter and antenna performance during contests

SO2R Antenna Improvement Ideas in Addition to Single Op Improvements for the Years Near Solar Maximum

- Monoband antennas
  - multiple triband antennas can cause excessive cross-band interference that requires expensive bandpass filtering
  - multiple triband antennas can cause excessive antenna performance degradation

- In-band receiving antennas
  - A 50 foot high 2 or 3 element tribander is an excellent in-band receiving antenna
  - allows SO2R or multi-op operation in the same band
  - must use transmitter interlocks to make it impossible to transmit two simultaneous signals on the same band

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When Good Antennas Go Bad…

common antenna system design errors

- 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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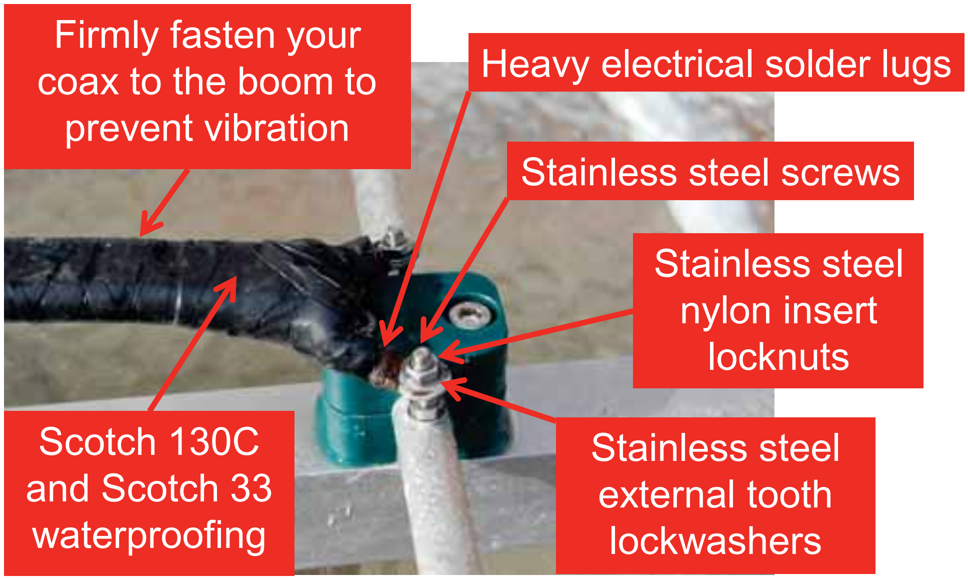
Antenna Feedpoint

Waterproof and Shakeproof Connections



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Performance Evaluations Inspections Preventive Maintenance

- Maintaining consistent 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-259 shell tightness
    - SO-239 center pin contact pressure

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<u>Well Before</u> Your Next Contest Evaluate Your Antenna Strengths and Weaknesses <u>Relative to Your Peers</u>

- Evaluate your transmitting antenna strengths and weaknesses on every band relative to your peers
  - antenna and feedline performance and reliability
- Evaluate your receiving antenna strengths and weaknesses on every band relative to your peers
  - antenna and feedline performance and reliability
- Identify opportunities to improve your transmitting and receiving antenna and feedline performance and reliability
  - understanding the capabilities your peers is very helpful
- <u>Prioritize</u> your list of antenna improvement opportunities
  - prioritize in order of <u>improving your competitiveness</u>

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Execute Your Antenna Proof of Performance Checklist Well Before Every Competitive Contest

- Prove that all of your antennas, rotators and feedlines are working properly
  - improve and update your checklist regularly
  - record all performance measurements
- Never enter a competition with unproven antennas
- Prove that all of your antennas, feedlines, towers and rotators are working reliably
  - far enough in advance so you can make necessary repairs well before the contest

Execute Your Tower Inspection Checklist Months Before a Competition

Helps You Avoid Mid-Winter Failures, Reliability Problems and Safety Issues 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 your tower base for standing water and
  - corrosion, settling and cracks at the tower-to-concrete interface
- Regularly blow all debris from tower bases to avoid corrosion
- Inspect rotator performance and play
- Inspect the tower for wind damage especially after major storms
- 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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At least annual inspections are essential to owning and operating a safe and reliable tower

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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 your tower bases for standing water and
  - corrosion, settling and cracks at the tower-to-concrete interface
  - Use a blower regularly to remove all debris from tower bases to avoid corrosion
- Inspect rotator performance and play
- Inspect your tower for wind damage after every major storm
- Pay special attention to damaged, loose, missing or corroded:
  - diagonal and horizontal trusses, welds and hardware
  - especially adjacent to guy attachments

At least annual tower inspections are essential to your safety

Execute Your Antenna Inspection Checklist Months Before a Competition

Helps You Avoid Mid-Winter Failures and Reliability Problems During Your Next Contest

- Inspect coax cable for cuts, cracks, damage and moisture intrusion
  - deteriorated jacket, cuts, chaffing and especially worn rotator loops
  - water intrusion at electrical and physical attachments to antennas
  - deteriorated or inadequate cable attachments to the tower
- Compare coax cable losses and TDR displays to last inspection
- 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, feed lines and connectors for lightning and wind damage
- Inspect antennas, feed lines and rotators for lightning and wind damage

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

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When Good Antennas Go Bad…

common coaxial cable errors

- 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 inadequately 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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Reduce Coaxial Cable Loss and Improve the Reliability of Your Coaxial Cables and Connectors

- Coaxial cables longer than 300 feet are often used in larger 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
- Coaxial cables must be securely attached to your tower

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Improving the Reliability of Your 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 mating force 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 just 1/4 turn
- Inspect center pin mating pressure of SO-239 connectors

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The Gold Standard PL-259 Connector
Amphenol 83-1SP

www.dxengineering.com/parts/aml-83-1sp-6

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

This is the worst place to save money in a competitive contest station

Coaxial Cable Connector Waterproofing

Cover your 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+ or Scotch 88 vinyl electrical tape

Station Automation Techniques & Recommendations

Presented by N6TV
n6tv@arrl.net

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Presentation Overview

- Why Automate?
- Transceivers
- Amplifiers
- Band Decoders
- Antenna Switches
- Bandpass Filters
- Tuners
- Summary of Recommendations
- Q & A

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ICOM 2

Why Automate?

- Contesting is hard work
- You will get tired. You will get sleepy.
- Fatigue leads to *misteaks*
- Automation helps prevent *disastrous* mistakes
- Let the machines do what they do best
- You do the rest (while not getting much rest)

What should be automated?

- Computer Logging of:
  - Date, time, <u>frequency</u>, mode, callsign, exchange
- Most transmissions (CQ, Your Callsign)
  - CW, RTTY, Voice Keying
- Changing bands should automatically switch:
  - Antenna, Amplifier, Tuner
  - Bandpass filters / coax stubs
    (For Multi-Transmitter or SO2R)

What should *not* be automated?

- CW copying
  - Do not rely on Code Readers
  - Do not blindly trust every cluster spot
- Voice Keying of Callsigns, Letter By Letter
  - “Oscar” “Hotel” “Two” “Bravo” “Alpha” “Delta”
- Exception: persons with disabilities
- Band change decisions
- How often to sign your call when running
- Where to call CQ

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ICOM 5

Automating Band Changes Saves Time, *and* your Equipment

- Speed and Reliability is key
- Recommendation: Use hardware automation, not software
  - Everything should switch automatically even when PC is OFF or rebooting
  - Not always possible for some transceivers or peripherals
- Transceivers provide “Band Data” or “Operating Frequency” data to Peripherals
- Peripherals track transceiver using “Band Data” or “Operating Frequency” inputs
  - Amplifiers and Tuners usually have RF Frequency Counters that will override incorrect input

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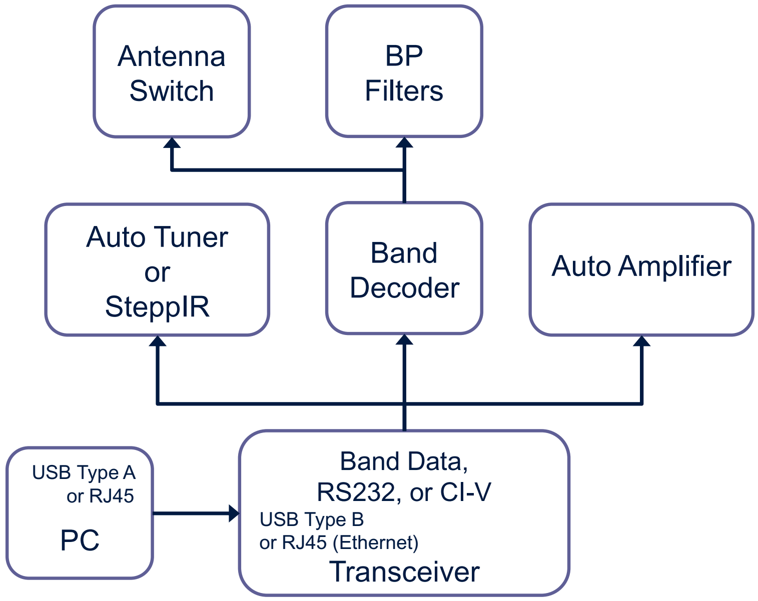
ICOM 6

Transceiver Drives the Peripherals



Band Data

- Only provides transceiver's TX Band
  - Does not provide any VFO frequencies
- TX Band Data is ideal for:
  - Broadband solid state amplifiers without tuners
    - KPA500, ACOM 500S, 600S, 700S, 1200S, PGXL, some SPE
  - Band decoders for antenna switches / BP filters
    - Top Ten, Bandmaster, ShackMaster SM-8, Hamplus, BandPasser II, OM6BPF, Unified Micro BCD-14, EA4TX RemoteBox, Antenna Genius
- TX Band Data is *not* good enough for devices that need *exact* TX *frequency*
  - Automatic tuners and amplifiers with auto tuners
    - Tuners: Kessler AT-AUTO, Elecraft KAT500, Tuner Genius
    - KPA1500, ACOM 2000A RCU, ACOM with 04AT/06AT tuner, most SPE
  - SteppIR controllers (FluidMotion, SDA100, SDA2000, OptimizIR)
  - Baby Loop controller

Band Data Encoding

- Yaesu and Elecraft use 4-bit "BCD"
  - Binary Coded Decimal, "Band A" to "Band D"
- Icom uses 2-pin Band Voltage: "8V Ref", "Band"

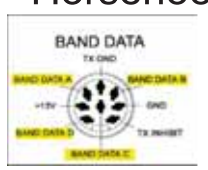
	Band	160m	80m	40m	30m	20m	17m	15m	12m	10m	6m	None
	Frequency	1.8	3.5	7	10	14	18	21	24	28	50	NA
	Icom Voltage	7.0v to 8.0v	6.0v to 6.5v	5.0v to 5.5v	0.1v to 1.2v	4.0v to 4.5v	3.0v to 3.5v	3.0v to 3.5v	2.0v to 2.5v	2.0v to 2.5v	1.2v to 2.0v	0v
Yaesu	Band A	H	L	H	L	H	L	H	L	H	L	L
	Band B	L	H	H	L	L	H	H	L	L	H	L
	Band C	L	L	L	H	H	H	H	L	L	L	L
	Band D	L	L	L	L	L	L	L	H	H	H	L

* Icom outputs same voltage for 17m/15m and 12m/10m

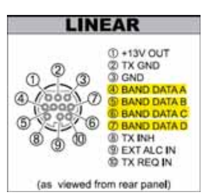
- Flex band data output requires special cable
- Kenwood does not provide any band data output

Yaesu Band Data Output Connectors

- Yaesu FT-1000MP, FTdx5000, FTdx9000
  Uncommon 262° "Horsehoe" 8-pin DIN

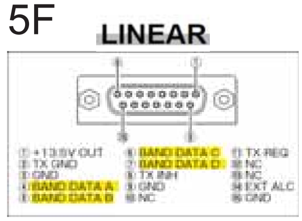


- FTdx10, FTdx1200
  Uncommon 10-pin MINI DIN

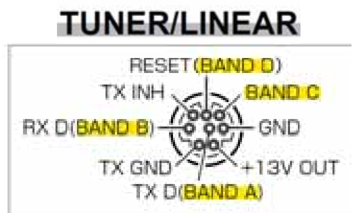


Yaesu Band Data Output Connectors

- Yaesu FTdx101D, FTdx101MP
  Standard DA-15F



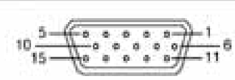
- FT-710
  Standard 8-pin MINI DIN – Set MENU TUN/LIN PORT SELECT to **LINEAR**



Elecraft Band Data Output

- Elecraft K3 and K4
  Standard 15-pin DE-15F Connector ("ACC")

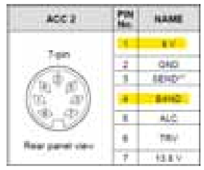
Pin #	Description
1	FSK IN (see **FSK Input**)
2	AUXBUS IN/OUT (see KRC2 or XV-Series transverter instruction manual)
3	BAND1 OUT (see **Band Outputs**)
4	PTT IN (in parallel with MIC PTT)
5	Ground (RF isolated)
6	DIGOUT0 (see **Transverter Control**)
7	K3S ON signal (out) or TX INH (in) (see **Transverter Control, TX INH**)
8	POWER ON (see pg. 46)
9	BAND2 OUT (see **Band Outputs**)
10	KEYOUT-LP (10 mA keying output)
11	DIGOUT1 (see **DIGOUT1**)
12	Ground (RF isolated)
13	BAND0 OUT (see **Band Outputs**)
14	BAND3 OUT (see **Band Outputs**)
15	EXT ALC input (see **External ALC**, pg. 29)



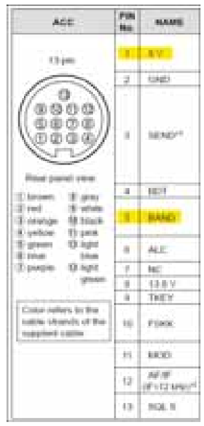
Band	BAND3	BAND2	BAND1	BAND0
160 m	0	0	0	1
80 m	0	0	1	0
60 m	0	0	0	0
40 m	0	0	1	1
30 m	0	1	0	0
20 m	0	1	0	1
17 m	0	1	1	0
15 m	0	1	1	1
12 m	1	0	0	0
10 m	1	0	0	1
6 m	1	0	1	0

ICOM “Band Voltage” Output

- IC-7700, 7800, 7851, 7600, 7610
  Standard 7-pin DIN:



  IC-7300, IC-7410
  Standard 13-pin DIN:



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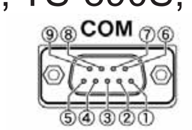
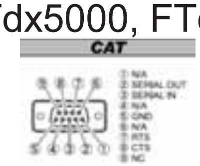
ICOM 13

Exact Frequency Output via RS-232

- Kenwood TS-590SG, TS-890S, TS-990S “COM”
  DE-9M



  - COM is independent of Kenwood virtual USB port used by logger
  - One device can “poll” radio for frequency via RS232 cable
- Yaesu FTdx3000, FTdx5000, FTdx9000 “CAT”
  DE-9M



  - No USB, or FTdx3000 “CAT SELECT” = RS-232
  - PC polls radio, peripherals “just listen” (Pin 2 wired, Pin 3 open)
    - Custom RS-232 “Y-Cable” or “S-BOX” required for sharing

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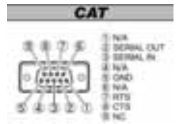
ICOM 14

Exact Frequency Output via RS-232

- Yaesu FTdx10, FTdx101D, FTdx101MP
  DE-9M

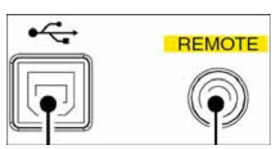


  - COM connector independent of USB
  - One device can "poll" radio for frequency via RS232 cable
- Elecraft K3 or K3S
  DE-9F

  - No *independent* USB connector (Elecraft K4 RS232 *is* independent)
  - PC polls radio, peripherals "just listen" (Pin 2 wired, Pin 3 open)
    - Custom RS-232 "Y-Cable" or "S-BOX" required

Exact Frequency Output via ICOM CI-V

- All ICOM rigs except IC-705 provide a legacy "REMOTE" (CI-V) connector
  3.5mm MONO



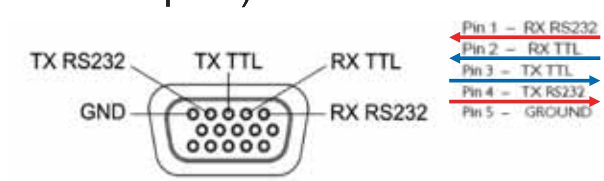
- Two wire serial bus, 19200 baud max
- Important menu setting:
  Set USB CI-V Port to Unlink from [REMOTE]
  (Not available on older rigs like IC-7600, IC-7700)

Automatic Amplifiers

- Usually Solid State and Broadband
- Often include built-in tuners
- Communicate with transceiver via Band Data, RS-232, ICOM CI-V, or Ethernet LAN
- Change bands automatically, no RF transmission required
- Usually have internal RF Frequency Counter as safety, in case RF input doesn't match band or frequency supplied from the transceiver

ACOM 2000A Amplifier

- "New" RCU "CAT" connector: DE-15F (no Band Data pins)



ACOM Solid State Amplifiers

- ACOM 500S, 600S, 700S, 1200S
  “CAT/AUX” connector: DE-15F

Table 2-1

CAT/AUX interface	PIN NO	PIN NAME	DESCRIPTION	SPECIFICATIONS
Rear panel view	1	RxD	Received Data	TTL input
	2	RxD	Received Data	RS232 input
	3	TxD	Transmitted Data	RS232 output
	4	TxD	Transmitted Data	TTL output
	5	GND	Ground	0 Volt
	6	BAND voltage	Analogue input	0 to +5V
	7	Band data 0	Bit 0	TTL input
	8	Band data 1	Bit 1	TTL input
	9	Band data 2	Bit 2	TTL input
	10	Band data 3	Bit 3	TTL input
	11	ON RMT	Remote Pwr On	+4.5 to + 15V / 2mA max
	12	Debug mode	CPU only Pwr input	+8 to + 15V / 0.4A
	13	KEY-IN	Tx Request	Less than +12V / 5mA
	14	KEY-OUT	Tx Ready	O.C. output, up to +30V / 200mA
	15	GND	Ground	0 Volt

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ICOM 19

Ameritron Solid State Amplifiers

- For ALS-500M, ALS-600, ALS-1300 series, use ARI-500 Interface and transceiver cables

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ICOM 20

Elecraft KPA500

- “AUX” Connector: DE-15M for Band Data, K3/K4
  ICOM Band Voltage, but no ICOM CI-V support.
  RS232 “XCVR” Connector: DE-9M (RS232) for Kenwood

Signal Name	Pin	Direction	Notes
Band VRef (Icom)	1	In	Reference for Icom input – connect to 8V
AuxBus I/O	2	Out	K3 Only
Band1 In	3	In	BCD Band Input – Bit 1*
NC	4		
GND	5		
Band V (Icom)	6	In	Uses Icom standard band voltages
Alarm Out	7	Out	Drives low for fault input Not used by K3. Must not be connected to K3.
Power On/Off	8	In	Pulse low to turn KPA on or off – do not hold low!
Band2 In	9	In	BCD Band Input – Bit 2*
Key	10	In	Low enables amplification. Internally pulled up to +5V. Sources 1 mA when pulled to ground. Diode isolated from the PA KEY RCA jack.
Inhibit	11	In	Low inhibits amplifier operation
GND	12		
Band0 In	13	In	BCD Band Input – Bit 0*
Band3 In	14	In	BCD Band Input – Bit 3*
ALC	15	Out	ALC output to transceiver

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ICOM 21

Elecraft KPA1500

- With built-in Antenna Tuner
  “AUX” Connector: DE-15M for K3/K4 Band Data,
  Elecraft AUXBUS, ICOM Band Voltage
  “XCVR Serial” Connector: 3.5mm TRS for
  Kenwood / Yaesu RS-232 *or* Icom CI-V

Signal Name	Pin	Direction	Notes
Band VRef (Icom)	1	In	Reference for Icom input – connect to 8V
AuxBus I/O	2	Out	K3 Only
Band1 In	3	In	BCD Band Input – Bit 1*
NC	4		
GND	5		
Band V (Icom)	6	In	Uses Icom standard band voltages
Alarm Out	7	Out	Drives low for fault input Not used by K3. Must not be connected to K3.
Power On/Off	8	In	Pulse low to turn KPA on or off – do not hold low!
Band2 In	9	In	BCD Band Input – Bit 2*
Key	10	In	Low enables amplification. Internally pulled up to +5V. Sources 1 mA when pulled to ground. Diode isolated from the PA KEY RCA jack.
Inhibit	11	In	Low inhibits amplifier operation
GND	12		
Band0 In	13	In	BCD Band Input – Bit 0*
Band3 In	14	In	BCD Band Input – Bit 3*
ALC	15	Out	ALC output to transceiver

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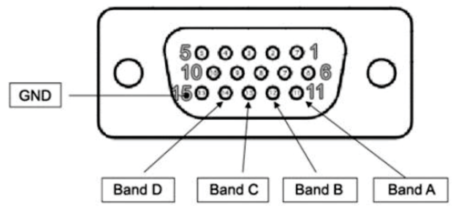
ICOM 22

FlexRadio Power Genius XL (PGXL)

- DE-15F for Elecraft or Yaesu Band Data (x 2)
  DE-9M for RS-232 (x 2), Ethernet LAN port for Flex,
  3.5mm TS for ICOM CI-V (x 2)

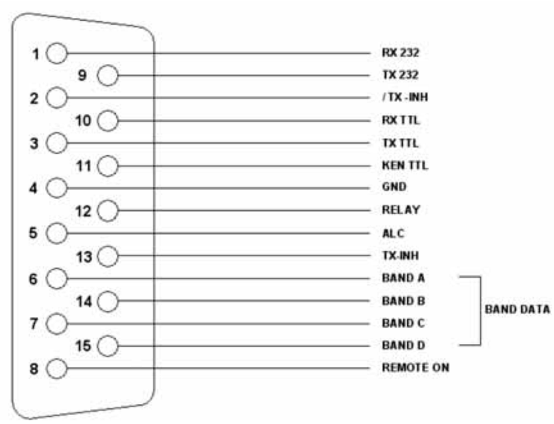


RF Kit RF2K-S

- USB Type A Connector Supports FTDI USB-to-Serial adapters or USB-to-CI-V (CT-17) interface cables. LAN support. No Band Data input.

SPE Expert 1K, 1.3K, 1.5K, 2.0K-FA

- DA-15F (x 2) for RS232, CI-V, and Band Data input



Standalone Band Decoders

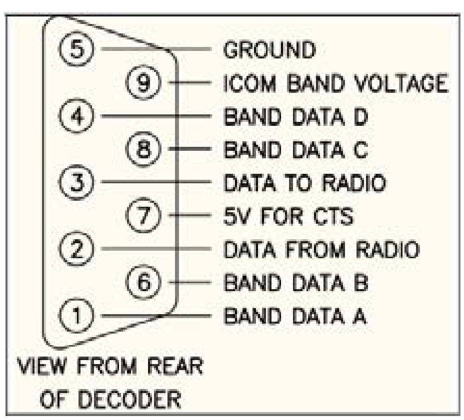
- Connect Band Decoder input to transceiver
  - Band Data, Icom Band Voltage, CI-V, or RS-232
- Connect Band Decoder output to Antenna Relay Box and/or Bandpass Filter Box
- Output is typically 13.8V “Source” or 0.0V “Sink”, one line per band
- For triband antennas, Band Decoder can be programmed to select same output line for multiple bands

Array Solutions BandMaster III, IV, V, Shack Master SM-8

- Decodes Band Data, RS-232, or ICOM CI-V
- Drives Antenna Relay box and/or BPF box

Array Solutions BandMaster III, IV, V

- All use the same DE-9M connector for Band Data, Icom Band Voltage, and RXD/TXD RS-232 DATA



Elecraft KRC-2 Band Decoder

- Interior screw terminals for inputs and outputs

HamPlus MBD-8G Band Decoder

- Decodes ICOM CI-V, Elecraft/Yaesu BCD, and Kenwood RS-232
- Drives HamPlus Antenna Relays, Bandpasser II Filter
- “SEND” In / Out jacks prevent antenna hot-switching during TX

EA4TX RemoteBox

- Decodes Elecraft or Yaesu BCD, Icom Band Voltage (no CI-V)
- PTT input prevents hot-switching
- TX Inhibit option prevents transmission if two rigs are on same band

This is the Pin Out of the Band Data port:

- Pin-1: Common Ground
- Pin-2: Band Data A
- Pin-3 Band Data B
- Pin-4 Band Data C
- Pin-5 Band Data D
- Pin-6: Inhibit (see *Note 1)
- Pin-7: PTT In
- Pin-8: Not used
- Pin-9: Band Voltage Input (ICOM)

Top Ten Devices Band Decoder and Band Aide

- Yaesu/Elecraft Band Data
- No longer in production ☹

Unified Microsystems BCD-14 + HSD-9

- Yaesu/Elecraft Band Data with “High Side Driver”
- “Some assembly required”

Automatic Antenna Switches

- Controlled by one or two band decoders
- Switches to correct antenna automatically, when rig changes band
- Prevents two rigs from using the same TX antenna at the same time
- Uses low loss, high power relays

Ameritron RCS-8V and RCS-10
8- and 10-port Remote Coax Switches

- Replace the Ameritron manual switchbox with an automatic band decoder
- One +13.8V line in control cable selects one antenna port

Array Solutions EightPak 2x8 Antenna Switch

- Controlled by a pair of BandMaster Band Decoders
- Prevents 2 radios from connecting to the same antenna at the same time

FlexRadio Antenna Genius 8x2 Switch

- Built-in Band Decoder (nice)
- DE-15F for Elecraft or Yaesu Band Data (x 2)
- Same Band Data pins as PGXL.
  LAN Port for Flex.
  New Dual PTT IN/OUT (RCA) prevent hot-switching

HamPlus AS-62 Antenna Switch

- 2 inputs, 6 Outputs
- Driven by HamPlus Band Decoder

microHAM micro SIX and DOUBLE SIX, switches (10 port version also available)

- One +13.8V line in control cable selects antenna port
- Connect control cable to Band Decoder output

EA4TX AS2x8 Antenna Switch

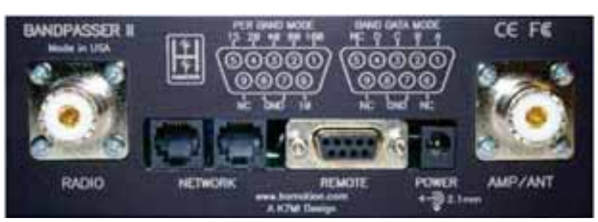
- Connect control cable to RemoteBox output

Automatic Bandpass Filters

- A must for operating SO2R, Multi-Op, or Field Day with more than one TX
- Attenuates nearby signals from adjacent bands
- Typically 100 to 200W max.
- High Power BPFs are also available, but much larger, much more expensive, noisy fans
- Will not attenuate in-band harmonics
- Switch BPFs to correct band *automatically* to prevent filter damage, high SWR

Array Solutions AS-419 “BandPasser II”

- Same as SureFire BF-100 with different label
- Built-in Band Decoder for Elecraft / Yaesu Band DATA



DuneStar 600

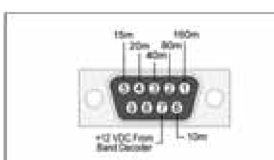
- Requires Source or Sink Band Decoder to DE-9M connector (see manual)

DB9 Pin outs:

(1) Brown 160M
(2) Red 80M
(3) Orange 40M
(4) Yellow 20M
(5) Green 15M
(6) Blue 10M
(7) Violet Ground (gray on older models)
(8) White Not Used
(9) Black +12V
Shell Shield

DX Engineering DXE-419-P

- Requires separate Band Decoder with "Sink" outputs to DE-9F "BAND IN" jack:

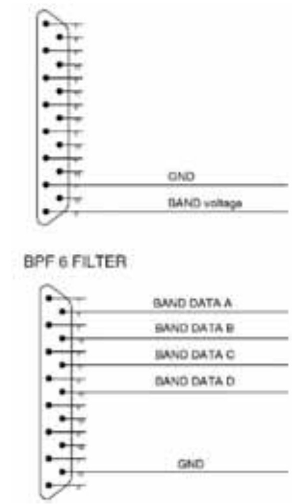


DB-9 Connector on rear of unit

Pin	Band Decoder minus trigger signal
1	160 meters selected
2	80 meters selected
3	40 meters selected
4	20 meters selected
5	15 meters selected
6	10 meters selected
7	+12 VDC from Band Decoder
8	No Connection
9	No Connection

OM Power OM6BPF

- Built-in Band Decoder (Elecraft, Yaesu, Icom Band Voltage)



Automatic Antenna Tuners

- Once programmed for each segment, tuner remembers the tuning solution(s) for that frequency
- Tuner restores correct tuning solution, based on rig's frequency, well before you transmit
- Tuner can bypass itself automatically when SWR is low
- Tuner may remember multiple solutions per frequency to support multiple antennas

Elecraft KAT500

- DE-15M and DE-15F passthrough for Elecraft AUX CABLES
- 3.5mm TRS “PC DATA” for Kenwood RS-232
- Safety feature: Opens amplifier keying line when tuning

FlexRadio Tuner Genius XL (TGXL)

- Same connectors and pins as PGXL
- Recommendation: Use CAT or CI-V or LAN
- Safety feature: Dual PTT IN / OUT to amplifier

Kessler Engineering AT-AUTO

- Not to be confused with Palstar AT-AUTO
- The Kessler can track rig frequency by RS232 instead of RF

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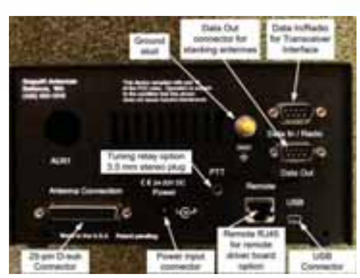
ICOM 49

SteppIR Automatic Antenna Controller

- FluidMotion, SDA100, SDA2000, OptimizIR
- Tracks by RS-232 or CI-V – set AutoTrack ON
- Custom SteppIR interface cable or S-BOX required
- “PTT” Relay Interrupt opens amp. keying line while antenna is tuning



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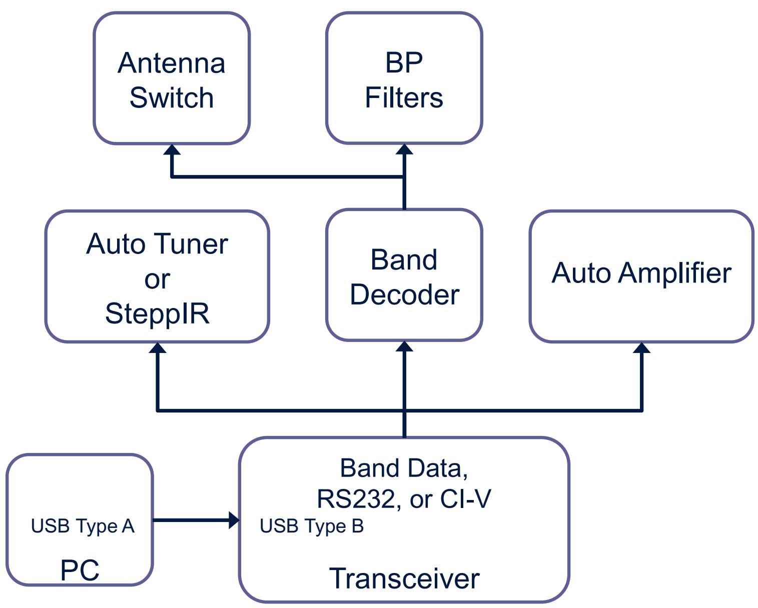
ICOM 50

WiMo Ultrabeam RCU-06 Antenna Controller

- Tracks by RS-232 or CI-V, Poll ON or OFF set by app.
- Tuning Relay Interrupt opens Amp. Keying Line while tuning

"So how do I connect all this together?"



Interface Cables

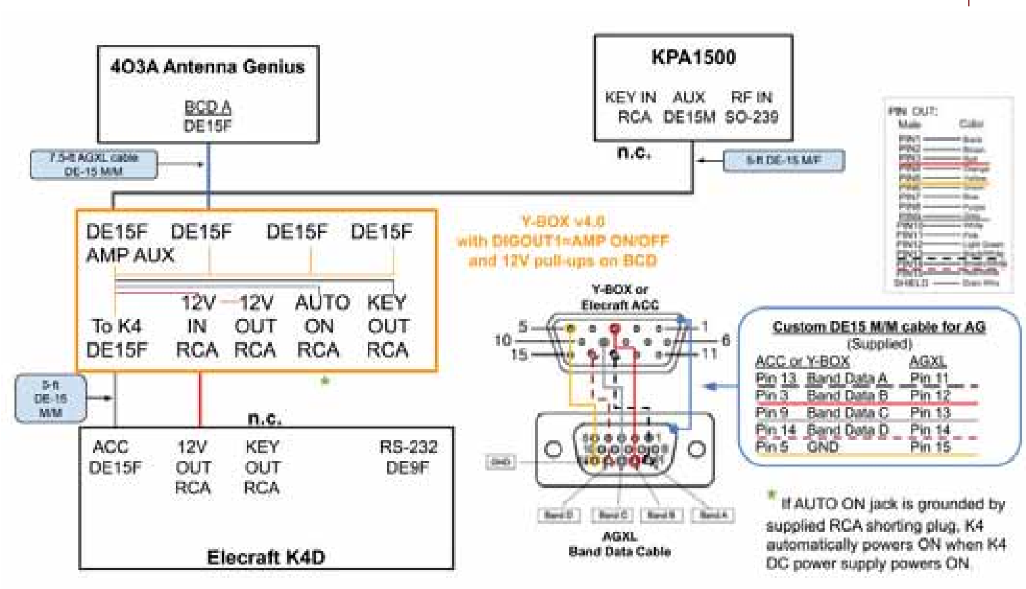
- Check DXE website or eBay
  - Many premade "Interface Cables" are listed
  - But some only provide a "Band Data" and "Keying" connection instead of RS-232 / Frequency.
- You can also try to build your own from the documentation and pinouts
- Things get more complicated when you need to split Band Data Outputs or a single RS-232 connector to multiple devices (PC, Amplifier, BP Filters, SteppIR Controller)

Y-Cables for Band Data outputs

- Wiring Band Data Lines in parallel generally works OK, if voltages are compatible
- Winford Engineering CDY15HDMFF:

- N6TV Y-BOX:

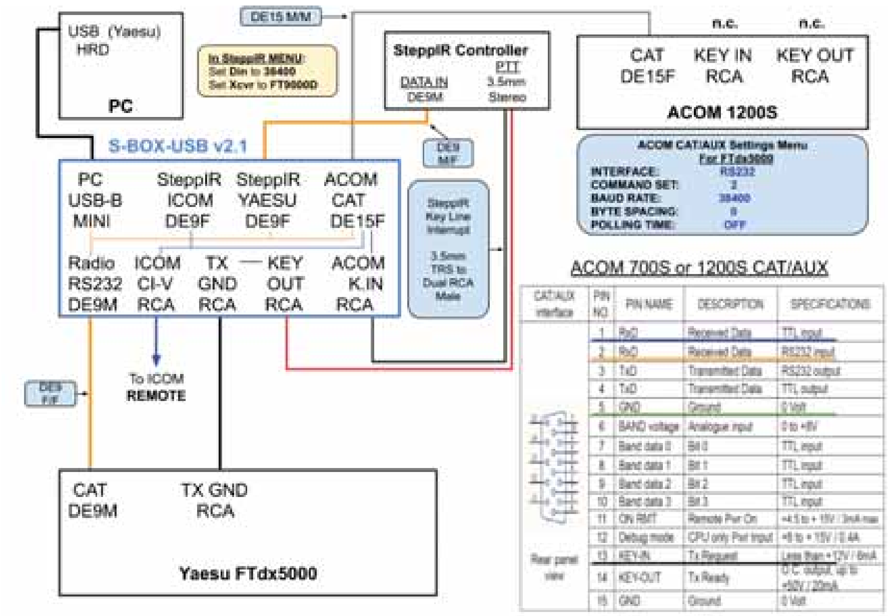
Typical Y-BOX Block Diagram



Sharing Transceiver RS-232 port requires special wiring

- Cannot wire two Pin 3s (“TXD”) lines in parallel
- Simple DE-9 Y-cables will *not* work
- Connect only *one* TXD line to radio for polling
- Wire RXD lines (Pin 2) in parallel to all devices
- The N6TV S-BOX and S-BOX-USB
  - Connects rig to SteppIR controllers, ACOM, SPE, RF Kit, etc. using standard molded cables

Typical S-BOX Block Diagram



Key Recommendations

- When possible, let the transceiver drive the devices, instead of PC ports or software
- Use Band Data when frequency is not needed
  - BPFs, Antenna Switches, Broadband Amplifiers
- Use RS-232 or CI-V data when frequency is needed
  - Amps with tuners, SteppIR Controllers, automatic tuners
- Use off-the-shelf solutions if you're not comfortable wiring your own interconnection cables, in other words …
- "If you don't know what you're doing, please don't *do* anything."

References

- Product websites
- https://www.qrz.com/db/n6tv - Links to this and other presentations
- https://bit.ly/Y-BOX - The “Y-BOX” by N6TV
- https://bit.ly/S-BOX - The “Serial Box” by N6TV
- n6tv@arrl.net

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ICOM 59

Questions?

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ICOM 60

CTU Presents

Busting Contesting Myths to Get Started in RadioSport

Anthony Luscre, K8ZT

CTU CONTEST UNIVERSITY ICOM

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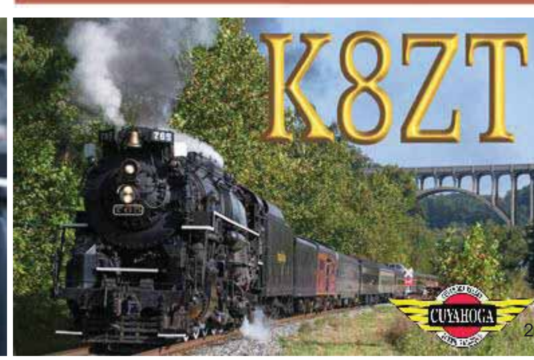
- Email - k8zt73@gmail.com
- Website - www.k8zt.com



2

There are many slides & links so you're probably going to want to review the extended version of Today's Presentation

View complete slide show and access links at

tiny.cc/ctu-myths

If you need a PDF copy click here

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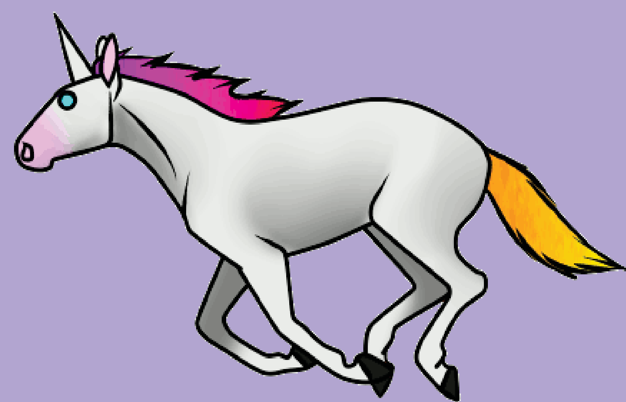
ICOM 4

Contesting Myths



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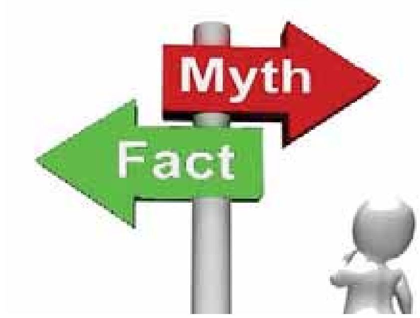
Contesting Myths

- New Contesters and even some veterans are often confused by a number of Contesting Myths



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6

Biggest Myth of All

- The biggest Myth is that There is **ONLY ONE WAY** to Contest

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ICOM 7

Contesting Myths

- You must get a Trophy/Plaque to be Successful
- You must have a Kilowatt
- You must have Stacked Yagis
- You need Antennas (or Radios) that cover every band
- There is only One Mode for Contesting
- There is no Digital Contesting

8

Contesting Myths

- All Contest Scoring is the Same
- Sending in a Log with My Score would be Meaningless
- There is No Way to Keep Up With All the Available Contests
- There is no way to know how well I did in a contest until final results are published/posted

9

You must get a Plaque to be Successful

- Hams actually contest for many reasons both competitive and noncompetitive
  - Competitive participation means trying to finish with the highest possible score
  - Noncompetitive participation is focused on other Amateur Radio goals

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ICOM 10

You must get a Plaque to be Successful

- **Competitive Contesting, Your Way**
  - Set your own goals
    - Surpass last year's score
    - Place first in a sub-category (high score for your state, call area, etc.)
    - Choose single-band, single-mode categories
    - Continue to improve over time

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ICOM 11

You must get a Plaque to be Successful

- **Noncompetitive Contest Participation**
  - Award Chasing- DXCC, WAS, WAZ, etc.
    - *AJ8B - Chasing DX During a Contest*
  - County hunting
  - Improving operating skills
  - Testing antennas, equipment, etc.
  - Portable operations
  - Social aspect of multi-op

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You must get a Plaque to be Successful

- **How to be more Competitive & Get that Plaque**
  - You are competing against yourself... Improving in each contest is the best measure of success
  - Seek out a competitor who 'mirrors' your station/skills and have a friendly competition in the contest. Challenge them so you both have a goal in the contest
  - Practice, Practice & more Practice

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ICOM 13

You must get a Plaque to be Successful

- **How to be more Competitive & Get that Plaque**
  - Try entering smaller contests to have a better chance of finishing higher (i.e. State QSO Parties)
  - Choose contests & categories in which you & your station are more competitive (contests favoring your region, that best match your antennas, different power levels categories, assisted vs. non-assisted categories, etc.)

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ICOM 14

You must have a Kilowatt

- Actually using a kilowatt limits you to one power entry category- probably the most competitive
  - Amplifiers only increase outgoings signals, but gain antennas work on both transmit & receive
  - If you want even more of a challenge than 100 watts give QRP Contesting a try- *tiny.cc/ctu-qrp*

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ICOM 15

You must have Stacked Yagis

- Having the best possible antennas is always a great start to a successful contesting station
  - But, towers and yagis are not possible for many hams
  - Recently more contests are including new restricted antenna overlay categories

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16

You must have Stacked Yagis

- **Limited Antenna Overlays**
  - ARRL's new *Limited Antennas Overlay*-
    "... operation is limited to use of single-element antennas, such as a single vertical, an end-fed wire, or a single dipole antenna no more than 50 feet above ground at its highest point. The antenna(s) may cover multiple bands, as in the case of multiband verticals and dipoles with fan or trap constructions."

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ICOM 17

You must have Stacked Yagis

- **Overlay Categories**
  - There are other *overlay categories* new contesters should be aware of:
    - TB-Wire (T): tribander for 10-20m and single-element wire antennas for 40-160m
    - CLASSIC (C): single op, no assistance, 1 radio, max 24 hrs
    - ROOKIE (R): licensed less than 3 years
    - YOUTH (Y): less than 26 years old

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ICOM 18

You need Antennas (or Radios) that Cover Every Band

- There are single band contests
- Even in multiband contests missing one or two bands (especially lower bands in DX contests) may not affect your score that much
- Many operators in VHF/UHF contests use only two of the many bands available (there are also 3-Band & FM Only Categories)

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ICOM 19

There is Only One Mode for Contesting

- Many contesters have personal preferred modes
  - Many prefer CW, but don't let that force your choice
  - Don't limit yourself to a single mode and thus limit your chances for success (especially as a beginning contester)

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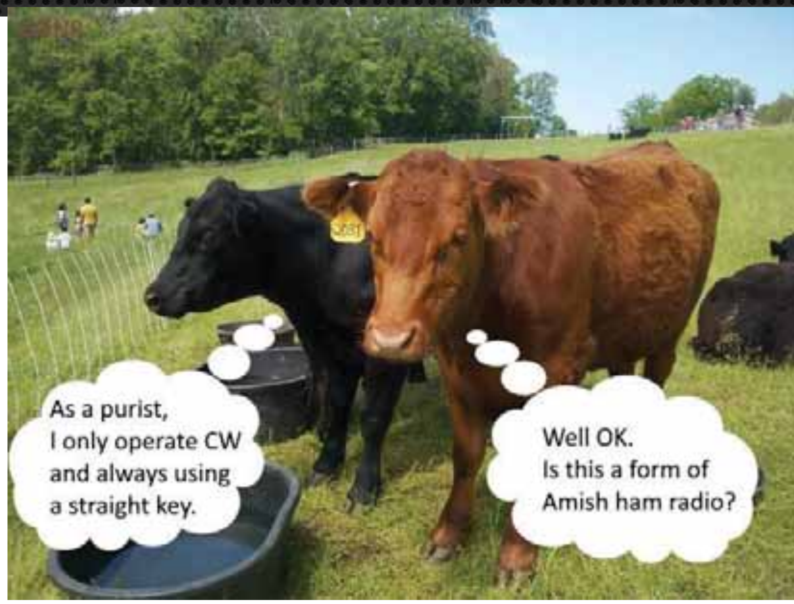
ICOM 20

There is only one mode for contesting



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ICOM 21

There is only one mode for contesting

- **Single Mode Contests**
  - CW
  - SSB
  - Digital
    - RTTY
    - FT8/FT4
    - PSK
    - Other Digital Modes

- Even a few contests with AM on HF & FM on VHF/UHF

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ICOM 22

There is only one mode for contesting

- **Multiple Mode Contests**
  - Typically CW & SSB or CW, SSB & Digi
  - Require some planning to optimize your scoring
    - Different point values per mode?
    - Where can you personally get best QSO Rate?
      - Operating Speed vs. # of Available potential contacts
    - How are Multipliers counted?
      - Per Contest, Band, Mode or Band & Mode

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There is only one mode for contesting

- **If you really want to try CW contesting, but don't know CW**
  - Long Island CW Club
    - Website - *longislandcwclub.org*
    - Video - *youtu.be/yhGLn3btTS0*
  - CWops Academy
    - Website - *cwops.org/cw-academy*
    - Video - *youtu.be/yegPZTAHYJ4*

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There is only one mode for contesting

- Bands for Contesting
  - Typically contesters focus on multiband HF Contests
  - Typically no contesting on WARC & post-WARC Bands
  - But there are also…
    - Single Band Contests (esp. on 160 & 10 M)
    - VHF/UHF Contests

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ICOM

25

There is no Digital Contesting

- We already busted that myth
  - Check out two CTU presentations
  - Digital Contesting
    - Traditionally focused on RTTY
    - Now there are also FT8/FT4 contests
    - Other contesting Digital modes- PSK, wide variety of DSCMs (Digital Sound Card Modes)

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26

All Contest Scoring is the Same

- No, the way contests are scored can very widely
  - How Multipliers are counted
    - By Contest
    - By Band
    - By Mode
    - By Band & Mode
    - Contests with Double Multipliers
    - Contests with No Multipliers at all

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ICOM 27

All Contest Scoring is the Same

- No, it can very widely
  - Point Values per QSO
    - Different by Modes
    - Different by Bands
    - Difference by Location of Station
    - Distance between stations (often using Grid Squares)
    - Bonus Stations

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ICOM 28

All Contest Scoring is the Same

- No, it can very widely
  - Power, in addition to separate entry categories or in lieu of separate entry categories
    - Multiplier by power level of transmitting station (typically <5, <100, >100)
    - Multiplier for working QRP stations (Stew Perry 160)

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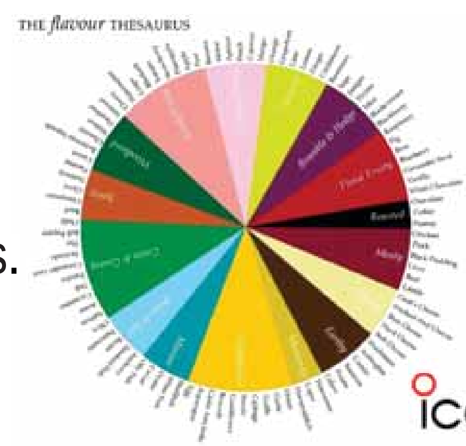
ICOM 29

All Contest Scoring is the Same

- Not only can scoring be different, different contests have different “flavors”, each with its own subtle differences
  - This is one of the great things about contesting, providing opportunities for hams with different tastes.



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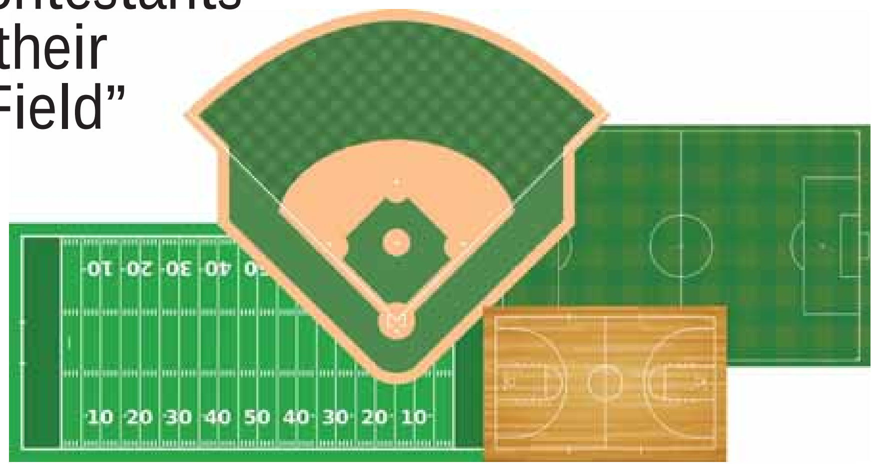
ICOM 30

All Contest Scoring is the Same

- Unlike most other sports competitions, in Radio Sport, contestants get to choose their own “Playing Field”



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All Contest Scoring is the Same

- By choosing specific contests and entry categories you can best match your…
  - Interests & Modes
  - Operating skills
  - Radio equipment & antennas
  - Level of competitiveness

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All Contest Scoring is the Same

- You can also choose specific contests that also favor...
  - Your Geographic Location
  - Specific Bands
  - Increasing your DXCC, WAS, etc. totals
  - Winning or finishing in a top spot

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All Contest Scoring is the Same

- Avoiding the Multipliers Only Trap
  - Although multipliers can be important you still need points to multiply them by

Points X Multipliers = Score

  - The more stations you work the better your score
  - That is also why QSO Rate & BIC Time is so important

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ICOM 34

All contest scoring is the same

- Multiple Factors lead to contest scoring success

Factors Contributing to Contest Scoring Success		
1	**Number of QSOs**	Running (Calling CQ) with prolonged high rates is key to high numbers
2	**Point Values of QSOs**	Can be greatly influenced by Geographic Location
3	**Multipliers**	Importance to Final Score influenced by individual Contest's Rules
4	**Secondary Multipliers**	Varies by Contest, may include Power and/or Mode multipliers, Multipliers by Band, by Mode or One Time, Scoring by Distance, Bonus Points for working certain stations or station types
5	**Accuracy**	Avoiding UBNs, Lost Points, Lost Multipliers, Penalties, etc.
6	**Competition**	Who you are competing against varies by year, category, etc.

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ICOM 35

Sending in a Log with My Score would be Meaningless

- Actually you never know; your score could be the highest one in your category
  - Or at least highest in your State, Division or Section
  - This is even more likely if you are in a rare location, smaller entry category or an overlay category
    - Certificate on right was from an entry using an FT-817 & the included 6 Meter Rubber duck whip

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Sending in a Log with My Score would be Meaningless

- **Sending in a Log can have Additional Perks**
  - Your call will start to get included/recognized
    - In Super Partial Check (SPC)
    - By those that sponsor the contests
    - By those that read the results
    - By local Contesting Clubs
  - In addition to submitting your log to contest sponsor make sure to submit all results to 3830 website

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There is No Way to Keep Up With All of Available Contests

- There are actually a number of great websites, bulletins & journals that can keep you up on what is going on in the contesting world

There is No Way to Keep Up With All of Available Contests

- Contest Calendars

WA7BNM Contest Calendar

ARRL Contest Calendar

Ham Radio Contest Calendar DL2NBY

N2SLN- VHF/UHF Contest Calendar

State & Province QSO Party Calendar

State QSO Party CHALLENGE

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There is No Way to Keep Up With All of Available Contests

- News, Bulletins & Journals
  - *ARRL Contest Update*
  - *National Contest Journal*
  - *NG3K- Contesting*
  - *K8ZT.com Contesting*
  - *DXnews- Contesting*

ARRL Contest Update ARRL

NG3K ADXO CIS-Pfx ContestAO

DXnews.com More than just DX News

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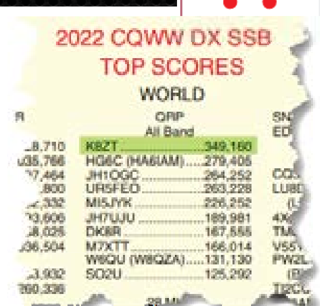
There is No Way to Keep Up With All of Available Contests

- **Contesting & Other AR News**
  - Video- youtu.be/iF59esKcfRs
  - Slideshow- *tiny.cc/qst-arn*

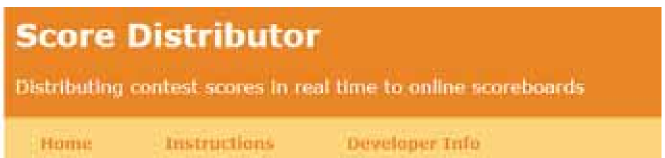
There is no way to know how well I did in a contest until final results are published/posted



- For the Final Results, You do need to wait for them to published/ posted, **but...**
  - There are many other ways to assess your relative scoring/finishing position...
    - During the contest
    - Before posting of final results

How Am I Doing ?

- Online Live Contest Score Boards
  - During the contest you can:
    - Participate in real-time contest score websites like *CQ Contest.net* & *Contest Online Scoreboard*
    - You can use Contest Score Distributor (*scoredistributor.net*) to post to multiple scoreboard sites



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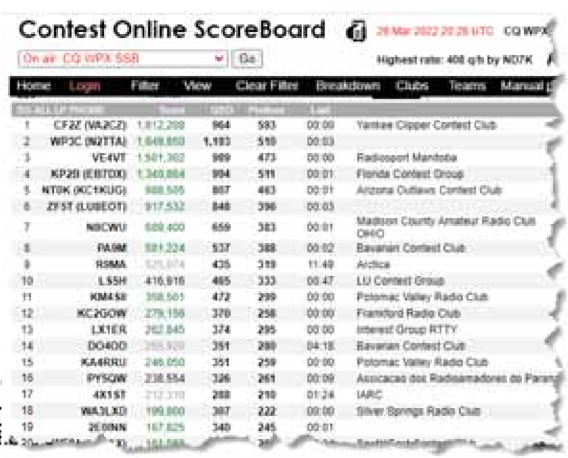
How AM I Doing ?

- Participate in real-time contest score websites like *CQ Contest.net* & *Contest Online Scoreboard*



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How Did I Do ?

- 3830 Website
  - While you may be waiting months for results, in the meantime you can:
    - After the contest- post your scores & monitor other's results on "contest score rumor" sites like *3830 Scores*
      - Video- *youtu.be/Lwfe6c4T_BA*
      - Slideshow- *tiny.cc/3830*

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Questions / Comments ?

View this slideshow and access all resources links at

tiny.cc/ctu-myths

If you need a PDF copy click *here*

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Presentations

- If your local club is interested in a online presentation I am currently offering multiple options, for a list visit

tiny.cc/k8zt-p

- Email me if interested k8zt73@gmail.com

This list- tiny.cc/k8zt-p	Slideshow	Video
Amateur Radio Logging- ARRL Webinar	tiny.cc/arrl-log	https://ww
Choosing Your Ideal Callsign- QSO Today Expo 2021	TBA	TBA
Dx Engineering Interview by K3LR- K8ZT		https://www
Field Day In Social Distancing	tiny.cc/fdsd	https://yout
FT8/FT4 Digital Modes	tiny.cc/ft8ft4	
Fun with Morse	tiny.cc/fwm	https://yout
Intro to AR Contesting	TBA	TBA
N1MM Contesting Software- Elmering Day	.cc/n1mm-eln	https://yout
Pandemic Ham Radio Activities An Opportunity to Grow- RATPAC	ny.cc/clubcovi	Jan 27, 2
QRP Amateur Radio	tiny.cc/qar	
QSLing In Digital World	tiny.cc/qx3	https://yout
Radio, Radio, Radio- 100 yrs of Commercial Broadcasting	tiny.cc/rrradio	https://you
RATPAC Programs Listings	ny.cc/ratpac-list	
RATPAC- Ham Radio- Online Meeting Resources	tiny.cc/hromr	https://vime
Software & Web Resources for Contesting	ny.cc/gl-contest	
State QSO Party Challenge	tiny.cc/stqspc	https://yout
Technicians, Life Beyond Repeaters	tiny.cc/btech	
Top Secret Techniques to WAS & DXCC	tiny.cc/ham50	
Youth in Amateur Radio	tiny.cc/yiar	

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CTU Presents

The Road to WRTC 2026 in the United Kingdom

Mark Haynes M0DXR

Traditional Contesting – fair game?

- A station on a hilltop will have a louder signal than a station in a valley
- A station with a big antenna will have a louder signal than a station with a smaller antenna
- DX stations in rare countries attract more callers than stations in non-rare countries
- Operator ability also counts...a lot...but...

What if… (a quick recap)

- All operators were in the same geographic region on flat ground?
- All operators had identical antennas?
- All operators used 100-Watt transmitters?
- All operators had a referee looking over their shoulder?

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WRTC!

- WRTC is an “Olympic-style”, every-4-years, ham radio world championship
- All two-operator teams get identical antennas and are in the same area
- Operating skill and strategy will determine the winning team

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WRTC Goals

- Publicise radiosport worldwide both inside and outside Amateur Radio
- Facilitate international gatherings of radiosport participants
- Promote advances in radiosport technology, such as:
  - Team operating technique
  - Real-time scoring and logging
  - Spectator viewing and education
  - Log-checking and reporting
  - Operator ranking and comparison
- Encourage the growth of radiosport participation worldwide, especially to:
  - Youth and young adults
  - Regions with populations under-represented in radiosport

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WRTC 20 year vision

- Premier international radiosport event
- Competition between teams attracting participants, spectators and mainstream sport media
- Development of radiosport standards for operating, adjudication and technology.

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WRTC History

1990 - Seattle

1996 – San Francisco

2000 – Slovenia

2002 - Finland

2006 - Brazil

2010 - Russia

2014 – Boston

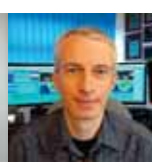
2018 - Germany

2022 (2023) - Italy

2026 – United Kingdom

WRTC 2026 – the organising team

Mark M0DXR
Chairman & Programme Manager



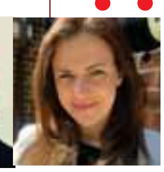
Lee G0MTN
Vice-Chairman & Director of Rules

Fred G4BWP
Director of Finance

Chris G0DWV
Director of Fundraising

Andy G4PIQ
Director of Sites and Stations

Steve M1ACB
Director of Volunteers



Georgina M6YGL
Director of Hospitality

IT Team

Tim GW4VXE
Peter 2M0SQL
Michael G7VJR

Advisory Committee

Tim K3LR	Olof G0CKV
Robert G3NSM	Bob MD0CCE
John K1AR	Kam N3KS
Chris DL1MGB (also on SC)	

Sanctioning Committee POCs

Doug K1DG	Tine S50A
Chris DL1MGB (also on AC)	

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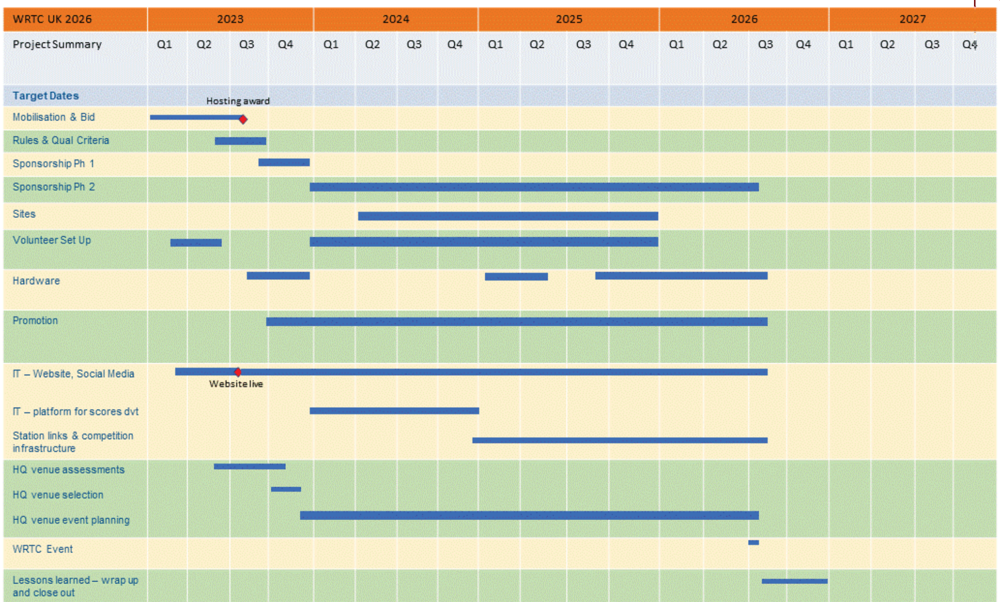
Plan on a page



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Key project activities to date

- Work has been underway for 12 months+
- Creation of core team, creation of WRTC hosting bid
- Registered WRTC 2026 as a Community Interest Company
- In person presentation at WRTC 2022 closing ceremony, announcement of WRTC 2026 in the UK and launch of website and social media channels.
- Raising focus of WRTC 2026 online, in the amateur radio press, and at radio conventions.
- Successful sponsorship request programme began with corporate, club and individual supporters.
- A key part of the operating site infrastructure is already complete with agreement to obtain antennas and masts used in Italy.
- HQ venue identified following down-selection process. Contract signed.

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Qualifying Contests - a competitors jouorney to WRTC

Contest	Value	2023	2024	2025	# of Events
CQ WW DX CW	1000	X	X		2
CQ WW DX SSB	1000	X	X		2
CQ WW WPX CW	950		X		1
CQ WW WPX SSB	950		X		1
IARU HF Championship	1000		X		1
ARRL Int. DX CW	800		X	X	2
ARRL Int. DX SSB	800		X	X	2
WAE DX CW	900		X		1
WAE DX SSB	900		X		1
All Asian DX CW	800		X		1
All Asian DX SSB	800		X		1

KL9A's road…

Physical training
feeds mental training…

{OPEN}

…and helps you be
ready for the contest!

{OPEN}

Team breakdown

WRTC	Qualifying Teams	Wild Cards	Previous Champions	Youth	Donor / Sponsored Teams	Total
UK 2026	42	1	1	4	2	50
Italy 2023	47	3	0	4	4	58
Germany 2018	49	7	1	3	5	65
USA 2014	51	2	1	1	4	59
Russia 2010	44	1	1	0	4	50
Brazil 2006	52	1	2	4	3	62

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Area and Team breakdown

There are 42 qualifying teams across 30 Qualification Areas

Continent	Teams from Continent	Qualification Area	Countries in Qualification Area	Teams from Area
Europe	18	EU #1	ES, JW, JX, LA, LY, OH, OH0, OJ0, OY, SM, TF, YL	2
		EU #2	3A, C3, EI, F, LX, ON, PA	2
		EU #3	DL, OE, OK, OZ, HB9, HB0	4
		EU #4	CT, CU, EA, EA6, ZB	1
		EU #5	9H, I, IS0, T7, TK	1
		EU #6	4O, 9A, E7, ER, LZ, S5, SV, SV5, SV9, YO, YU, Z3, Z6, ZA	3
		EU #7	EU, UA1-6, UA2	2
		EU #8	G, GD, GI, GJ, GM, GU, GW	1
		EU #9	HA, OM, SP, UR	2
North America	14	NA #1	W1, W2, W3 (ME, VT, NH, MA, RI, CT, NY, NJ, DE, MD, PA, DC), 4U1UN	3
		NA #2	W4 North (KY, VA, TN, NC)	1
		NA #3	W4 South (AL, GA, SC, FL)	1
		NA #4	W5 (TX, NM, OK, AR, LA, MS)	1
		NA #5	W6 (CA)	1
		NA #6	W7 (WA, OR, ID, MT, WY, UT, AZ, NV)	1
		NA #7	W8 (MI, OH, WV)	1
		NA #8	W9 (WI, IL, IN)	1
		NA #9	W0 (ND, SD, MN, NE, IA, CO, KS, MO)	1
		NA #10	VE1, VE2, VE3, VE9, VO, VY2, VY0	1
		NA #11	VE4, VE5, VE6, VE7, VE8, VY1, KL7	1
		NA #12	CQ Zones 6, 7, 8, VP9	1
Asia	5	AS #1	CQ Zone 17, 18, 23 (except BY), UA9 in Zone 16	1
		AS #2	CQ Zone 20 (AS portion), 21	1
		AS #3	CQ Zones 22, 24, 26, BY/23,9M2, 9V	1
		AS #4	CQ Zone 19, 25 (HL-JA)	2
Africa	1	AF #1	Africa North/West or South/East *	1
South America	2	SA #1	CQ Zone 11 (PY-ZP)	1
		SA #2	South America except CQ Zone 11: CQ Zones 9-10 or 12-13 *	1
Oceania	2	OC #1	CQ Zones 27, 28, 31 (minus 9M2, 9V)	1
		OC #2	CQ Zones 29, 30, 32	1

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Referees

- Each team will be assigned a referee
- Referee applications will become live in 2025
- Role of the referee

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WRTC 2026 and Youth

Philipp DK6SP and Jamie M0SDV @ WRTC Italy

Alan, G4DJX will assist with youth visits to HQ and education programme

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WRTC 2026 Site Selection

Responsibility of Andy G4PIQ

55 site locations required of equal terrain and RF/noise performance

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How will we arrange the sites?

- On broadly flat & clear terrain
  - East Anglia
  - But using terrain analysis software to optimise
- Away from significant noise sources
  - Noise surveys planned for sites
- Where possible in clusters
- With at least 500m between sites
- Examples
  - Privately-owned back gardens, orchards, farms
  - Town/county/parks, recreation/conservation land
  - Other local club Field Day sites in SE England

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Typical site

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The Insides Evolve

2002 – Finland – G4PIQ + G4BWP

2010 – Russia – G4BUO + G4PIQ + UA9MA ref

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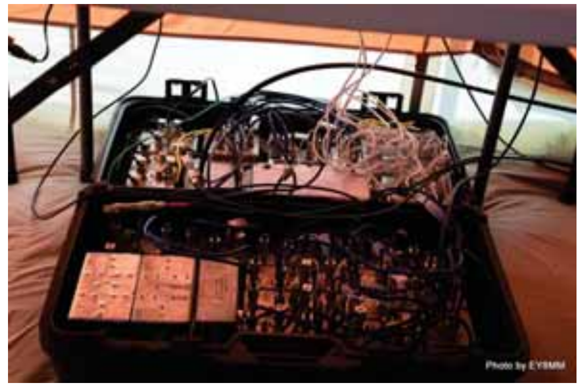
Some Hours in…

2014 – USA – G0CKV + M0DXR



"Wireless?" – K1LZ + YT6A's switching

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Site testing

- Representative stations set up for testing during the IARU Contest in July 2025 using the official antennas
- Signal reports from the Reverse Beacon Network (RBN) will be used to *help* verify that the sites perform equally well
- Logs from the testing will be made public so competitors can review band strategy
- Sites that are "too loud" or "too weak" or that have noise will not be used

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HQ Venue

- Conference complex
- Accommodation facilities
- Able to support large ceremonies / parties
- Reasonable access to operating sites
- Transport links (airports, roads, railway)
- IT infrastructure
- Suitable HQ Venue identified and contract signed – details to be revealed !

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Schedule for week long 2026 Event

- Arrival of 100's of international visitors
- Opening ceremony
- Competitor and referee meetings
- Site visits and testing
- Allocation of sites, referees and callsigns
- Socialising and having fun!
- WRTC Contest
- Log checking and adjudication
- Sight-seeing and tourism
- Results presentation and closing ceremony
- More socialising and having more fun!









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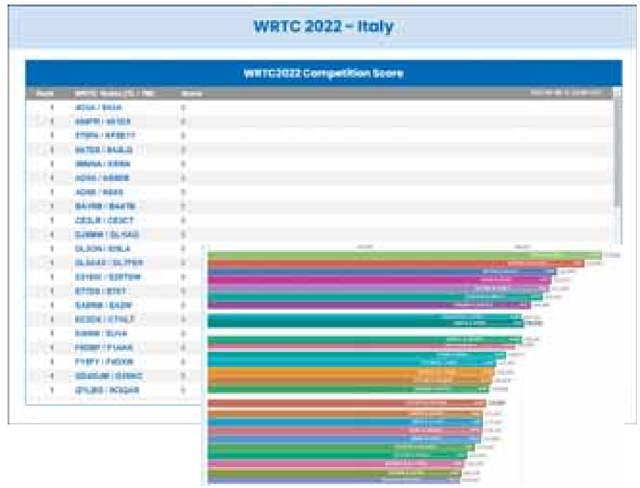
Live scoreboard and media

- Intent to have live updating scoreboard during the contest.
- Possibility of 'sports event' type internet broadcast explaining the game and analysing the strategies in real time to a worldwide audience.
- Media team will stream news and events from the ceremonies and around the HQ complex.
- Separately a film team we aim will record WRTC 2026 for a documentary video.



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Volunteers

There is no WRTC without an army of volunteers!

Helping visitors with transportation and contest preparation

Site managers and hosts

Site build and tear down

Many different skill sets needed!

Make great friendships and special memories at a unique international event in the UK.

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WRTC Fundraising

- Corporate Sponsors
- Radio Clubs/Organisations
- Individual sponsors
- Sponsored teams (min. qty. 2)
- Tent sponsors
- Raffles
- Auctions
- Hardware at the end

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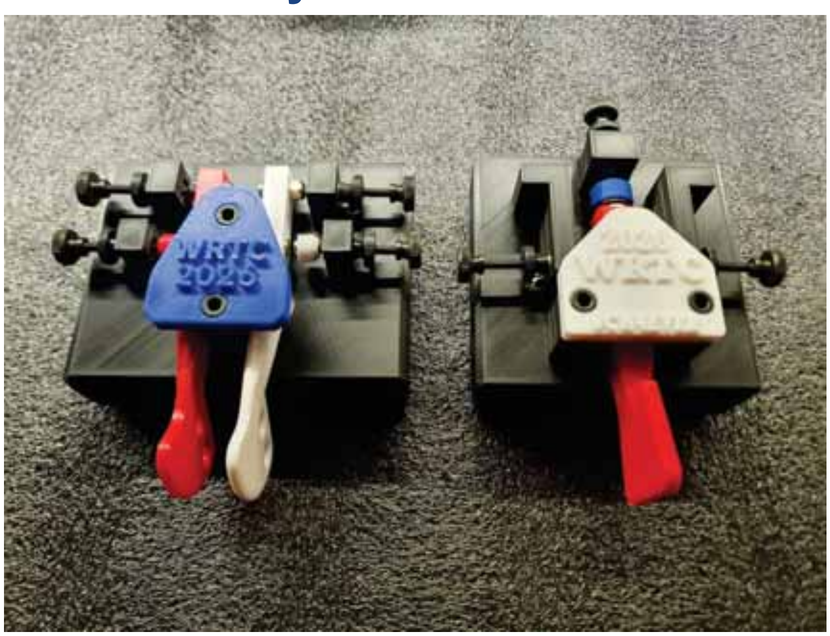
WRTC Mose Keys



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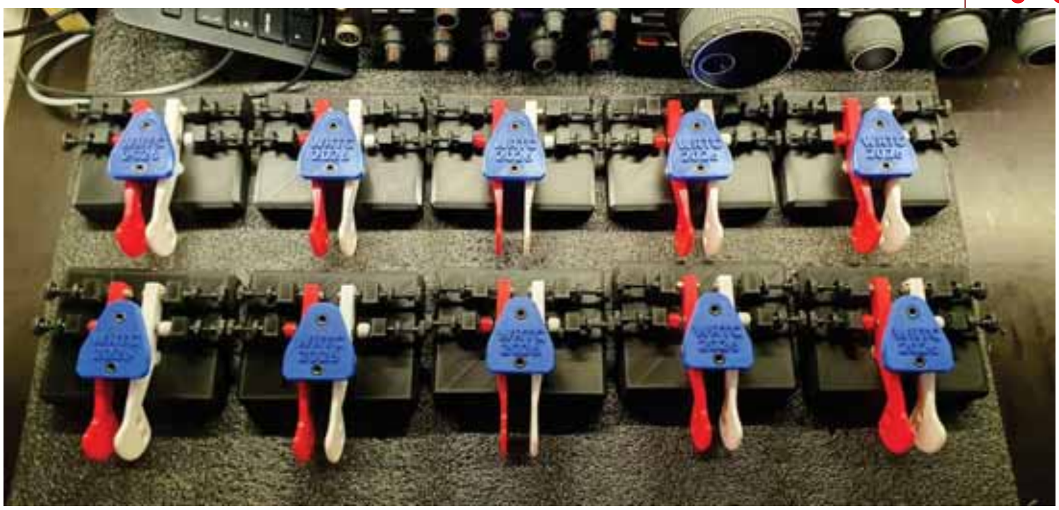
WRTC Morse Keys



WRTC Supporter Coin Programme

Bronze Coin: Min £100 donation in 2023/4

Silver Coin: Min £100 donation in 2025

Gold Coin: Min £100 donation in 2026

Don’t delay! Get involved!
Plan your own road to WRTC!

- Team Leader
- Team Mate
- Referee
- Volunteer
- Sponsor
- Spectator

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Find out more…

www.wrtc2026.org

info@wrtc2026.org

WRTC2026

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Tower Safety

Tim Jellison W3YQ/KL7WV

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Some disclaimers:

- I am not a certified instructor.
- You will not be a certified climber after this talk.
- I am, however, a certified climber/rescuer.
- My only goal is to help you stay safe.

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Hazards

- Electrocution
- Structure Failure
- Incapacitation (Don’t climb crank-ups)
- Falls

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Hazards

- Electrocution

Check for powerlines before beginning work.
Dipoles, verticals, towers, Yagis, ropes.

They’re all conductive.

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Hazards

• Structural failure

Check all guy wires.
Check foundation.
Check for rust/degraded components.
Cheap hardware used?
Guyed towers need to be straight and plumb.
Install temporary guys when stacking or dismantling towers.

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Hazards

• Incapacitation

Know your body.
Heat/cold. Both can tap your strength.
Work slowly and methodically.
Insects and birds.

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Hazards

- Falls

Any fall could be fatal.
Even falling 10 feet could kill you.
100% tie-off. No free climbing. No exceptions.

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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

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- 100% Tie off. No free climbing!
- Always use a full body harness.
- It will keep you safe(r) and it will greatly assist the rescuer during a rescue.
- I use a DBI Sala Exofit harness. But there are all kinds of approved options on the market.
- None of it is cheap, however. But what's your life worth?

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

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Positioning Device

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Double Fall Arrest Lanyards

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Double Fall Arrest Lanyards

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Full Body Harness

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Fall Arrest Equipment

- The true, proper and safe methods of using fall arrest equipment is complicated and beyond the capabilities of this class. But we'll do our best.
- Using it improperly can be dangerous. And it might give you a false sense of security.
- Taking a professional tower climbing class is highly recommended.

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Fall Arrest Equipment

- The forces exerted on your body during a fall will surprise you.
- The tie-off point for your fall arrest equipment is critical.
- And while (if used properly) the fall arrest equipment will save your life, you WILL be hurt.

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Fall Arrest

Only attach to the back, dorsal D-ring.

Your attachment point must hold 4000 lbs.

Will it hold a pickup truck?

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

Snap around the tower leg instead

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

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- Using man lifts and cranes cost you some $, but they're a good way to do tower work. And do it safely.
- When using a man lift or a man basket hung from a crane, a full body harness with fall arrest lanyard MUST be used.

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

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And above all, when climbing follow all safety rules!

NO SK's

Antenna/Tower Reliability

Tim Jellison W3YQ/KL7WV

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- Use quality materials (don't be a cheap ham!)
- Do it right the first time
- Perform regular inspections
- Be safe when working on antennas and towers
- Is it K3LR approved?

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Use only good quality materials

- Name-brand connectors only

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Use only good quality materials

- Only use good quality tape. NO ZIP-TIES

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Use only good quality materials

- Consider pre-made cables

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When soldering PL259's, don't be afraid to use a big iron and get the connector hot – the solder must flow. Just keep everything straight in-line and be sure to let it cool down completely before you move it. That way the center dielectric will harden back up. I let mine sit about 10 minutes after soldering before doing anything with it.

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Moisture is coax's worst enemy. All outdoor connections must be properly sealed. Here's a proven method to keep connections dry.

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Weatherproofing connections

- First, tighten with pliers. Finger-tight is not good enough.

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Weatherproofing connections

- One wrap of 88 tape. And always cut the end when taping. Never pull/tear the end or you'll end up with a tail.

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Weatherproofing connections

- Add a layer of mastic.

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Weatherproofing connections

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Weatherproofing connections

- Two wraps of 88 tape. Overlap each layer by ½ the width of the tape.

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- There are two tips in the next photo.
- First, tape your cables with 88 tape – no tiewraps. Tiewraps can smash the coax and they will eventually fail due to weathering.
- Second, always put a barrel at the top of your tower if the feedpoint is out of reach. Makes antenna removal much easier.

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Use a piece of split loom if there's a concern about cables rubbing.

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Waterproofing a bearing

- Does your antenna sometimes not turn in the cold weather? It might be ice in your thrust bearing. Make a boot out of one of these.

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Waterproofing a bearing

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It can also keep the water out of an Orion 2800's top bearing.

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The bolts in a TB3 can seize up. Apply anti-seize before installation or swap out the bolts with stainless (and maybe still use anti-seize?)

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Notice all the blue stuff? You should also use a lubricant on all stainless hardware. Blue Locktite is a good choice. It lubricates, locks, yet can still be removed later.

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Also, when installing a Rohn tower, use anti-seize on the leg joints. It's conductive and makes the inevitable disassembly much easier.

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Does your rotor or antenna slip on the mast? You can add a secondary clamp which will help out your U-bolts. It’s better than drilling/pinning the mast.

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Here we give a Yaesu rotor some help

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Here is a secondary clamp below the mast clamp of a 40M Yagi

If the top section of your tower is above the top set of guys, the leg bolts MUST be tight and should be regularly checked. This is a point of great lateral stress and if the bolts loosen, the holes in the legs will elongate.

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Do not over tighten anything on a Rohn tower leg. You could smash the leg (it can even split) and the tower will be compromised.

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CONTEST UNIVERSITY

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Solder all your crimps, otherwise the wire could pull out. If you're using insulated lugs, don't worry about melting the plastic.

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Conductive paste

- Usable on all metal to metal joints, especially aluminum antenna joints.

And above all, when climbing follow all safety rules!

NO SK's

Contest University 2024

A lot has changed in 10 years.

Are you considering a New Radio?

Rob Sherwood
NCØB

Let's demand cleaner transmitters.
Comments on popular rigs

Sherwood Engineering

Are you considering a new HF rig?

Subjects to emphasize today

Choosing a new rig is both subjective and complex.

What do you need for your typical on-air day?

Mainly operate SSB and FT8? You don't need a $4000 rig.

You may need a better antenna, possibly limited by an HOA or family desiring the antenna be invisible.

What has changed in 10 years?

- While receive-function lab numbers for many transceivers are excellent, the user interface is all over the map.
- I consider everything today an SDR.
- Computer operated or not, software runs all current rigs on the market.

How do we interface with a radio?

- Stand-alone or computer controlled?
- Large or small LCD screen
- Mostly knobs and buttons or touch screen & mouse?
- How complex and intuitive are the menus?
- Is a band scope and waterfall important to you?

How old is your current rig?

- If older than 10 years it is a new experience.
- Major types today:
- Superhet, Hybrid Superhet, Direct Sampling & "IF Direct Sampling" * Coined by Dr. Ulrich Rohde
- TS-890S = Hybrid   New Yaesus = IF Direct Sampling
- Only Kenwood doesn't offer direct sampling.

Does the architecture matter?

- Most of the time it doesn't matter.
- A superhet has a roofing filter, 5 to 70 MHz IF.
- Hybrid Superhet adds a direct sampling band scope
- "IF Direct Sampling" also has roofing filters, ADC at IF.
- Direct Sampling does not have roofing filters.
- If signals are S9+60 dB a roofing filter helps.

A Few Examples per Type

Architectures Dominating Today

- Superhet: TS-590SG, IC-7100
- Hybrid Superhet: TS-890S
- IF Direct Sampling: FTdx-101D/MP, FTdx10
- Direct Sampling: K4D, IC-7610, Flex 6600

- Either direct sampling has ADC in RX path.
- Only IF direct sampling have roofing filters.
- All but superhet have ADC for the band scope.

What often limits reception?

- Receivers cannot eliminate key clicks in your passband or splatter from an adjacent signal.

- Transmit composite noise is mostly a line of sight issue with signals in excess of S9+60 dB

- Composite noise can be a Field Day problem.

- Field Day, very close by hams & MM contest stations are prime cases for a transceiver with a roofing filter.

The Challenge – Cleaner Transmitters

- Since we all share our bands we need to support OEMs who improve their transmitters.
- Competition drove massive RX improvements.
- Can competition do the same for TX?
- Does the typical ham care if his signal is wide?
- He should !

Needed TX Improvements

ARRL Clean Signal Initiative

- Reduce CW key clicks with software update
- Reduce SSB IMD splatter. (Pre-distortion?)
-
- Today that is Apache PureSignal & Icom DPD
- (Yaesu Class A no longer offered)
- Reduce TX Composite Noise
- (Usually an excessive AM noise issue)

Some tips from contesting experience

- You can learn a lot from proper receiver settings and band scope observations.
- Preamps and attenuation are tools to be used when appropriate, not on by default.
- Let's take a look at 10m and 160m examples.

December 2018

Over 20 stations in 10 kHz   TS-890S

ARRL 10m Saturday afternoon

Note preamp

Bottom of the sun spot cycle 2018

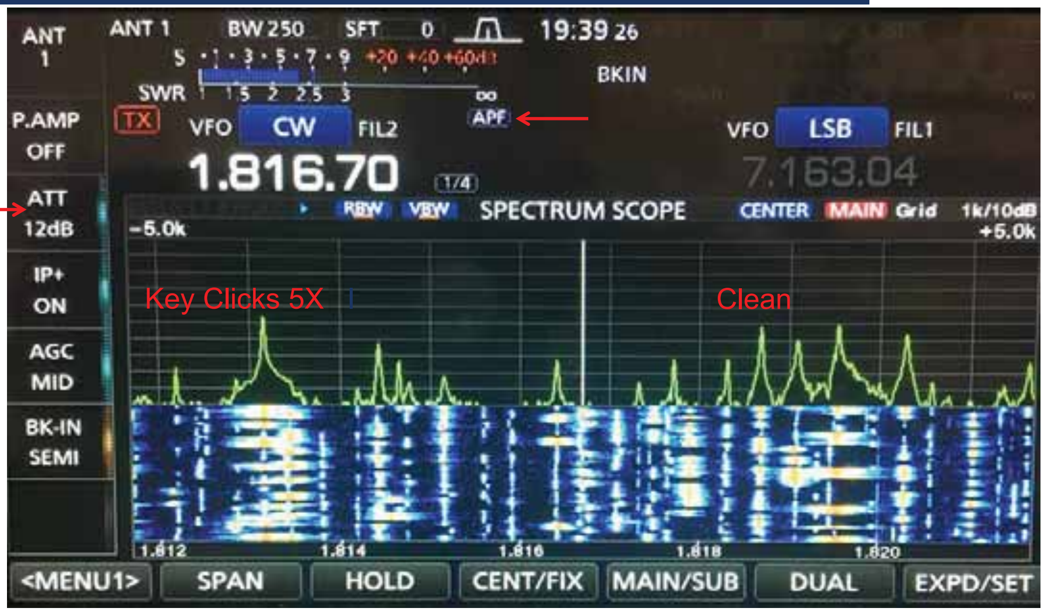
December 2018

Over 30 stations in 10 kHz   IC-7610

ARRL 160m CW Friday 7:40 PM

Note

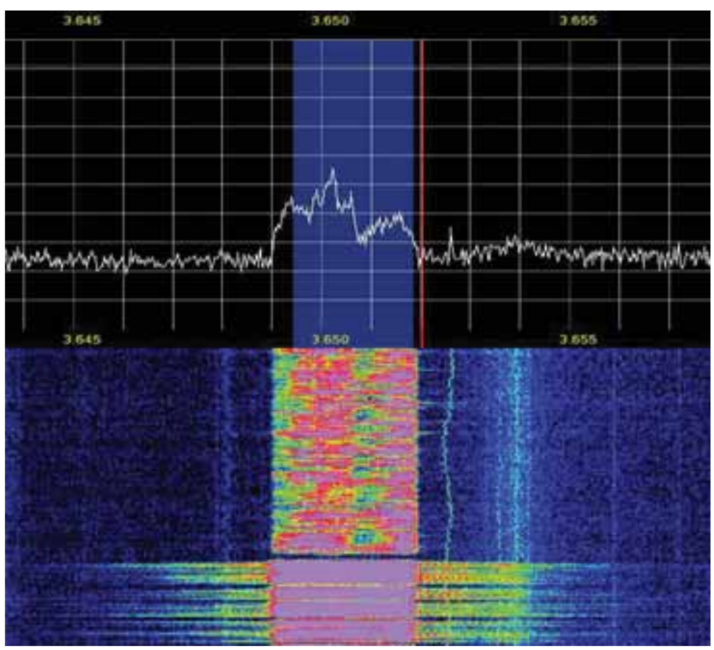
ATT



IC-7300 & TS-990S 18 dB attenuation example 2019

Both stations running legal limit amplifiers

Typical SSB Splatter vs. PureSignal Adaptive Pre-distortion



Class A is gone with current rigs

Icom now offers DPD predistortion

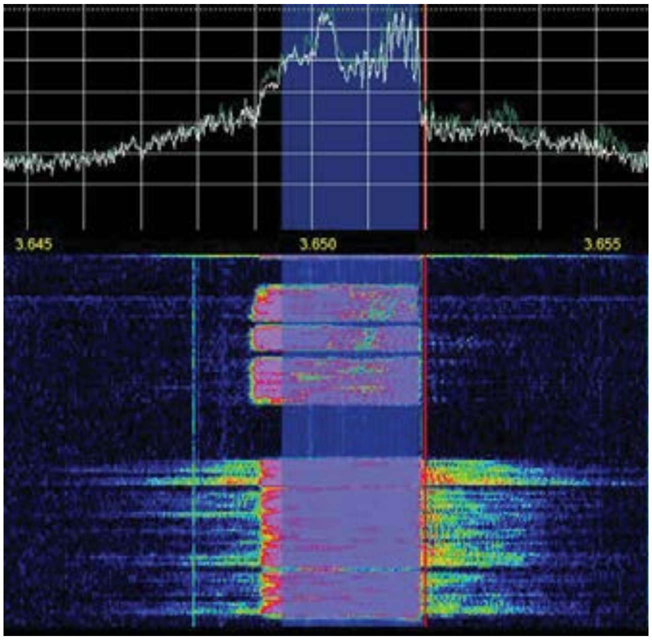
Flex & K4 maybe someday ?

Apache PureSignal for 10 years

Kenwood TS-890S

Both stations 75 meters S9+30 dB

Typical SSB splatter vs. Icom Digital Pre-Distortion (DPD)



Display 10 kHz span
Apache 7000DLE RX

Blue shading is the
2.4 kHz RX bandwidth

Icom 7610 with DPD
driving an Acom 1000
(Amp not in DPD loop)

Flex 6700 driving a
PowerGenius XL

IMD down more than 45 dB max hold 15 seconds

Icom Digital Pre-Distortion for cleaner SSB

On-air bandwidth screen capture 10 dB per division 25 kHz span

Is it time for a new rig in you shack?

- There are lots of great choices today if you operate contests or DX pile-ups.
- In general if all you do is rag chew and operate FT8 your current rig is likely fine.
- Current rigs with built-in sound cards make WSJT X or other digital software setup much easier than years ago.

Top 25 out of 150 radios nc0b.com

Lab data from my web site

Dynamic Range of Top 25 HF Transceivers

Yaesu FTdx-101D	110 dB	
Yaesu FTdx10	107 dB	
Yaesu FT-710	107 dB	
Elecraft K3S	106 dB	
Icom 7851	105 dB	
Kenwood TS-890S	105 dB	
Hilberling PT-8000A	105 dB	
Elecraft KX3	104 dB	
Apache 7000DLE	103 dB	
Elecraft K4	101 dB	
Yaesu FTdx-5000D	101 dB	
Flex 6400	100 dB	
Flex 6600	99 dB	(16 dB preamp ON)
Flex 6700 (2017)	99 dB	(Preamp OFF)
Icom 7610	98 dB	(IP+ ON)
Icom 7300	97 dB	(IP+ ON, S/N around 10,000 and up)
Flex 5000	96 dB	
Ten-Tec Orion II	95 dB	
Ten-Tec Orion I	93 dB	
Kenwood TS-590SG	92 dB	
Ten-Tec Eagle	90 dB	
Flex 6300	89 dB	
Icom 705	88 dB	(No IP+ ADC linearization)
TS-990S	87 dB	(RMDR limited close-in)
Elecraft KX2	86 dB	

You can effectively work DX and Contests with any of these fine transceivers.

New price range $900 to $12,560+

Used market price even lower !

100 dB radios unheard of 20 years ago !

I have run contests with 20 of these 25

How do you select a new radio?

- Do you pick one of those top 25 models?
- Married to one brand? Pick $ that fits your budget.
- Price range for new rigs $900 to $12,000+
- Ergonomics and User Interface (UI) are important
- Quality of Noise Mitigation – NB and NR
- Antennas are more important than the rig model.
- Location, Antennas, Operator Skill, Radio Model

Every ADC needs preamp gain on upper HF bands

Direct Sampling Radio Examples

You need to know your radio

Model	Noise floor no preamp	Dynamic Range
Flex 6600	-111 dBm	99 dB
Flex 6400	-112 dBm	100 dB
Elecraft K4	-121 dBm	101 dB
Yaesu FT-710	-127 dBm	106 dB
Apache 7000	-131 dBm	103 dB
Icom 7610	-132 dBm	98 dB
Icom 7300	-133 dBm	97 dB

Up to 22 dB gain differences with no preamp or attenuation.

With the Flex you likely need preamp gain 20m and up.
With the Icom you likely need attenuation on 40m and down.

None of the designs are right or wrong, but they are VERY different.

Current Rig Offerings

- Subjective comments to follow on several different current transceivers.
- Observations from operating all the following transceivers in major CW and SSB contests.

User Interfaces all over the map

Main Architecture Types Today

- Hybrid Superhet, Direct Sampling or IF Direct Sampling
- Most common UI today: Internal LCD or computer screen
- Flex runs on Windows or Apple OS
- Apache Windows only, except new G2 Raspberry pi 4 piHPSDR
- Windows updates can "break" things !
- Complication – Computer OS not real-time operating system
- All others are stand-alone embedded operating system
- How you interface with your radio is very personal.
- Let's look at some examples.

Prices as of January 3, 2024

Some Rig Price Comparisons

Model	Price	New since 2020
Elecraft K4D	$6480 (tuner included)	Yes
Yaesu FTdx10	$1400	Yes
Icom IC-705	$1350	Yes
Yaesu FT-710 AESS	$1000	Yes
Yaesu FT-710 Field	$900	Yes
Icom IC-7300	$1000	For comparison
Icom IC-7610	$3250	
FTdx-101D	$3250	
FTdx-101MP	$4550	
TS-890S	$4000	
Flex 6600	$4600	

Comments on Flex

- Preoccupied with a military contracts several years
- Focused last 5 years on remote and contesting
- Very few DSP improvements for years
- Some CW bugs have been around for a very long time.

- Very loyal customer base
- No schematics or documentation published

- Non-M models are currently shipping. M models will ship this summer. Maestros scheduled to ship 2/19/2024. A few months to fill backlog.

Comments on Apache

- Leading noise mitigation (NB and NR)
- 1 of 2 brands with pre-distortion splatter reduction.
- A fiddlers delight
- Don’t consider it “plug and play”.
- Not recommended for your first HF transceiver.
- Buy a 100-watt standalone radio (no computer).
- Incomplete documentation on dozens of settings
- OEM makes the radio
- Open Source software runs the radio
- Consider a separate computer for just the radio.

Comments on the IC-7300

- A game changer that came out 8 years ago.
- First direct sampling transceiver with knobs
- More than 50,000 sold in just the USA and Canada !
- Good Dynamic Range
- 7300 operates much like more expensive IC-7610
- Excellent ergonomics and scope display
- Common user interface for all the Icom direct sampling transceivers: 7300, 7610, 9700 & 705
- Added scrolling & re-center feature for these Icom rigs.
- Very stable firmware. No Audio Peak Filter (APF)
- Latest firmware 1.42 updated 11/2023, wait for now.

Comments on the Yaesu FT-710

- Yaesu's first direct sampling transceiver
- Similar to IC-7300 but better lab numbers 7 years later

- Price FT-710 AESS: $1000 (with external speaker)
- Price FT-710 Field: $900 (no external speaker)
- Price 7300: $1000
- Price FTdx10: $1400

- User Interface and band scope could be improved.
- Multiple contest evaluations 4th quarter 2022.
(CQ WW CW, ARRL 160 & 10m)

Comments on the Yaesu FTdx10

- Excellent Lab numbers
- Ergonomics different than the FT-710
- User Interface & band scope could be improved.
- "IF direct sampling" superhet with roofing filters
- Both 710 and 10 have an Audio Peak Filter for CW.
- Multiple contest evaluations 4th quarter 2022.
(ARRL 160 & 10m plus Stew Perry Top Band CW)

Yaesu FTdx10 vs. FT-710

- Sitting in front of both it is as if they were designed by different companies.
- Adjusting filter bandwidth & IF shift easy on the 10 and not very flexible on the 710.
- The 10 has the volume control on the left side of the VFO while the 710 has it on the right side of VFO.
- The 710 has less crowded button placement
- Neither of the band scopes and waterfall displays automatically re-center when tuning, a major limitation for me as an S&P contester.

Kenwood TS-590 series

- TS-590SG shipped late 2014
- Excellent overall performer
- Lacks a band scope that is now typical.
- Can be added with an SDR dongle or Elecraft P3
- TS-590S goes back to late 2010
- Reasonable used price option
- Easy User Interface
- I operated both S and SG 160m CW contests several years ago along with T-T Eagle.

Will Kenwood bring out a new rig in 2024?

- The TS-590SG came out in late 2014.
- The TS-890S came out in late 2018.
- TS-890S has the best waterfall in my opinion.
- The HF to UHF TS-2000 discontinued with no replacement.
- Hamvention 2023 only announced a new TH-D75A handheld.
- Planned competitors to 7300 & 9700 have never materialized.
- Every new radio in last 7 years has a band scope and waterfall.

10 watts and a battery

Summits and Parks on the air

- Does operating outdoors interests you?
- Consider the Icom IC-705
- 160 m through 70cm
- SSB, CW, FM, Digital FT8 (with laptop) $1350
- Companion AH-705 single wire tuner $360
- 23 foot single wire plus a radial 40m – 6m
- I worked an IC-705 POTA on new year’s day 2023
  S9 2m SSB signal on a mountain 100 miles away.

Much smaller than 9.3 pound IC-7300

2.4 pound Icom IC-705

Comments on the IC-705

- For HF, operates much like an IC-7300
- Lots of VHF features
- Excellent ergonomics and scope display
- Common user interface for all the Icom direct sampling transceivers: 7300, 7610, 9700 & now the 705
- Display re-centers when tuning as with the other three.
- Operated ARRL 160m & 10m contests December 2020

Comments on the Elecraft K4

- Much of the K3 firmware was ported to the K4.
- Major firmware improvements in the last two years.

- Firmware and features still under development.
- New Beta releases often have new bugs.
- AGC threshold & AF level issues still unresolved.

- The most expensive current mainstream rig. $6480 with tuner
- Price increased 9% April 20, 2023. (Some discounts at festivals)
- HD model, pre-distortion, transverters & remote still in development.

- Customer base is likely past K3 owners.
- Lots of brand loyalty and reflector support.
- Note: With a single multi-band antenna Sub RX cannot be on a higher band than the main RX due to TX low pass filter in the circuit.

Digital Pre-Distortion (DPD) arrived November

Comments on IC-7610 compared to IC-7300

- No noisy relays for T/R or amp key line
- Audio Peak Filter (APF) for CW
- Identical dual receivers, DXpedition split or other band
- More physical buttons and larger LCD screen
- Buttons for each band
- Two transmit antenna ports
- One RX antenna port (Beverage?)
- DVI-D port for external LCD monitor
- Quieter fan
- RC-28 tuning knob for Sub RX $300 as with other brands
- New firmware 1.40 added pre-distortion (DPD) barefoot.
- If you only operate SSB and FT8, IC-7300 is just fine.

DPD = Digital
Pre-Distortion

Don't select a new radio by one single number !

Important factors to consider

- Operator fatigue is made worse by poor receive audio and poor AGC performance.

- NB and NR very important for urban QTHs.
- You might select a radio mainly due to its ability to do noise mitigation.

- Flex may be best for remote operation.
- Apache has PureSignal and great NR & NB.
- Both require an internal or external computer.

- Icom DPD, awaiting PW2 & 3rd party amp hack

More factors to consider

- Bad ergonomics are frustrating.
- Is speech processor adequate?
- Standalone or Computer Operated?
- Is firmware regularly updated?
- Is warranty service done well and quickly?
- Is the radio supported with parts and service after it is out of production? K3?

- Bottom Line: Do you enjoy using your radio?

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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. In 2023 this was modified – the new limit is 250 miles.

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 used to take place (the 3830 reflector) has recently been decommissioned. 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

8-circle

An array of eight vertical antennas arranged in a circle that is electronically steered in eight directions. When used as a receive antenna, short, non-resonant, vertical may be used, most commonly for lower frequencies where full sized verticals would be more challenging mechanically. In receive applications, most array designs use “active” elements, which refers to the use of base mounted preamplifiers.

Categories: station hardware

See Also: Receive antennas

Ack

Shorthand term for acknowledgement of received information. The ack is as old as radio communication itself. In contest use, this is a short transmission that acknowledges the receipt of an exchange or a call sign or other contest information. On CW this might be sent as “TU” or abbreviated to just a dash or dot in high rate situations. On voice the phrases “thanks” or “QSL” communicate the acknowledgement satisfactorily. When there has been a correction, especially to a callsign, it is important to send the corrected information along with the ack. Contest operating techniques that skip or inadequately communicate acknowledgement at the end of a QSO risk causing busted QSOs.

Categories: operating technique

See Also: Bust

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

Couplet

Refers to the pair of QSOs that a station can work on a single frequency during a Sprint contest – which is unique type of contest that requires a CQ-ing station to vacate their frequency after the completion of a QSO (and QSY). You can work a couplet in a Sprint by (i) successfully responding to a CQ-ing station, (ii) staying on the frequency and responding to a station calling you, and then (iii) QSY-ing away after the second QSO (as the rules require). Since the Sprint QSY rules do not permit you to remain on a single frequency to run successive stations as most contests do, completing couplets can be a very effective means of working stations quickly.

Categories: operating technique

See Also: Sprint, Run

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

CWT

A set of popular, informal, weekly contests on CW sponsored by the CWOps club. The CWT's consist of three sessions, each lasting one hour each, on the high bands during the morning, afternoon and evening each Wednesday (North America time). Stations may be worked on multiple bands in each session.

Categories: contest specific concepts

See Also:

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

In-band Station

A station (and operator) that is used on the same band as a Run Station that typically calls other stations who are calling CQ on other frequencies within the band (S&P mode). The in-band station must be inhibited from transmitting at the same time as the Run Station transmits to conform to the rules of most contests. An In-Band Station also needs filtering and receive antenna separation to be able to copy weak signals on the band while the Run Station is transmitting. Sophisticated multi-operator stations make extensive use of in-band stations to work new stations as well as multipliers. Multiple in-band stations, suitably interlocked, have been used as well.

Categories: station hardware, operating technique

See Also: Multi-operator, interlock

Interlock

See Lockout.

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

Jump Ball

Refers to the pileup that can occur when a QSO in a Sprint contest is completed. This is an artifact of the special Sprint QSY rules that require the CQ-ing station to vacate their frequency at the completion of a QSO. It is good practice for the calling station (who will inherit the frequency when the CQ-ing station leaves) to send their callsign at the end of the contest exchange. The intensity of the pileups that can occur at this moment has inspired the "jump ball" phrase to describe them, since the Sprint rules force everyone – big guns and little pistols – to continuously tune and call in these pileups.

Categories: contest specific concepts

See Also: Sprint, sprint logic, ack

K3, K4

A popular HF transceiver available from Elecraft that is used by many contesters. It has been superseded by the newer model, the K4.

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:

Linrad

A free computer program that, together with hardware that converts RF signals to digital form, forms an SDR receiver. Originally developed under Linux, the digital processing enabled by the software can be very effective in weak signal detection in high noise environments.

Categories: contest hardware/software

See Also: SDR

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: contesting hardware/software, ethics

See Also: Multi-operator, single operator

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. The extension “.dta” is not used by all contest software, and the precise format of the file can differ.

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

Multi-operator

A generic term to refer to any contest entry that uses more than one operator performing operating and logging functions. Specific contests have their own rules and terms for multi-operator categories, such as MS, M2, or MM. See the contest specific rules for more specific information.

Categories: operating classification

See Also: M2, MM, MS

Multiplier

See the discussion under mult above.

Multiplier Bell

A frequently used motivational device for multi-operator 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: Multi-operator

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 permitted self-spotting beginning in 2023 for the ARRL DX contests, but other major contest have not followed suite.

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:

Sprint Logic

Refers to the ordering of components in a Sprint exchange, which informs those tuning by on the status of the QSO. Sprint rules require the sending of both callsigns as part of the exchange. If the sending station's callsign is first in the exchange, it means that QSO is still underway. If the sending station sends their callsign at the end of the exchange, it means that the QSO is almost finished, and after the ack, new stations can call.

Categories: contest specific concepts

See Also: Sprint, exchange, ack, jump ball

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

Wideband Recording

Recording an entire segment of a band, which can be "tuned" to hear signals across the band afterwards. This can be done in a number of ways, including using CW Skimmer or other suitable SDRs. Wideband recordings are often used as part of the log checking and verification process.

Categories: contesting hardware/software

See Also: Skimmer

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 and to support advance in DXpeditioning skills, technology, and infrastructure. 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
- Learning and Developing teamwork skills.

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.

In 2023, NCDXF made an initiative to fund youth operators to travel with an NCDXF funded DXpedition. CTU training prepares youth operators for this initiative.

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
Kevin Rowett, K6TD
President, NCDXF

Proud Sponsor of Contest University and World Radiosport Team Championships

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Notes

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