# ·CTU·
# CONTEST UNIVERSITY

**Dayton Contest University**
**May 16, 2019**
**Crowne Plaza Hotel**
**Dayton, Ohio**

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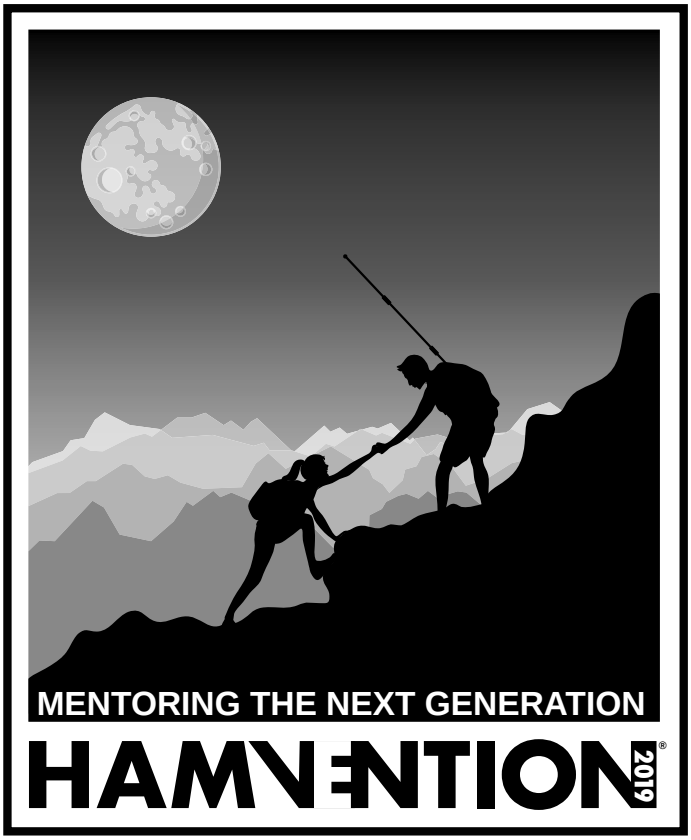


***Hamvention recognizes the great contribution CTU brings to Amateur Radio. It is our belief advancing the art of Contesting advances and elevates the awareness of the finer elements of our hobby. Enjoy this grand weekend where we meet and celebrate Amateur Radio!***

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
Dennis Motschenbacher, K7BV, Director

## Donate

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

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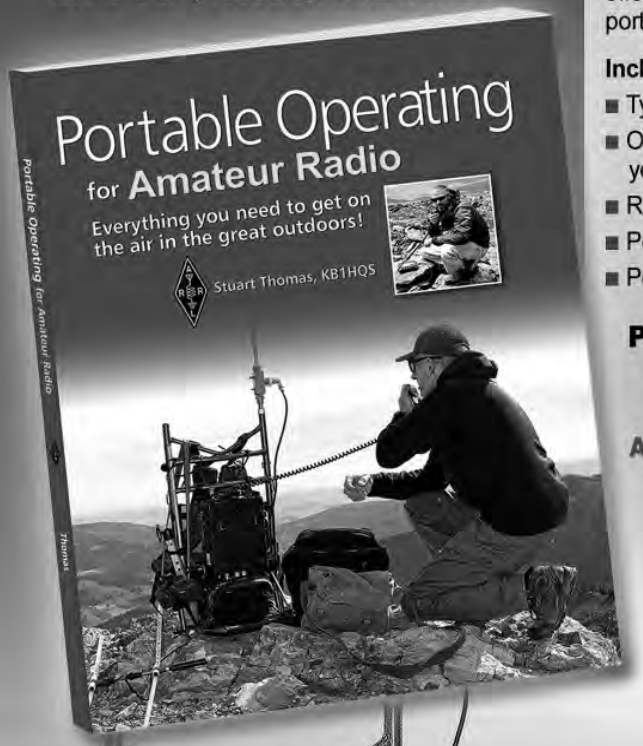
**Chris Clark, W6CBC, ARRL Member**

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# ∘ CTU ∘
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May 16, 2019
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# Welcome

On behalf of the CTU Board of Directors K1DG, N9JA and K1AR, K8MNJ and the 14 CTU Professors of Dayton Contest University 2019 we are pleased you are here, and we extend a warm welcome to you!

There have been more than 40 CTU's held in the past thirteen years. CTU's have been held here in Dayton, Chicago, Brazil, England, Germany, Finland, Italy, Australia, Russia and Puerto Rico.

Over 20 presentations are available here at Dayton Contest University 2019. They are the work product of many hours of effort by your Professors and the CTU staff (special thanks to K8MNJ, N9RV, DL1QQ and K1SO). This year's presentations will include a CTU first, a presentation given by one of the ham radio community's youth, Bryant, KG5HVO. The Youth are the future of ham radio and as the 2018 Young Ham of the Year, KG5HVO is helping to lead the way. We have also given Frank, W3LPL, a much-needed sabbatical. After 12 years of giving two, sometimes even three or more presentations, this sabbatical is a much-needed break. W3LPL will still be on hand to answer some of the questions you may have.

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

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

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

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

Very 73!

Tim Duffy K3LR
CTU Chairman

## 2019 Dayton Contest University "CTU" – COURSE OUTLINE – 7:00 AM to 5:00 PM

7:00 ALL SALONS ABCD – Student Registration and Contest Buffet Breakfast – ALL - 60 minutes
8:00 ALL SALONS ABCD – Welcome to CTU 2019 – K3LR & W8CI – ALL – 10 minutes
8:10 ALL SALONS ABCD – Radio Sport Contesting with Integrity – K5ZD – ALL – 40 minutes

**9:00 CONTEST TOPIC SESSION #1 – attend ONE of 4 sessions – 60 minutes**
SALON A – How to Recruit New Contest Operators – K1DG
SALON B – 2BSIQ & SO3R: Riding the Edge of Human Capabilities – N6MJ
SALON C/D – Everything You Want to Know about USB Interfaces – N6TV
HARDING – FT8 and the WSJT-X 2.0 Software Suite for 6-meter Contesting – W5ZN

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

**10:15 CONTEST TOPIC SESSION #2 – attend ONE of 4 sessions – 60 minutes**
SALON A – All Together Now – Grounding and Bonding For Contest Stations – NØAX
SALON B – No Compromise Remote Contesting – KL9A
SALON C/D – Preparation and Practice for Better Contest Scores – K5ZD
HARDING – Digital Contesting is Fun – WØYK

**11:20 CONTEST TOPIC SESSION #3 – attend ONE of 4 sessions – 55 minutes**
SALON A – New Blood: Drafting the Next Generation of Contesters – KG5HVO
SALON B – Solar Cycle Impacts on Radio Propagation: Forecasting Cycle 25 – WX6SWW
SALON C/D – The Advantages of Waterfall Displays for Contesting and DXing – N6TV
HARDING – Taking Digital Contesting to the Limit – WØYK

**12:15 ALL SALONS ABCD – *CONTEST LUNCH* – ALL – 35 minutes**
12:50 ALL SALONS ABCD – 2019 Eye Ball Sprint Contest "LIVE" – ALL – 10 minutes – K1DG
1:00–1:35 ALL SALONS ABCD – Contest Station Optimization – K3LR

***1:45 CONTEST TOPIC SESSION by REQUEST to RERUN** – 50 minutes
*SALON A – As determined by *vote 1
SALON B – As determined by *vote 2
*SALON C/D – As determined by *vote 3
*HARDING – As determined by *vote 4

**2:40 CONTEST OPEN DISCUSSION Q&A GROUPs – Attend ONE of 4 sessions – 30 minutes**
SALON A – Building and Optimizing Your Station – NØAX and K1DG
SALON B – Waterfalls, Recordings and Reverse Beacon Network – N6TV
SALON C/D – Operating Multiple Radios at the Same Time – N6MJ
HARDING – Antenna/Tower Reliability and Safety – W3YQ

**3:15 CONTEST OPEN DISCUSSION Q&A GROUPs – Attend ONE of 4 sessions – 30 minutes**
SALON A – Space Weather and Ham Radio Propagation – WX6SWW
SALON B – Improving your Contest Scores – K5ZD
SALON C/D – What Attracts Young People to Contesting – KL9A and KG5HVO
HARDING – Digital Contesting Discussion – WØYK and W5ZN

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

4:00 ALL SALONS ABCD – Contest Radio Comparisons & Hybrid Architecture Explained – NCØB – ALL – 50 minutes
4:50 ALL SALONS ABCD – 2019 CTU Survey – K3LR – ALL – 10 minutes

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

**x**

# Biographies

### Randy Thompson, K5ZD

Randy has been licensed and active in contesting since 1973 at the age of 13. He is an accomplished contester, 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" (a post he has held three separate times) and a co-founder of the eHam.net website. Randy was the Director of the CQ WPX Contest from 2008 until 2013 and Director of the CQ World Wide DX Contest from 2013 to 2017. He is a member of the CQ Magazine Contest Hall of Fame. He has competed in five World Radiosport Team Championships and was Co-Chairman of the WRTC2014 organizing committee. When not in front of a radio, Randy does product planning involving the Internet of Things or playing golf any chance he can.

### Doug Grant, K1DG

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

Doug is a past president of the Yankee Clipper Contest Club, past member and Chairman of the ARRL Contest Advisory Committee, member of the CQWW Contest Committee and has chaired the Dayton Hamvention Contest Forum for over 10 years. He is a Director of Contest University and the World Wide Radio Operators Foundation, and was Chairman of the WRTC2014 Organizing Committee. He is currently working on a book about contesting for ARRL, due to be published in late 2019.

### Dan Craig, N6MJ

Dan has been an active ham and contester since he was licensed in 1989 at the age of 8. He has been fortunate to have participated in the last 5 WRTC's, finishing in the top 4 all 5 times including a win in 2014 in Boston. He also holds the call ZF2MJ and has been operating from the Cayman Islands for the previous 5 years as both a single op and part of many multi ops. He has been fortunate to operate from some of the biggest stations across the country, including K3LR, KC1XX, K4XS, K5TR, NK7U and W6YI among others.

### Bob Wilson, N6TV

"TV Bob" is an active CW Contester and Win-Test supporter. Licensed for 47 years, Bob competed at the World Radiosport Team Championship (WRTC) in San Francisco (1996), Slovenia (2000), and Moscow (2010). He finished first in the 2013 ARRL November CW Sweepstakes CW (at W7RN), and the September 2014 NA Sprint CW (from home). In 2017, he was inducted into the CQ Contest Hall of Fame.

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

### Joel Harrison, W5ZN

Joel was first licensed as WN5IGF in 1972. His first contest was the old ARRL CD Party in 1973. His interests later turned to VHF contesting, finally breaking into the top 10 in the ARRL June VHF contest in 1993. In June 1996 he won first place in the single op category setting a new world record under

the call sign WB5IGF. In 1998 he returned to the June contest as W5ZN, once again winning first place and breaking his previous 1996 record, taking the #1 SOHP spot again in 2018. In 2001 he won first place single op in the ARRL UHF Contest and in 2011 the W5ZN team won first place in the Limited Multiop category of the ARRL June VHF Contest. W5ZN was a team member of the record setting WA8WZG contest team in 1999 and 2000 and the K1WHS team that finished first in the multiop category of the 2010 ARRL September VHF contest outing multi-year winner W2SZ. W5ZN is also active in HF contests. In the 2006 ARRL DX Contest he set a new 80 meter CW record for the W5 call area that held until 2009. In 2011 he reclaimed that record that still holds today. He is a member of the N2CEI Multi-op team for the ARRL 160 Meter Contest and in 2016 was a team member of the W2GD CQWW 160 CW Contest Team finishing with the top claimed NA score. In 2015 he challenged a group of “Rookies” in his local club to learn CW and the prize was their operating in the 2015 ARRL Rookie Roundup – CW contest from his station as a Multi-op team that finished with the most Q’s. Joel is on the DXCC Honor Roll for Mixed. Phone & CW and holds 11 band DXCC (160 thru 2 meters) and 11 band VUCC (50 MHz thru 24 GHz), is an A-1 Operator and served as ARRL President from 2006 until 2010 when he retired from ARRL elected service after 27 years. In 2014 he was awarded the ARRL Medal of Honor for outstanding service to amateur radio. He has published 160 meter antenna articles in QEX, NCJ and presented at the Dayton Hamvention® Antenna Forum in 2010 and 2018. Professionally Joel is a Principal Consultant and NDE Level III in ultrasound technology in the nuclear power industry.

**Ward Silver, NØAX**

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

Ward has been an active contester since before his Novice days began in 1972, participating with high school club friends as WA0WBJ and WB0DQI. His list of contest operating spans four continents and includes a variety of good scores from home and multioperator stations such as HC8N, PJ4Q, KH6RS/NH6T, K3LR, K9CT, W7RM, KL7RA, W5ZN, and W1AW. He considers himself fortunate to have a few top finish plaques on the wall of the radio room but the best is participating in record-setting team efforts with friends from around the world.

**Chris Hurlbut, KL9A**

Chris was licensed in 1993 at age 10 as WL7KY. Elmered by my father, KL7FH, and grandfather, KE7MP. I really learned how to operate contests at the KL7Y multi ops. I have been really fortunate to operate at some of the best stations in the world with some of the best ops. Learning from others really helped my enthusiasm and skill level. The K3LR and NK7U multi ops became my contesting homes for several years, and continue to be the highlights of my contest season. Operated WRTC 2006 with Ward, N0AX (8th place), WRTC 2010 (3rd place), 2014 (1st place), and 2018 (3rd place) with Dan, N6MJ. I am more of a multi op guy, but recently I have been dabbling in pushing the limits as a single op in CQWW CW from the TI7W station in Costa Rica. Remote operating is how I am most active, and it is a really great thing for those of us that need to live in the city with strict HOA's. I am also the current NCJ NAQP CW Contest Manager. I manage a large supermarket in Bozeman, MT with my wife and two kids.

**Ed Muns, WØYK**

Ed 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 K0RF multi-multi. Today, CW and RTTY contesting dominate Ed's operating time. His local contest club, the Northern California Contest Club (NCCC), mounted an effort for the club competition gavel first offered in the 2004 ARRL RTTY Round-Up where Ed reluctantly (kicking and screaming) learned how to setup RTTY and ultimately won the Pacific Division SOHP plaque. He ironically enjoyed that induction into RTTY so much that he now includes all the major RTTY contests in his contesting schedule. With his P49X call sign, Ed holds the world SOHP record in ARRL RTTY Round-Up, having broken the record eight times, and the world SOHP record in CQ WPX RTTY, having broken that record seven times and set a world SOHP record in the 2010 CQ WW RTTY. Ed is the contest manager for the NCJ NA RTTY Sprint and the contest director for the two CQ RTTY contests, CQ WW RTTY and CQ WPX RTTY. He and Don, AA5AU, sponsor the Ten-Meter RTTY Contest which they initiated 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 twelfth year at CTU delivering the two Digital Contesting presentations and Q&A.

**Bryant Rascoll, KG5HVO**

Bryant, age 15, was licensed in 2015 after earning the Boy Scout Radio Merit Badge. As an Extra Class operator, he enjoys contesting, CW, and small station antenna building. Bryant was a team member on the 2017 Dave Kalter Memorial YDXA to Costa Rica. He competed in WRTC 2018 in Germany as a youth team member and has written for the *National Contest Journal*, *Solid Copy* (the CWops newsletter), and the *K9YA Telegraph* e-zine. Bryant also serves as the Section Youth Coordinator (SYC) for the ARRL Alabama Section. In radiosport, he enjoys contesting with the Georgia Contesting Club at WW4LL as well as single ops from his home QTH and is a member of CWops. Most recently, Bryant was part of *Team Exuberance*, an all-youth team who competed in CQ WPX SSB 2019 from superstation K3LR. He is the 2018 Dave Pasternack Amateur Radio Newsline Young Ham of the Year and the Radio Club of America (RCA) Young Achiever Award recipient. Bryant also enjoys playing varsity baseball for the Ezekiel Academy Knights and working toward Eagle Scout in Troop 307 in Montgomery, AL.

**Dr. Tamitha Mulligan Skov**

Tamitha Skov holds B.S. degrees in physics and physical chemistry, as well as M.S. and Ph.D. degrees in geophysics and planetary physics from the University of California at Los Angeles (UCLA). In 2004 she joined The Aerospace Corporation in Los Angeles where she is currently a Research Scientist in the Physical Sciences Laboratory. Tamitha works primarily in the fields of solar and space physics research and in the testing of spacecraft materials in realistic space radiation environments. She is an instructor at The Aerospace Institute and has served as an audio forensics analyst and instructor for the National Law Enforcement and Corrections Technology Center (NLECTC), funded by the Department of Justice. Her forecasting work as the **"Space Weather Woman"** is widely known on social media such as You Tube, Twitter, and Facebook. Tamitha has been featured in *Popular Science Magazine* and on television shows for *The Weather Channel* and *The History Channel*. She makes regular appearances on *TMRO.TV* for *Space News* and *TwiT TV* for *Ham Nation*, doing space weather forecasts under her callsign WX6SWW.

**Tim Duffy, K3LR**

Tim has been an active contest operator for over 47 years. He has hosted over 140 different operators as part of the K3LR multi operator DX contest efforts since 1992 – which have made over

770,000 QSOs. Tim served on the ARRL Contest Advisory Committee as a member and multi-year Chairman. K3LR has been an active member of the CQ Contest Committee for 29 years. Tim was the Atlantic Division Technical Achievement award winner in 1998. He was moderator of the Dayton Contest Forum for 10 years and has been moderator of the Hamvention Antenna forum for 36 years. He is a founding member and President of the North Coast Contesters. K3LR serves as founder and chairman of Contest University (13 years) and the Dayton Contest Dinner (27 years), chairman of the Top Band Dinner (8 years) – as well as coordinator of the Contest Super Suite (34 years) in Dayton. He is founder and moderator of the popular RFI Reflector (RFI@contesting.com). He has been a guest on Ham Nation many times. Tim was a member of Team USA at WRTC – five times. Tim serves on the board of directors of the World Wide Radio Operators Foundation (WWROF) as Chairman. He was President of The Radio Club of America (RCA) from 2016 to 2018. Tim is President of the Mercer County Amateur Radio Club - W3LIF (18 years). K3LR was elected to the CQ Contest Hall of Fame in 2006. He was honored with the prestigious Barry Goldwater Amateur Radio service award by RCA in 2010. Tim served as ARRL Section Manager for Western Pennsylvania 2015/2016. K3LR currently serves as a director on the ARRL Foundation board. Tim was honored to be the 2015 Hamvention Amateur of the Year. K3LR was awarded the YASME Excellence Award in 2016. K3LR is a graduate of the Pennsylvania State University. Tim is the Chief Operating Officer and General Manager at DX Engineering.

**Tim Jellison, W3YQ/KL7WV**

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

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

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

**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 over 100 transceivers included at www.nc0b.com/table.html.

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

batch of DSP transceivers. In 2009 I made a presentation at the Dayton Hamvention Antenna Forum on ground systems for vertical antennas.

2016 included a presentation at the Visalia DX Convention. In 2017 I spoke at ARRL Hamcon in Cody Wyoming, and a second appearance at the Duke City Hamfest in Albuquerque, NM. Contest University 2018 was my eleventh annual wrap-up presentation at this event, followed by the Tucson Oro-Valley hamfest later that year.

Other speaking invitations at ham events have included W0DXCC, W9DXCC, W4DXCC, YCCC, New Orleans, Austin, and Huntsville hamfests. Locally around Colorado I have discussed receiver performance at the Boulder Amateur Radio, Northern Colorado Amateur Radio, Colorado QRP & 285 TechConnect Radio Clubs.

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

My most recent new project has been making contacts on the new 630m band with a transverter from Australia. An IC-7300 on 160 meters handles receiver and transmit on 630m. I use my 160-meter Marconi T antenna with a separate tuner. My log includes 32 states, including Hawaii, Alaska and Maine using WSJT X mode JT9. I currently hold the world distance record on 475 kHz of over 8000 miles between Colorado and Australia, and have worked Roger VK4YB three times.

**Frank Donovan, W3LPL**

Frank's contesting career began as twelve year old at the Providence Radio Assn. 1959 ARRL Field Day, W1OP/1, on Neutaconkanut Hill two miles from his home in Providence, Rhode Island. Soon afterwards he began to slowly build his own small contest station on 1/10$^{th}$ acre in a densely populated urban neighborhood.

17 year old K1LPL 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 in first place in the 4A category from a former World War II FCC monitoring site in Scituate, RI. Immediately after college, US Air Force 2$^{nd}$ Lieutenant Frank Donovan's first military assignment was in the Washington D.C. area where he worked under PVRC member W3GN and with his multi-multi mentor W4BVV.

Frank finished first place USA single operator in four CQWW CW and four ARRL CW DX contests from 1973 to 1978. His first multi-multi experience was with the world high scoring 1974 PJ9JT CQWW CW team. W3LPL multi-multi teams started 41 years ago with a small entry in the 1978 CQWW Phone DX Contest. Less than four years later two incredible long nights of 10 meter JA runs unexpectedly produced his team's first USA multi-multi win in the 1982 ARRL Phone DX Contest, the same year that renowned multi-multi competitor W2PV became a silent key.

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

# 2019 Contesting Related Events

**May 15th – Wednesday night**

7 PM Contest Super Suite at the Crowne Plaza opens hosted by the Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and the North Coast Contesters (NCC).

8 PM to 10 PM Dayton Contest University 2019 Registration

9 PM Hamnation Live, Harding Room, 2nd Floor of the Crowne Plaza

10:30 PM Pizza Party in the Harding Room sponsored by Dayton Contest University 2019. **http://www.contestsupersuite.com**.

**May 16th – Thursday daytime**

7 AM Dayton Contest University 2019 Registration opens. Must sign up in advance – **http://www.contestuniversity.com**.

8 AM – 5 PM Dayton Contest University 2019 at the Crowne Plaza – 2nd floor.

**May 16th – Thursday night**

6 PM: RTTY Contesting Dinner, Spaghetti Warehouse.

7 PM Contest Super Suite at the Crowne Plaza hosted by the Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and the North Coast Contesters (NCC).

10:30 PM Pizza Party in the Harding Room sponsored by Society of Midwest Contesters (SMC). **http://www.contestsupersuite.com**

**May 17th – Friday daytime**

2:00 PM – 5:00 PM Antenna Forum at Hamvention in Xenia, Ohio, Room 1 Moderator: Tim Duffy, K3LR.

"How to Use Your Tower as a Dual-Band Single-Feed 80 Meter/160 Meter Vertical Antenna Using No Traps, Switches, or Tuners – And Extensions to Phased Arrays" – Dr. Ted Rappaport, N9NB and Jim Parnell, W5JAW

"Big and Small High Performance 6 meter Yagis You Can Build" – Frank Donovan, W3LPL

"Forecasting the Next Solar Cycle for Radio Propagation; Separating Fact from Myth" – Dr. Tamitha Skov, WX6SWW

"A Four Element Vertical Dipole Array – Super on the Beach for DXpeditioners – Chris Janssen, DL1MGB

**May 17th – Friday night**

7 PM Contest Super Suite at the Crowne Plaza hosted by The Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and North Coast Contesters (NCC).

7:00 PM 30th Annual Top Band Dinner at the Crowne Plaza – Presidential Ballroom. Speaker is Ken Claerbout, K4ZW. Tickets in advance from **http://www.topbanddinner.com**.

10:00 PM: HARDING – We are pleased to announce that the Friday evening entertainment this year will be the very popular professional Japanese recording artist Ms. Kaori Mita, JI1BTL performing live in the Harding Ballroom (second floor) at the Crowne Plaza in downtown Dayton, OH. You can see photos and more information about Ms. Mita here: **http://kbakers.com/hamradio/hamfair.html**

11:00 PM Pizza Party in the Harding Room sponsored by the Potomac Valley Radio Club (PVRC). **http://www.contestsupersuite.com**

**May 18th – Saturday daytime**

10:45 AM – 11:45 AM RTTY Contest Forum at Hamvention in Xenia, Ohio Room 3 Moderator: Ed Muns, WØYK

"Future of FT8 in Digital Contesting" – John Pescatore, K3TN

"Future of RTTY Contesting" – Jeff Blaine, ACØC

1:20 PM – 3:05 PM Contest Forum at Hamvention in Xenia, OH, Room 1 Moderator: Doug Grant, K1DG.

"The Team Exuberance WPX SSB Operation at K3LR" – Violetta Latham, KM4ATT and Marty Sullaway, NN1C

"Changing the Game – Contesting with a Live Scoreboard" – Victor Androsov, VA2WA and Randy Thompson, K5ZD

"The Road to WRTC2022" – Carlo de Mari, IK2HJS

"FT8 and the Future of Contesting" – Ed Muns, WØYK

"TI7W and the Quest for 10,000 QSOs" – Chris Hurlbut, KL9A and Kam Sirageldin, N3KS

**May 18th – Saturday evening**

6:30 PM – 27th Annual Dayton Contest Dinner hosted by North Coast Contesters at the Crowne Plaza Presidential Ballroom. Dinner speaker is Dr. Ted Rappaport, N9NB. Space is limited. Details and tickets in advance are available at **http://www.contestdinner.com**.

7 PM Contest Super Suite at the Crowne Plaza hosted by The Mad River Radio Club (MRRC), Frankford Radio Club (FRC) and North Coast Contesters (NCC).

11 PM Pizza Party in the Harding Room sponsored by the Yankee Clipper Contest Club (YCCC). **http://www.contestsupersuite.com**

World Wide Radio Operators Foundation


## Contester's Code of Ethics

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

# Table of Contents



## Index of Advertisers

# CTU Presents

## Contesting with Integrity

**Randy Thompson, K5ZD**

## Purpose of this Session

- Discuss why ethical behavior is important in radio contesting
- Understand the impact of unethical behavior
- Encourage participants to take ownership of their own behavior and encourage others to do the same

**Integrity** is the practice of being honest and showing a consistent and uncompromising adherence to strong moral and ethical principles and values.

It is the bedrock principle that radio contesting depends on.

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## Explaining Radio Contesting to a non-ham

"We operate for 24/48 hours, log all the stations we contact, and see who can make the most contacts in the most states or countries."

*"How do you know who won?"*

"We send our logs to the sponsor, and they check them."

*"How do you know someone didn't cheat?"*

"We trust, but verify as best we can."

*"What do you get for winning?"*

"Nothing."

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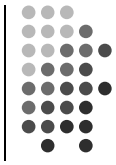
## What is a game?



- A competition with rules to define constraints and scoring
- Ending in a definite result

- Games provide players with
  - An amusement or pastime
  - A means of exploring one's own capabilities
  - An opportunity to share experience and learning

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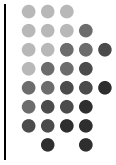
## Contesting is not a Fair Game



- Unequal stations
- Unequal geography
- Unequal propagation
- Different operating time
- Privately conducted

**Yet we calculate scores,**
**stack rank them,**
**and celebrate the "winners"**

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## Why do we do radio contests?

- Personal Satisfaction
  - Better score than last year
  - Better score than “that guy”
  - Cool band opening
  - High rates, crushing pileups
- Be part of a team
  - Help your club (or multi-op) win
- Peer recognition (aka ego)

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## Peer recognition?

- You are recognized by the sum total of your achievements and how you went about achieving those results
- That recognition is strongly influenced by what other people say about you

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## Competitors earn respect; cheaters do not


Hank Aaron
755 Home Runs

Barry Bonds
762 Home Runs

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## Negative Peer Recognition

- "That station was too loud in the NAQP."
- "That guy uses a pair of 8877s and has remote receivers in Europe."
- "Joe uses packet but claims unassisted."
- "Ken had a second operator help him."
- "Larry always splatters to keep a clear frequency."

**While most of these examples can not be proven – they are often based upon something not being quite right about an entry.**

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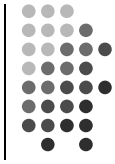
## What do we mean … Ethics?



- Ethics denote the theory of right and wrong actions
  - Written and unwritten codes of principles and values that govern decisions and actions
- Morals indicate their practice within guidelines
  - Standards for determining the difference between good and bad decision making and behavior
- Ethics are… knowing the difference between right and wrong and choosing to do what is right.

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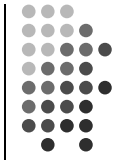
## Why people cheat



- 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 (rivalry)
- A means to prove self-worth

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# I don't actually cross the fence

I just lean on it

I just straddle it a tiny bit !



# Rationalizations for cheating

- *Everybody is doing it*
  - *(#1 Reason, and provably false)*
- Nobody is hurt
  - (*Except those you beat*)
- Overcome unfair disadvantages
  - *(Life is not fair)*
- Nobody is watching
  - (*Not any longer*)
- Rules don't specifically disallow a practice
- Rules apply to others, not me/us

## "All the top guys 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!

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## "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."

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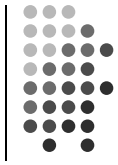
## How do you know what to do?



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

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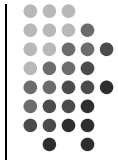
## Some written rules are very clear
**(some people break these anyway)**



- **“A. Single Operator categories**: For all single operator categories, only one person (the operator) can contribute to the final score during the official contest period.”
- “Total output power per band must not exceed 1500 watts or the output power regulations of the country in which the entrant is operating, whichever is less.”

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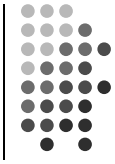
## More Examples of Written Rules



- Off times must be a minimum of 60 minutes in length.
- The log MUST show the correct serial number sent and received for each contact.
- The exchange consists of signal report and serial number. Serial numbers sent must be progressive, starting with 001.
- Self-spotting or asking other stations to spot you is not allowed.

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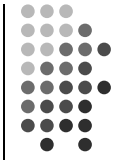
## Essence of Unwritten Rules



- Just because it's not specifically prohibited by written rules doesn't mean you should do it!
- Keep the contest on the radio and within the contest period
- Don't give or take unfair advantage of others
- Learn and follow the spirit of the rules

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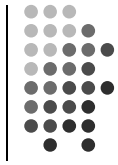
# Examples of Unwritten "Rules"



| Do NOT | Do |
|---|---|
| • Make pre-arranged schedules<br>• Ask friends to work you … only<br>• Work friends with multiple calls<br>• Intentionally QRM others in anger or to prevent them from making QSOs | • Identify frequently<br>• Work and spot stations equally<br>• Encourage club members to work everyone<br>• Make an effort to help casual callers enjoy the contest and make a contact |

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

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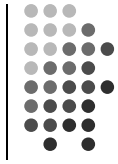
# No log washing



- "Research" using QRZ.com, Spot history, 3830 reports, LoTW
- Replaying the contest to change the log
- Asking others who they worked or if a call sign is correct
- Using email to confirm QSOs or get fills
- "Fixing" off times or band changes
- It's **over** when the 2359 rolls over to 0000

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# Play fair

- Do not exceed power limits for your category
- Just because the knobs go to 11…


(Search YouTube for “Spinal Tap” “these go to 11” – or watch the whole movie).
See also: “smoke”, “gas”, “soup”, “smash”, “Eimac antenna tuner”. . .

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# At some point, you make a decision

**Play by the rules**

- Work on improving skills
- Power consistent with class
- Don’t use cluster when single op
- 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.)

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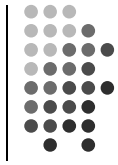
## Honor Code



- 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

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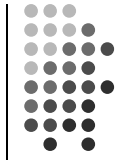
## Peer Pressure



- Good
  - Encourage others to follow the rules
  - People respect those who are true to their beliefs
- Bad
  - Letting others influence you into not doing the right thing
  - "everyone else is doing it."

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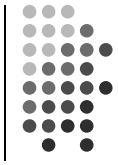
# Applying Positive Peer Pressure



- Be aware of your motives
  - Is it personal?
  - If necessary, enlist others to help deliver the message
- Give the benefit of the doubt
  - They may not realize what they are doing is against the rules
- Choose the right time
  - Can they listen without feeling attacked?
- Don't be angry or accusatory
  - Treat the issue as a mistake, not a crime
  - Focus on actions, not character
- Be there
  - People cheat because they see others get away with it
  - Not confronting the problem hurts everyone

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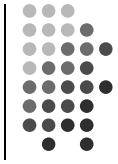
# Scenario 1



- You discover a local contester uses cluster spotting and enters as single operator unassisted. What do you do?
  - He doesn't win anything so assume it doesn't matter
  - Avoid speaking to him ever again
  - Publicly call him a cheater at the next club meeting
  - Send a letter to the contest sponsor
  - Call him up and ask if he is aware of the rules for the single-operator category

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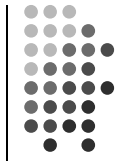
## Scenario 2



- You are invited to a multi-op and upon arrival, you discover they are running 2.5 kW. What do you do?
  - You are there, loud is good, operate anyway
  - Turn the power down to 1500W when you are operating
  - Loudly encourage the other ops to follow your example
  - Quietly ask the owner if he always runs this much power
  - Ask the other ops if they are comfortable with this
  - Leave
  - Send a note to the contest sponsor and FCC

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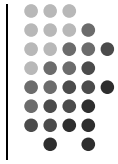
## The RIGHT way to do contesting



- Play fair
  - Obey the rules, remember this presentation
- Try to do better next time
  - Congratulate the winner
  - Keep learning
  - Improve your skills, station

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# Have fun!

Make your enjoyment of contesting be more about the journey, than the destination

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## Who are you?

- What does contesting mean to you?
- How important is your radio identity to you?

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# Who is the final judge ?

- The person in the mirror

  "Success without honor is an unseasoned dish; it will satisfy your hunger, but it won't taste good."

  *- Joe Paterno, football coach*

- Your peers

  "Yeah, I know that guy. He cheats."

  *- Anonymous Contester*

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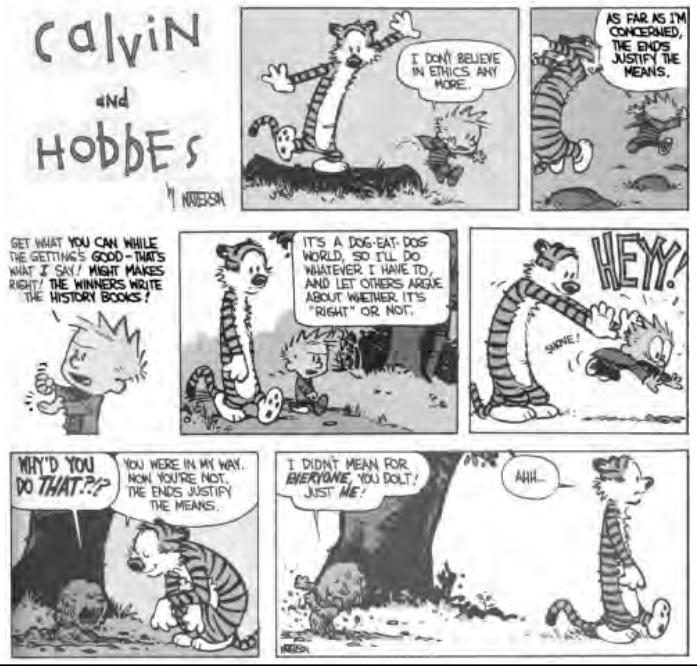
# Final Thought

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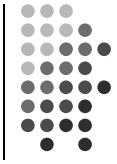
## Acknowledgments



- This presentation draws on material developed by:
  - Ken Adams, K5KA (SK)
  - Larry Tyree, N6TR
  - Dave McCarty, K5GN
  - Ward Silver, NØAX
  - Kirk Pickering, K4RO
  - Tim Duffy, K3LR
  - Joel Harrison, W5ZN

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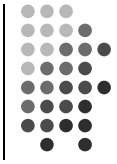
## The Contest Code of Ethics www.wwrof.org



1. I will learn and obey the rules of any contest I enter, including the rules of my entry category.
2. I will obey the rules for amateur radio in my country.
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5. I will adhere to the DX Code of Conduct in my operating style (see dx-code.org).
6. I will yield my frequency to any emergency communications activity.
7. I will operate my transmitter with sufficient signal quality to minimize interference to others.

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# How to recruit new contesters

Doug Grant K1DG

## How many licensed hams are "active" HF operators?

- CQWW (biggest contest):
  - About 8000 logs per mode, involving about 16,000 operators
- Unique good callsigns in those logs:
  - 38,792 SSB  23,193 CW  8,266 both modes
  - COMBINED: 53,716 unique good calls
- Biggest DXpeditions work 25,000 – 50,000 unique callsigns (K5D 32,000)
- There are around 2.5 Million hams in the world, so active HF operators is about 1-2%
- How do we get the other 98% in the game?

## Average age of hams is…?

- KG5HVO is giving a talk later on getting “youth “involved in contesting
- How do we get “Oldth” involved (there are LOTS MORE of them)?

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## A “better-than-average” radio club


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## Some people are just not going to be interested

- "Every night for 20 years on this frequency" ops
- "14300" and "7200" guys
- AMers
- QRP/microwave builders
- SDR "builders" ("I needed a transmitter to test the antenna so I wrote one")

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## Newer HF operators see the game differently

- "What do you mean I shouldn't look a call up on QRZ.COM if I didn't copy his state?"
- "Prefills are my friend"
- "Headphones? Why? Just let the computer copy it."
- Just keep calling…and calling….and calling…

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## This really happened one night when I was on FT8

- I received an email from a guy in RI that said: "Doug needing NH for WAS and I'm on 1773 20M now can you help me out?"
  - New ops only know one frequency on each band
- I had already moved to another band, but replied that we could try…he was already calling me on 40M FT8.
- 18 (!!!) emails later, we completed a QSO
- Confirmed that night on LOTW

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## New ops don't speak our language

- **"Pyrrhuloxia" is:**

a. A gum disease
b. A type of volcanic rock
c. A songbird of the American Southwest
d. Forensic evidence in an arson investigation
e. N9JA's middle name

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## Operating with a newbie

- **Which of these is a callsign?**

a. 2ASTX
b. CQFD
c. QRZ
d. W1AW
e. IC7610

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## We have to meet prospective new contesters where they are

- They have no experience with tuning in SSB signals
- Some think that stations should transmit on exact kHz (14.200.00)
- Their “channel selectors” click
- They don’t copy by ear – some have never used the speaker in their radio
- They have never turned the big knob
- EVERYTHING in HF contesting is new to them

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## Best chance is to get involved with a local club

- Go to their pre-FD meetings
- Volunteer to help (but don't be too pushy)
- Go to FD
- Offer to do CW - most clubs don't have many (or any) CW ops
- Sit with a phone op and help them (logging, etc.)
- Bring two pairs of headphones and an audio splitter

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## Field Day

- Not really a contest, but the higher scores are listed first
- "Gateway drug" of radiosport

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## IF there is interest, volunteer to do a talk about contesting

- After FD, maybe before NAQP
- Or in the fall before SS
- Feel free to use the following slides…they were developed for a similar purpose over several iterations and will help you get started

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## Why operate contests?

- Improve operating skills
- Uncover weak spots in your station
- Pickup new states, countries, etc.
- FUN!!!!

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## Skills involved

- Copying the other station's exchange accurately
- Having a big enough signal to be heard
- Knowing when to call between the bigger signals
- Knowing which band is the best at the time
- Ability to maintain focus for 48 hours

***ALL OF THESE SKILLS WILL HELP YOU IN PUBLIC SERVICE ACTIVITIES***

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## When was the First Contest?

- "The first contest was when the third guy got on the air" *…FCC Official*
- Early amateur radio was all about message relaying
  - Some wondered how far their signals could reach
- The first "TransAtlantic Tests" were held in the early 1920s, organized by M. B. Sleeper of "Everyday Engineering" magazine in the U.K.

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## The Object of the Game

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

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## The First Successful Transatlantic Test - 1921


- It was also the first DXpedition – Paul Godley took the best available receivers to Ardrossan, Scotland
- Copied 26 North American stations (most ~200 meters)

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# The First Official "contest"

- 1927 International Relay Party, sponsored by ARRL
- Two weeks long in May 1927
- *Wavelengths as short at 20 meters* were in wide use

Re: The International Tests

THESE tests which were announced in last *QST* have a number of important objectives. They promote international fellowship and goodwill in addition to making possible some rare sport with a pile of new records for every station that takes part. Stations must help each other over with test messages to boost the score equally at both ends of a QSO.

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# First VHF Contest

- Also in 1927, on 5 meter band
- Covered in the "Experimenter's Section" of QST
- "Try to keep your wave between 4.9 and 5.1 meters" (58.8 and 61.2 MHz)

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## Contests of all kinds

- North American QSO Party
  - Operate 10 of 12 hours, 100W max power
  - Exchange:  name and state
  - May work that same station on multiple bands
- ARRL November Sweepstakes
  - Operate 24 of 30 hours
  - Based on message handling – long complicated exchange
  - Work station only once regardless of band

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## More…

- State QSO Parties
  - World works target state (FL, CA most popular)
  - Many mobile stations going from county to county
- North American Sprint
  - 4 hours long
  - Special QSY rule

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# International Contests

- ARRL International DX Contest
  - 48 hours long; World works USA/Canada
  - Last weekend of Feb (CW); 1st weekend of March (SSB)
- CQ World Wide DX Contest
  - 48 hours long; World works world
  - Last full weekend of Sept (RTTY), Oct (SSB), Nov (CW)
- CQ WPX Contest
  - Operate 36 of 48 hours; World works world;
  - Prefixes are multipliers
  - Feb (RTTY); March (SSB); May (CW)

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# The World Radiosport Team Championship

- The “Olympics of Ham Radio”
  - Held every 4 years
- Top two-operator teams from around the world
  - Identical power and antennas
  - Same geographic area
- Operator skill and strategy determine the winners

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## Most contests have multiple categories

- Single-operator
  - Assisted = DX Cluster
- Multi-operator
  - (1, 2, or “unlimited” transmitters)
- High power, low power, QRP
- “Overlay” categories
  - “Rookie”, “Tribander/wire”

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## How to get into a contest

- Get on the air!
  - No pre-registration required
- Review the rules first
  - Who can work you for points?
  - What is the exchange?
- Find a station calling “CQ Contest”, make the QSO, log it
  - Then work another one!

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# During the contest - A Contest QSO

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

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# A More Realistic Contest QSO

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

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# A Very Bad Contest QSO

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

***What part of this is wrong?***

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

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

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

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# Keeping track

- Many logging programs available
  - Some are free, some cost a few dollars
  - Most for PC/Windows, some for Mac, some for Linux
  - Better-suited than general-purpose everyday loggers

- What they do
  - Track stations worked (so you don't make a duplicate contact)
  - Track multipliers worked
  - Score computation
  - Send pre-recorded CW or voice messages
  - Produce Cabrillo-format log for submission to sponsor

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# Common misconceptions about contests

- "Contesters are rude and obnoxious"
  - Are there any rude obnoxious people on your 2M repeater?
- "There are too many contests."
  - Most contests are single-mode. There are ***none*** on the "new bands" (12, 17, 30 meters, which we have had since 1979…)

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# More misconceptions


- "Contesters all run illegal power"
  - No…but since they usually have superior locations and antennas, it may seem like they are!
- "The only way to win is to have the biggest station"
  - Compare to car racing…a good driver in a slower car can beat a poor driver in a faster car.

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# And more…

- I only have a small station…it won't be much fun
  - Set reasonable expectations
- I can't copy CW well, so I'll never be any good
  - Practice, practice, practice…
- I'm too old
  - You can be competitive into your late 60s, even 70s



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# After the contest…

- Send in your log, no matter how big or small
  - It helps the log-checking process
  - Email or Web upload
- Compare your score to:
  - last year
  - guy across town
- Upload your log to LoTW
  - Watch the QSLs roll in
- "How can I do better?"


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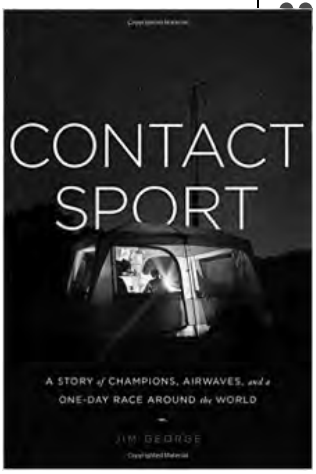
# Resources…

- CQ-Contest email list
- “Contest Update”
- Yankee Clipper Contest Club
- Contest University
- National Contest Journal
- WWROF.org Webinars, etc.




***Available at Amazon.com***

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# What you will get from Radiosport

- You will improve your operating skill
- You will improve your station
- You will learn more about propagation
- You will make friends worldwide
- You and your station will be ready for anything
- You will have ***fun!***

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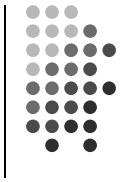

# 73 &
# see you in the next contest!

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# 2BSIQ and SO3R: Riding the edge of Human Capabilities

Dayton Contest University 2019
By Dan Craig N6MJ/ZF2MJ

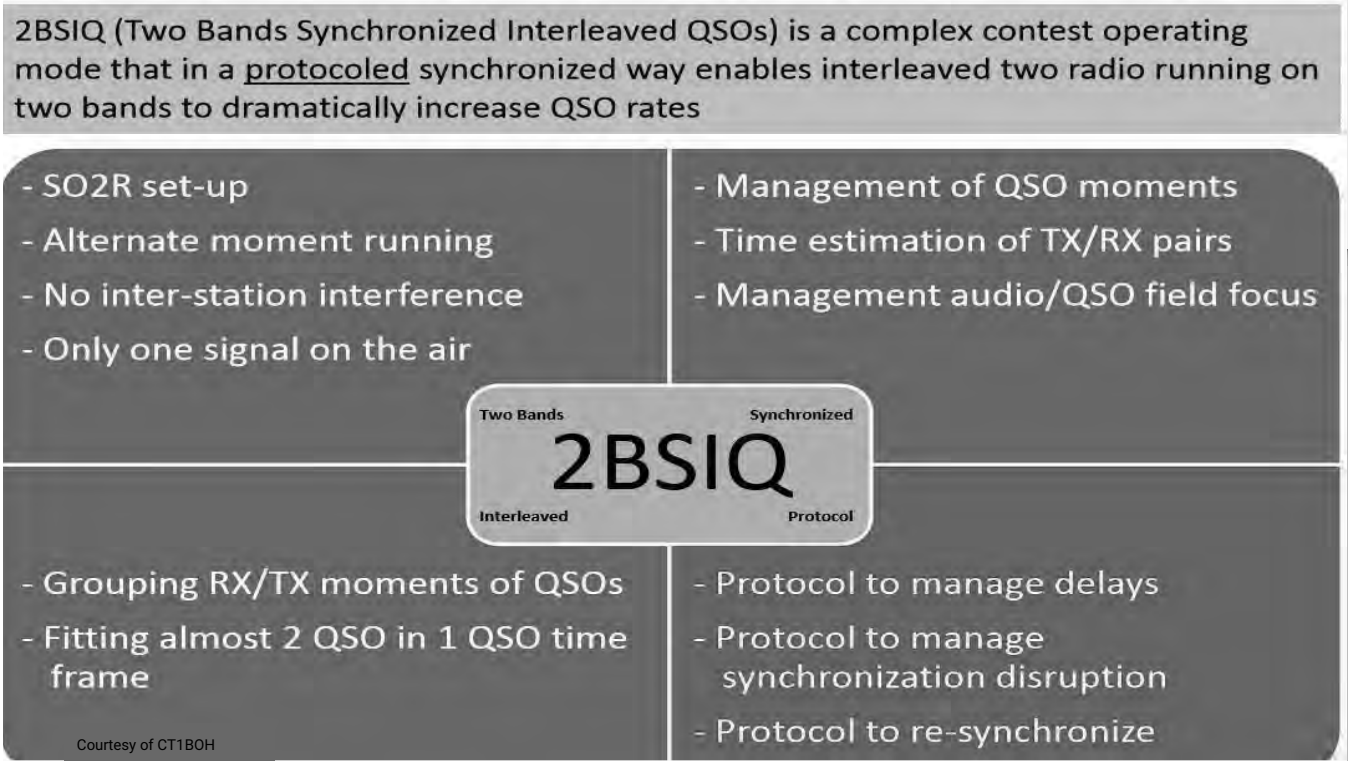
## Contents

- Presentation will focus on high rate 2BSIQ on CW and SSB operating from a DX location.  Digital modes will not be covered
- Definition of 2BSIQ
- Origin of 2BSIQ, where it all started
- 2BSIQ Setups
- How to train for 2BSIQ
- 2BSIQ on SSB
- SO3R

# Definition of 2BSIQ

- 2BSIQ stands for 2 Bands Synchronized Interleaved QSOs
- Goal is to run on 2 bands simultaneously without interruption
- Must have:  2 interlocked radios with no interstation interference

- What it is not - SO2R, or having 2 different pileups but not attempting to sync them



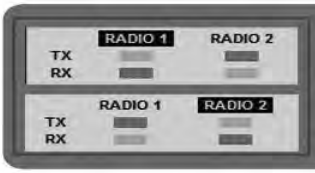
# Two Bands

Slide Courtesy of CT1BOH

2BSIQ requires the capability to RUN with no interstation interference, in an alternate way, on two bands, interleaving transmitting signals one at a time

## SO2R set-up

- Two radios; No inter-station interference
- No interference to be able to RUN on any two bands




## Alternate running on two bands

- If radio1 on band 1 is TX, radio2 on band 2 must be RX
- If radio1 on band 1 is RX, radio 2 can be TX

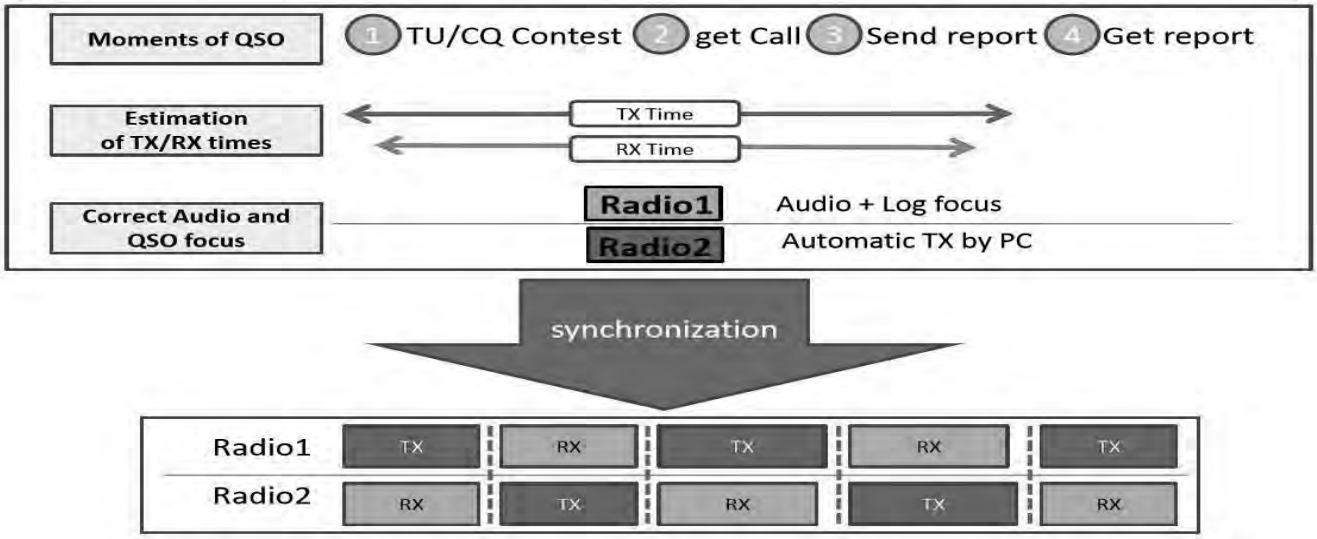

## Only one signal on the air

- To comply with SOAB only one signal on the air
- To comply with SOAB each TX signal to different band

# Synchronized

Slide courtesy of CT1BOH

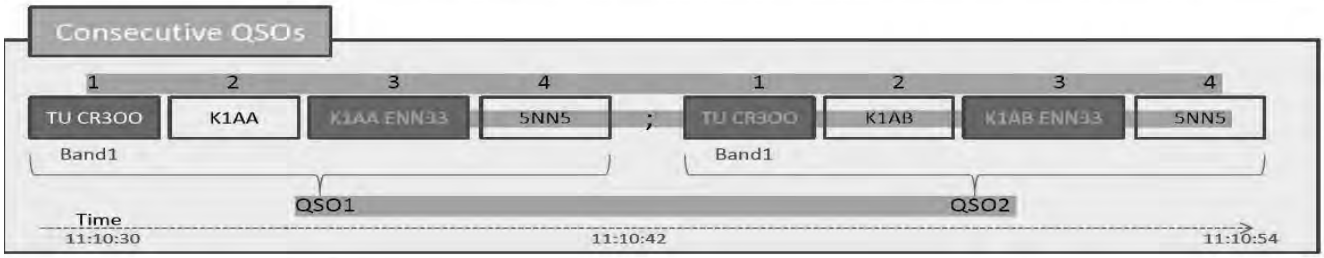
Synchronization on two bands is the key to a dramatic increase in QSO rates, obtained with management of key QSO moments, estimation of exact length of TX and RX pairs and correct focus of audio and QSO focus

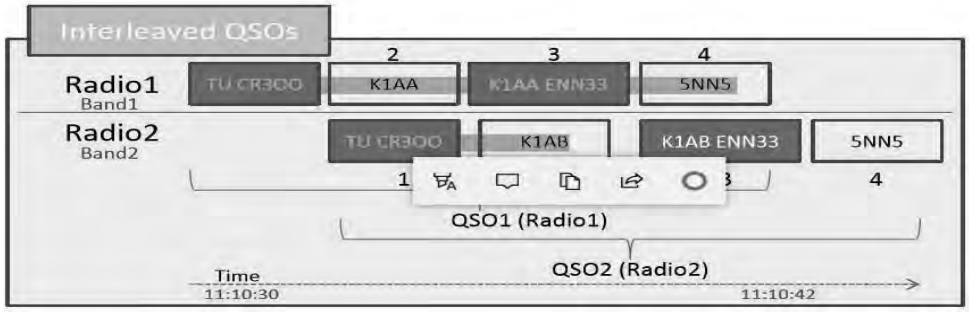


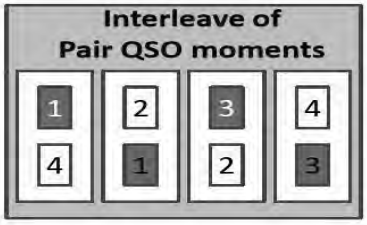
# Interleaved QSOs

Slide courtesy of CT1BOH

2BSIQ changes the paradigm from consecutive (one radio, one band) to interleaved (two radios, two bands). "Two QSOs" fit in the approximate time frame needed for one QSO



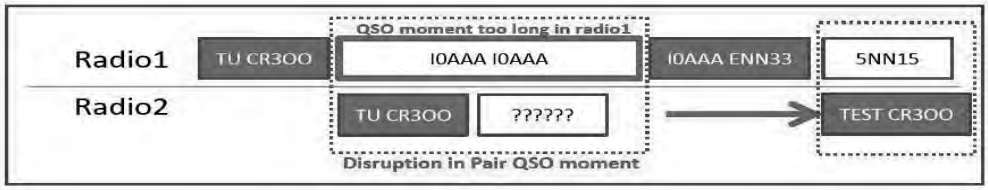




# Operating Protocol

Slide courtesy of CT1BOH

Perfect synchronization of "pair QSO moments" in two bands is not always possible, therefore an operating protocol must be followed to handle efficiently those situations


Perfect "pair QSO moment" synchronization




Disruption in "pair QSO moment" synchronization

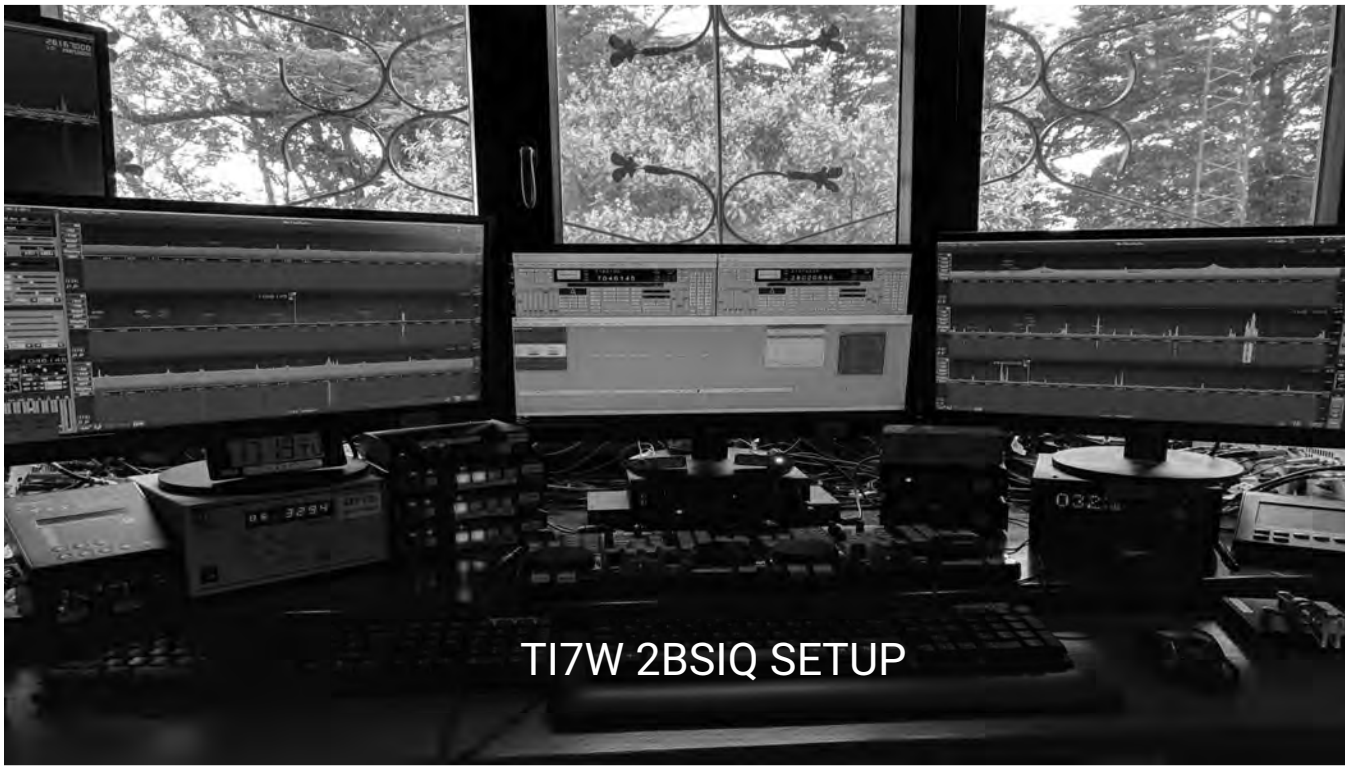
**Operating protocol "What to do when":**

1. There are situations that push forward next pair QSO moment
2. There is disruption of synchronization
3. Re-synchronization of moments of QSO is needed

# Origin of 2BSIQ

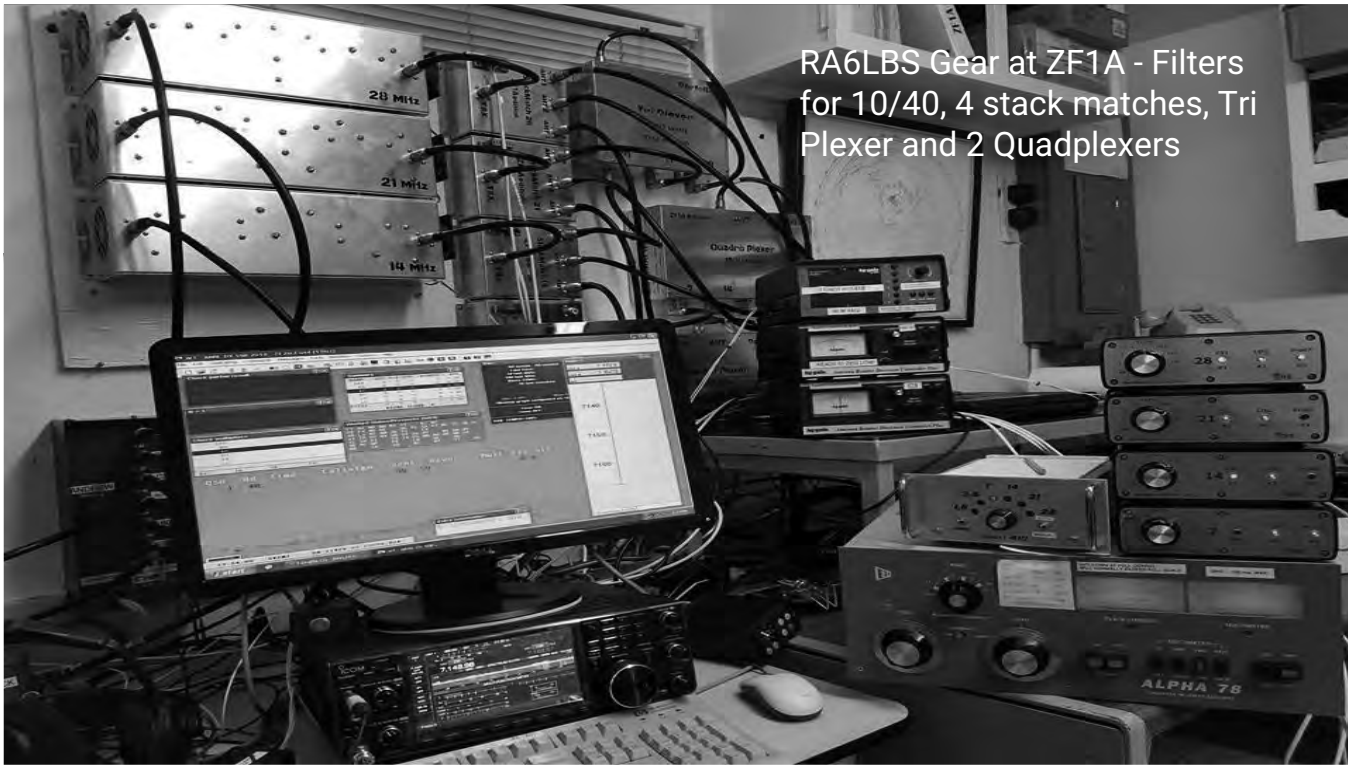
- When did it all start?
- How I became involved
- Why there was controversy when this practice first started
- What steps I took to prove that 2BSIQ was possible
- First attempt at ZF2MJ


ZF2MJ 2BSIQ SET UP



TI7W 2BSIQ SETUP

**ZF1A Antennas, 17el LP at 100ft, C31XR at 50ft, Pro67 at 60ft, 2 el 80m yagi at 90 ft and Inv V on 160m**




RA6LBS Gear at ZF1A - Filters for 10/40, 4 stack matches, Tri Plexer and 2 Quadplexers

# Success at ZF2MJ

- 2015 CQWW CW was first 2BSIQ implementation
- Had 8 hours over 300
- 10,223 claimed q's and 10,014 after log checking
- 27 300+ hours over the last 4 years in CQWW CW
- Won first place in the world 2015 and 2016

Summary

| BAND | QSO | CQ | DXC | DUP | POINTS | AVG |
|---|---|---|---|---|---|---|
| 160 | 262 | 14 | 40 | 2 | 579 | 2.21 |
| 80 | 987 | 25 | 80 | 18 | 2354 | 2.39 |
| 40 | 2390 | 34 | 100 | 39 | 6204 | 2.60 |
| 20 | 2473 | 37 | 106 | 61 | 6030 | 2.44 |
| 15 | 2676 | 34 | 110 | 42 | 6688 | 2.50 |
| 10 | 1435 | 26 | 88 | 14 | 3440 | 2.40 |
| TOTAL | 10223 | 170 | 524 | 176 | 25295 | 2.47 |

FINAL SCORE: 17 554 730

# Training for 2BSIQ

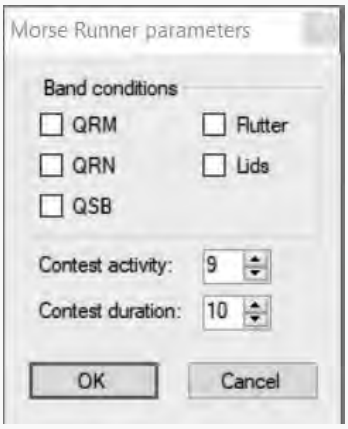
- Practice Practice Practice!
- RUFZ
- Get on the air!
- DX Log with Morserunner Built in
- Should already be proficient in SO1R and Standard SO2R before moving on to 2BSIQ

# Importance of DX Log

- By far the most realistic training method for 2BSIQ

Best settings:

1. Remove all Band Conditions (QRM, QRN, QSB etc)
2. Set Contest activity to 9
3. Set Contest duration to 10
4. Set the speed to 48wpm



# When is training complete?

- You should be able to routinely get 300 q’s an hour
- You should have roughly the same number of q’s on each side
- Start by attempting it in smaller contests like NAQP
- Note, it is difficult to try outside of contests as the timing will rarely be correct

10 Min Youtube video, 80q, 420/hr DXLog Practice
https://www.youtube.com/watch?v=HuiCch0uUqE&t=351s

## 2BSIQ during lower rate periods

- Can still increase over all rate
- Interleaving not as crucial, but still important
- Send slower CW during these times
- Send longer CQ’s if needed

## Tips for 2BSIQ

- Never listen to your transmit audio!
- Sign your callsign after every single QSO!
- Keep speed between 40 and 52wpm
- Goal should be a minimum of 45 hours of 2BSIQ
- The other hours should be used to S&P for mults

# Operator Health

- 2BSIQ is more taxing than any other kind of operating
- Must aim to be in good health both mentally and physically
- Meals and drinks should be planned out in advance

# Meals

Things to eat during contest

- [ ] Chicken
- [ ] Hardboiled eggs
- [ ] Nuts
- [ ] Protein bars
- [ ] Water
- [ ] Bcaa powder
- [ ] Caffeine ok on 2nd day
- [ ] Oatmeal
- [ ] Whole grain bread
- [ ] Will need either melatonin or tylenol pm for thursday night
- [ ] Fruits, especially mandarin oranges

## 2BSIQ on SSB

- Difficulties in doing 2BSIQ on phone
- How to properly interleave QSO’s on SSB
- Learning to speak while not listening to your voice
- Slowing down to keep everything in sync

## The future of 2BSIQ on SSB

- In order for it to work properly, all sending must be done by the computer
- Current technology not good enough yet, but getting close
- Important to have a non computerized voice, or else it turns people away

# Theoretical Max QSO Rates and Total Q's

Current Max QSO's per Hour

| 2BSIQ CW | SO1R CW | 2BSIQ SSB | SO1R SSB |
|---|---|---|---|
| 387 | 275ish | 395 | 470 |

Theortical Max QSO Rates

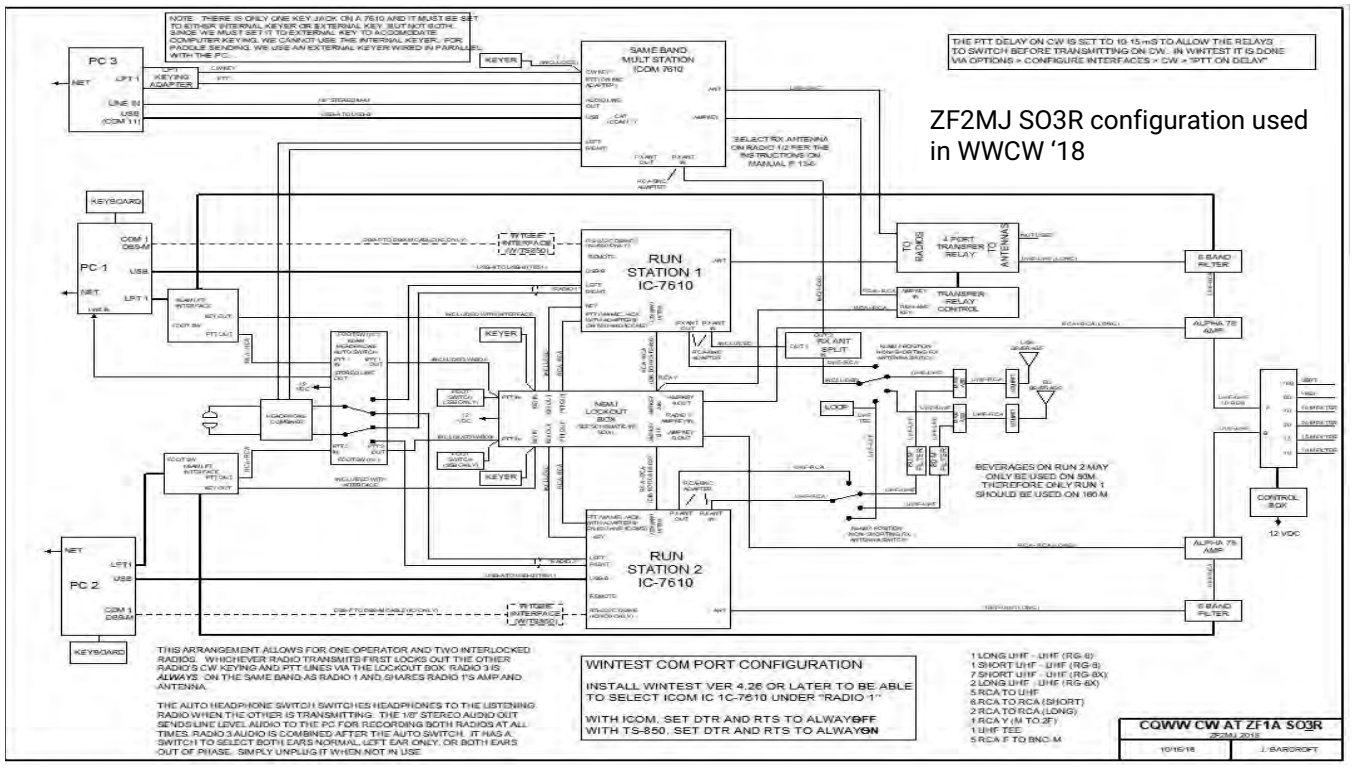
| 2BSIQ CW | SO1R CW | 2BSIQ SSB | SO1R SSB |
|---|---|---|---|
| 400-410 | 300 | 410 | 500 |

# SO3R

- Why do SO3R?
- SO3R Strategy
- When to implement it

# SO3R Audio and Technology

- 2BSIQ audio remains the same
- 3rd radio audio added in, and always in both ears at the same time
- BIP / BOP switch
- Lockout box, 3rd radio should always win



# Important links

https://www.youtube.com/watch?v=lu2lO3P9o_0&t=1s CT1BOH 2BSIQ Presentation

https://www.youtube.com/watch?v=bIW1Z1uFbRw&t=1s ZF2MJ 2BSIQ with audio

https://www.youtube.com/watch?v=42TCOtmJuEI CT1BOH 2BSIQ with audio

https://www.youtube.com/watch?v=XujVshm8ROI N6MJ@KP3Z 2BSIQ on SSB, no audio

https://www.youtube.com/watch?v=HuiCch0uUqE DXLog 10 min practice session

# Q & A

Any questions are welcome!

# Special Thanks!

This presentation would not have been possible without contributions from the follwing:  CT1BOH, K6AM, KL9A, N4YDU, N6WIN and NN1C.

# Everything You Need to Know About USB and Serial Interfaces

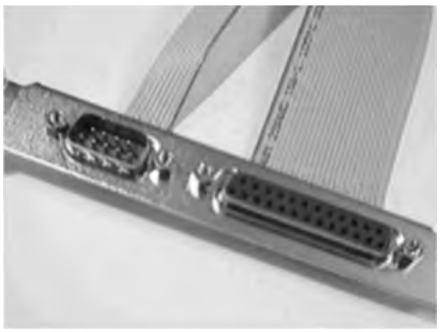
Presented by N6TV
n6tv@arrl.net

## Presentation Overview

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

## Legacy PC Serial Ports

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



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ICOM 3

## Life was Simple

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



  - Male: Yaesu Kenwood


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## Computers “Improved”

- “Real” serial and parallel ports disappear, replaced by USB ports
- Notebook computers: PCMCIA, PC Card, ExpressCard slots for serial adapters disappear
- Radios (until recently) still had 9-pin serial ports
- Peripherals are still using 9-pin serial ports
  - Rotator controllers, SteppIR antenna controllers, some band decoders, etc.
- Common Solution:  USB-to-Serial adapters



## USB 2.0 and 3.0 Ports

- Standard connector on most PCs and MACs

| | | |
|---|---|---|
| PC: | Type A<br>1 2 3 4<br>Type-A | Type A<br>9 8 7 6 5<br>1 2 3 4<br>Type-A SuperSpeed |
| Radio: | Type B<br>2 1<br>3 4<br>Type-B | Type B<br>9 8 7 6 5<br>2 1<br>3 4<br>Type-B SuperSpeed |

## USB-to-Serial Adapters

- Reliability and Compatibility Varies Greatly

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



## Digi International Edgeport/4


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

# Digi International Edgeport/8


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



# microHAM uses Eltima drivers

## microHAM MK2R+


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

## Recommended FTDI USB-to-Serial Adapters

**FTDI CHIPI-X10 - $15**


**GearMo 2-port - $30**

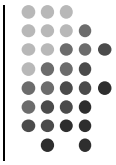
**GearMo 4-port - $40**



## Prolific USB-to-Serial Adapters

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

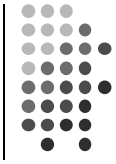
## Connecting USB-to-Serial Adapters



- Connect FTDI, Elecraft, or Edgeport device to PC
- Windows (usually) locates and installs appropriate device driver(s)
- COM ports assigned sequentially
- Use Windows Device Manager to view assigned COM Port number



## Connecting USB Radios / Devices



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

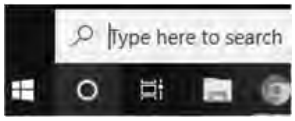
## Using the Windows Device Manager

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



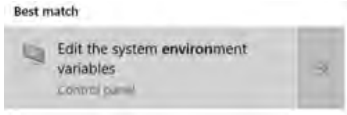
## Setting System Environment Variable

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

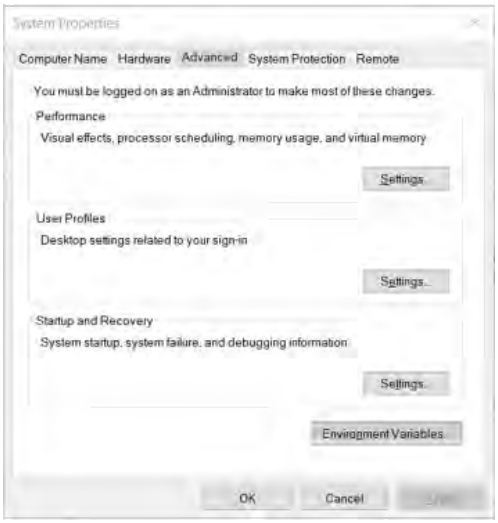




- Click “Edit the System Environment Variables”

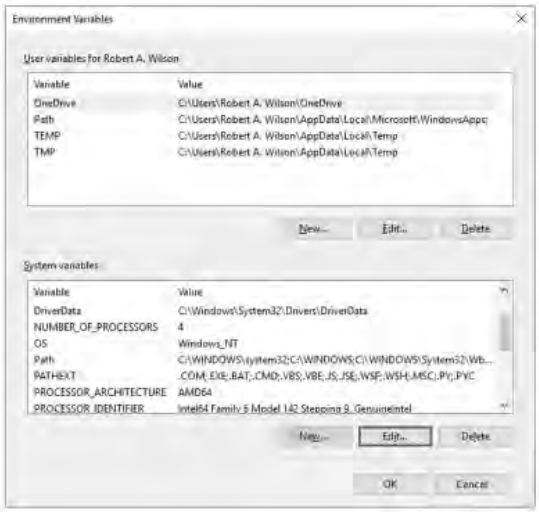


## Step 1 – Under Advanced tab click Environment Variables…






## Step 2 – Under System variables, click New…



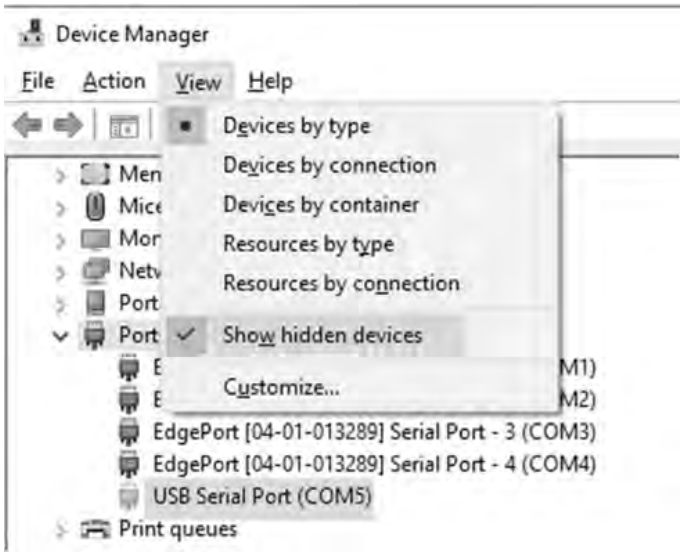
## Step 3 – Add the new environment variable

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


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



## Step 4 – in Device Manager:
## Select View → Show Hidden Devices



## Expand Ports section
## Right click offline devices, Properties




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


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

## Uninstall the Prolific Device AND Delete the Driver Software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## If Driver is FTDI, go to Port Settings tab Click Advanced… button


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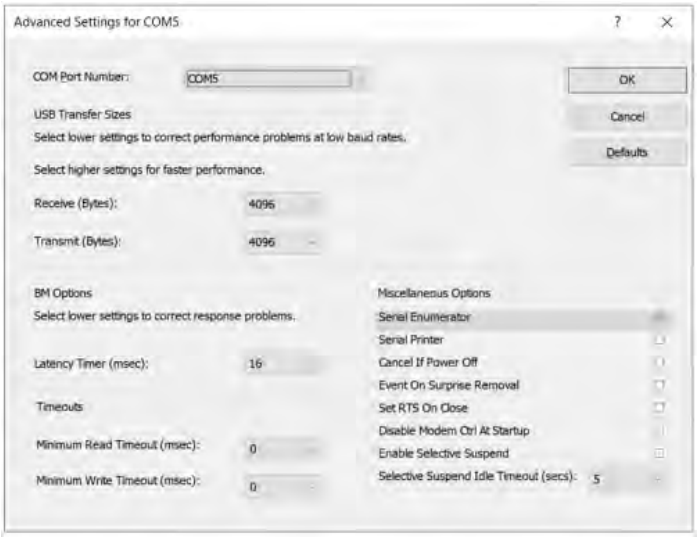
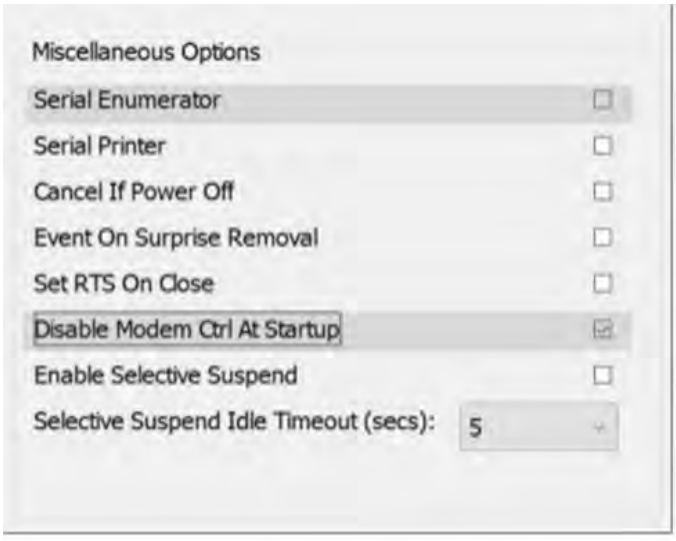
ICOM 24

# FTDI Default Options – not good






# Change the FTDI Options To This



## Another USB Dev. Management Tool: NirSoft's USBDeview

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

**Feedback**

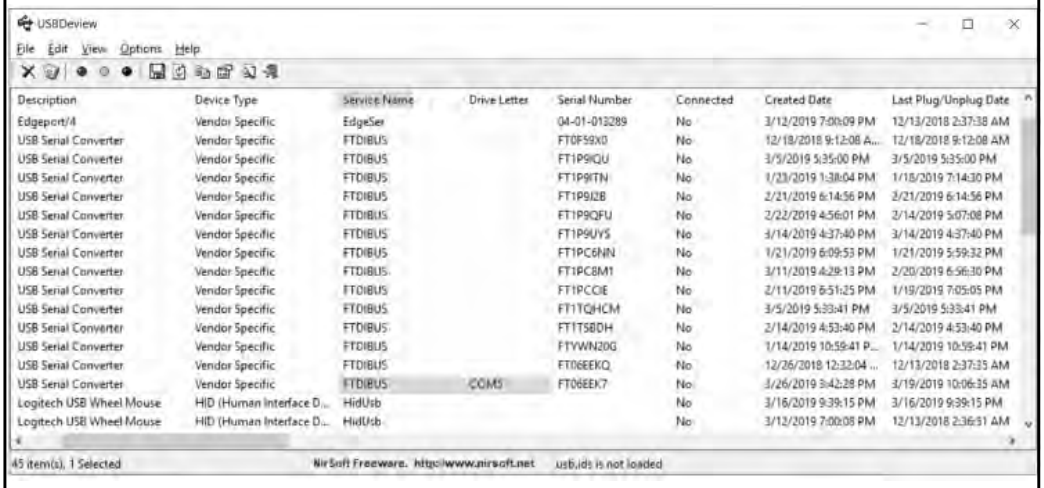
If you have any problem, suggestion, comment, or you found a bug in my utility, you can send a message to nirsofer@yahoo.com

Download USBDeview

Download USBDeview for x64 systems



## USBDeview Screen Shot

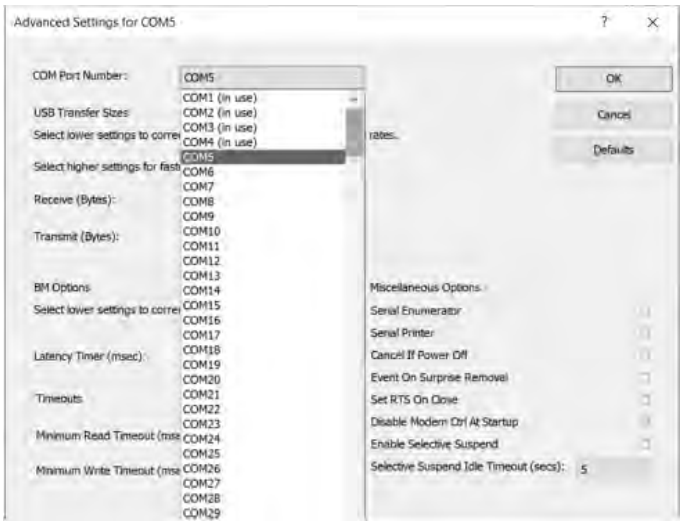


## Managing COM Port Numbers

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



## Renumbering Serial Ports



## What does “In Use” Mean?

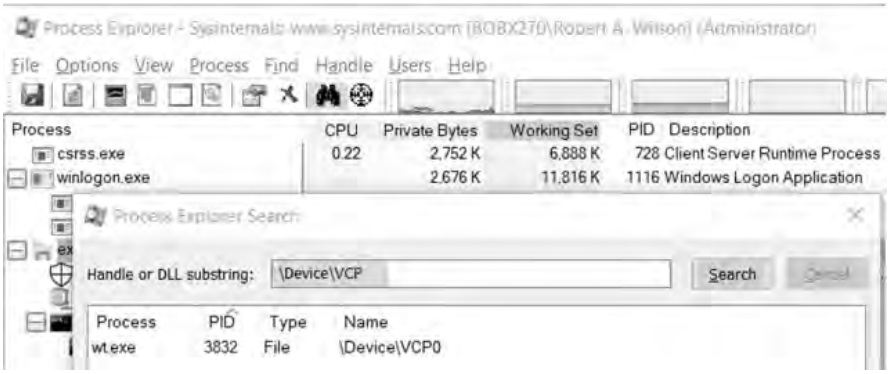
- It means this COM port number was assigned to some device, maybe years ago
- It usually does *not* mean that you can’t use it during reassignment, especially if it is “grayed out” (hidden)
- Uninstalling disconnected devices first will help
- Usually safe to ignore this warning and click YES:




## What program is currently using my serial port?

- Use Windows Process Explorer
- https://docs.microsoft.com/en-us/sysinternals/downloads/process-explorer
- On Windows 10, run **procexp64.exe** as **Administrator**
- Click Search button (binoculars icon)
- Enter one of the following partial search strings
  **\Device\VCP** - FTDI virtual serial ports
  **\Device\Edg** - Edgeport virtual serial ports
  **\Device\Ser** - Hardware serial ports
  **\Device\Sil** - Icom/Kenwood/Yaesu Silicon Labs ports

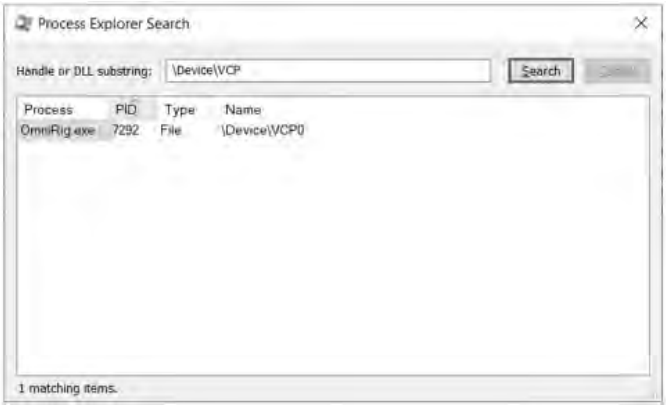
## Search Example 1




Win-Test (wt.exe) has opened the FTDI Serial Port



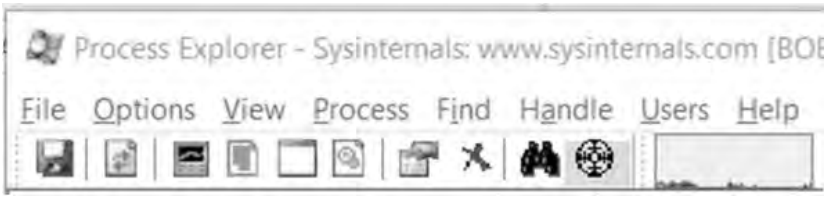
## Search Example 2




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

## Not sure what to search for?

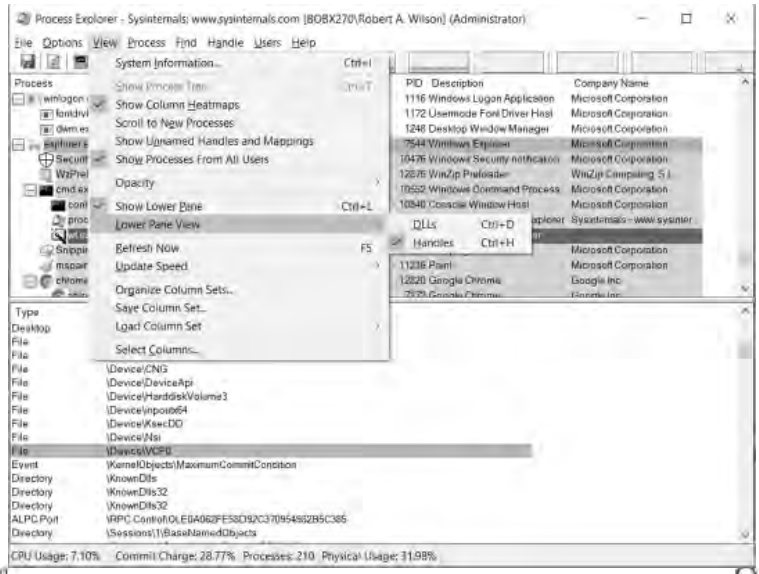
- Open a program known to use a particular serial port
- In Process Explorer, *drag* the “Find Windows Process” icon on top of the program window




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

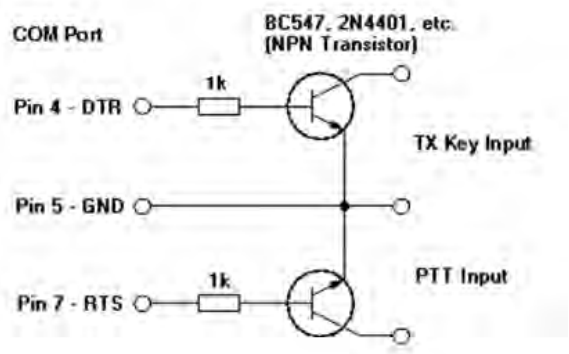


## Select View, Lower Pane View, Handles, then sort by Name



## Computer CW, PTT, and FSK RTTY Keying Using Serial Port pins (DTR=CW, RTS=PTT)

- A simple hardware keying circuit, used for decades:



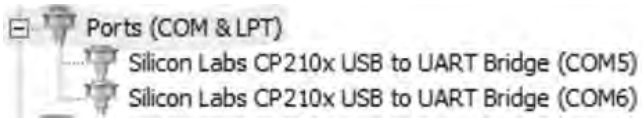



## Elecraft K3 / K3S keying via serial port

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

## ICOM Copies Elecraft, Adds FSK Keying

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



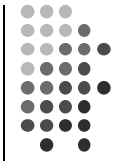

- To keep it simple use DTR pin for keying, RTS pin for PTT
- Use port "B" for MMTTY exclusively
- Mnemonic: **C**W : **D**TR : **F**SK • **P**TT : **R**TS : **S**end



## ICOM: Determining COM Port A and B

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

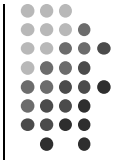
## ICOM IC-7300



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



## ICOM IC-7610



- USB cable provides *two* virtual serial ports
- In IC-7610 **SET > Connectors > USB Send/Keying**:
  Set **USB Keying (CW)** to **USB1(A) DTR**
  Set **USB Keying (RTTY)** to **USB1(B) DTR**
  Set **USB Send** to **USB1(A) RTS** or **USB1(B) RTS**
- In Logging Software, rig control COM Port (A):
  DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** to select second COM Port (B):
  FSK=DTR, PTT=RTS

## ICOM IC-7850, IC-7851

- USB cable provides *two* virtual serial ports
- In IC-785x **SET > Others** menu:
  Set **USB Keying (CW)** to **USB1 DTR**
  Set **USB Keying (RTTY)** to **USB2 DTR**
  Set **USB Send** to **USB1 RTS** (CW) or **USB2 RTS** (RTTY)
- In Logging Software, rig control COM Port (USB1) set DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** to select second COM port (USB2)
  FSK=DTR, PTT=RTS

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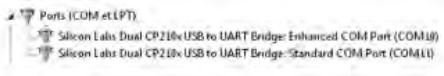
## Yaesu FT-991

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




- In Yaesu Menu, set
  **033 CAT RTS: Disable** (Turns off RS232 handshaking)
  **060 PC Keying: DTR**
  **047 AM PTT SELECT: RTS**
  **071 DATA PTT SELECT: RTS**
  **076 FM PKT PTT SELECT: RTS**
  **110 SSB PTT SELECT: RTS**
- In Logging Software, rig control is via the “Enhanced” COM Port, CW / PTT via “Standard” COM Port: DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** with the “Standard” COM port: FSK=DTR, PTT=RTS

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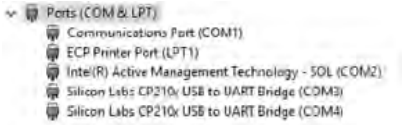
## Kenwood TS-890

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




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



## N1MM+ Contest Software

- CW Timing over USB is usually OK!
- Set DTR (pin 4) = CW, RTS (pin 7) = PTT

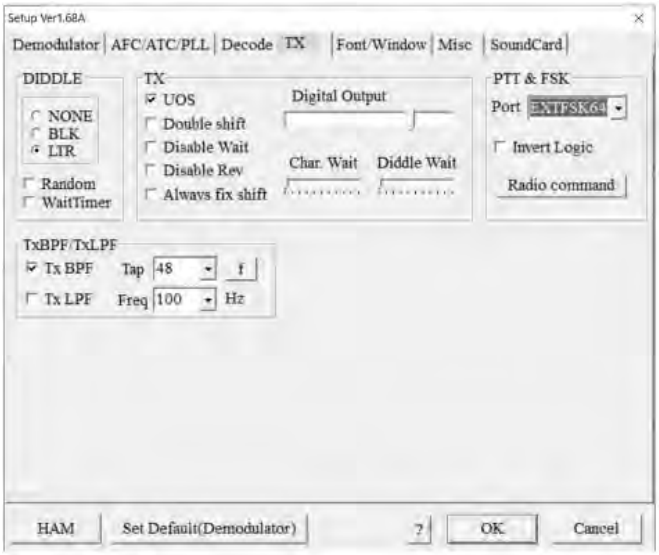
## Win-Test Contest Software

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



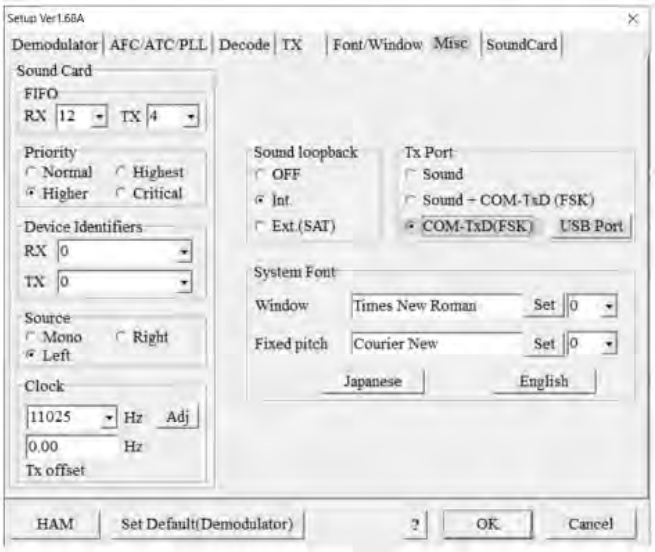

## MMTTY Setup Menu, TX Tab

- Set **Port** to **EXTFSK64**



## MMTTY Setup Menu, Misc Tab

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



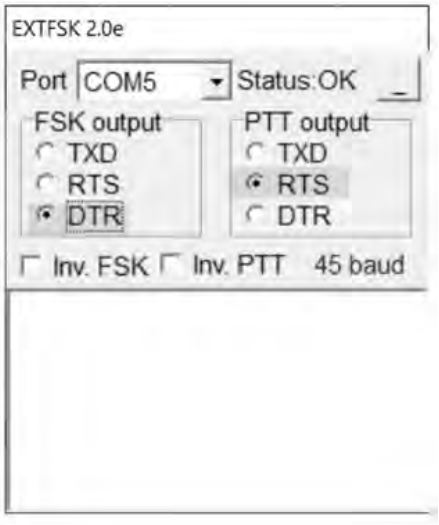



## MMTTY USB Port Menu

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

## EXTFSK Pop-Up Menu

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






## Serial Port Hardware Sharing

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

## Shameless Plug

- The N6TV “Serial Box” (S-BOX and S-BOX-USB w/FTDI) by N6TV implements parallel connections to RXD pin via standard D-SUB cables:

  https://bit.ly/S-BOX

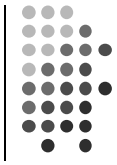
- S-BOXs provide four NPN keying circuits for rigs that do not have any RTS/DTR CW/FSK/PTT keying support (Yaesu FTdx5000, FT-1000MP, Kenwood TS-990s, TS-590s, ICOM IC-7700, IC-7800, etc.)



## Serial Port Software Sharing

- Software sharing:  multiple programs simultaneously access the radio’s rig control serial port
- Implemented by VE3NEA’s **OmniRig** software
- OmniRig may be used by Win-Test, Writelog, HDSDR, WJST-X, Log4OM, etc. for rig control
- NOT supported by N1MM+, N3FJP, others
- OmniRig owns the serial port, acts as traffic cop, no collisions or conflicts between applications
- Can I use VSPE instead?  Maybe, but collisions / conflicts may occur
- CW / PTT / FSK Keying via OmniRig port not supported

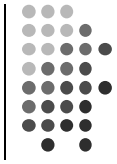
## Radios with USB *and* DE-9 connectors



- Elecraft K3: USB and Serial Port ("P3/RS232") do not operate independently (parallel TXD wiring)
- Kenwood TS-590S and others: USB and Serial Port operate independently
- ICOM USB and CI-V Ports (3.5mm, not DE-9) may operate independently (set **USB CI-V Port** to **Unlink from [REMOTE]**)
- Provides possibility for two programs to poll radio at same time via independent serial ports, one USB, one DE-9 or CI-V.



## USB connection to radio adds a new Windows Sound Card



- **USB Audio CODEC**
- Can be use for contest recording, voice keying, MMTTY / FT8 decoding
- Multiple "USB Audio CODEC" devices, which is which?
- Right click on Speaker icon, Open Sound Settings
- Scroll down and select **Sound Control Panel**
- Select **USB Audio CODEC** device that appears when you connect USB Cable
- Click **Properties**
- Label both the "Recording" and "Playback" devices

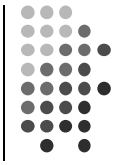
## Labeling a USB Audio CODEC Device




## Key Points to Remember

- Set **devmgr_show_nonpresent_devices** to **1**
- Use the Windows Device Manager to manage and renumber COM ports
- Always uninstall Prolific devices and drivers
- Always change the FTDI Default Options
- Try CW, FSK and PTT via serial port pins
- Use DTR for CW/FSK, RTS for PTT
- Understand serial port conflicts and sharing
- Label your USB Audio CODEC devices

# Questions?



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

# CTU Presents

**FT8 and the WSJT-X 2.0 Software Suite for 6 Meter Contesting**

**Joel Harrison, W5ZN**

## Session Objective

- We're not going to discuss or debate contest rules. They are what they are….follow them or change them
- We're not going to debate FT8 as a mode compared to CW, SSB, AM or Spark
  - We will discuss how to implement it into your station
- FT8 is simply a "Disruptive Technology"!

# Disruptive Technology

- Technology that is new and constantly innovating
- Initially only appeals to a small group
- They disrupt by creating new users and challenging existing technology
- Examples
  - Email & social media transformed the way we communicate
  - Cell phones disrupted the telecom industry
  - Notebook computers & tablets created a mobile workforce
  - FT8 has transformed amateur digital communications

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# First – A Bit of History

- Created by Dr. Joe Taylor, K1JT
  - Astrophysicist & Nobel Laureate
    - Nobel Prize in Physics - 1993
    - Discovered new type of pulsar that has opened up new possibilities for the study of gravitation.
- WSJT Originally Released in 2001
  - Has undergone major revisions since then
  - Became “Open Source” in 2005
  - Original version up through “WSJT7” contained 16 different modes

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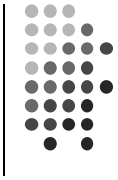
## WSJT-X 2.0 Modes



- 9 Different Protocols or Modes
- FT8, JT4, JT9, JT65, QRA64, ISCAT, MSK144, WSPR and Echo
- First 5 are for making reliable QSOs under extreme weak signal conditions
  - All use nearly identical message structure and source encoding.

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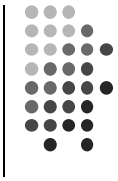
## WSJT-X 2.0 Modes



- JT65 and QRA64 were designed for EME (moonbounce) on the VHF/UHF bands
  - Also proven very effective for worldwide QRP communications on HF
- MSK144 and ISCAT are “fast” protocols designed forionized meteor trails, aircraft scatter and other types of scatter propagation

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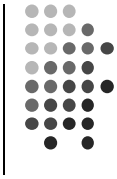
## WSJT-X 2.0 Modes



- WSPR (pronounced Whisper) stands for “Weak Signal Propagation Reporter”
  - Designed for probing potential propagation paths using low-power transmissions.
- Echo mode allows you to detect and measure your own station’s echoes from the moon, even if they are below the audible threshold

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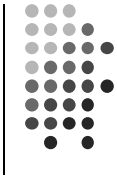
## WSJT-X 2.0 Modes



- Free software & documentation
- Download from WSJT “Home” is at:

https://www.physics.princeton.edu/pulsar/K1JT/

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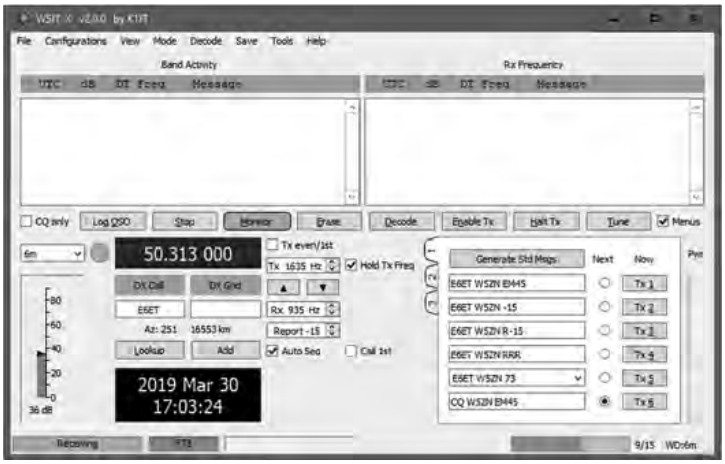
# WSJT-X 2.0 Modes

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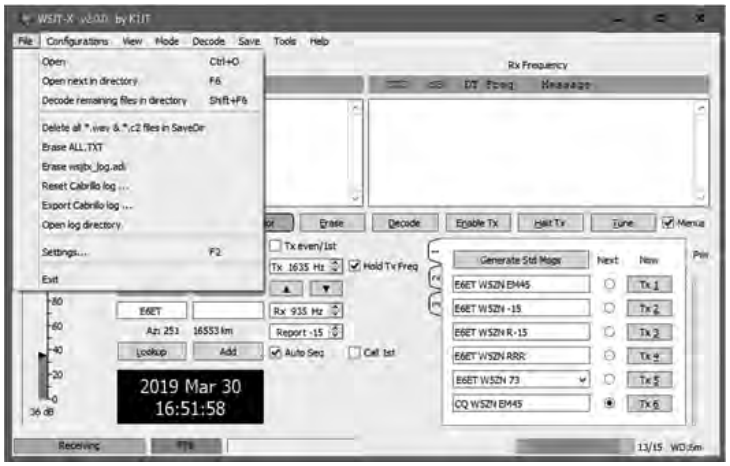
# WSJT-X 2.0 Modes

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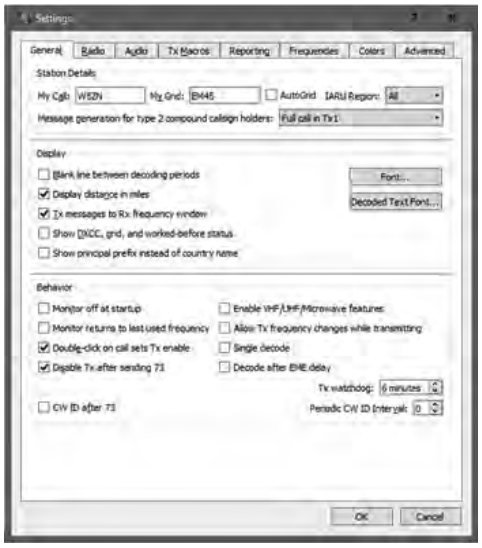
# WSJT-X 2.0 Modes



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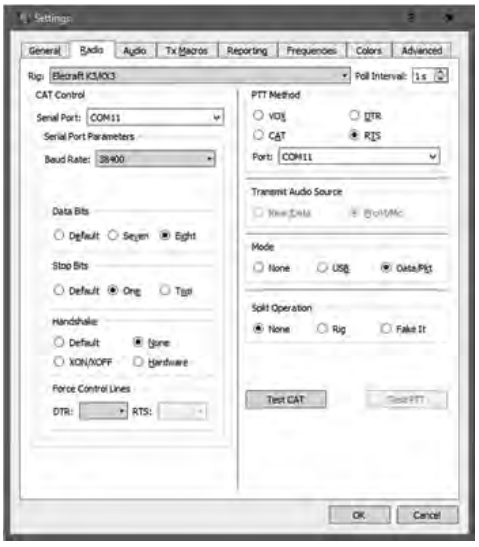

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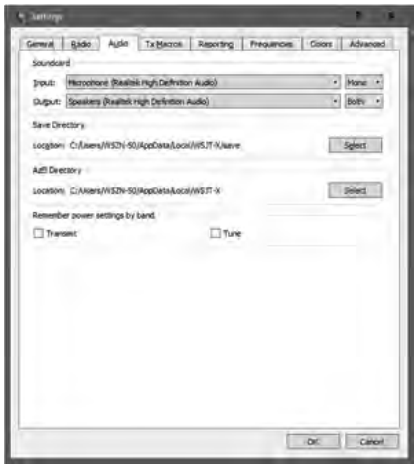

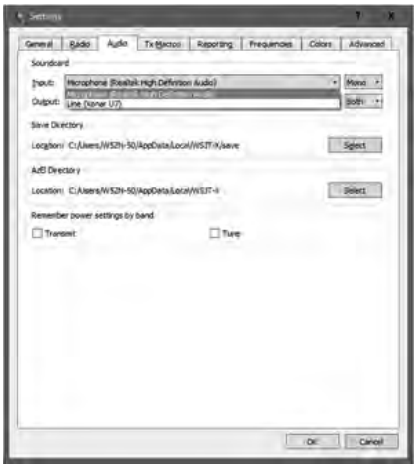

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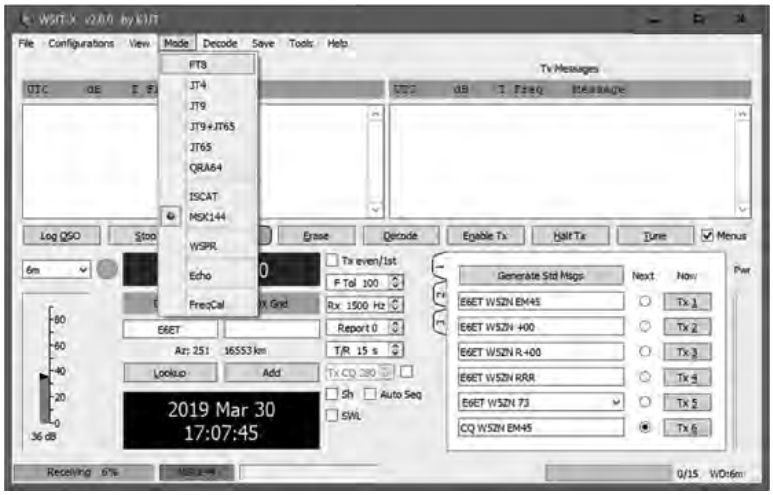
# WSJT-X 2.0 Modes

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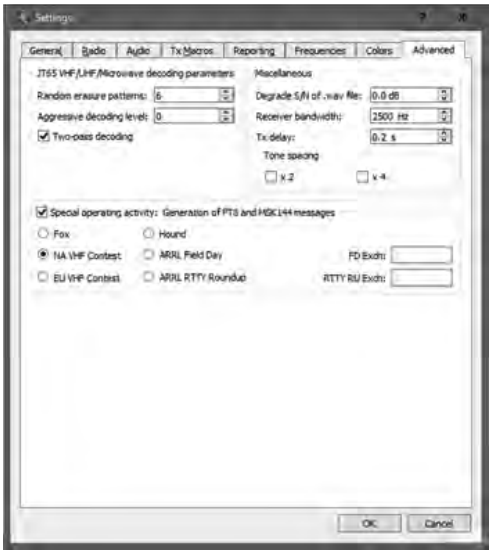
# WSJT-X 2.0 Special Operating

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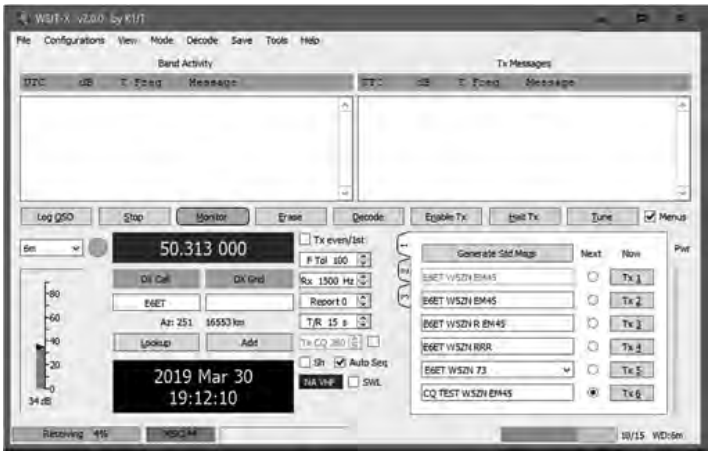
# WSJT-X 2.0 Modes

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# WSJT-X 2.0 Modes

- WHAT TIME IS IT???????????????
  - Your computer's time ***MUST*** be accurate
  - How you do dat?
    - Do NOT relay on the Windows time sync service
      - Time.is will identify your computers descrepancy
    - Dimension 4 is my recommendation

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# FT-8

- Outgrowth of JT65
- Shorter transmit-receive cycle
  - Faster contacts – up to 4 times faster
  - Can complete within 1 minute
- Sensitivity down to -20 dB
- Uses 8-Frequency Shift Keying format

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# FT-8 Six Meter Advantages

- Excellent for multi-hop sporadic E
  - Deep QSB often times impacts normal mode Q's
- Operation centered on 50.313

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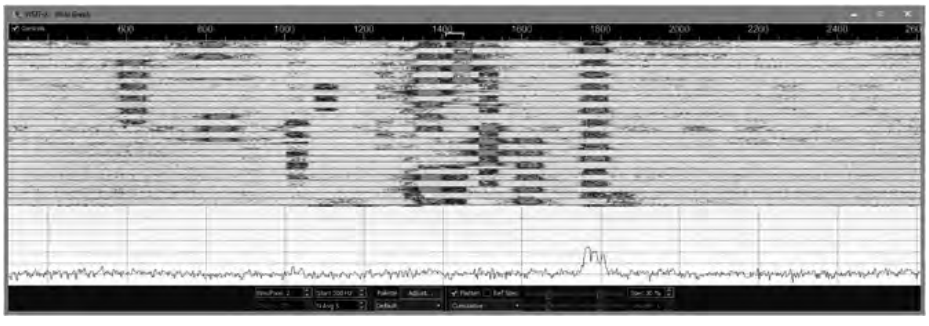
# FT-8 Wide Graph



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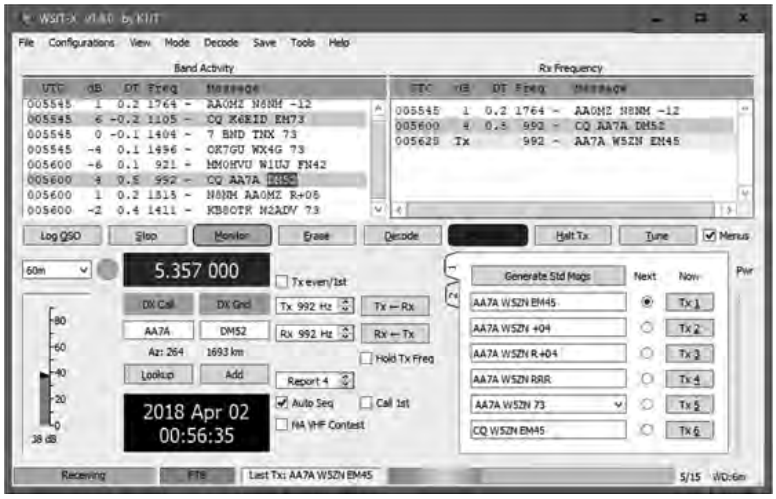
# FT-8 Main Screen

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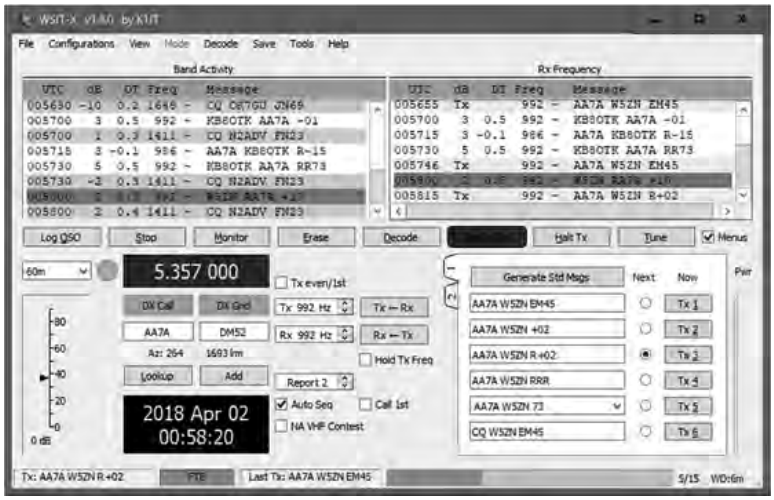
# FT-8 Main Screen

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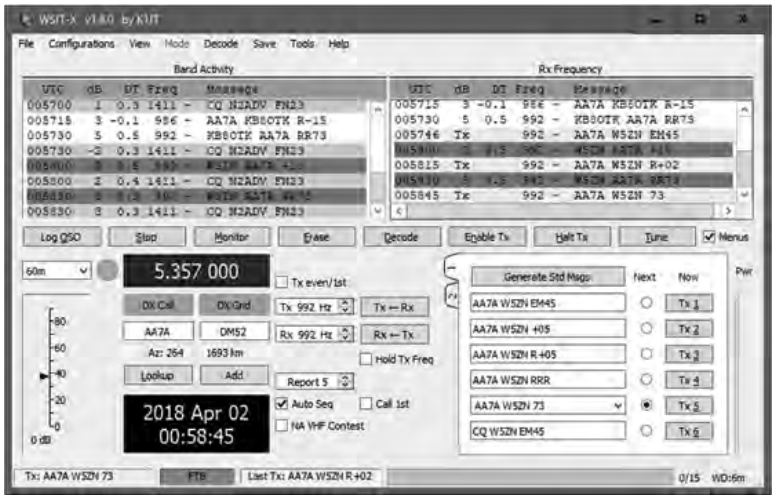
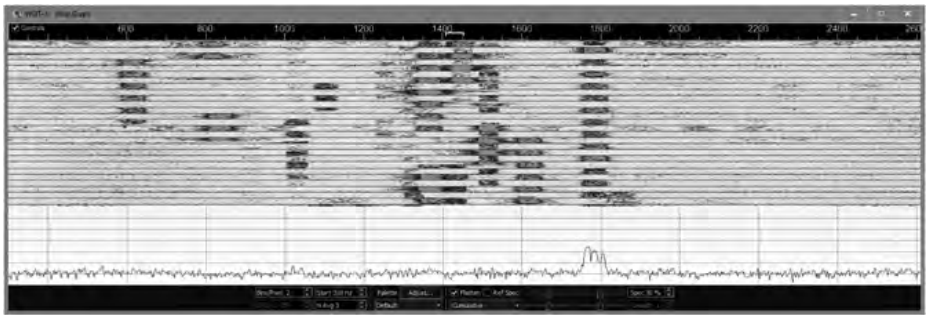
# FT-8 Main Screen





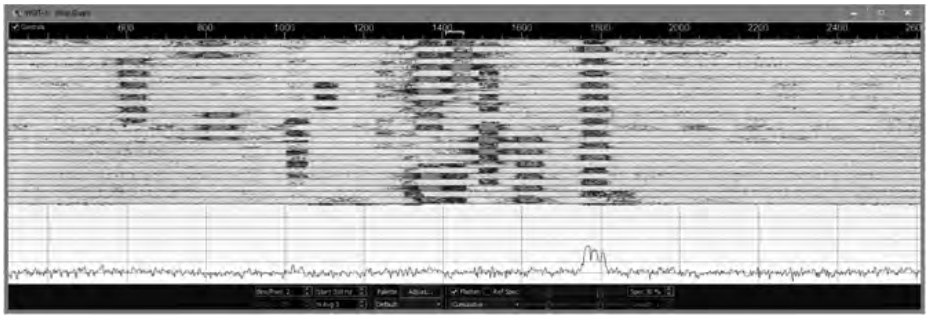

# FT-8 What Freq Am I On?

My dial says 14080.0 but the station was spotted on 14081.7



# FT-8 Bandwidth

An FT8 Signal has a 50 Hz bandwidth. Should I use my CW filter to narrow my receivers bandwidth?



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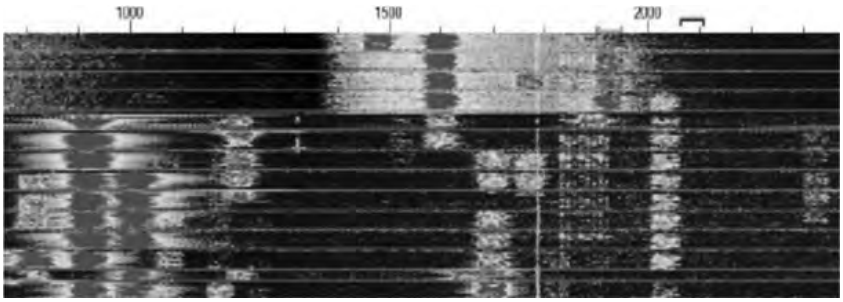
# FT-8 Narrow RX Filters

Narrowing your receivers bandwidth “may” improve the RX conditions.

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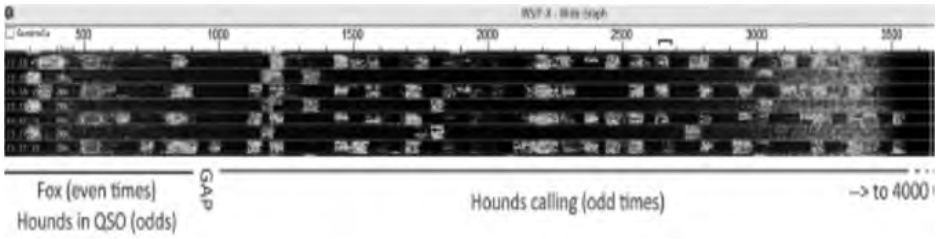
# FT-8 Special Applications

Fox/Hound Mode

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# FT-8 Special Applications

Fox/Hound Mode


- If you cannot copy the fox, ***DO NOT CALL HIM*** as you will simply create QRM and aggravation.
- Even if by some miracle he responds to you, you won't see his response and someone else may miss out on a QSO as he tries to contact you in vain.
- Simply be patient, watching the screen, poised to pounce like a hawk (hound) when you do see decodes from him.


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# FT-8 Special Applications

Fox/Hound Mode

- In DXpedition mode, a special hard-coded timer automatically disables your transmissions after 2 minutes without a response
- During this time the fox may have put you in the queue.

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# FT-8 Special Applications

Fox/Hound Mode

If the fox responds to you later, after your DXpedition mode timer has timed out and before you re-start transmissions, your Tx will automatically be re-enabled to send him his report, completing the QSO when he acknowledges it with his RR73 message back to you

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# FT-8 Special Applications

Fox/Hound Mode

- If the fox responds to your call with his Tx 2 message (your callsign and report), your system will automatically QSY your Tx to a frequency below 1000 Hz to send him your Tx 3 message (both callsigns, R and his report).
- If you don't have CAT control, you must QSY manually below 1,000 to make the QSO unless the DXpedition op is around and manually completes it.

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# FT-8 Contest Disadvantage

- QSO rates can be larger on other modes during big Sporadic E Openings
  - While a quick FT-8 contact can be completed in 1 minute, SSB or CW rates can be 5 to 10 times that
- On 6 meters, too many stations sit on 50.313 when the band opens and closes quickly on CW & SSB Frequencies!

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# FT-8 HF Operating Guide

Gary Hinson, ZL2IFB, has a detailed operating guide at:

https://www.g4ifb.com/FT8_Hinson_tips_for_HF_DXers.pdf

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# Meteor Scatter

- The earth is bombarded by a constant stream of small particles, remnants of comets that when entering the earth's atmosphere can ionize a column of atoms in the E region at approximately 100km (~60 miles) above the surface of the earth which can reflect radio waves in the VHF region of the spectrum

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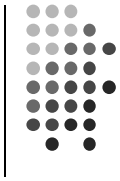
# Meteor Scatter



- There are seasonal variations in the number of sporadic meteors
  - Relative rate increases noticeably in May, peaking in July and August then tailing off into October and November.
- There is also an hourly variation in the relative rate of meteors peaking
  - around dawn local time with the minimum late afternoon before the ramp up begins again late evening.
  - The hourly relative rate is due to the fact that the earth's rotation is head on so to speak in the morning into the path of the particles and therefore there is an increase in the relative velocity of a particle entering the earth's atmosphere.

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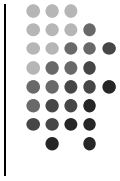
# Meteor Scatter



- The length of time of the ionization, or burst duration, is related to meteor velocity and increase in relative velocity results in longer ionization times.

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# Meteor Scatter

- Most particles entering the earth's atmosphere are the size of a grain of sand resulting in ionization lasting only a fraction of a second
  - much too short to convey any meaningful information using SSB or even high speed CW.
- The digital modes of FSK441 and MSK144 were designed to compress a limited amount of information in a packet and transmit that packet in a very short period of time.
  - In the case of MSK144 the information packet, with a transmission length 0.072 seconds, is repeated over and over again during the duration of the selected transmit interval of 5, 10, 15 or 30 seconds.

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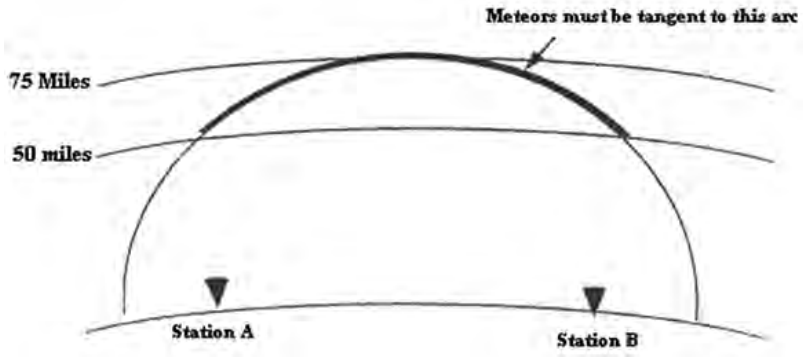
# Meteor Scatter

Reflection will occur when the trail is oriented as shown

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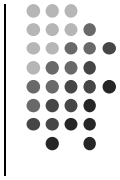
## Meteor Scatter



- Excellent for 50 MHz
- Very Predictable Paths
  - Best times between midnight & approx 9 AM
  - Peak during “showers” – Anytime with high speed procedures like ***WSJT***

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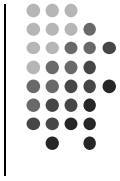
## Meteor Scatter



- Very Good for 144 MHz
- Very Predictable Paths
  - Best times between midnight & approx 9 AM
  - Peak during “showers” – Anytime with high speed procedures like ***WSJT***

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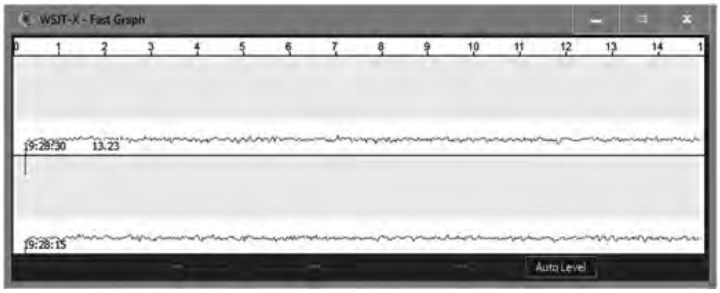
# Meteor Scatter – MSK144

Signal display “Fast Graph”

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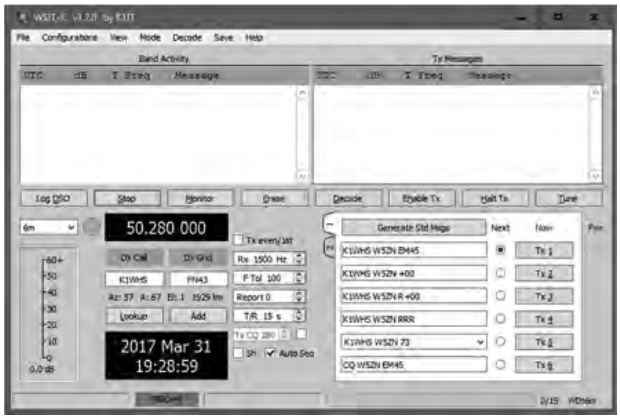
# Meteor Scatter – MSK144

FSK441 Main Screen

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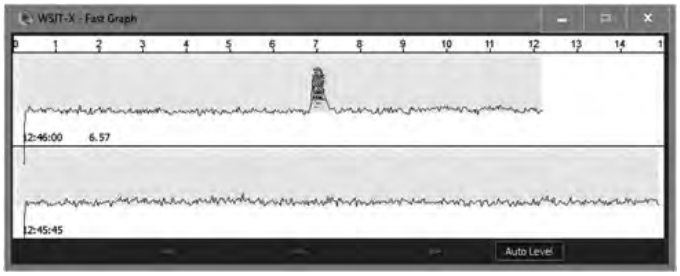
# Meteor Scatter – MSK144

Signal bursts appear in the “Fast Graph”

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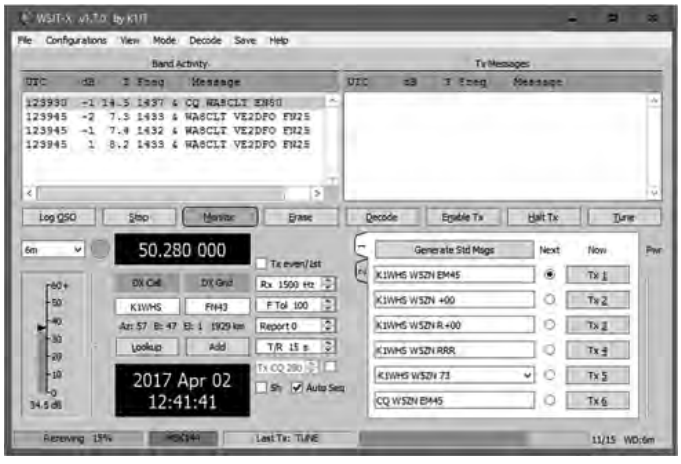
# Meteor Scatter – MSK144

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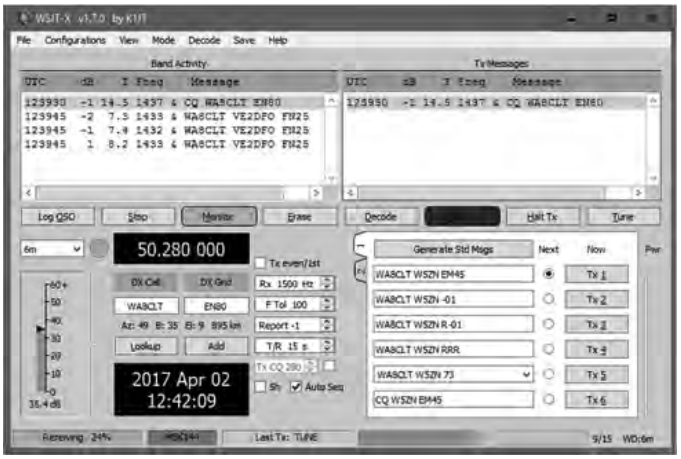
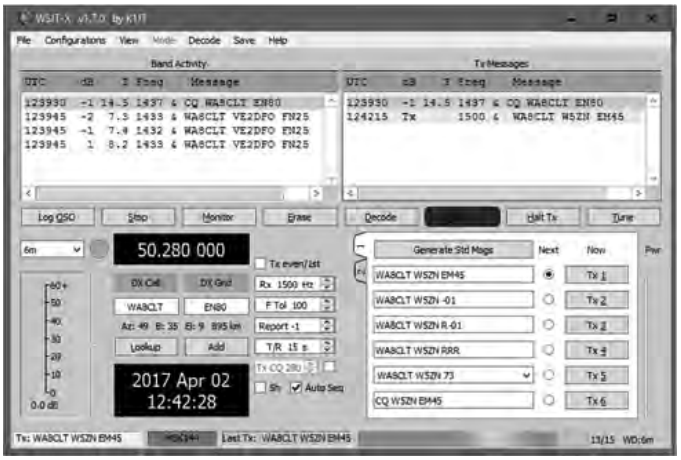
# Meteor Scatter – MSK144

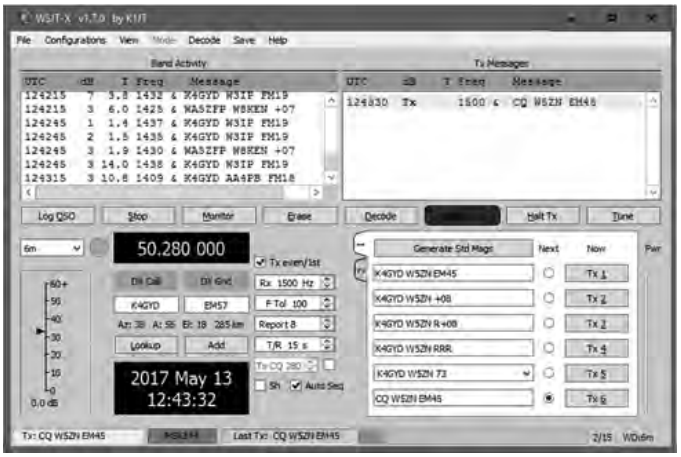





# Meteor Scatter – MSK144



# Meteor Scatter – MSK144

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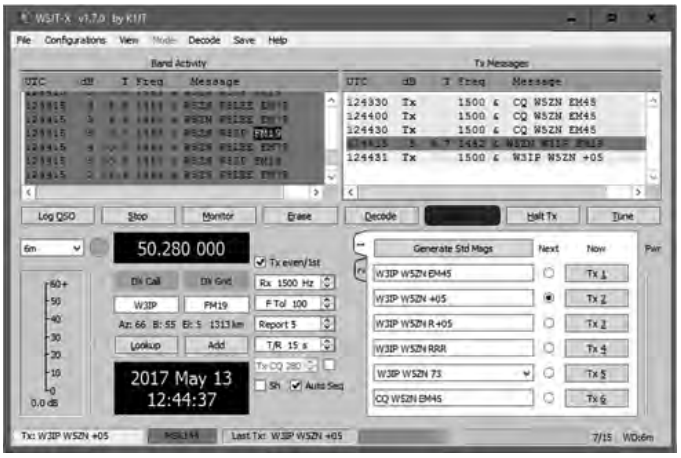
# Meteor Scatter – MSK144

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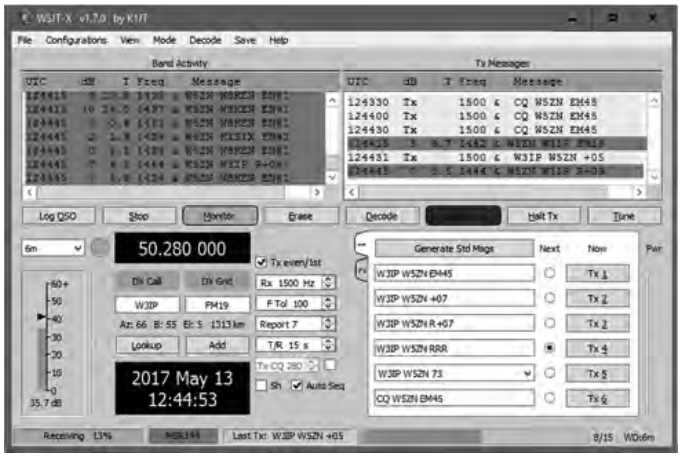
# Meteor Scatter – MSK144



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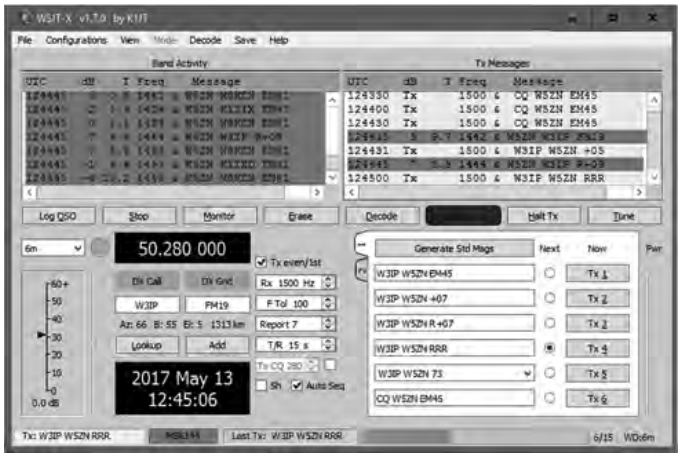

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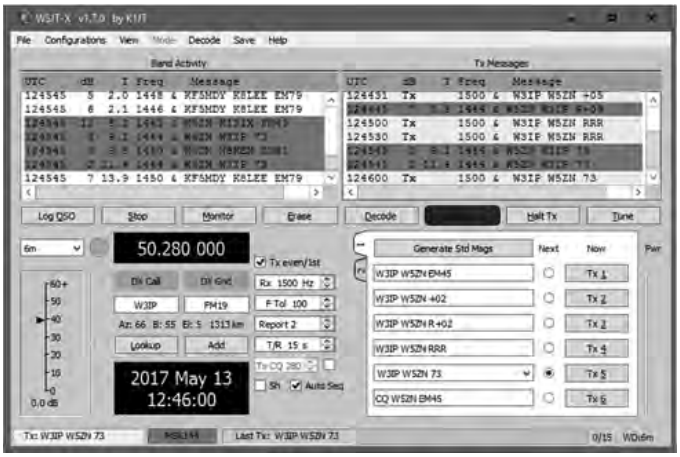
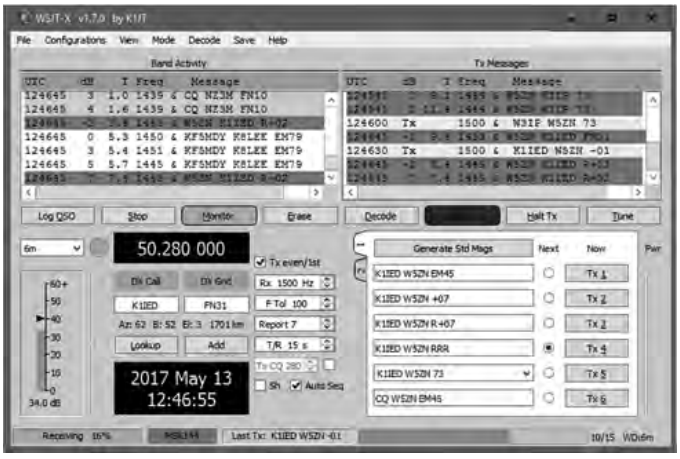
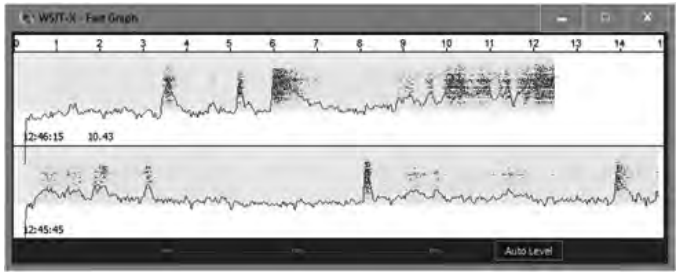




# Meteor Scatter – MSK144

# Meteor Scatter – MSK144

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# Meteor Scatter – MSK144

## K8ZR Test Results

- **Contest QSO Non-Contest QSO**
- **Tx Time:**
- 15 sec. CQ N8JX EN64
- 15 sec. N8JX K8ZR EN91
- 15 sec. K8ZR N8JX R EN64
- 15 sec. N8JX K8ZR RRR
- 15 sec. K8ZR N8JX 73
- Total time: 75 seconds

- **Non-Contest QSO**
- **Tx Time:**
- 15 sec. CQ WB4JWM EM83
- 15 sec. WB4JWM K8ZR EN91
- 15 sec. K8ZR WB4JWM +05
- 15 sec. WB4JWM K8ZR R+07
- 15 sec. K8ZR WB4JWM RRR
- 15 sec. WB4JWM K8ZR 73
- Total time: 90 seconds

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# Meteor Scatter – MSK144

## K8ZR Test Results

50 MHz MSK144 QSO Summary

- Period January 23rd- March 13th: 50 days
- Number of 50 MHz MSK144 QSOs: 225
- Average number of minutes to complete a QSO: 4.6
- Number of unique callsigns worked: 50
- Number of unique callsigns decoded: 98
- Number of States worked: 22
- Number of unique Grids worked: 42
- Number of 90 second QSOs: 10
- Best DX K5DOG EM00wh: 1,223 miles

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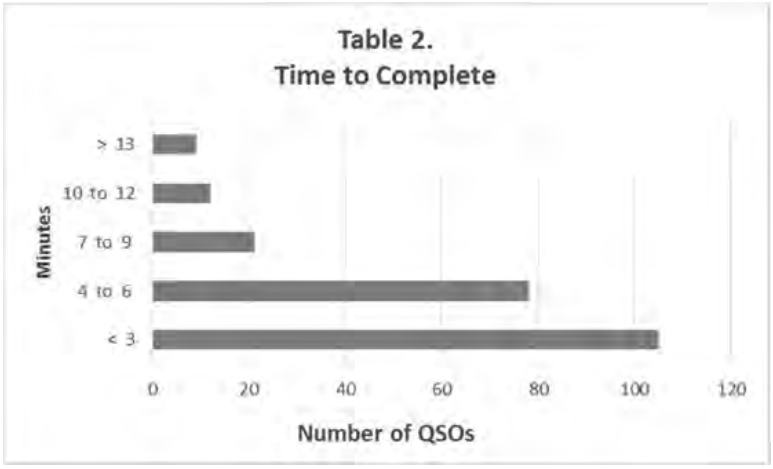
# Meteor Scatter – MSK144

## K8ZR Test Results

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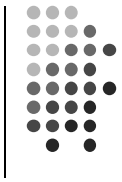
# WSJT-X 2.0 Modes



?

Or During the 3:15 PM Digital Contesting Discussion in this room

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# All Together Now – Grounding and Bonding For Contest Stations

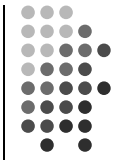
Presented Courtesy of
Contest University (CTU) &
Icom America

Ward Silver, NØAX

## Goals of the Session

- Understand “ground” and “bond”
- Appreciate the different requirements for ac safety, lightning protection, RF and audio
- Discuss issues and techniques for contest stations
- Illustrate the system approach
- Provide comprehensive resources

## Who Is This Talk For?



- Station builders…
  - Building a competitive station
  - Adding an amp
  - In lightning country
  - Trying for better performance
- But not really for…
  - K3LR, W3LPL, KC1XX, NR5M, etc

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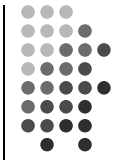
## Background References



- *ARRL Handbook, ARRL Antenna Book*
- *NEC Handbook* – at your library
- *Standards and Guidelines for Communication Sites* (Motorola R56) – available online
- *Lightning Protection for the Amateur Station* (Ron Block, NR2B – Jun/Jul/Aug 2002 QST) – ARRL website
- *Power, Grounding, Bonding, and Audio for Amateur Radio* and *RFI, Ferrites, and Common Mode Chokes For Hams* – available at **k9yc.com/publish.htm**

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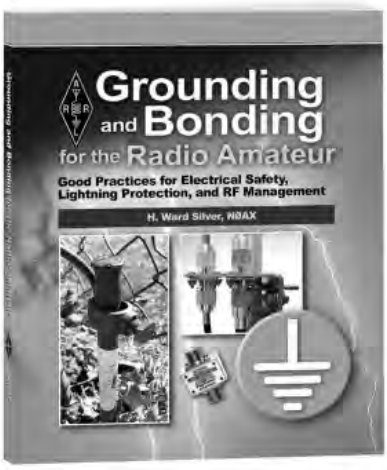
# Background References

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

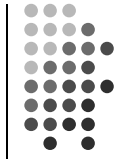





# What *IS* "Ground" Anyway

- What you are trying to do depends on frequency & wavelength, voltage, current
- Your **safety** depends on the right answer
- Your **equipment** depends on the right answer

# What *IS* "Ground" Anyway



- What you are trying to do depends on frequency & wavelength, voltage, current
- Your **safety** depends on the right answer
- Your **equipment** depends on the right answer
- Your **sanity** depends on the right answer

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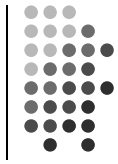
# What *IS* "Ground" Anyway



- It can be a noun, verb, and adjective – *all at the same time*
- Noun - an "earth connection" (ac, lightning) or a local reference potential (circuits, RF)
- Verb - an action "to connect to the reference potential"
- Adjective - a type of connection, such as a "ground conductor" or "ground system"

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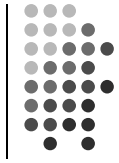
## What *IS* "Ground" Anyway



- Fuzzy definitions:
  - "RF ground" – ain't no such thing
  - "Ground loops" – not the problem you think it is
  - "Single-point ground" – it depends…
  - Long connections can be ***no*** connection
- The Earth is NOT – a magic sink into which we can pour RF or lightning and expect it to magically and safely disappear

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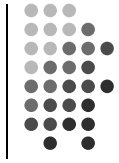
## What *IS* "Bonding" Anyway



- A connection intended to keep two points at the same voltage
- Sounds expensive but it's not
- Sounds hard but it's not
- Requires the right connecting materials and hardware
- Works in your favor for ac safety, lightning protection, and RF management

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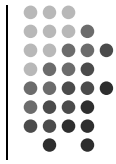
## What *IS* "Bonding" Anyway



- For bonding to work, it has to be…
  - Low-Z and "short" at the frequencies of interest
  - Heavy enough to carry the expected current
  - Sturdy enough to survive the environment
- Inside the ham station, use…
  - Strap (20 ga) or heavy wire (#14 or larger)
  - Flat-weave braid
    - Braid from old coax deteriorates

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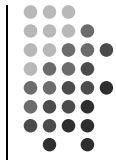
## AC Safety Grounding



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

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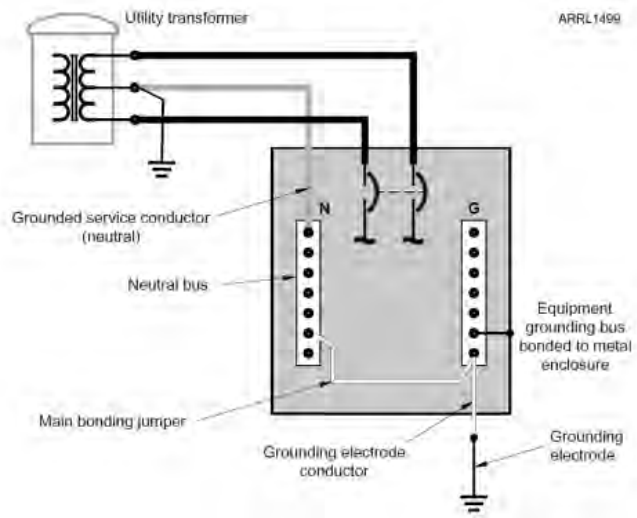
# AC Safety Grounding

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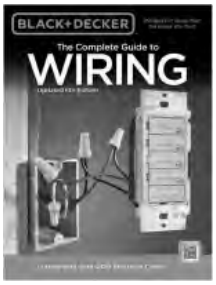
# AC Safety Grounding

- If you aren't sure you know what you're doing…get a how-to reference




- Or hire a professional electrician

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# Lightning Protection

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

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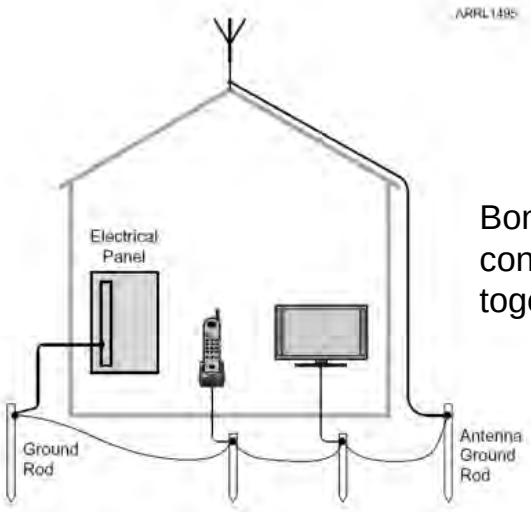
# Lightning Protection




Bond ALL earth connections together

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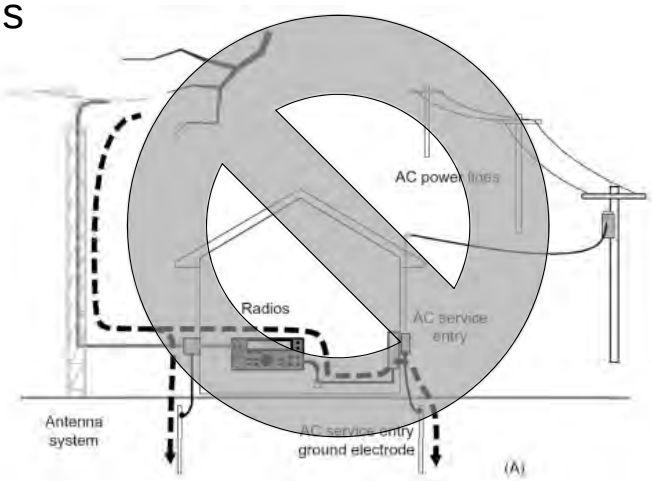
# Lightning Protection

- Ground paths should go *around* your station

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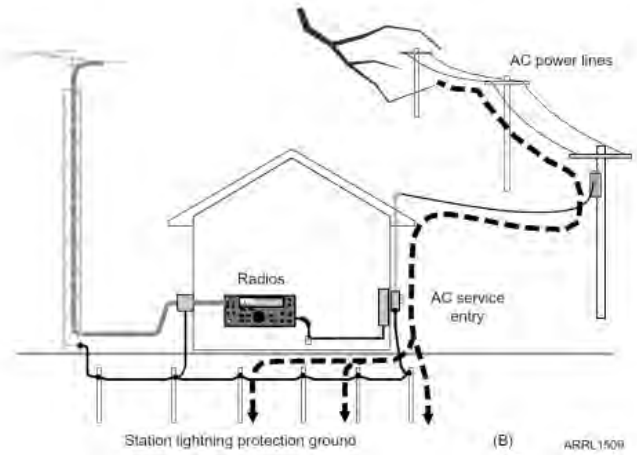
# Lightning Protection

- Ground paths should go *around* your station

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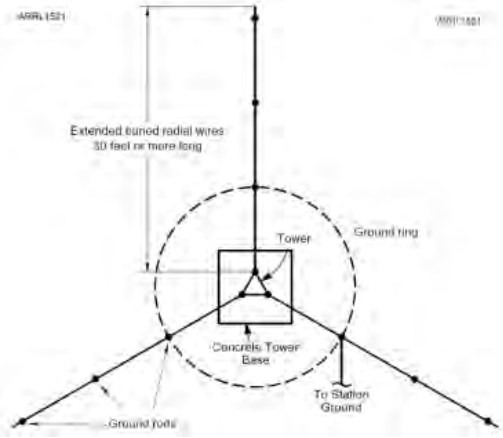
# Lightning Protection

- Tower grounding

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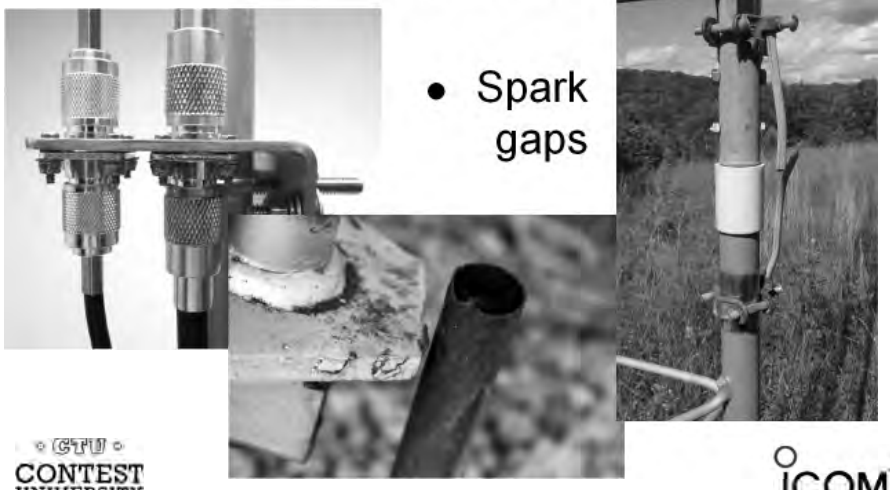
# Lightning Protection

- Bond feed lines to the tower



- Spark gaps

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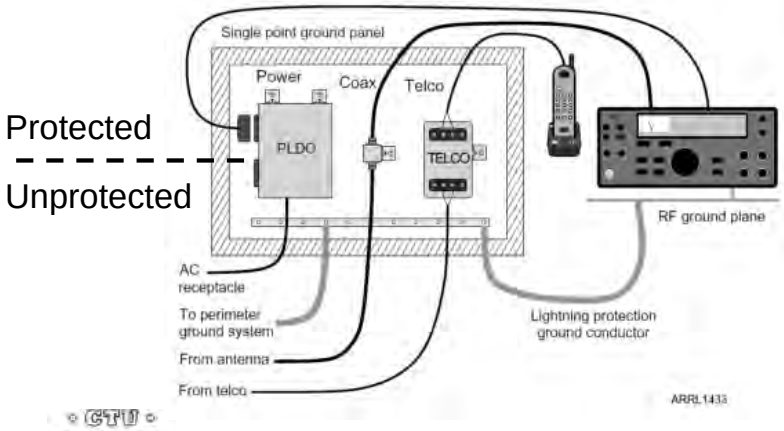
# Lightning Protection

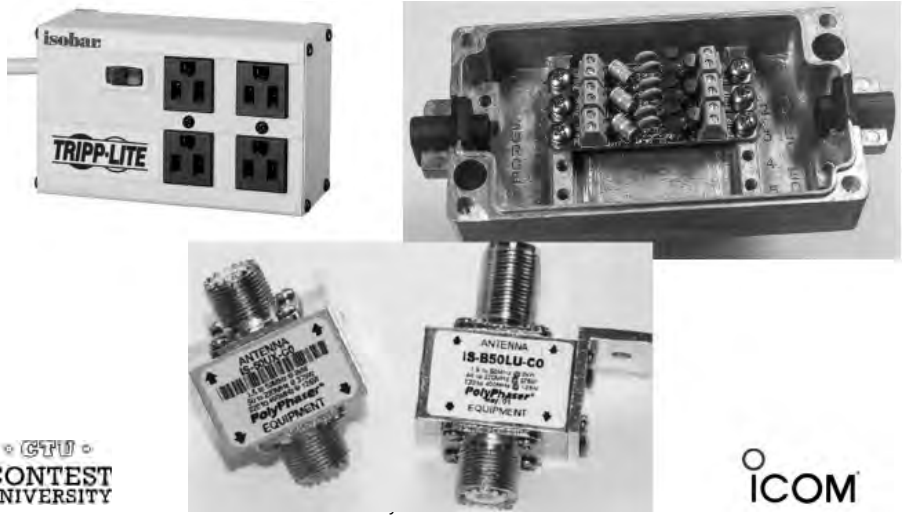
- Single-point Ground Panel





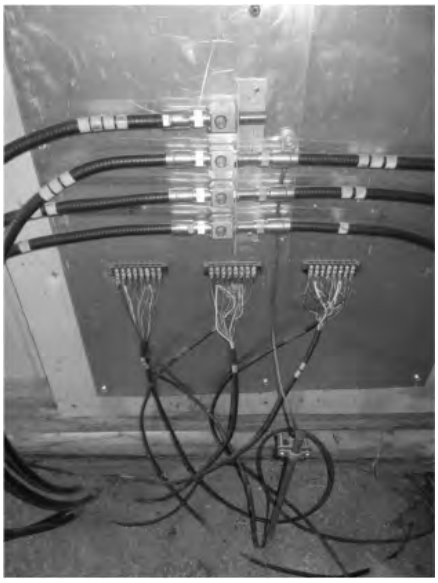

# Lightning Protection

- Single-point Ground Panel



# Lightning Protection

- Single-point Ground Panel



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# Lightning Protection

- Single-point Ground Panel

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# Lightning Protection

- Single-point Ground Panel

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# Lightning Protection

- Single-point Ground Panel

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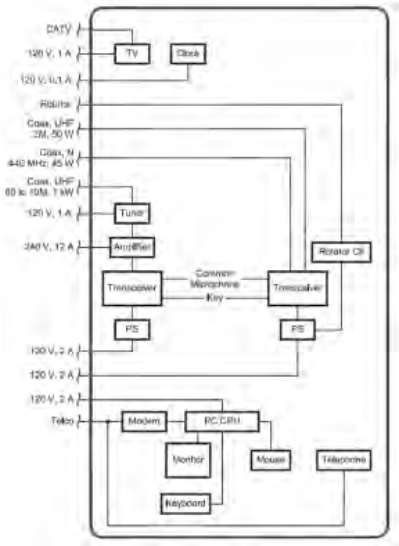
# Lightning Protection

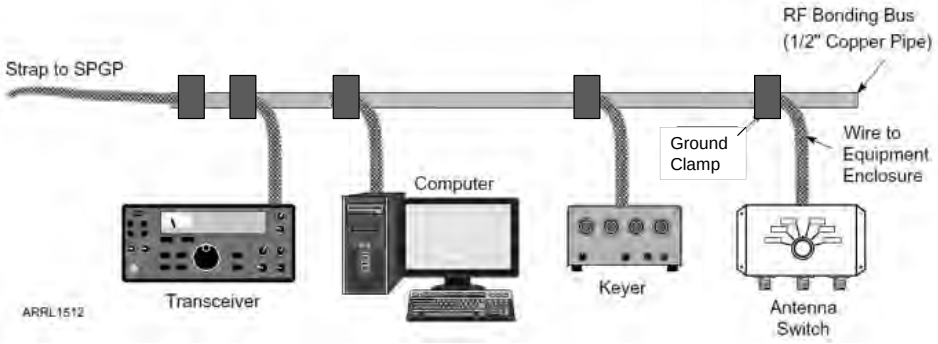
- Protected Zones
  - Every line crossing the boundary must be protected
  - Must all have a common or bonded ground connection
  - Bond equipment within the station






# Lightning Protection

- Bonding inside the shack



# RF Management

- Everything in the station is an antenna

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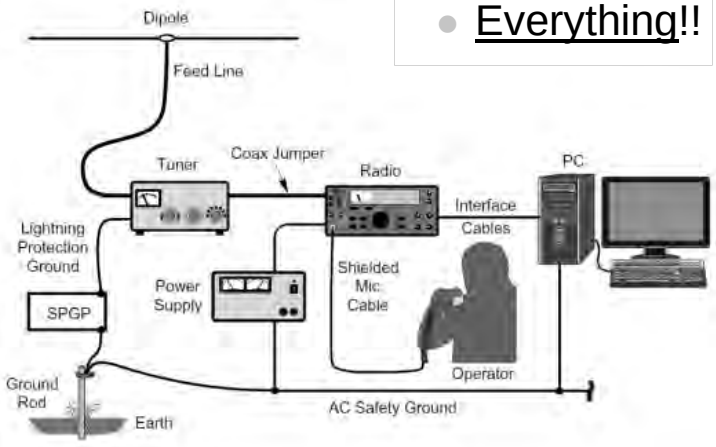
# RF Management

- Everything!!

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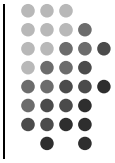
## RF Management



- Everything in the station is an antenna
- Forget about an “RF ground”
- Concentrate instead on bonding
- Contest stations = high RF field strength
- Requires extra attention to bonding
- Create common reference plane and/or bus

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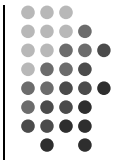
## RF Management



- Equalize voltage to minimize current
  - Eliminates “hot spots”
  - Reduces RFI from common-mode current
  - Reduces sensitivity to physical configuration
  - Minimizes audio “buzz” and hum
- Tie everything to a common plane or bus
- Keep cables short or coiled
- Heavy, direct connection to SPGP

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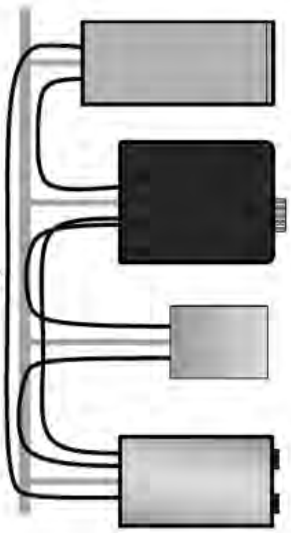
# RF Management

- Keep cables short
- Use a bonding bus and reference plane
- Minimize loop area




- Use shielded cables
- Short straps or wires

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# RF Management

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

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# RF Management

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# RF Management

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# RF Management

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# Ground System

- Now for some good news…

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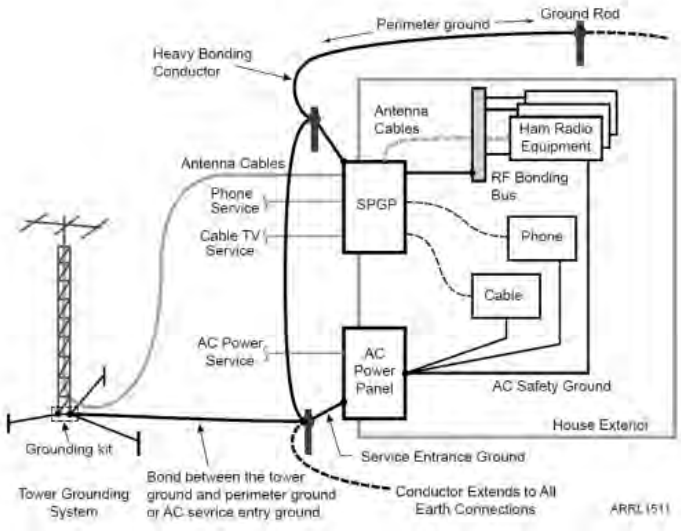
# Ground System

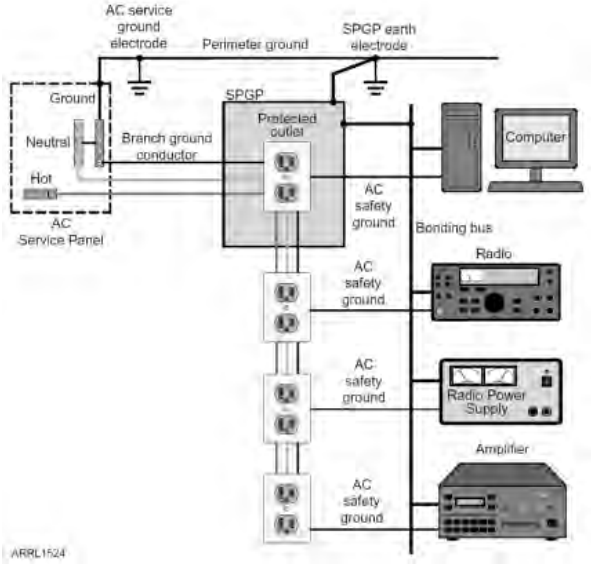
- “One system to rule them all”
- All currents flow on all wires
- A single, solid ground system made of short, heavy, direct connections satisfies all of the requirements for…
  - AC Safety
  - Lightning Protection
  - RF Management & Clean Audio



# Ground System



# Ground System

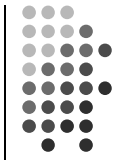





# Additional Resources

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

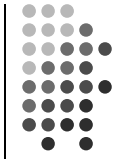
# Additional Resources



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



# Additional Resources



- Books and Online Material
  - Block, R. R., The "Grounds" for Lightning and EMP Protection, Second Edition, PolyPhaser Corporation, 1993.
  - Rand, K. A., Lightning Protection and Grounding Solutions for Communications Sites, PolyPhaser Corporation, 2000.
  - ARRL Technical Information Service sections
    - Electrical Safety — **www.arrl.org/electrical-safety**
    - Grounding (various types and topics) — **www.arrl.org/grounding**
    - Lightning Protection - **www.arrl.org/lightning-protection**
  - W8JI's web pages on ground systems (**w8ji.com/ground_systems.htm**)

# *ARE WE DONE YET?*

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# *THANKS!!*

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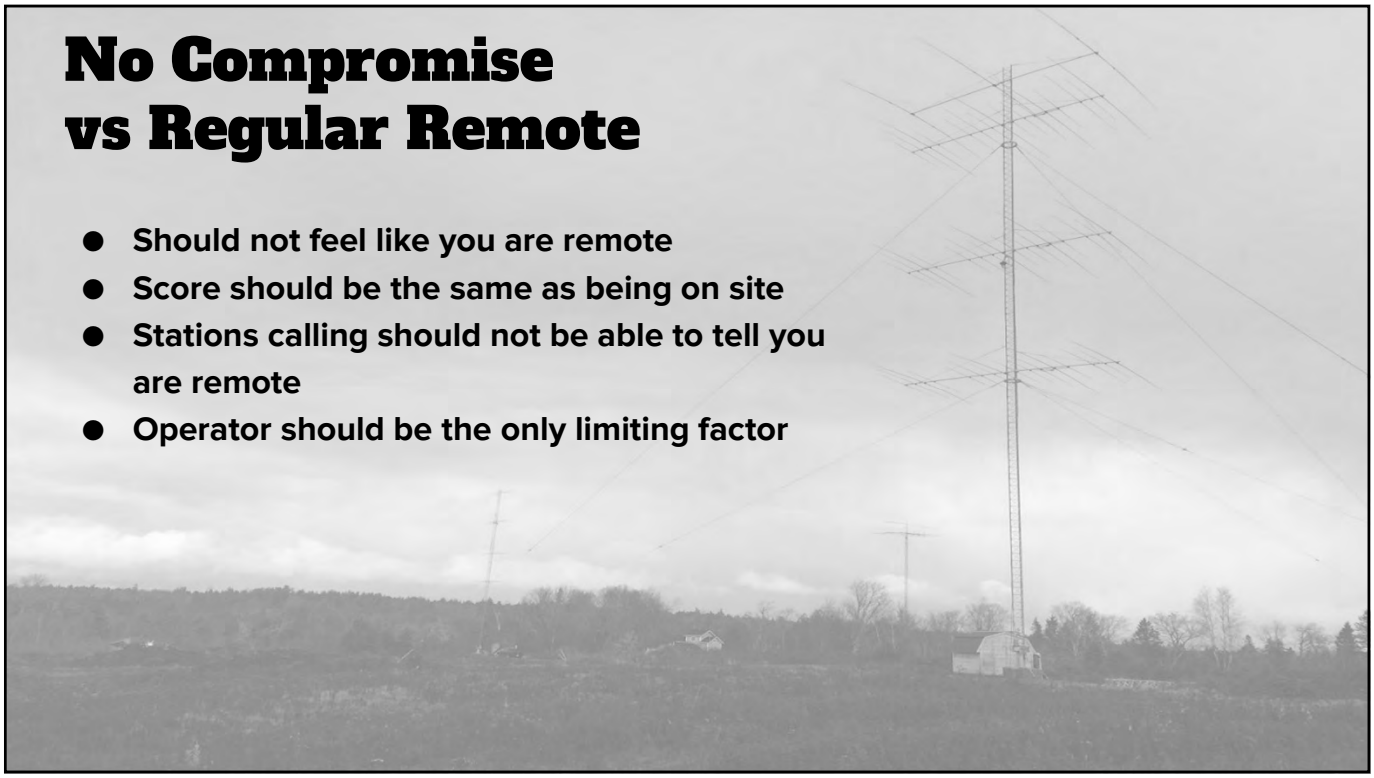
# No Compromise Remote Contesting

Dayton Contest University 2019
Chris Hurlbut, KL9A

## No Compromise vs Regular Remote



- Should not feel like you are remote
- Score should be the same as being on site
- Stations calling should not be able to tell you are remote
- Operator should be the only limiting factor

# Internet Connection: The most important piece of the puzzle

- Pure speed is not the only metric to consider
- Latency is the bigger issue, especially on CW
- Consistent connection is the key
- Cable modems very susceptible to the “Netflix effect”
- Fiber or DSL has been the best
- Consider upload speeds especially for SO2R and remote end
- RF the last mile can be OK also
- IQ Router or similar helps
- Use ethernet, not WiFi

# Remote Access to Every Peripheral

- PC’s and routers
- Power supplies, battery backups, surge protectors
- Amplifiers
- Antenna switching
- Adds another level of complexity and maintenance
- The devil is in the details!

# So what are guys using to win?

- Remoterig RRC-1258MkIIs
  - Private setups - NK7U, K7ZS, N2QV
  - K3/0-Mini or similar most popular, but other rigs also used
  - Commercial - RemoteHamRadio.com (RHR)
- App based systems, no RRC required - RHR
- Lots of other options available, but as far as I can tell every USA remote win has been done using one of these setups

# Why is the Remote Rig box so popular?

**Pros**

- Long history, proven to work
- Can use any radio, but K3 integration is elegant
- Best CW sending so far (controversial - more later)
- Economical
- Allows a true “Big Knob” experience

**Cons**

- Setup can be cumbersome
- Virtual COM Ports are no fun
- Old technology, things are evolving quickly

**SO2R into NK7U Super Station**

**Not winning the USA from Oregon, but absolutely "No Compromise"**

- **K3/0-Mini's**
- **RRC's**
- **YCCC SO2R Controller**
- **Each radio has independent controls for antennas and amps, just like being on site**
- **VNC using two Raspberry Pi 3's**
- **Lots of mice!**
- **Special VPN setup for fully networked Multi-Ops using N1MM+**


**K7ZS (NK7U remote version 2.0)**

- **The remote side is usually very clean looking**
- **This is one side of a growing M/2 or SO2R setup at K7ZS**

Same as the previous setup, except logging into the RHR site for all station controls.

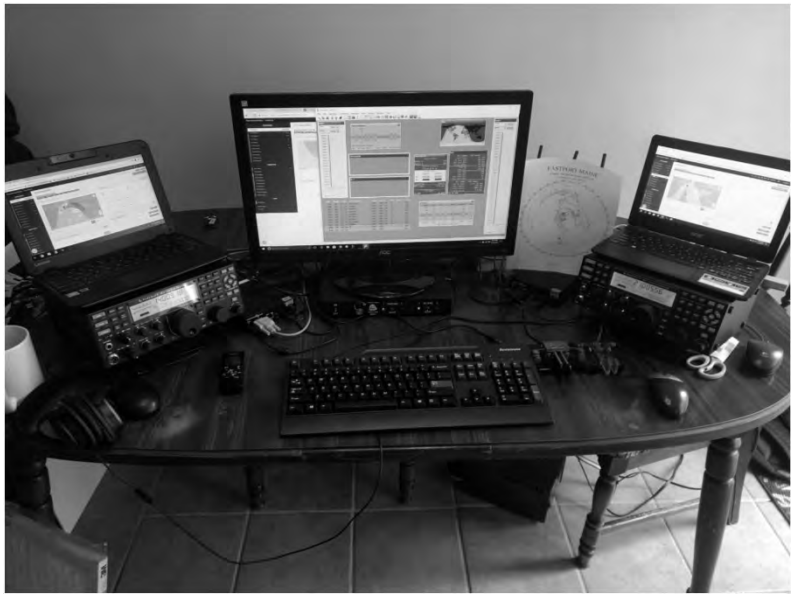
- RHR has lots of fail safes and is more forgiving and less complex than a private system typically

## SO2R into RHR Network

- One PC
- Impressive software to work with N1MM+
- K3 + TS590
- RRC's

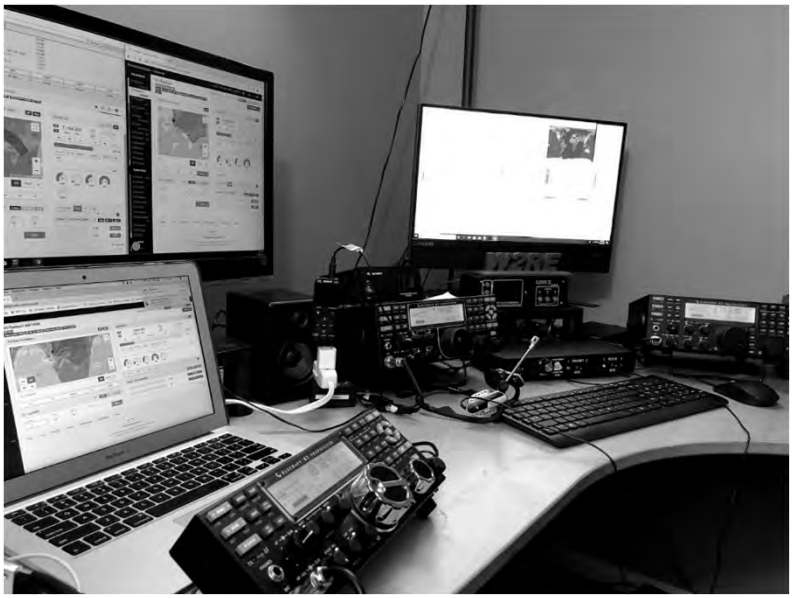
## N5DX into N2QV

**N2QV side - N5DX**



- **Similar to KL9A setup**
- **Separate PC's for each radio eliminates logging program focus issues - very important for quick antenna changes or adjustments**

**N4YDU into RHR**

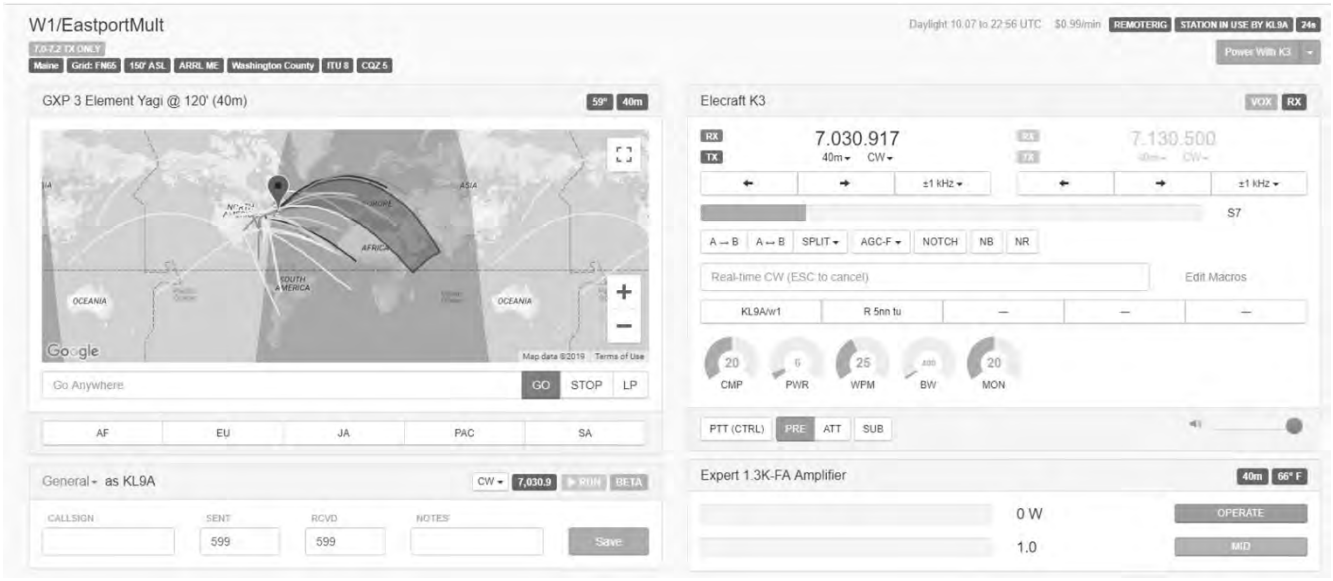


- **A great reason to use RRC's is you can continue to use your logging program of choice and preferred SO2R controller or other peripherals**

**W2RE into RHR**


- **Notes for multi-op network setup**
- **Notes for general station use**
- **Hamation switching interface**
- **Alpha 9500 control**

**K7ZS Interface**




**RHR Interface**

**W9SN Multi Op Setup**

- **Flex Radios**
- **Very clean desk**
- **Start of the next evolution of serious remote contesting**

# Other Remote Contesting Options

- Remote login to a PC on site for everything, including logging
  - Not No Compromise, but the CW is 100% solid
  - A reasonable option for multi-ops
- Software only interface, no real radio interface to use
  - Not No Compromise, but could be made to work with external knob and button interfaces
  - Expect to see some impressive software in this category in the future
- Detachable head radios - TS480HX etc.
  - Typically not “contest grade”
- Flex Radios
  - The future of remote?
  - No external boxes required
  - Integrated waterfalls are cool
  - Choice of “Big Knob” or software only user interface
  - Not proven yet, still being tested

# Why is CW so tricky to get right?

- Timing and latency is critical and any instability is noticeable on the air - we have all heard it!
- Computer keying via the RRC’s is better than paddle sending thanks to the special way Remote Rig handles CW
- Sending CW from the remote side solves this issue
  - Logging into the remote PC via VNC, TeamViewer etc.
  - Unfortunately this is not “No Compromise” remote contesting right now
- Luckily SSB is easy on all systems
  - Use the DVK built into the rig if possible
  - No special hardware required
- This presentation does not address digital contesting

# Operating

- Latency and jitter will increase your error rate
- Poor CW or audio will reduce callers, reducing your score
- Grayline map very important if you are far away
  - Montana to Maine is a mindset change, for example
- Strategy research ahead of time is always a good idea, but extra important if you are unfamiliar with conditions where you will be operating from

# USA Remote Wins (as best I can tell)

- N5DX
  - 2016 WPX CW - USA
  - 2017 IARU Mixed - USA
  - 2018 CQ 160 CW - USA
- W2RE
  - 2017 ARRL DX SSB - USA
  - 2017 WPX SSB M/S - USA
  - 2018 WPX SSB - SO(A) USA
  - 2018 CQWW SSB - USA
  - 2019 ARRL DX SSB - Claimed USA
- KL9A
  - 2017 Stew Perry 160 - USA
  - 2018 ARRL DX CW - W/VE
  - 2018 WPX CW - USA
- N4YDU
  - 2017 WPX CW - USA
  - 2017 WAE CW - USA
  - 2018 IOTA - SO(A) World
  - 2018 Stew Perry - USA
  - 2019 RDXC - Claimed USA

16 remote wins in 3 years!

# Thanks!

- The future of remote contesting is bright - exciting stuff is ahead!
- HOA restricted contesters are no longer stuck not being competitive in the game they love
- The investment is not much more than building an “on site” station
- “Guest op” stations available for rent are popping up in desirable locations - pick your service!
- Pictures courtesy of W2RE, N6MJ, N4YDU, N5DX, K7ZS

# CTU Presents

## Preparation and Practice for Better Contest Scores

**Randy Thompson, K5ZD**

## Purpose of this Session

- Explore the value of preparation and practice for better performance in radio contests

# Practice? Preparation?

Yo-Yo Ma

Mariano Rivera

**Yeah, they do that.**



# No instant experts

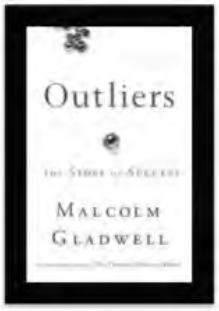
*"There are no instant experts in chess—certainly no instant masters or grandmasters.*

*There appears not to be on record any case (including Bobby Fischer) where a person reached grandmaster level with less than about a decade's intense preoccupation with the game.*

*We would estimate, very roughly, that a master has spent perhaps 10,000 to 50,000 hours staring at chess positions…"*

Herbert Simon and William Chase, *American Scientist*, 1973

## 10,000 hours




*"the closer psychologists look at the careers of the gifted, the smaller the role innate talent seems to play and the bigger the role preparation seems to play."*

Malcolm Gladwell

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## Contesting Requires Skillz

- How well can you type?
- Copy CW or SSB?
- Is that callsign valid? What country?
- When are the bands open?
- What is the multi-single 10-minute rule?
- What countries are in CQ zone 22 or 39?
- What is the beam heading to 9V1?
- What is polar flutter and what does it mean?

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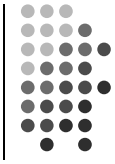
## Practice



- No one expects to play sports at a high level without practice and coaching
- Why is radio competition any different?

**CTU provides the coaching,**
**you have to do the practice!**

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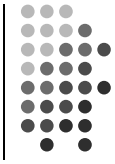
## Skills Development



- Know the “flow”
  - Contest QSOs have a rhythm and sequence
  - Good operating habits require less thinking, less energy
- Driving a car
  - Had to think about everything at first
  - With experience, able to focus on other things
- Learn to type
  - Contesting requires a lot of typing without room for errors

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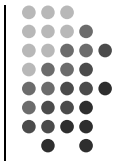
## Necessary Contest Skills That can be Improved with Practice



- Copying/Logging
- Callsign Vocabulary
- Running
- Search and Pounce
- Changing Bands

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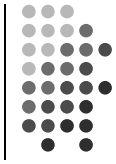
## Copying/Logging



- Translate sound to keyboard – accurately!
- A callsign is only 4 to 12 characters
- Exchanges have expectations
- Get on the air and listen/make QSOs
- Listen to recordings of good operators
- Use a simulator like MorseRunner
- Record yourself
- Review your log checking reports

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**Repetition is a key learning aid because it helps transition a skill from the conscious to the subconscious.**

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## Know Your Logging Software

- Find a consistent set up that you use for all contests
- Practice entering calls and exchanges by typing in old contest logs
- Practice FIXING typing errors
  - Learn the accelerator keys (start, end, wipe)
  - Know how transit the entry fields
- Logging needs to be automatic so you have brain power left for processing other info

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**Spacing out the rehearsal of a task is important for making sure a task "sticks."**

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## N5DX 10,000 QSO Rule

- Make 10,000 Qs before the start of each contest using DXLog in Dual Run mode.
- Practice for at least one hour per day in ten minute increments.
- Track number of Qs per 10 minutes, average number of Qs, Overall Qs, average pileup size, and average speed.
- Make notes after sessions in order to document thoughts or strategies to improve performance.
- Use a tailored database comprised of the most active DX callsigns.

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Source: http://zf2dx.com/blog/contest-preparation-strategies/

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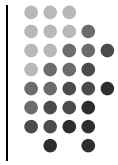
# Improve your Callsign Vocabulary



- English has 180,000 words
  - Average person uses 10,000 – 12,000 words
  - College educated uses 15,000 – 20,000 words

- CQ WW SSB 2018 logs had 65,590 raw calls
- 39,870 remained after checking
  - 13,475 only appeared only once
    - Experience says >90% of these are errors
  - 11,467 appeared 20 or more times
    - You should “recognize” >5,000 of these calls

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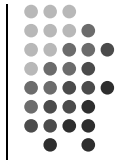
# Common Busts



**SSB**

- V and W
- E and I
- G and J

- WW SSB Most Busted (2018)
  - OG6ØF
  - TM3R
  - HC0E
  - IK2YCW
  - DF0HQ
  - JE2YRB
  - EF8R
  - ED3M
  - YT7ØSRV
  - VE3JM

**CW**

- I, S, H, 5
- V and 4
- B and 6

- WW CW Most Busted (2018)
  - PE75W
  - ES9C
  - UA4S
  - RM9A
  - CR3W
  - EF8R
  - TI7W
  - DR4A
  - CN3A
  - SN8B

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# Which of these calls are bad?

| | | | |
|---|---|---|---|
| C73NL | FY5KE | LY7A | RG8U |
| CD6416 | GT8IOM | OB9DCM | TM6M |
| E2E | 1B1B | M5O | W0ASH |
| EY8MM | HI3TIJ | P3W | YU15OTC |

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# Which of these calls are bad?

| | | | |
|---|---|---|---|
| C73NL | FY5KE | LY7A | RG8U |
| CD6416 | GT8IOM | OB9DCM | TM6M |
| E2E | 1B1B | M5O | W0ASH |
| EY8MM | HI3TIJ | P3W | YU15OTC |

Correct Calls

| | | | |
|---|---|---|---|
| C37NL | FY5KE | LY7A | RG8U |
| CD6416 | GT8IOM | HB9DCM | TM6M |
| E2E | IB1B | M5O | W0AIH |
| EY8MM | HI3TEJ | P33W | YU15OTC |

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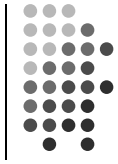
## Running



- Get calls in the log as fast as possible
  - Talk/send less
  - Get calls right the first time (less repeats)
  - Be in command
- Operate where you are the hunted
  - In-state QSO parties
  - Be loud and CQ as band opens
  - Be new near end of a contest
- MorseRunner or other simulator

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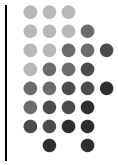
## Phone Technique Hints



- Breathe
- Consistency & Efficiency
  - Find a rhythm that suits the conditions/rate
  - Learn not to say, “Uh”, “Please copy”, “Roger the 5914, you are…”; “QSL, QRZ?”
  - Say your call often – almost every QSO
- Answer guys with the phonetics they use
- Speak Clearly
  - Go slow to go faster

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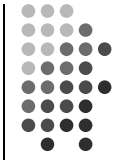
## Technique – CW



- Be consistent
- Let the computer send
- Sending speed depends on conditions
  - Go slow to go faster
- Cut Numbers
  - Sometimes OK, sometimes not
- Practice
  - CW is a learned skill that improves with practice

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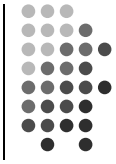
## Search & Pounce



- Key skills
  - Acquiring the next station/call
  - Recognition
    - Partial call
    - Accent
    - Exchange
- Find a regional contest and see how quickly you can tune up the band and work everyone
- Then repeat
- Take a break
- Repeat

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## Speed Search-and-Pounce

- Tune in a station on either VFO
- Set VFO-A = VFO-B
- Tune in another station and switch VFOs
- Assess, call, switch…repeat
- When one is worked, switch and equalize your VFOs
- Leapfrog your way along the band


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## Know when to…

| Run | Search and Pounce |
|---|---|
| • When you can | • When you can't run<br>• When you need mults<br>• When looking for a new run frequency |

**There is no magic formula for when to Run vs S&P**
Decision based on log analysis, scoring formula, band conditions, a "feeling"

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## Changing Bands

- How long does it take to change bands in your station?
- Is it hard enough that you don't want to do it when tired?
- Spend the time to make band changes easier
  - Less manual operations
  - Mark all settings on amps, etc.
- Practice

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## Preparation

"It's not the will to win that matters – everyone has that. It's the will to prepare to win that matters."

Paul Bear Bryant

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## Contesting Elements Requiring Preparation

- Goals
- Strategy
- Operator Commitment
- Station Readiness

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## Define Your Goals

- Select category
  - All band or single band?
  - Power – High, low, QRP?
  - Assisted or unassisted?
- Objective
  - Have fun?
  - Win a certificate?
  - Set a record?


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# Understand Scoring

- Points for each QSO?
  - Per mode?
  - Per continent?
  - By band?
- What is a multiplier?
  - Section? Zone? Country? Prefix?

Score - 3,774,014 Points

| Band | QSOs | Pts | Cty | ZN |
|---|---|---|---|---|
| 1.8 | 7 | 14 | 5 | 5 |
| 3.5 | 143 | 408 | 42 | 21 |
| 7 | 761 | 2252 | 59 | 24 |
| 14 | 401 | 1142 | 64 | 28 |
| 21 | 2021 | 5980 | 70 | 27 |
| 28 | 118 | 322 | 14 | 14 |
| Total | 3451 | 10118 | 264 | 119 |

Score: 3,774,014

- Do your homework to know what contributes to a good score

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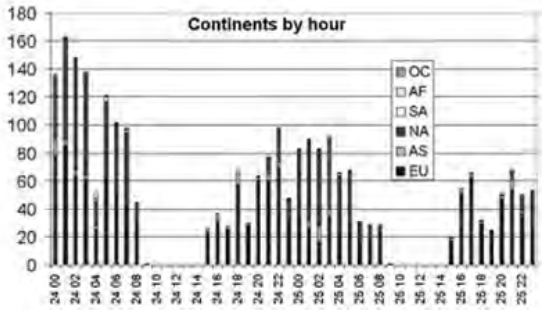
# Planning

- Study past results and logs
  - Do the winners focus on QSOs or multipliers?
  - Where do the QSOs come from?
  - Do activity patterns repeat?

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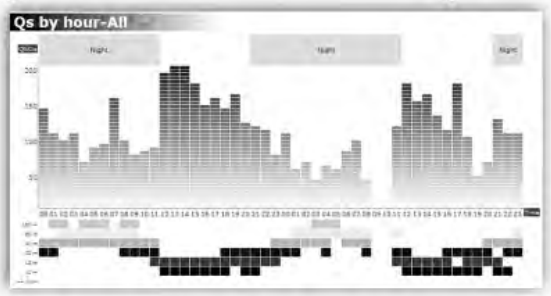
# Activity Patterns Do Repeat

K5ZD/1
WW CW
2013




K5ZD/1
WW CW
2006


Rate charts by SH5 software

# Understand What it Takes

- CQWW and WPX logs are open…what did your closest peer do differently?
  - Where do the QSOs come from?
  - What hours to be on the air?
  - Expected opening times for each band
  - When to “run” and when to “search”

# N5DX Visualization

"Below is a checklist of items that I attempted to think through and visualize on an hour by hour basis for the contest:"

- Decide which bands each radio would be operating.
- Visualize which operating strategy to use (e.g. dual run or SO2R).
- Visualize specific frequencies and beam headings.
- Create alternate plans in case the primary operating plan for that hour might not work.
- Make mental notes of target areas outside of Europe to find.

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Source: http://zf2dx.com/blog/contest-preparation-strategies/

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# BIC – Butt in Chair

- No other single thing will help you more to improve your scores
- It only works if you spend your time working people

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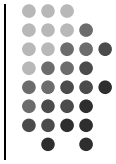
## BIC Strategy



- Plan your life to meet your contest goal
  - Work, family, food, rest, station repairs
- Part time?
  - BIC for the best rate or at different times each day
- Outline an operating plan
  - Bands and times
  - Likely off times

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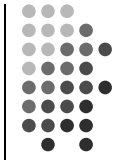
## Sleep Facts



- You can not train for lack of sleep
- You can not store sleep
- Under sleep deprivation, highly **practiced skills** will deteriorate more slowly than those which require new or creative thought

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## Contest Sleep Strategy

- Preparation
  - Have good physical fitness
  - Stay on your normal sleep schedule
  - Get extra sleep 4-7 days before the contest
  - Take 3 hour nap before contest starts
- During the contest
  - Sleep for 90 or 180 minutes
  - Avoid caffeine until needed

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## Station Readiness

- Invest in antennas
  - Effectiveness
  - Flexibility
- Station Configuration
  - Everything within easy reach
  - Comfortable chair
- Reliability
  - Do things right
  - Have spares!

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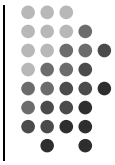
## Automate Everything You Can



- 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)
  - Sound card or voice keyer control
  - Parallel port band data for antenna and filter selection

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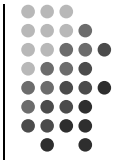
## Continuous Improvement



- When asked what was the most powerful force in the Universe, Albert Einstein replied, “Compound interest.”
- Incremental improvement, applied relentlessly, is unstoppable.
- Plaques are won a dB at a time

Every time you are on the air you are gaining experience and knowledge.

Be active!

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## Acknowledgments

- This presentation draws on material developed by:
  - Ward Silver, NØAX
  - Kevin Stockton, N5DX
- And thousands of people I have met and learned from over 35 years

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# CTU 2019 Presents

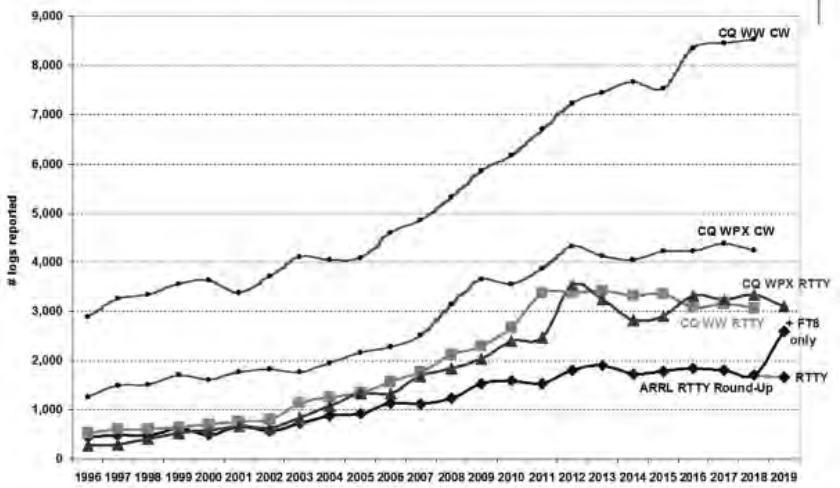
Digital Contesting is Fun!

*Ed Muns, W0YK*

## Digital Contesting is Fun!

- RTTY Contesting → Digital Contesting
- RTTY
  - Operating
  - Setting Up
    - Hardware
    - Software
- Introduction to FT8
- 2nd session: "*Taking Digital Contesting to the Limit*"

# Three Largest RTTY Contests

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# Lots of Digital Contests

***> two/month***

- **Biglies (7)**
  - CQ WW RTTY (last weekend in Sep)
  - CQ WPX RTTY (2nd weekend in Feb)
  - ARRL RTTY Roundup (1st weekend in Jan) + FT8
  - BARTG (3rd weekend Jan, 3rd weekend Mar)
    - 75 Baud (Apr & Sep)
  - WAE RTTY (2nd weekend in Nov)
- **NCJ contests (4)**
  - NAQP RTTY (3rd Sat. in Feb, 2nd Sat. in Jul)
  - Sprint RTTY (2nd Sat. in Mar & Oct)
- **Other popular RTTY contests (20)**
  - ~~Ten-Meter RTTY~~ (1st Sat. in Dec) FT8 Roundup
  - JARTS, Makrothen, SARTG (2)
  - FT8 DX Contest (Apr), FT8 Makrothen (Jun), SCC FT8

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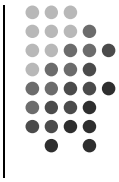
# What Makes a Great RTTY Contester?



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

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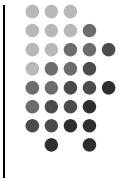
# What is RTTY?

***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<br>• key up is data 0<br>• key down is data 1 | 3) One on ***and*** other off<br>• Space is data 0<br>• Mark is data 1 |
| 4) ***Morse*** code<br>• typically 25-40 wpm | 4) ***Baudot*** code<br>• constant 60 wpm *(or 45.45 Baud)* |

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# 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?

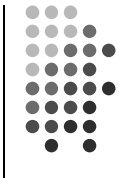
## *code history*

- 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*



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

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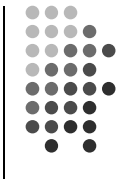
# What is RTTY?

## *UnShift on Space*



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

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# What is RTTY?

***audio tones***

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

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# What is RTTY?

***AFSK vs. FSK***

Two methods of transmission:

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

*Note: Receiving is the same in either case.*

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# What is RTTY?

***dial frequency***

***spots are often wrong***

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

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# What is RTTY?

***AFSK vs. FSK***

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

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# What is RTTY?

***summary***

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

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# The Cynics Say …

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

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# RTTY Considerations

Much like CW and SSB, except:

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

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# RTTY Sub-Bands

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

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# RTTY Sub-Bands

***don't QRM!***

- Avoid audio-digital operations near:
  - e.g., 14070-14080
- Avoid the NCDXF beacons:
  - e.g., 21150 and 14100

- More details:
  www.aa5au.com/rtty/rtty-sub-bands

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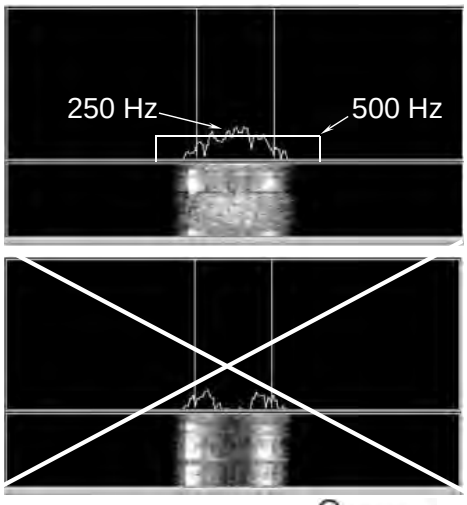
# Receiving

***radio IF filtering***

- 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

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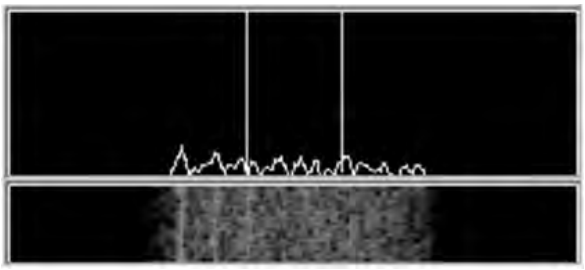
# Receiving

***adjust audio***



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

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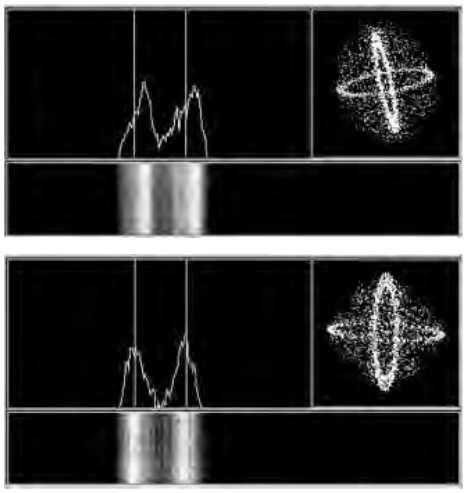
# Receiving

***tuning a RTTY signal***

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



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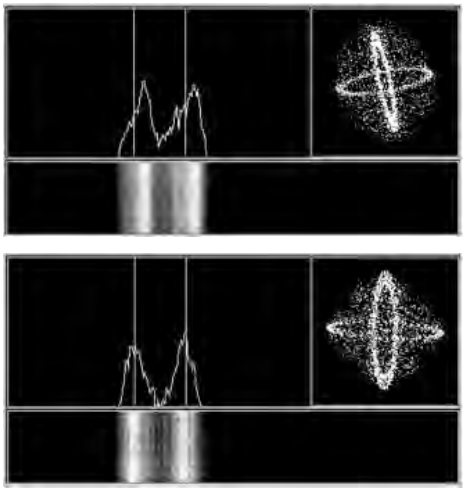
# Receiving

***MMTTY AFC***

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



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# Transmitting

***AFSK adjustment***

Insure SSB processor (compression) is Off.

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

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# Transmitting

***FSK adjustment***

- None!

*(That's the whole point of FSK.)*

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# Basic RTTY Contest QSO

***CQ WPX RTTY Contest***

- ***WPX K5AM K5AM CQ***
- ***ZC4LI ZC4LI***
- ***ZC4LI 599 1349 1349***
- ***[K5AM] TU 599 985 985***
- ***[ZC4LI] TU K5AM CQ***

*K5AM: running station*
*ZC4LI: S&P station*

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# RTTY Messages

## *CQ WPX RTTY Contest*

- Short, as with CW/SSB
- No extraneous info
- 599 (not 5NN) once
- Serial number twice
- Space (not hyphen)
- Omit ‘DE’
- RTTY chars (%R, %E)

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 |
| F09: | %RAGN %E |
| F10: | %RNR? %E |
| F11: | %R%N3 %E |

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

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# RTTY Messages

## *formatting*

CR/LF Space Receive

| | |
|---|---|
| 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 |
| F09: | %RAGN %E |
| F10: | %RNR? %E |
| F11: | %R%N3 %E |

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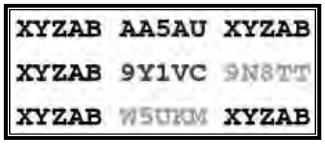
# Super Check Partial

## *call sign selection*

- SCP (Super Check Partial) enables computer to select call signs in receive window
  - Unworked calls (no mult)
  - New mults and double mults
  - Dupes



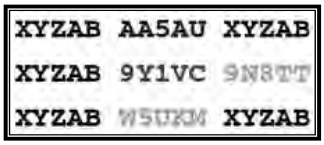

***N1MM Logger***

- Use main SCP from CW/SSB/RTTY contests
  - RTTY SCP is a subset



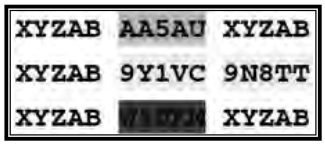
# Super Check Partial

## *logger differences*

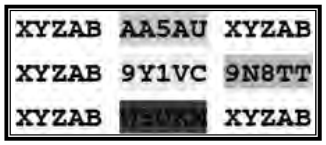



- ***Background option***
- ***Custom colors***

***N1MM Logger***




***WriteLog***

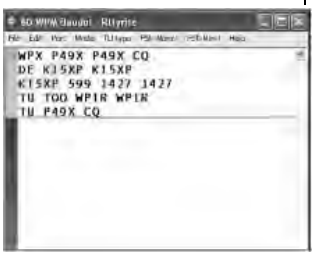



***Win-Test***

# Tips

***"All I receive is gibberish!"***

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

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# Tips

***"They never answer me!"***

- "Upside-down"
  - FSK: polarity switch in radio
  - AFSK: LSB vs. USB; polarity select in software
- Off frequency
  - AFC on with NET (AFSK only) off [recommend RIT instead]
  - AFC & NET are on by default; changes non-sticky
    - Change defaults in USERPARA.INI
- AFSK: Mic & SC levels; speech processor on
- Radio mode, tones, FSK interface

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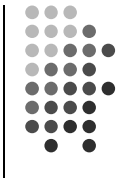
# More Tips



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

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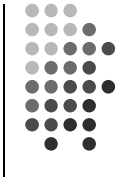
# RTTY Operating

***summary***



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

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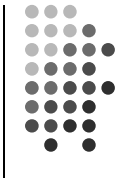
# The Cynics Say …



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

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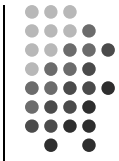
# How Do I Set it Up?

***overview***



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

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

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# How Do I Set it Up?

## *RTTY decoder/encoder*

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

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# How Do I Set it Up?

## *decoder/encoder terminology*

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

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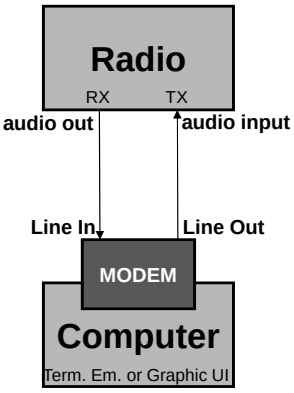
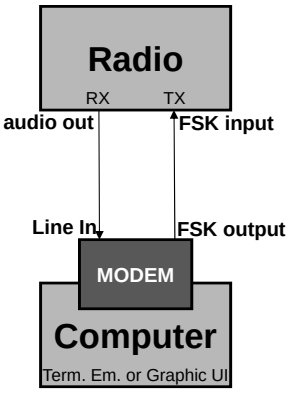
# How Do I Set It Up?

## *hardware MODEM*

### AFSK




### FSK

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# How Do I Set It Up?

## *hardware MODEM*





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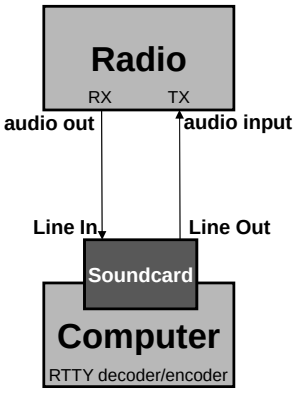
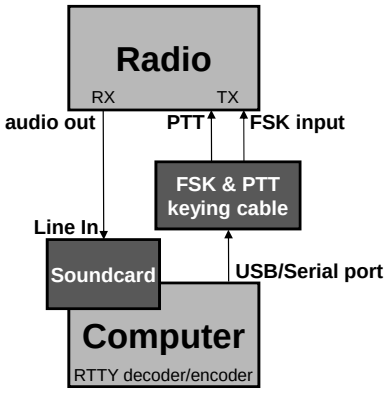
# How Do I Set It Up?

## *software application & soundcard*

### AFSK




### FSK






# How Do I Set it UP?

## *cables*

- Receive:
  - RX audio out to soundcard
  - ***Optional DSP filter***
- Transmit:
  - AFSK: TX audio in from soundcard, ***or***
  - FSK: FSK/PTT keying

- Receive:
  - 1:1 isolation transformer
  - ***JPS NIR-12, or …***
- Transmit:
  - 1:1 isolation transformer, ***or***
  - Keying interface

# How Do I Set It Up?

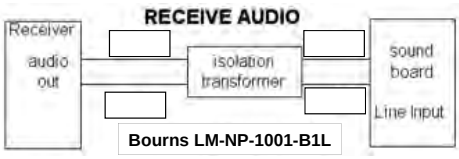
## *ground loops*

- 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*




**Bourns LM-NP-1001-B1L**


*-90 dBc 3rd order IMD*

# How Do I Set It Up?

## *ground loop isolators*

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

**eBay $3.35**

**eBay $5.50**

**eBay $7.45**



# How Do I Set It Up?

## *W2IHY iBox audio isolation*

# How Do I Set It Up?

## *commercial interface audio isolation*

**Rascal**



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# How Do I Set It Up?

## *radio audio isolation*

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


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# How Do I Set It Up?

## *SDR digital audio isolation*

digital: **soundcard**

analog: **IN – LINE – OUT**



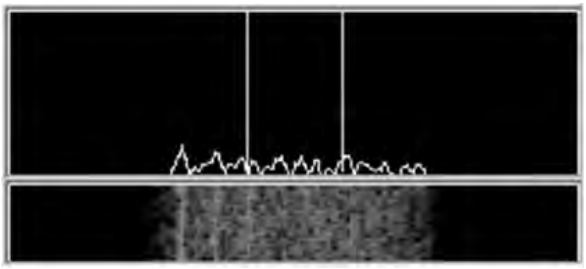

# How Do I Set It Up

## *optional radio AF filtering*

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

# How Do I Set It Up?

***adjust RX audio***



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

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# How Do I Set It Up?

***adjust AFSK audio***

Insure SSB processor (compression) is Off.

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

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# How Do I Set It Up?

## *PTT vs. VOX*

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

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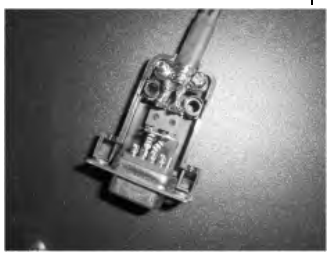
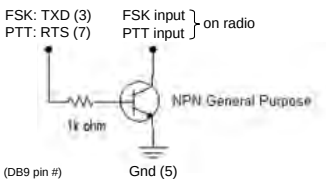
# How Do I Set It Up?

## *homebrew FSK & PTT keying cable*



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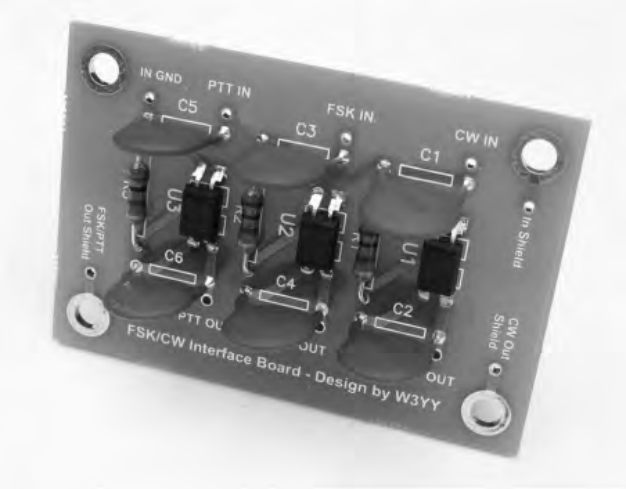
# How Do I Set It Up?

## W3YY *FSK & PTT keying cable*

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# How Do I Set It Up?

## *commercial interfaces*

**RASCAL**



**RIGblasters**



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# How Do I Set It Up?

## *RigExpert Interfaces*



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# How Do I Set It Up?

## *commercial interfaces*

| Vendor | Model | Price | PC In'fc | PTT | Soundcard | Level ctn | 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*

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# How Do I Set It Up?

## *microHAM interfaces*

One Radio

SO2R

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# 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*

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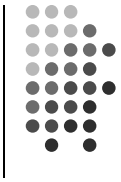
# How Do I Set It Up?

***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

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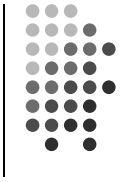
# How Do I Set It Up?

***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***

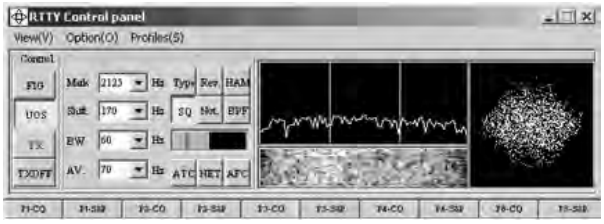
1. Connect the radio FSK and PTT inputs to:
   - the MODEM FSK and PTT outputs and connect the MODEM Serial port to the PC (USB adapter)

     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.



# Decoders

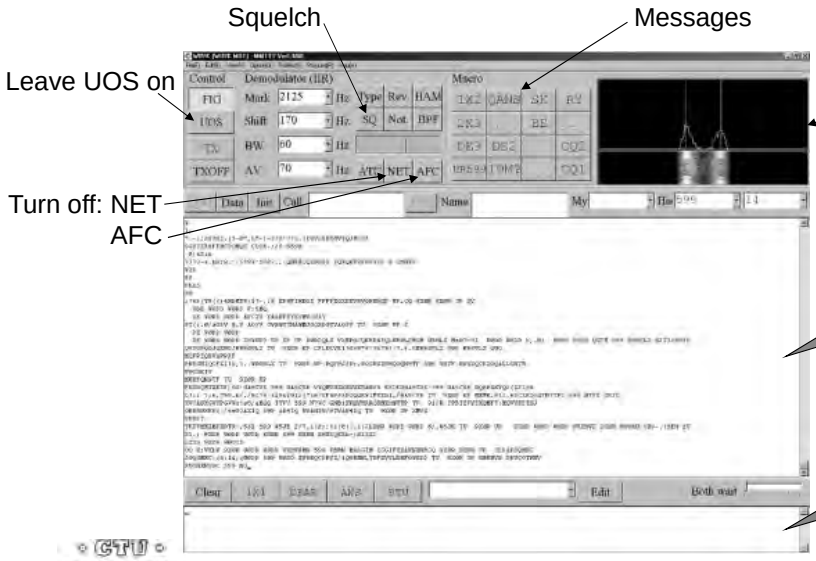
***MMTTY***




- 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?

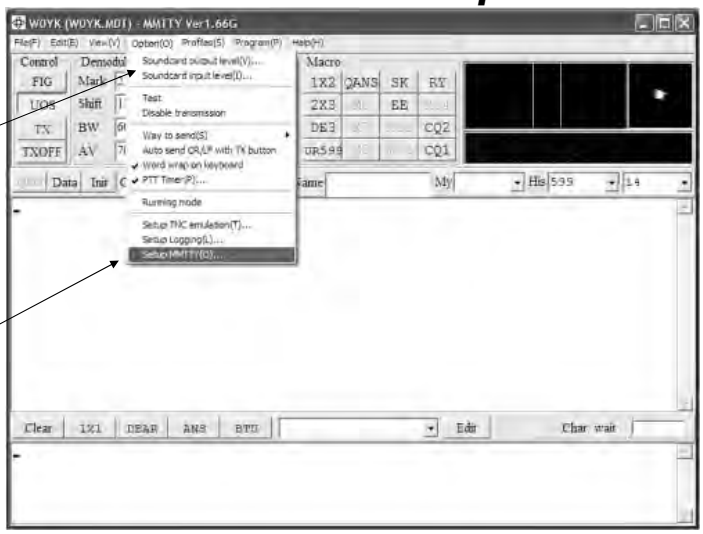
## *MMTTY standalone*





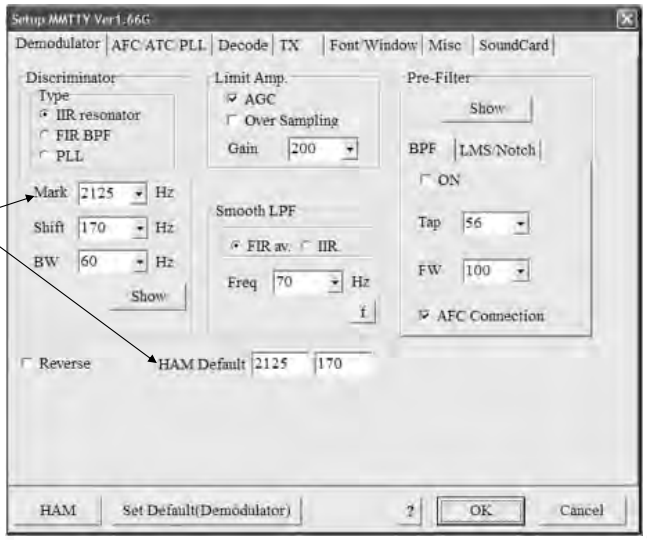

# How Do I Set It Up?

## *MMTTY Option menu*



# How Do I Set It Up?

## *MMTTY Option/Setup/Demodulator*

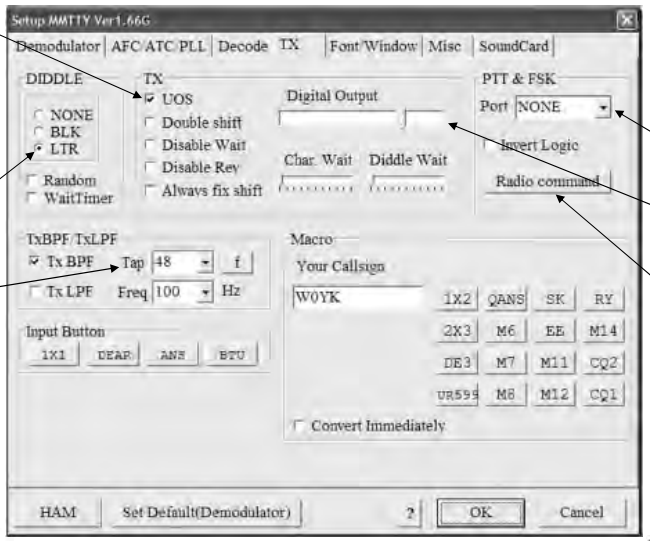



Set tones (radio same)



# How Do I Set It Up?

## *MMTTY Option/Setup/TX*




TX UOS on

Select LTR

512 Tap, if PC has perf.

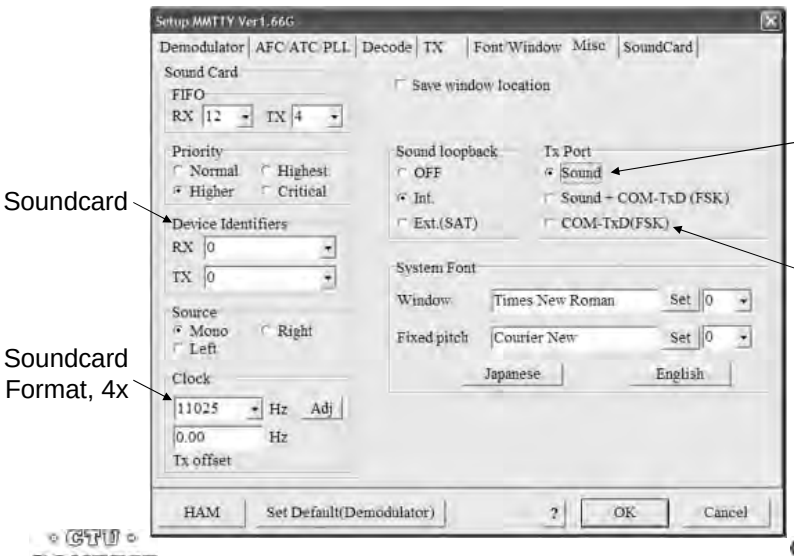
FSK/PTT port

Soundcard Line Out level

AFSK PTT

# How Do I Set It Up?

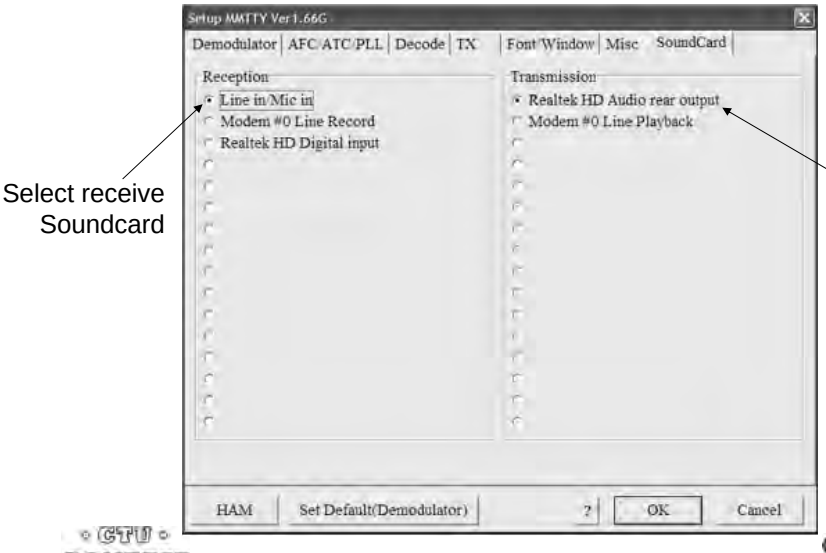
## *MMTTY Option/Setup/Misc*





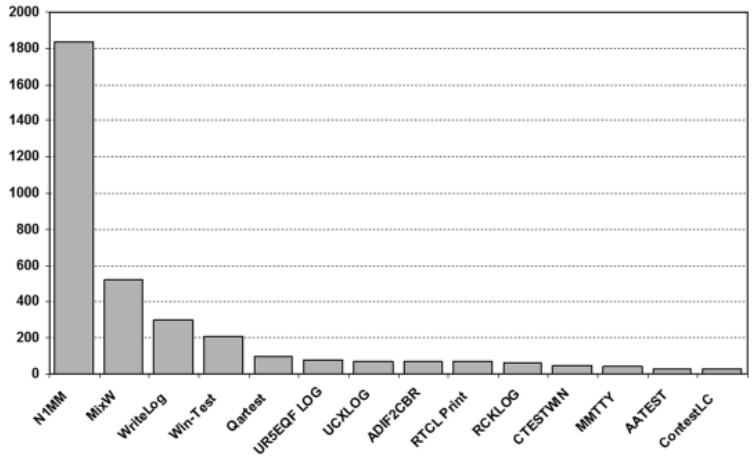

# How Do I Set It Up?

## *MMTTY Option/Setup/SoundCard*



# 2012 CQ WPX RTTY

***3550 submitted logs***

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# RTTY Contest Loggers

- WriteLog *(1994)*
  - created for RTTY *(CW & SSB 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 and have similar functionality for basic RTTY contesting.*

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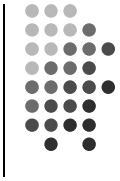
# A Blizzard of Details!

***this is fun??***



***Start Simple, then Enhance***

- MMTTY *(free)*
  - get RX working *(std audio cable from radio to PC)*
  - get TX working; use 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)*
  - Higher capability interface (DIY or commercial)
  - Advanced setup: SO2V, SO2R, multiple decoders, ...

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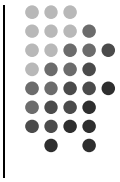
# Resources



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

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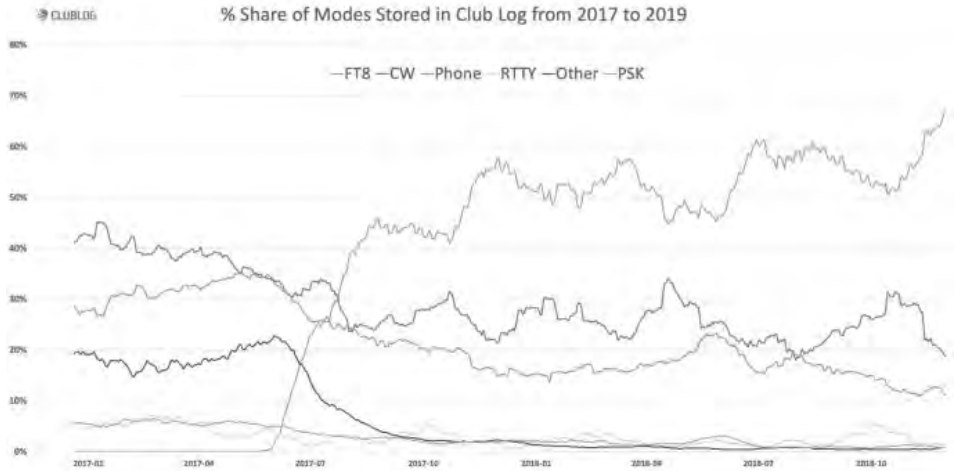
# Clublog QSOs by Mode

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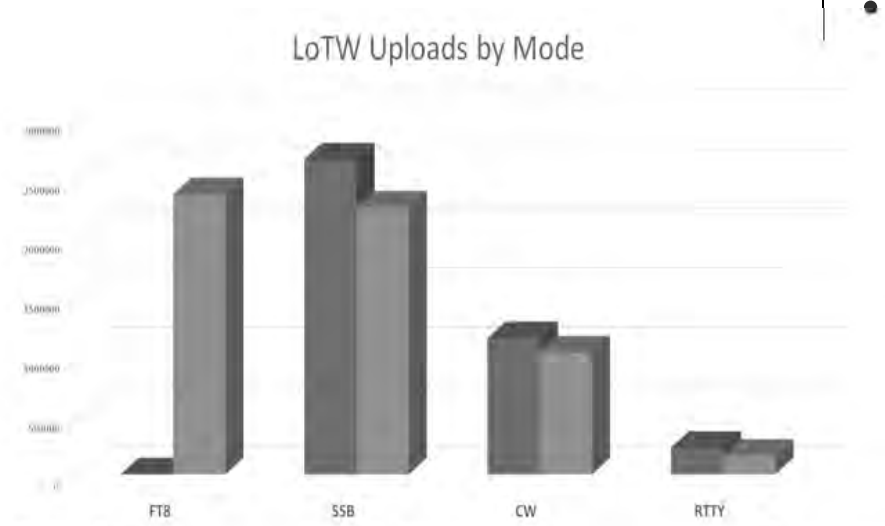
# The FT8 Explosion

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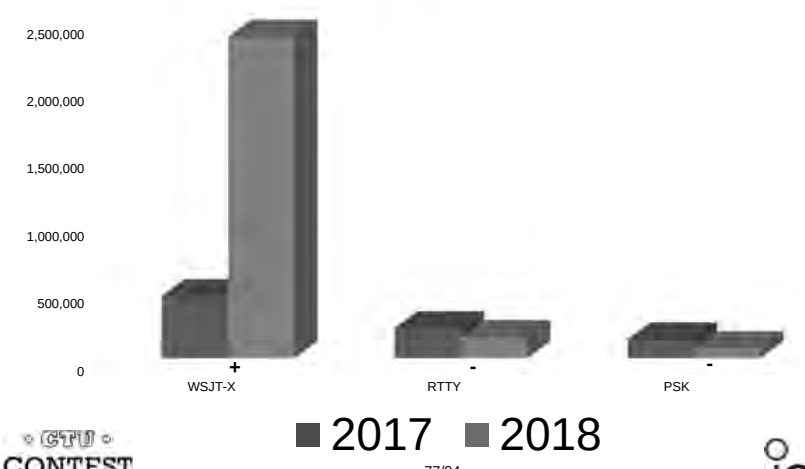
# Digital Mode Trends

Change by Application

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# WSJT & WSJT-X Overview

- **Weak Signal communication by Joe Taylor - eXperimental**
- **Developed for EME; adopted by HF**
- **Several modes (JT65, JT9, FT8, etc.)**

+ **Multi-channel**
+ **Weak signal (inaudible)**
  + **Longer DX**
  + **Lower power**
  + **Compromised antennas and/or QTH**
+ **Narrow bandwidth (4-176 Hz)**
+ **"Perfect" copy**

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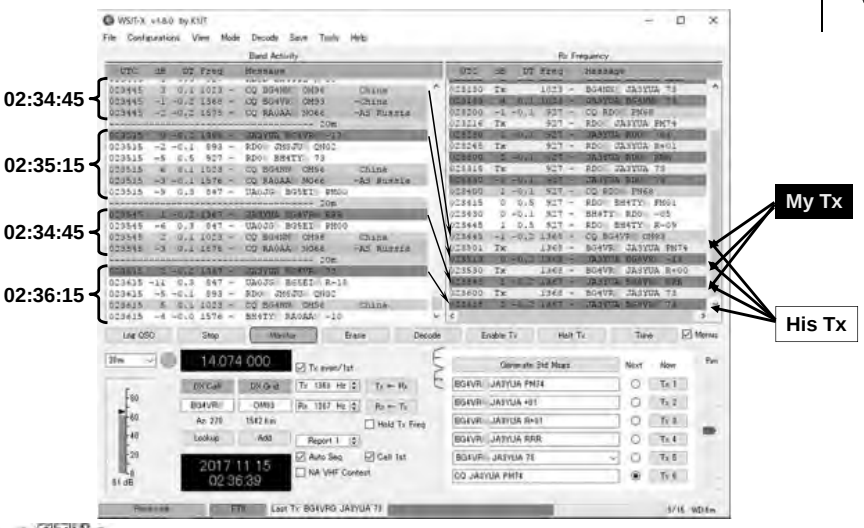
# FT8 Multi-Channel Reception



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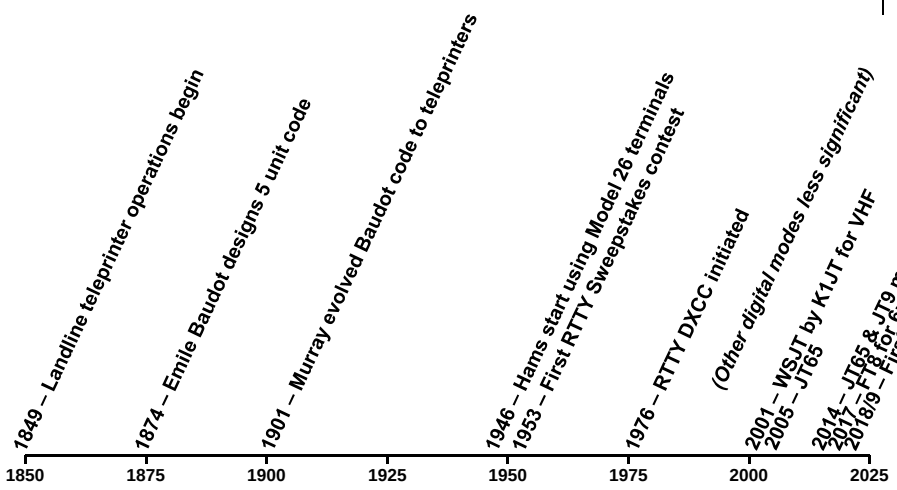
  + **Longer DX**
  + **Lower power**
  + **Compromised antennas and/or QTH**
+ **Narrow bandwidth (4-176 Hz)**
+ **“Perfect” copy**
- **Slow 1-6 minutes/QSO**
- **Limited, fixed messages**

# RTTY & WSJT History

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# WSJT & WSJT-X History

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

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# FT8 Standard QSO

*90 sec./QSO*

- CQ K1ABC FN42
- W9XYZ K1ABC -11
- W9XYZ K1ABC RRR
- K1ABC W9XYZ EN37
- K1ABC W9XYZ R-09
- K1ABC W9XYZ 73

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# FT8 Short-Cycle QSO

*75 sec./QSO*

- CQ K1ABC FN42
- W9XYZ K1ABC R-11
- W9XYZ K1ABC 73 <CQ K1ABC>
- K1ABC W9XYZ -09
- K1ABC W9XYZ RR73

***60 sec. rolling QSOs***

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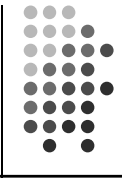
# FT8 DXpedition QSO

*75 sec./QSO*
*60 sec./5 QSOs*



QSO period 1
QSO period 2
QSO period 3

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

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# FT8 Contest QSO

*75 sec./QSO*
*30 sec./rolling QSO*

QSO period 1
QSO period 2
QSO period 3

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

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# FT8 Roundup

- 1-2 December 2018
- Replaced Ten-Meter RTTY Contest for 2018
  - Future TBD
- ARRL RTTY Roundup rules, except:
  - FT8 only
  - 100 watts maximum
  - Multi-channel Rx (no UNASSISTED SO)
  - Multi-stream Tx (no WSJT-X support yet)
  - Log submittal robot: ft8-ru@cqww.com; 7 day deadline
- *Results:*
  - *1277 logs submitted*
  - *Winner was a new ham*



# FT8 in ARRL RTTY Roundup

- 8-9 January 2019
- FT8 added to list of allowable digital modes
- FT8 QSOs → SO Unlimited (assisted only)
  - Due to multi-channel decoding of WSJT-X
- *Results:*
  - *Record 2,598 logs submitted*
    - *1,675 RTTY and RTTY/FT8 logs about normal*
    - *923 FT8-only logs incremental*
  - *FT8 is the first non-RTTY digital mode to be significant*
  - *FT8 rate exceeded RTTY rate in some scenarios*
  - *Participation decrease impact between modes was low*
  - *Cross-mode QRM negligible*

# FT8 DX Contest 2019

- 13-14 April 2019 (12z to 12z)
- Sponsor: European FT8 Club
- ARRL RTTY Roundup rules
  - Low Power (100 watts), QRP (5 watts)
  - SO, MO [MS only??]
  - [QSO spotting assistance probably OK]
- Must use WSJT-X 2.0 or MSHV 2.14



# FT8 Makrothen

- Possibly in June 2019
- Sponsor: K6TU & PL259 evaluating
- WSJT-X ARRL VHF Contest mode supports Makrothen

## SCC FT8 Contest

- Possibly in September 2019
- Sponsor: SCC (Slovenia Contest Club)
- Details to be announced

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## Setting Up for FT8

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

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# Conclusions

- **FT8 is controversial**
  - ***Explosive adoption threatens RTTY***
  - ***Fear of robotic, unattended operation***
  - ***Threatening to many "legacy" hams, but more appealing than CW/SSB/RTTY to new hams***
- **FT8 has instantly entrenched itself as:**
  - ***A primary amateur mode***
  - ***The pre-eminent digital DXing mode***
- **Will contest rules let FT8 be all it can be?**
- **Will FT8 subsume RTTY in digital contesting or become an additional mode? *(Contest participation will determine)***
- **Multiple digital modes in a single contest:**
  - \+ **Increases overall participation**
  - \- **Dilutes per-mode participation**
  - = **Net?**



# Resources

- **WSJT-X 2.0 web site with download link:**
  **https://physics.princeton.edu/pulsar/k1jt/wsjtx.html**
- **WSJT-X 2.0 Quick-Start Guide:**
  **https://physics.princeton.edu/pulsar/k1jt/Quick_Start_WSJT-X_2.0.pdf**
- **MSHV web site:**
  **http://lz2hv.org/mshv**
- **FT8 Roundup web site with tutorial:**
  **https://www.rttycontesting.com/ft8-roundup**
- **ARRL FT8 Press Release:**
  **http://www.arrl.org/news/ft8-to-be-permitted-in-2019-arrl-rtty-roundup**

# CTU Presents

## New Blood

### Drafting the Next Generation

*It's not just the NFL. Every other league has a draft. It has been fundamental to the success of professional sports.*

-Roger Goodell

## How I Get By

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## Assumptions

- You are a contester
- You are interested in attracting youth to contesting

## Sources

- LOTS!
- Youth contesters, experienced contesters, editors, bloggers, Elmers, educators

## Definitions

- Youth = < 26

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## Contesting Back in the Day

- Novice Roundup
- BSA
- Paper logs
- SSB and CW modes only
- EVERYBODY YOUNG (or young-ish)

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## Youth Contesting Now

- YOTA YCP (Region 1)
- Dave Kalter YDXA
- Team Exuberance
- YARC YCP
- Corporate/Club Support
- NACC
- WRTC Youth Teams

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## Youngsters on the Air (YOTA)

- Region 1
- Youth Contesting Program (YCP)
- Some funding through IARU
- Participants provide own travel
- Philipp Springer DK6SP PoC

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## Dave Kalter Memorial YDXA

- Founded 2010
- Takes youth to DX locations
- Current organizers: Don Dubon N6JRL, Jim Storms AB8YK, Ron Doyle N8VAR
- Challenges: finding DX stations & fundraising


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# Team Exuberance

- 1st all youth team at K3LR
  - KM4ATT, NN1C, VE7DZO, K6JO, HA8RT, KG5HVO
- Operating CQ WPX SSB M/2
- Average age 16
- Challenges – fundraising, forming team, travel/lodging logistics, communication

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# Team Exuberance

- Take-Aways
  - Be Coachable
  - Concise comms, quick response
  - YL – secret weapon
  - Persevere in the doldrums
  - Not 48 hours of fun but 48 hours of satisfaction

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## YARC YCP

- Brainchild of Sterling Mann N0SSC
- Matches youth contesters with host stations
- New territory

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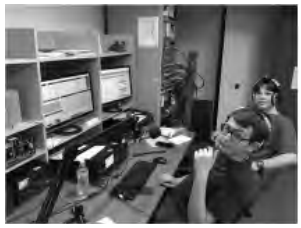
## YARC YCP/ CQ WPX Youth

- Brainchild of Sterling Mann N0SSC
- Matches youth contesters with host stations
- New territory



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## Corporate/Club Support

- NCDXF – CTU scholarships
- CWops – CW Youth Academy
- Deep Dixie Contest Club

RemoteHam RADIO

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DX ENGINEERING
www.DXEngineering.com • 1-800-777-0703

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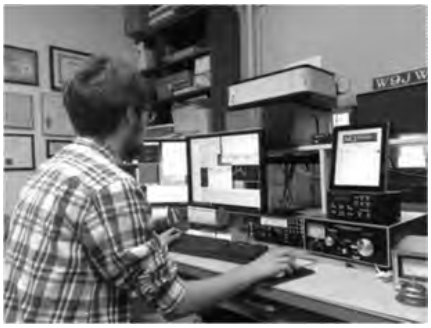
## NACC

- Sponsored by SMC and NCJ
- Active in NAQPs
- Started 2 years ago by K9CT and K7JOE
- 15+ collegiate clubs participated
- Live Scoreboard



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# Youth Teams

- WRTC 2014 = 1 youth team
- WRTC 2018 = 3 youth teams
- **WRTC 2022 = 6 YOUTH TEAMS!!!**


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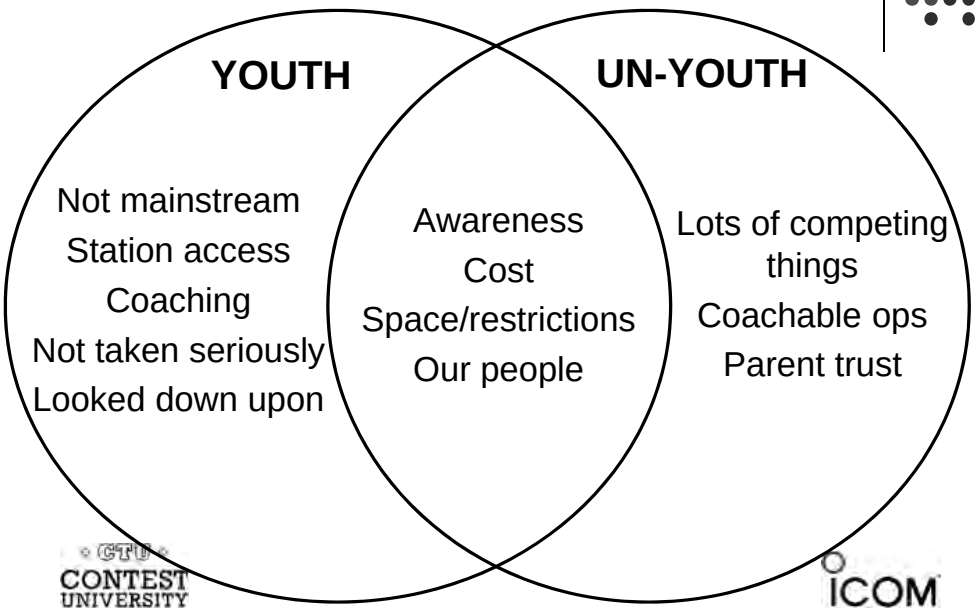
# Challenges

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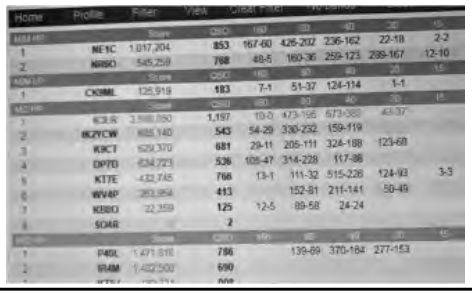
# Live Scoreboard

*Love it. I think it is a must. Nothing more exciting than trying to stay on top!*

*-NN1C*

*I love the live online scoreboard! It makes it feel more like a competition because you know where you stand ...I think it makes you try harder…"*

*-ZL4YL*



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# Play Ball!

**At Bat - This Weekend**

- YOTA YCP Phillip DK6SP
- Contest Forum Marty NN1C
- YDXA booth
- Talk to us!

**On Deck - Back home**

- Learn about youth contesting endeavors
- Invite youth to contest with you
- Open station to YARC YCP
- Consider inter-club challenges with youth/elmer teams
- Make the most of field day!

**In the Hole - Long Term**

- Marketing/branding ham radio
  - Fred Kramer AB1OC NARS
- Include youth voice in all levels
- Youth recognition

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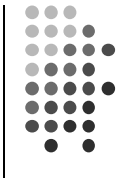
## Questions/Comments



*I found out that if you are going to win games, you had better be ready to adapt.* -Scotty Bowman, hockey

*All coaching is, is taking a player where he can't take himself.*

-Bill McCartney, football

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# CTU Presents

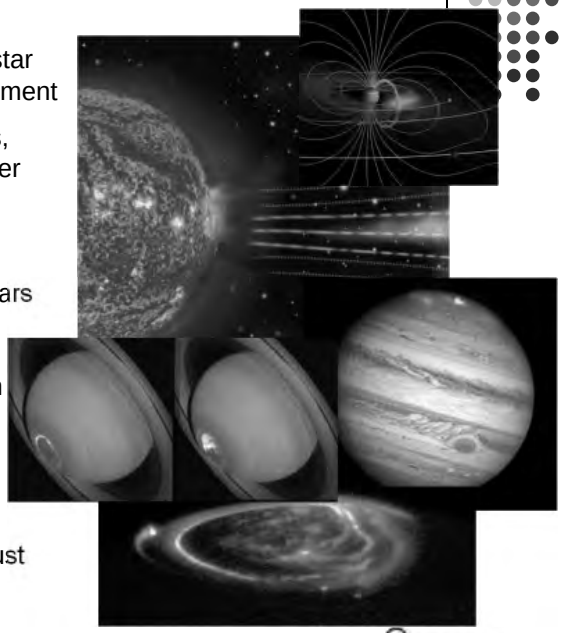
## *Solar Cycle Impacts on Radio Propagation: Forecasting Cycle 25*

*Dr. Tamitha Mulligan Skov*
*The Aerospace Corporation*

## What is Space Weather?

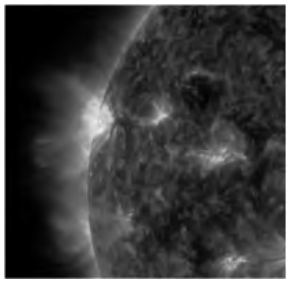
*Essentially* Space Weather is:

- A planet's interaction with its host star and the surrounding space environment
- More generally, it occurs at planets, moons, comets, asteroids, and other celestial bodies in the universe
- We see aurora at planets
  - Jupiter, Saturn, Uranus and Mars
- We see effects at Moons
  - Io, Europa, Ganymede, &Titan
- Main effects are **Sun-driven**
- Other sources of space weather
  - Cosmic rays
  - Micrometeroids & interstellar dust
  - Space junk

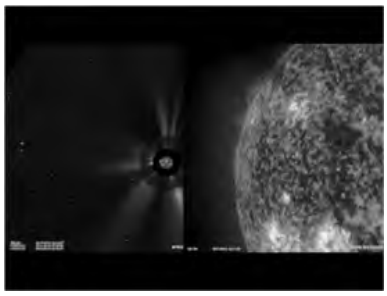


# Basic Types of Solar Phenomena Affecting Earth

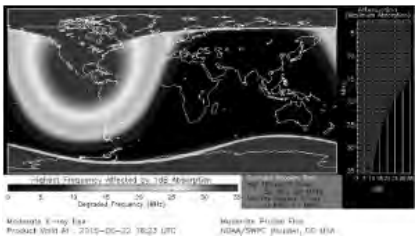
**Solar Flares**



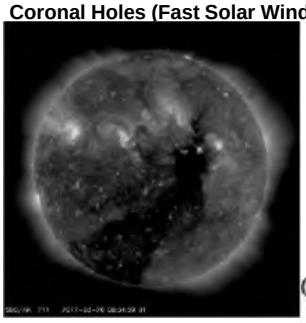
**Solar Storms (a.k.a. CMEs)**



**Solar Radiation Storms**



**Coronal Holes (Fast Solar Wind)**



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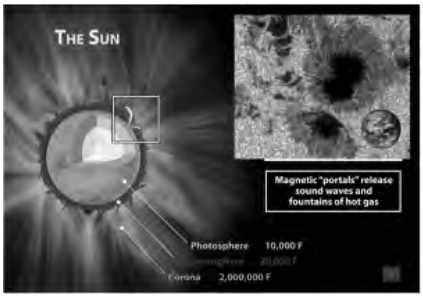
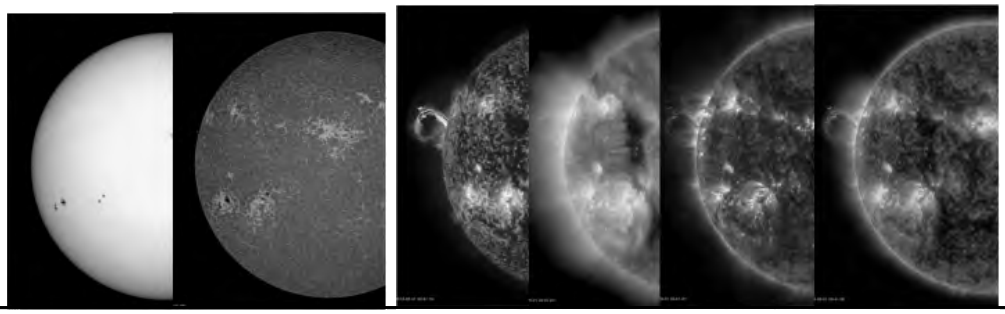
# Our Complex Star




What do Space Telescopes See?

- Giant fusion reactor: Drives Space Weather
- Energy output in the form of:
  - Electromagnetic radiation (from X-rays through radio)
  - Solar wind plasma & magnetic fields
  - Flares
  - Solar Energetic Particles (SEPs) (aka solar radiation storms)
  - Coronal Mass Ejections (CMEs)

5700 ° C → 6.3 Million ° C

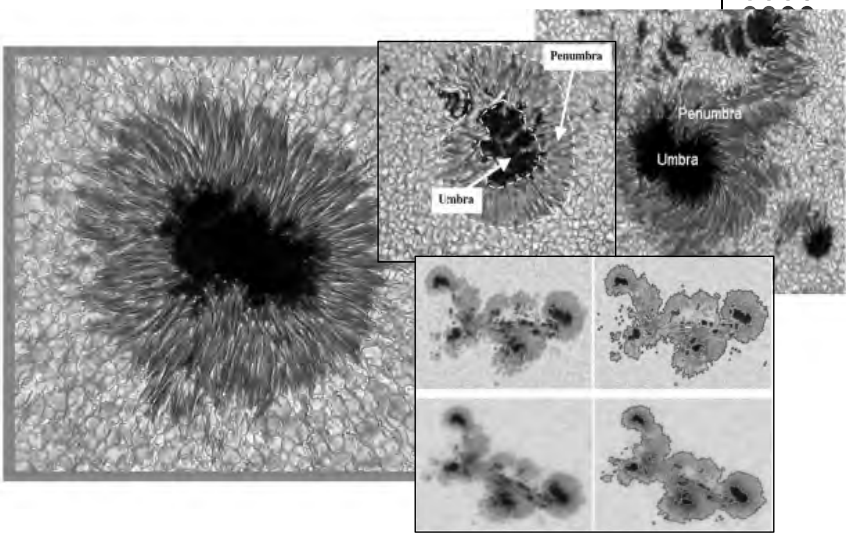


# How & Why Do Sunspots Form?

***Sunspot Umbra***: the dark core of a sunspot, cooler than the surrounding photosphere because is suppresses convection. Average size is ~10000 km, but can be as large as 60000 km.

***Sunspot Penumbra***: the lighter areas, marked by a radial filamentary structure. Typical size is ~5000 km. Waves are observed to move across the penumbral structures. Structure is thought to be 'uncombed'.

Image credit: Friedrich Woeger, KIS, and Chris Berst and Mark Komsa - taken here at the Dunn Tower.

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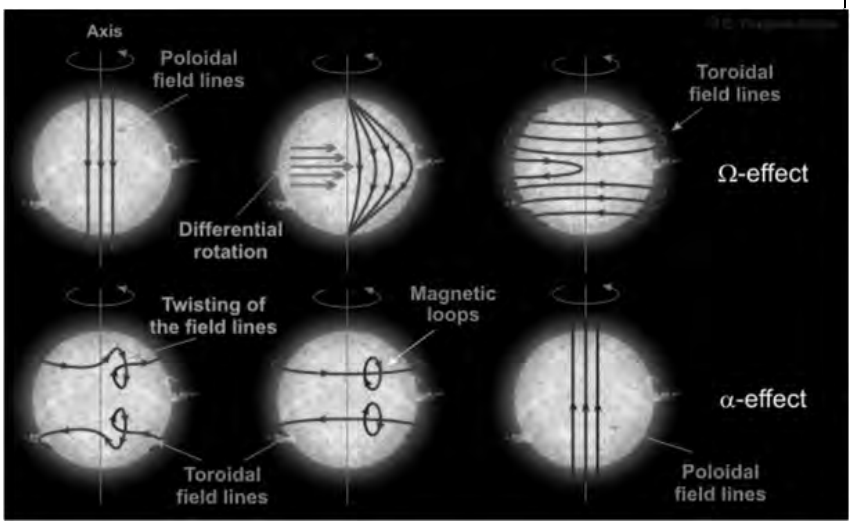
L. Gyõri et al, 2016

# Its All Part of the Solar Dynamo

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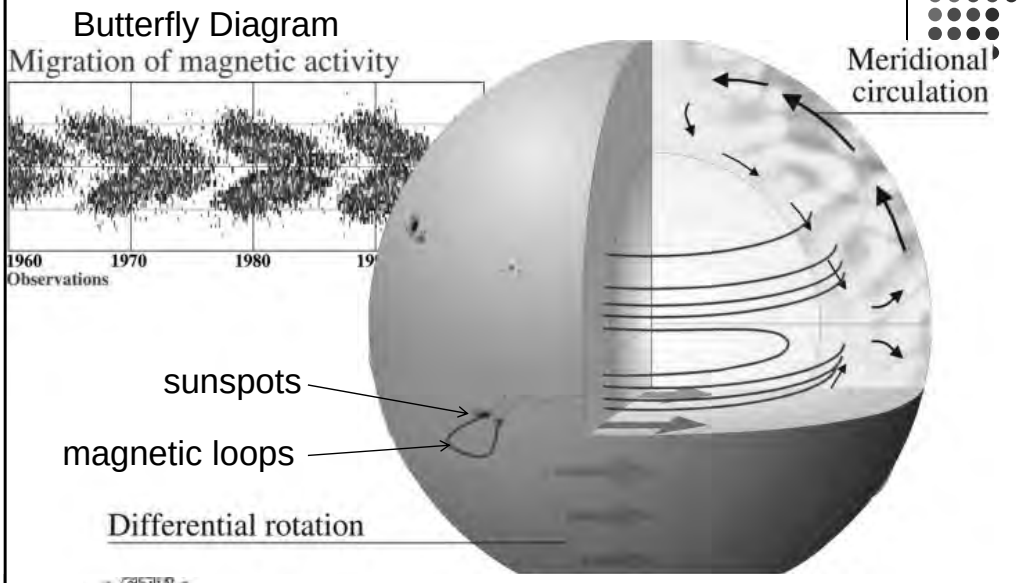
# Putting the Picture Together

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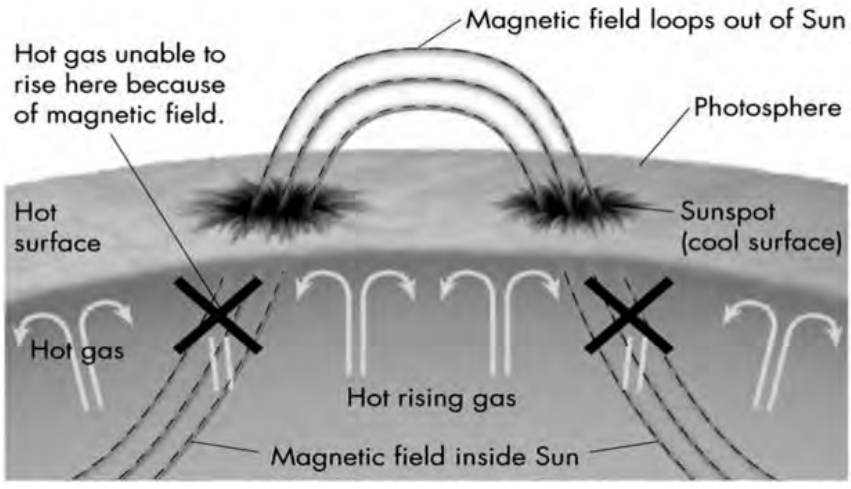
# Magnetic Loops Make Sunspots Dark

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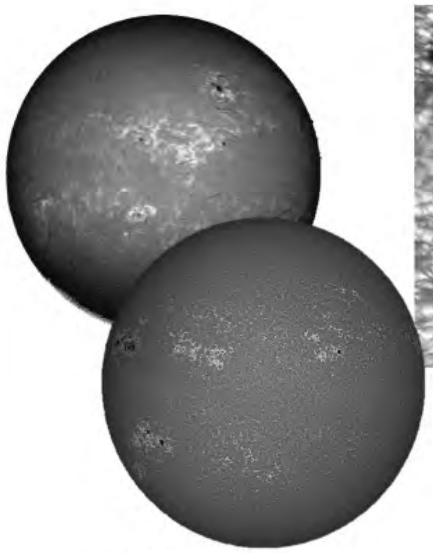
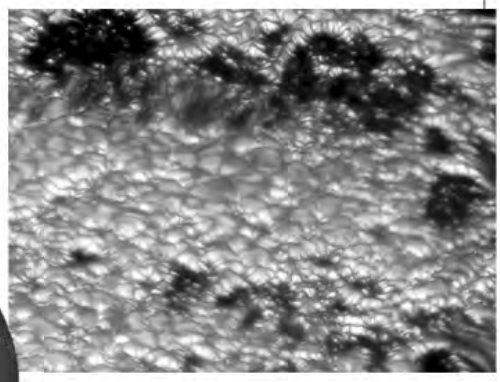
# The Hidden Source of Solar Flux: Plages & Faculae





Individual faculae are bright spots on the walls of solar granules, the cells of hot plasma that bubble up to the Sun's surface from the convention zone.

Goran Scharmer / Royal Swedish Academy of Sciences

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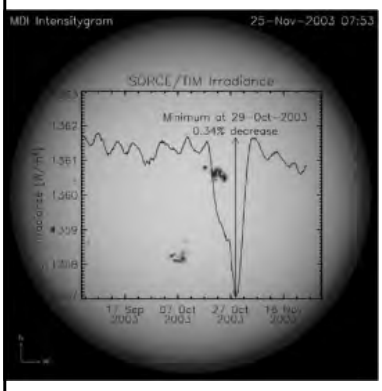
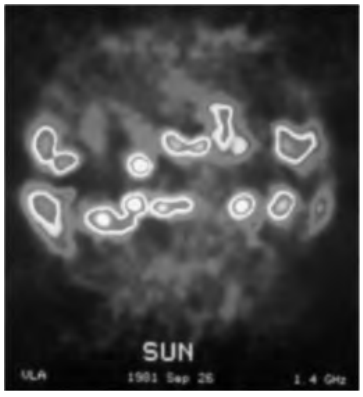
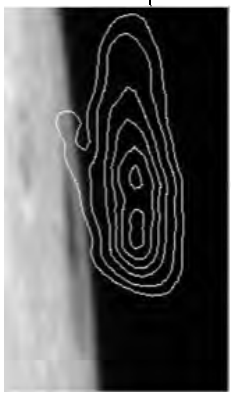
# Sunspots are Visibly Dark but Radio Loud




A sunspot group in 2003, observed by the Total Irradiance Monitor (TIM) radiometer on the SORCE satellite caused irradiance to drop by 0.34%.




This 14 GHz image of the Sun by the Very Large Array (VLA) radio telescope shows the highest intensity radio waves come from a similar location as sun spots



TRACE showing a 8 GHz radio source directly above this sunspot on the limb

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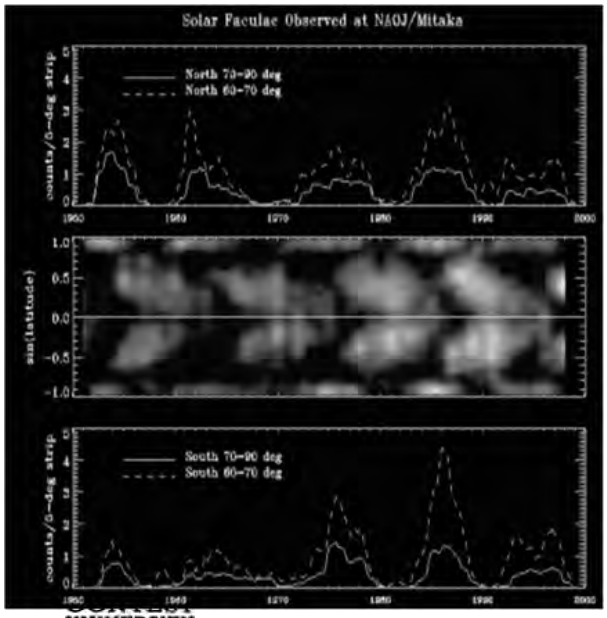
# A Different Kind of Butterfly Diagram



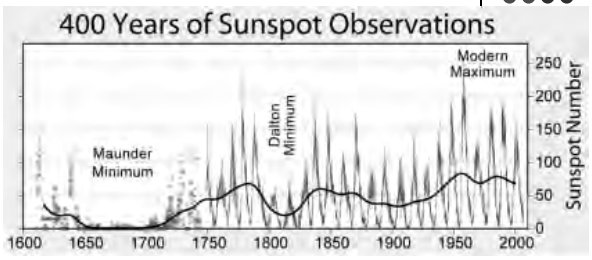

https://solarwww.mtk.nao.ac.jp/en/db_faculae.html

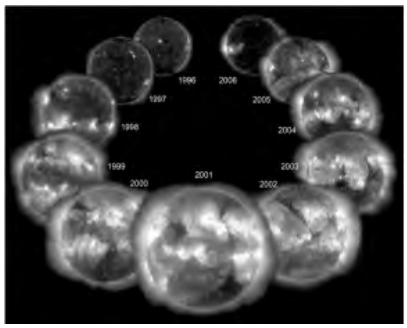
- Many but not all faculae are small bright patches seen around sunspots
- Thus they exhibit a similar latitude distribution over time as sunspots (The Butterfly Diagram)
- Yet another kind of faculae appear in the polar regions of the Butterfly diagram
- These 'polar faculae' are most numerous at the minimum of sunspot activity



# What does Solar Variability Mean for Cycle 25?

- Sun's activity cycle has a quasi 11-year periodicity
- Solar magnetic field constantly reversing orientation
- Activity increases for few years around field reversal (solar maximum) and decreases when field becomes ordered again (solar minimum)
- Other competing cycles cause deviations from 11-years and modulate the strength of the cycle over the long-term
- Sunspot numbers are used as a proxy for solar activity

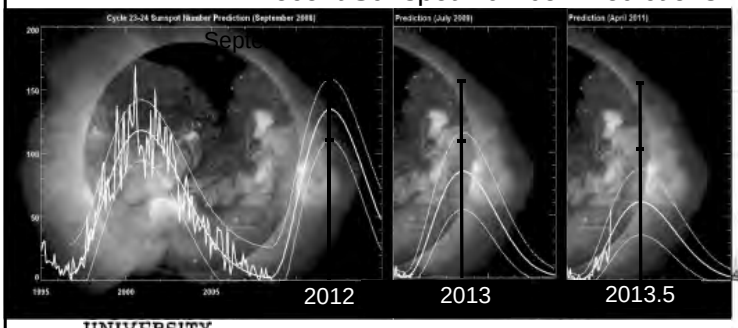


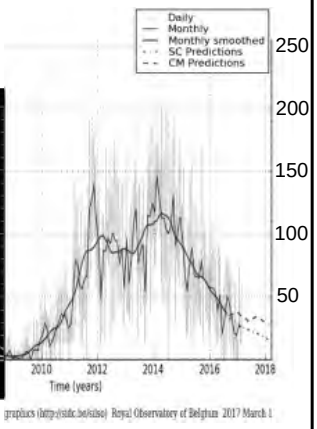



# Solar Cycle 24: Where Are We Now?

- Recent solar cycles are showing dramatic changes, making predictions more complicated
- Consensus is we are not dipping into another Maunder Minimum
  - Cycle is slower, up to 14 years with long deep minimum
  - Lower luminosity, slower currents beneath Sun's surface
  - Lower magnetic field means higher cosmic ray flux at minimum
  - lower activity at maximum
  - Approaching minimum expected sometime in 2019-2020
  - Extreme events still possible

Recent Sunspot Number Predictions

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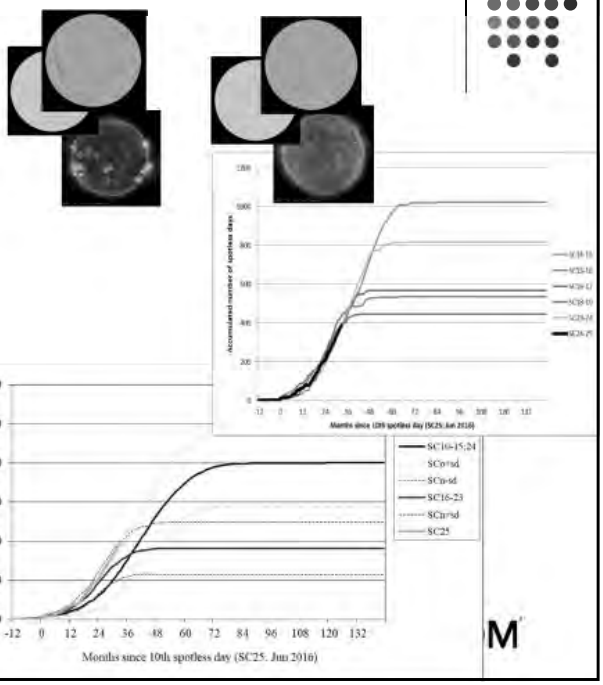
# Solar Cycle 24: Where Are We Now?

- Currently nearing the end of the declining phase of the solar cycle
- Solar storms due mainly to fast solar wind from coronal holes
- Very infrequent solar storms from solar eruptions
- Average solar flux very low due to increasing number of "spotless days"
- However, cosmic ray flux and plage maxima occur now
- Spotless Days can be used as a predictor of future activity up to a point
- Interesting trend developing but too early to be sure
- http://sidc.oma.be/silso/spotless

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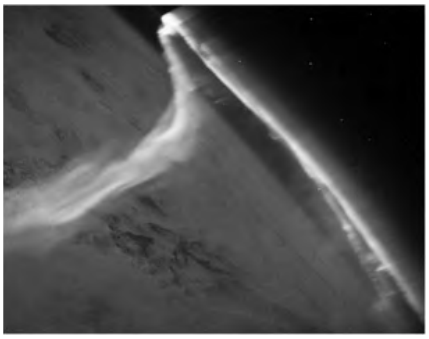
# How is the Ionosphere Affected?

- Ionosphere is a charged plasma layer above the atmosphere comprised of ions and electrons
- It would be neutral but it gets charged from exposure mainly to the Sun's UV radiation
- This charged nature facilitates radio propagation
- During active space weather, extra energy caught in the Earth's magnetic shield gets dumped into the ionosphere
- This energy (flow of charged particles) lights-up the plasma in the Earth's ionosphere similar to a fluorescent lamp or neon sign
- Result is the aurora borealis (northern lights) and aurora australis (southern lights) along with changes in radio propagation



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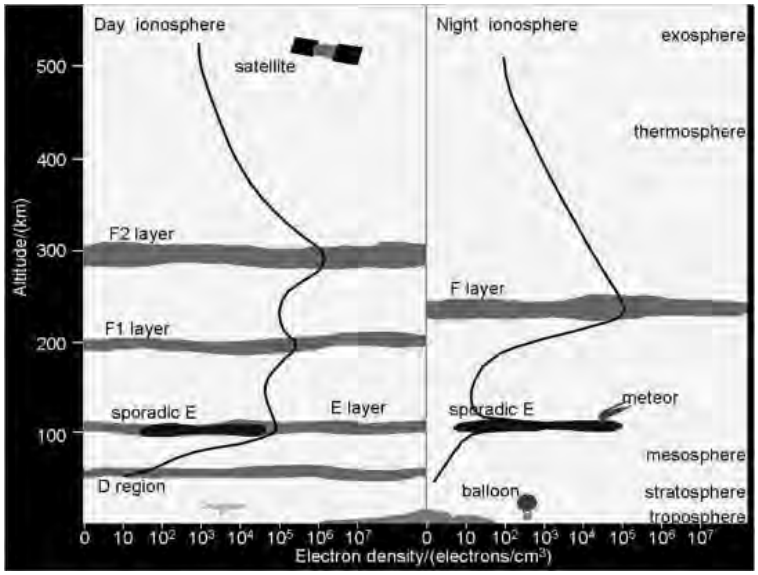
# What are Ionospheric Layers?

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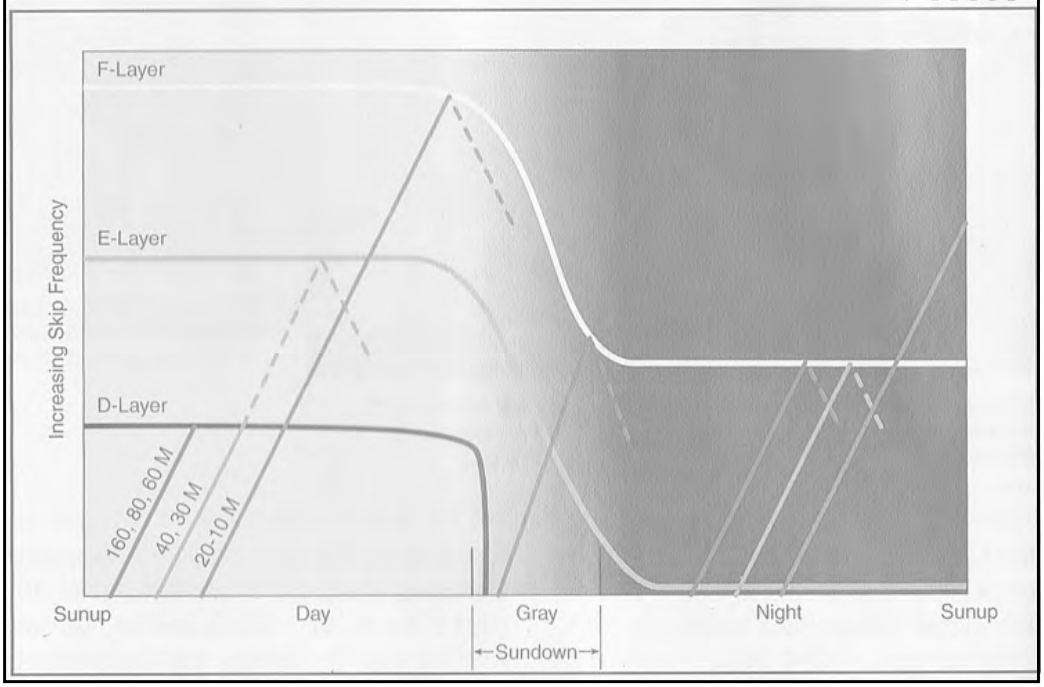
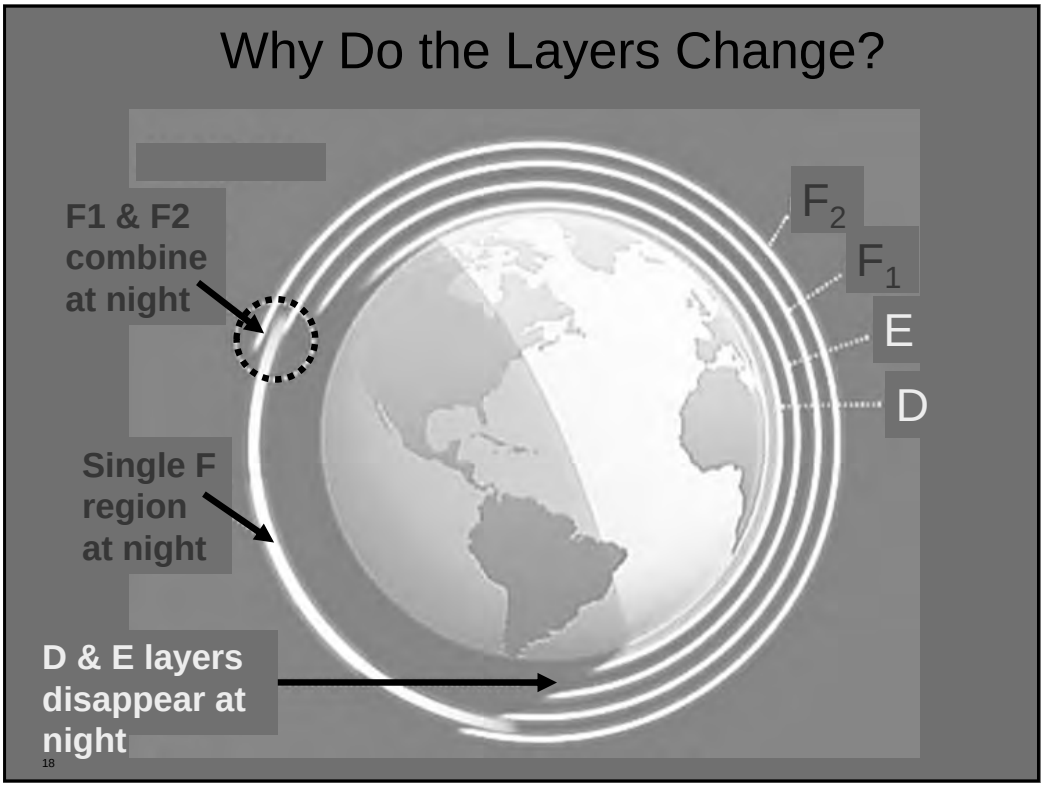
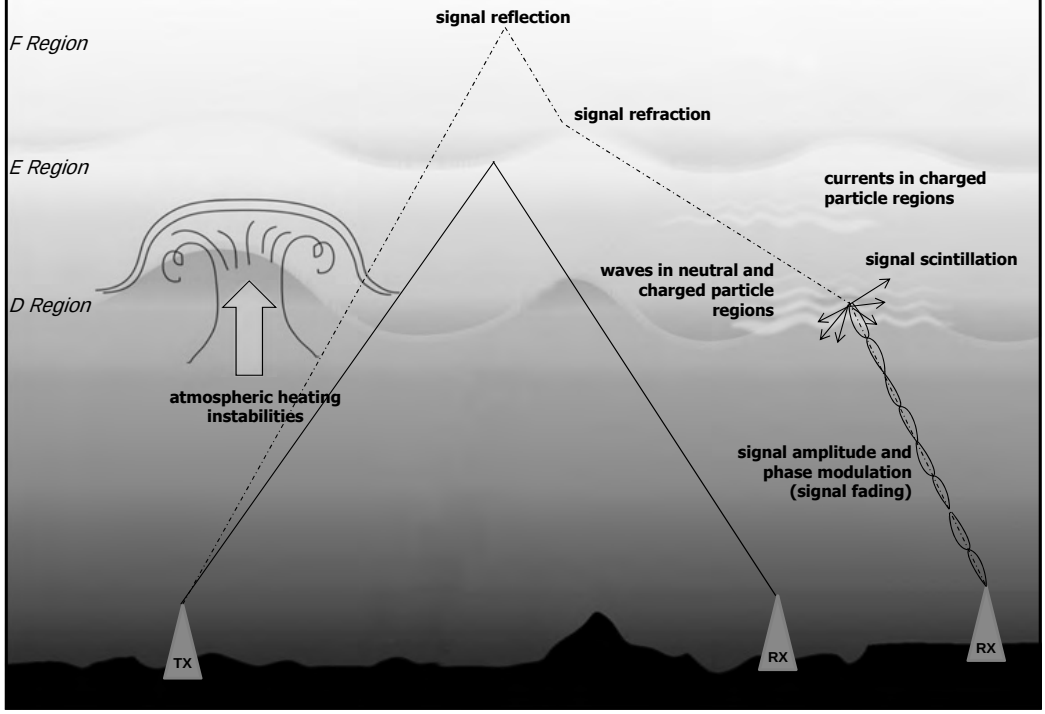
## Ionospheric Layers & Signal Propagation



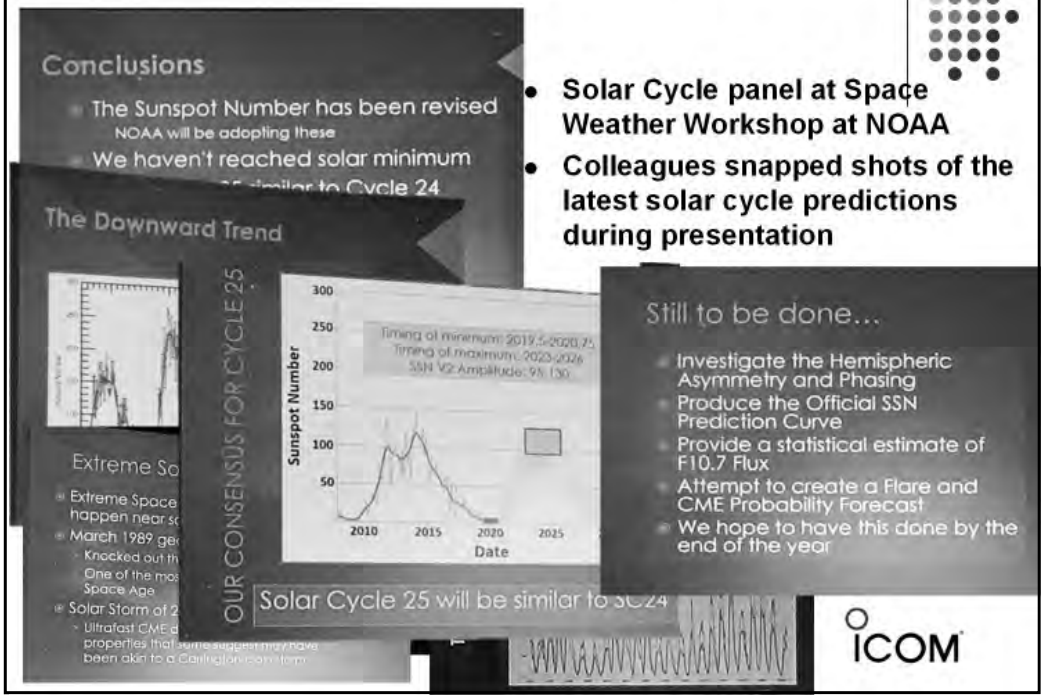

## Why Do the Layers Change?



# Space Weather Effects on Propagation

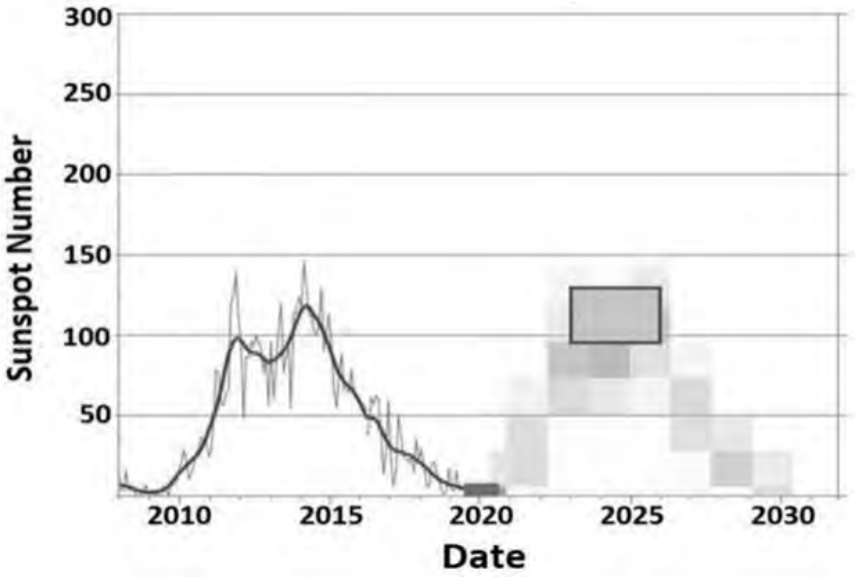



# Hot Off the Presses!




- Solar Cycle panel at Space Weather Workshop at NOAA
- Colleagues snapped shots of the latest solar cycle predictions during presentation

## Official Cycle 25 Prediction Remains Blurry

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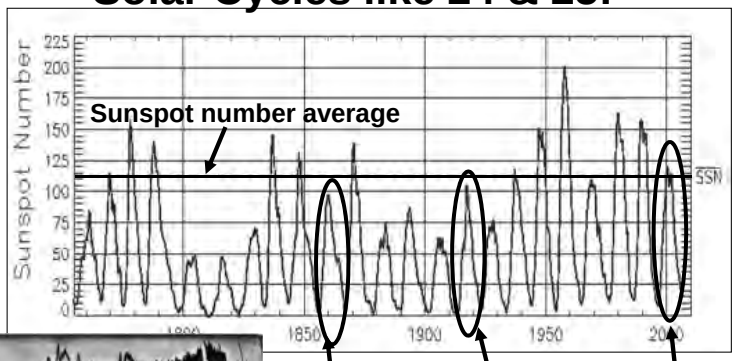
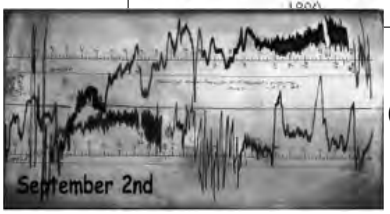
## Expect Big Activity During Small Solar Cycles like 24 & 25!




**1859 super storm (Carrington Event)**

**1921 super storm**

**2001 & 2003 super storms**

- Most of the largest geomagnetic storms on record occurred during smaller than average cycles or average cycles like the one we're in now
- We are due for a 100-year storm similar to the 1859 Carrington Event

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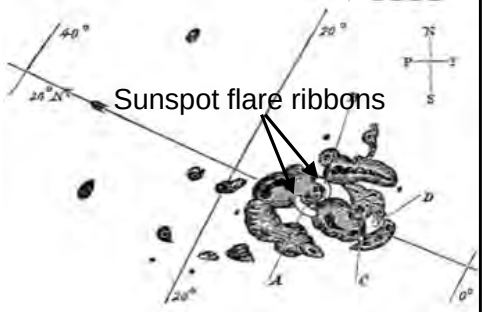
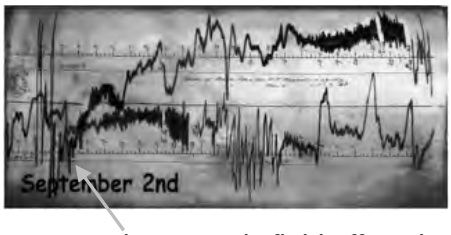
# Super-Storm Possibility During Cycle 25

**Carrington Event September 2, 1859**

- First ever recorded solar flare resulted in a massive solar storm
- Largest in last 500 years
- Three times larger than March 1989
- North American Telegraph system failed
- Telegraph systems functioned despite being unplugged
- Worst hit operating stations sparked and burst into flame from electrical discharges, burning their operators
- Aurora so bright animals thought it was sunrise
- Auroral displays seen as far south as the Caribbean, Hawaii, and Singapore
- If occurred today, cause $2B worth of damage (National Academy of Sciences)




Earth magnetic field off-scale!

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ICOM 23

# The Advantages of Waterfall Displays for Contesting and DXing

Presented by N6TV
n6tv@arrl.net

## Presentation Overview

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

# Legacy Panadapters

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


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

ICOM 3

# Legacy Panadapters

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


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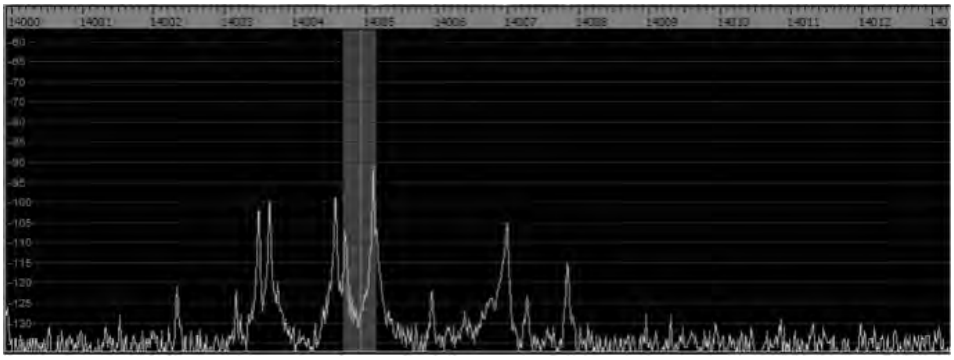
ICOM 4

## Spectrum Displays Hide Weak Signals



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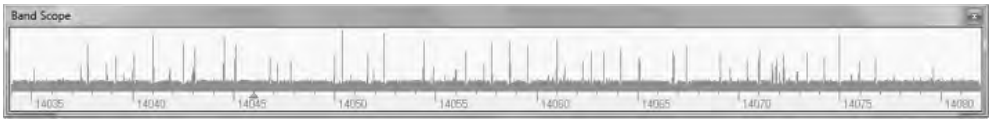
ICOM 5

## CW Skimmer's Band Scope

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




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

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ICOM 6

## Legacy Panadapter Limitations

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



## 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

- Major improvement over legacy designs

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Photo courtesy http://www.elecraft.com

ICOM 9

# Elecraft P3 + P3SVGA Option

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

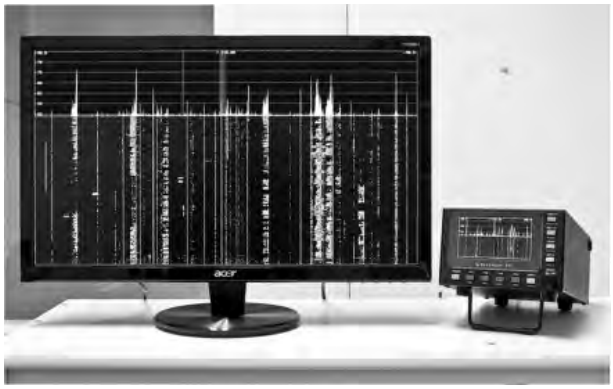

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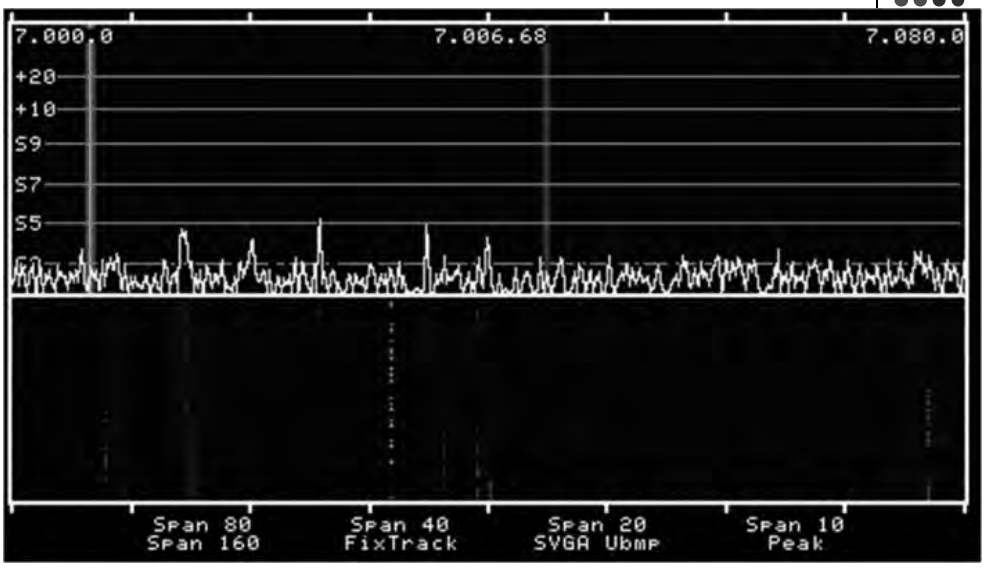
Photo courtesy http://www.elecraft.com

ICOM 10

# P3 Built-in Display at 480 x 272

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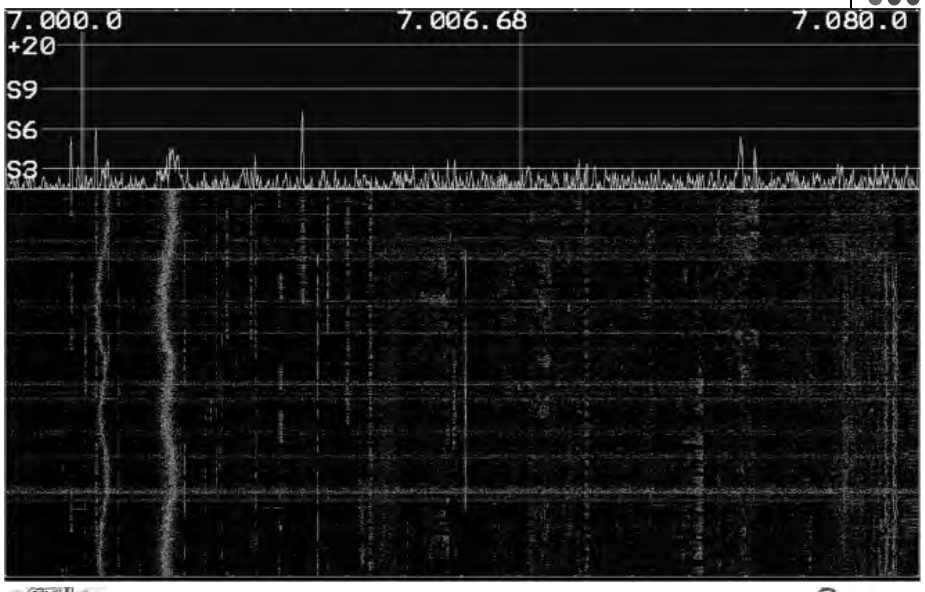
ICOM 11

# P3SVGA at 1440 x 900

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ICOM 12

# Old Icom IC-7800 firmware


(no waterfall)



Photo courtesy http://www.icomamerica.com



# Icom IC-7800 with V3.0 firmware

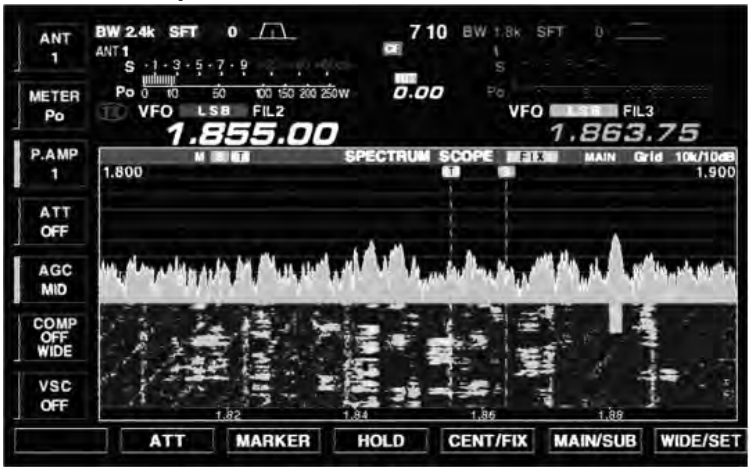



Photo courtesy http://www.icomamerica.com

# IC-7800 V3.0 Screen Shot

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

- 800 x 480 (with or without external monitor)






# IC-7850 / 7851 – *Huge* Improvement

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

## New IC-7300 has fast waterfall too!

- With touch screen




Photo courtesy http://www.icomamerica.com



## IC-7610 with dual band waterfall

# Kenwood TS-990S




Photo courtesy http://www.kenwoodusa.com



# FlexRadio FLEX-5000™, FLEX-6700™




Photos courtesy http://www.flexradio.com

## FlexRadio Systems® SmartSDR

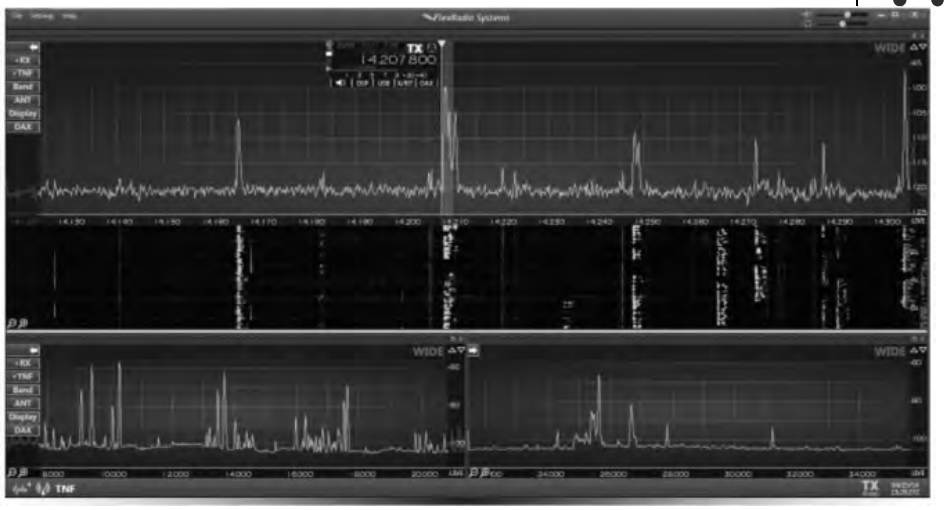
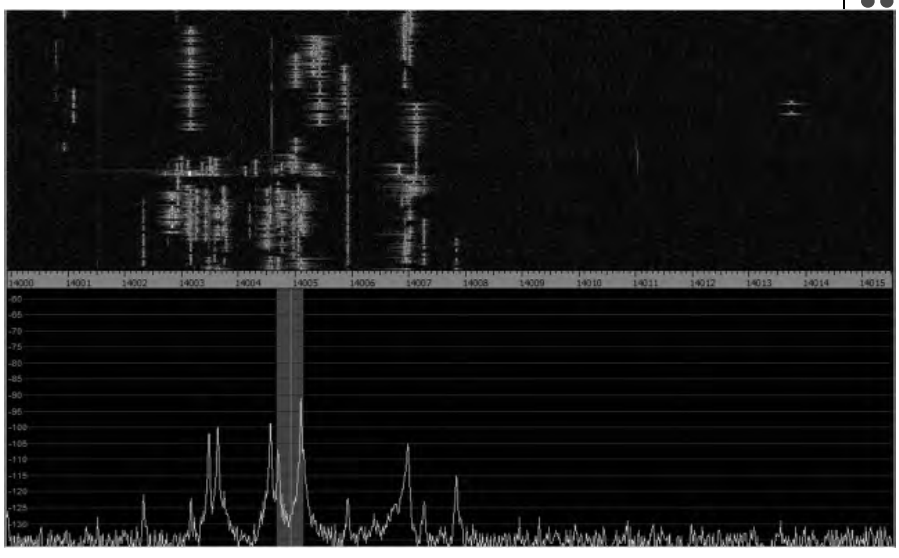


Image courtesy K3UK



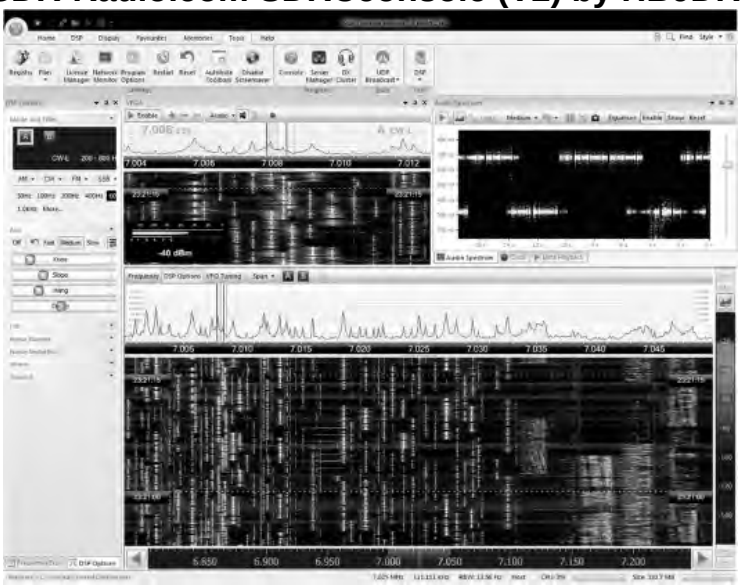
## Winrad Software



# HDSDR Software

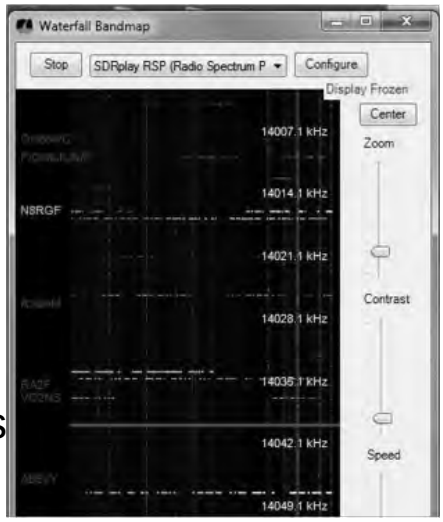



## SDR-Radio.com SDRConsole (V2) by HB9DRV



## 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






## LP-Pan and NaP3

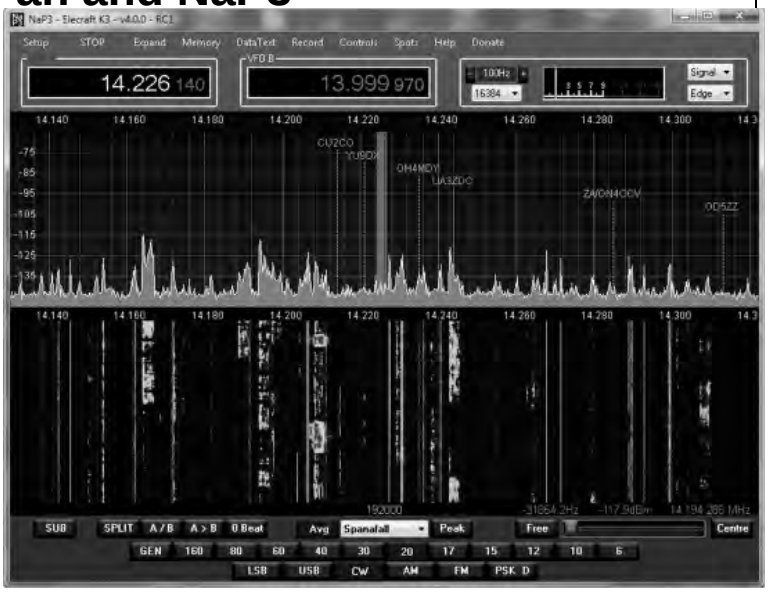
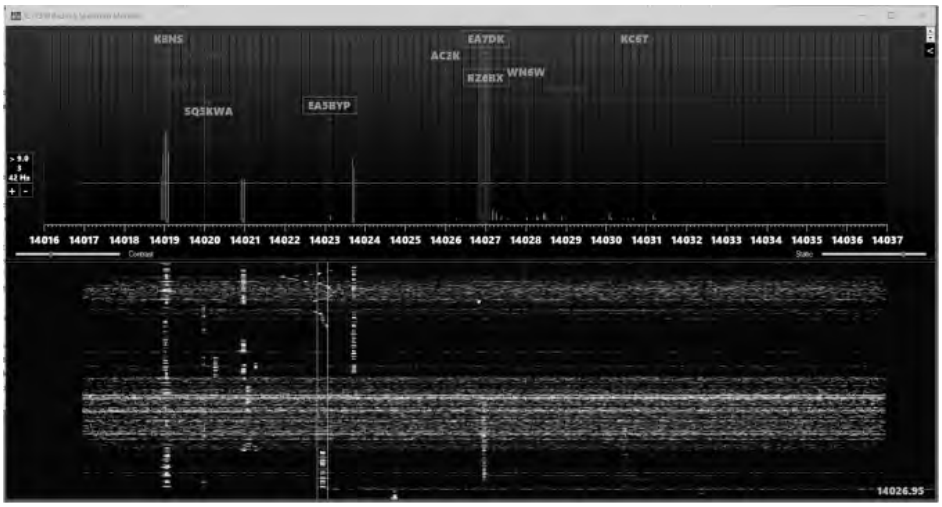



Photo courtesy http://www.telepostinc.com

# N1MM+ Spectrum Display Window

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

ICOM 27

# N1MM+ Vertical Spectrum Display Window


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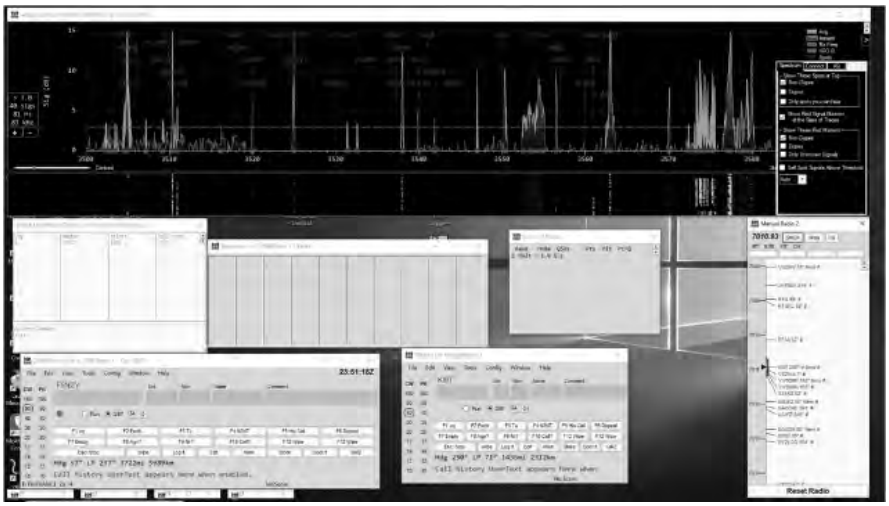
http://n1mm.hamdocs.com/tiki-index.php?page=Spectrum+Display+Window

ICOM 28

## N1MM+ with Spectrum Display



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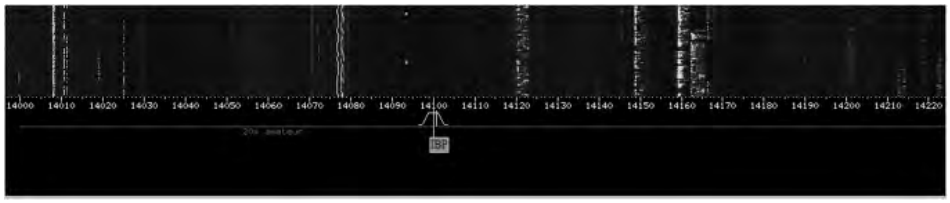
http://n1mm.hamdocs.com/tiki-index.php?page=Spectrum+Display+Window

ICOM 29

## WebSDR: Waterfalls on the Web

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




View / Zoom entire HF spectrum

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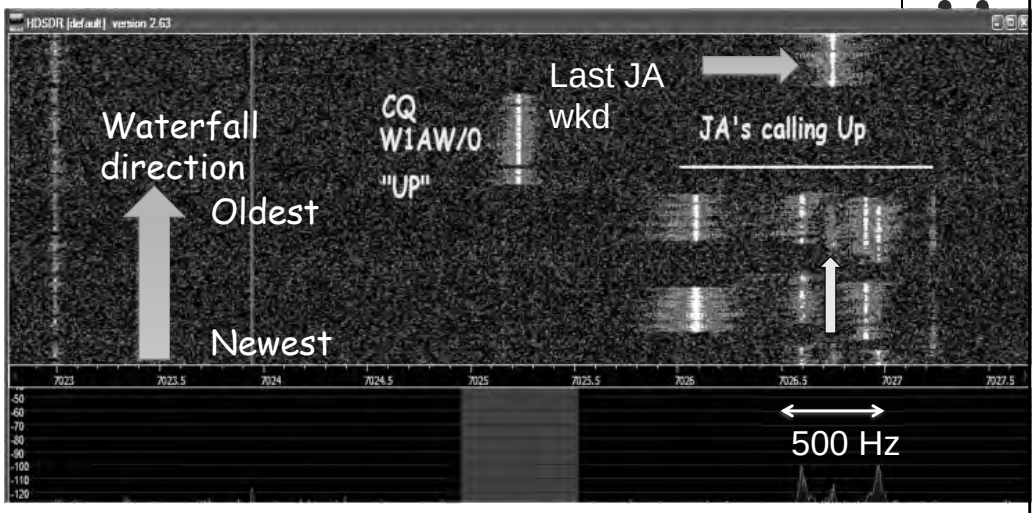
ICOM 30

# Waterfall Display Advantages

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

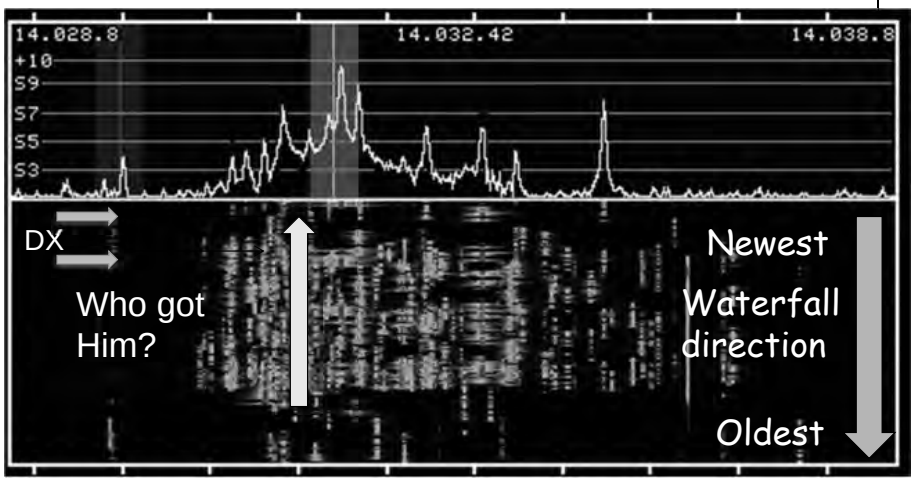


# Listening "Up"? Not a problem




**Who will W1AW/0 answer next?**

# E30FB CW Pileup on P3 display



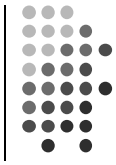

**Where will he listen next?**



# Advantage: Waterfall

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

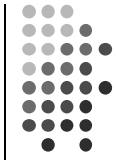
## Waterfall Display *Disadvantages*



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

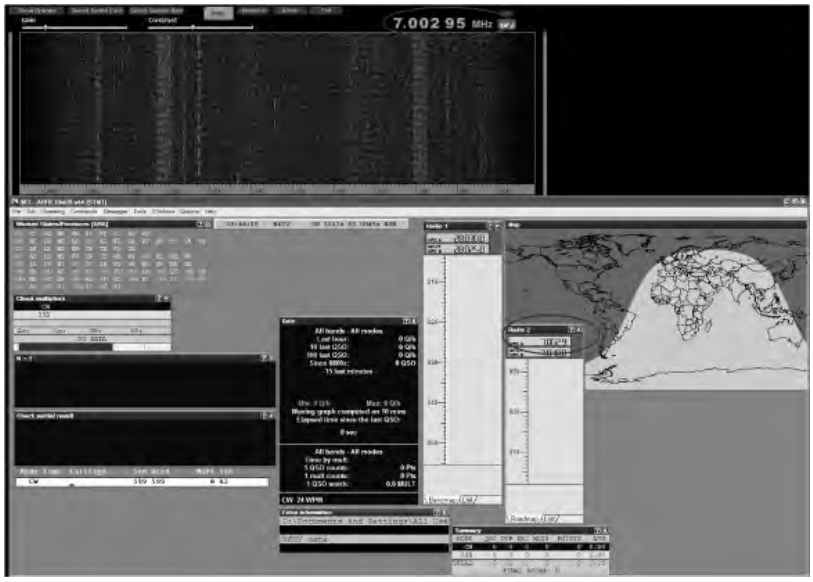


## Recommendations While Contesting



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

## Winrad on Top, Win-Test on Bottom

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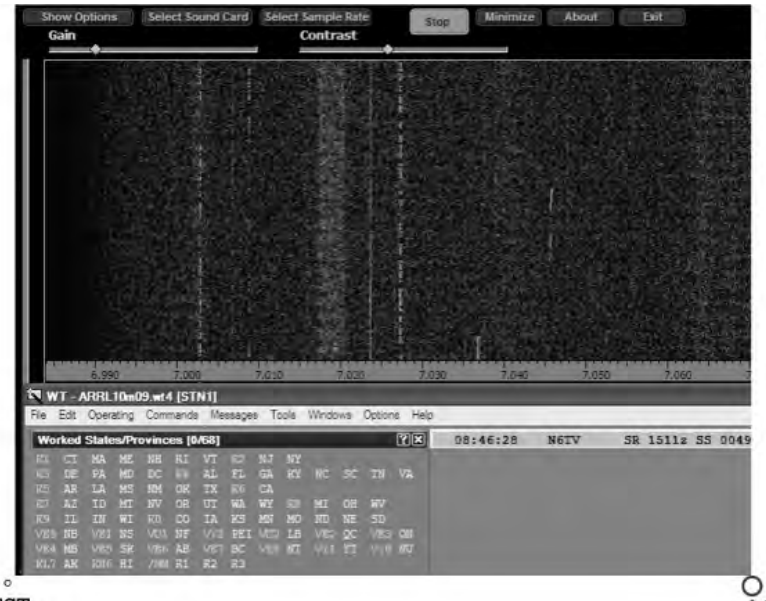
ICOM 37

## Winrad & Win-Test (zoomed)

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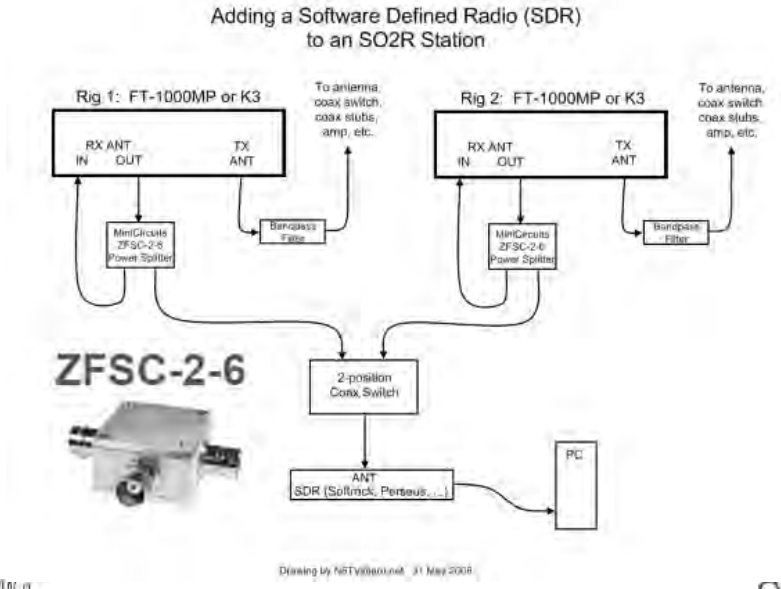
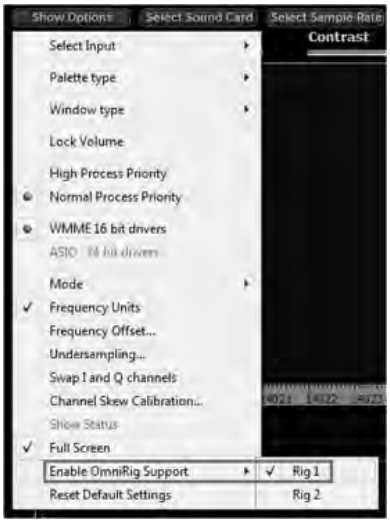
ICOM 38

## Click-To-Tune with a “Legacy” Transceiver + SDR






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



# Try Winrad Waterfall Demo

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



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

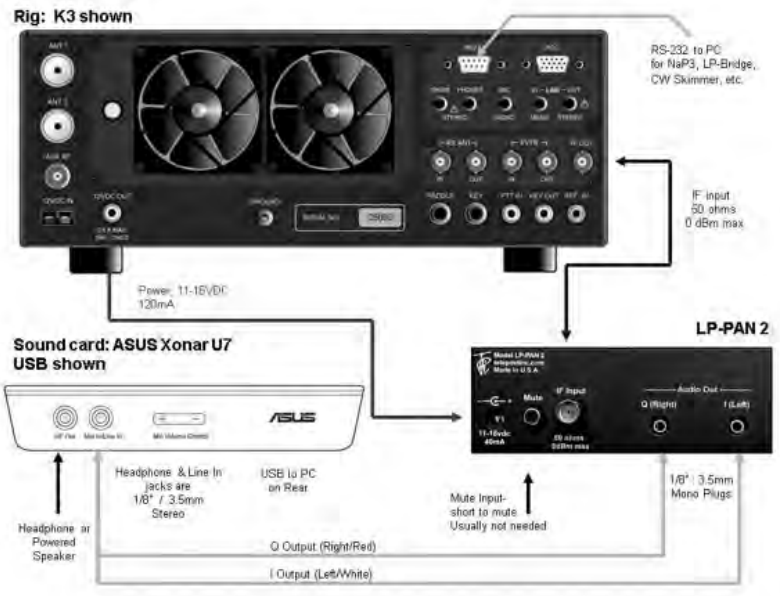
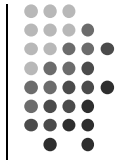




Photo courtesy http://www.telepostinc.com

# Questions?



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

# CTU 2019 Presents

Taking Digital Contesting to the Limit

*Ed Muns, W0YK*

# Taking Digital Contesting … to the Limit

- 1st session: *"Digital Contesting is Fun!"*
- Receiver Configuration
- Call Sign Stacking
- Multiple Decoders
- SO2V, SO2R-SOnR
- AFSK vs. FSK
- FSK Bit Timing
- RTTY Transmit Bandwidth
- FT8 Future

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# Receiver Configuration

## *AGC; headphone monitoring*

- Turn off AGC
  - or, at least minimize it, e.g., AGC=Slow
  - Fast AGC increases error rate in modern software decoders
- Minimize headphone monitoring fatigue
  - Use minimum discernible headphone volume
    - Only need to know start/stop of signal
  - Low Tones, e.g., 915/1085
    - Possible TX harmonics with AFSK

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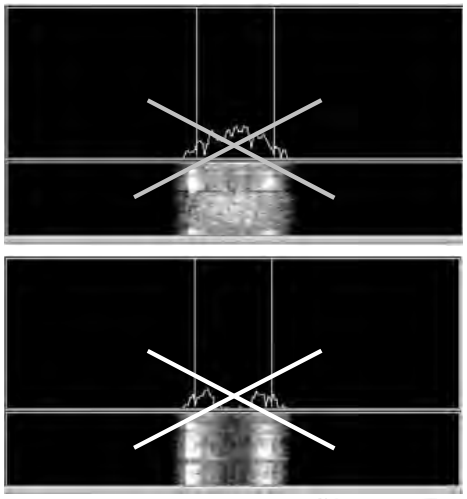
# Receiver Configuration

## *IF filtering*

- Narrow IF filters (Roofing & DSP)
  - 500 Hz - normal
  - 250 Hz - extreme QRM only
  - Tone filters – don't use!
    - Icom Twin Peak Filter
    - K3s Dual-Tone Filter



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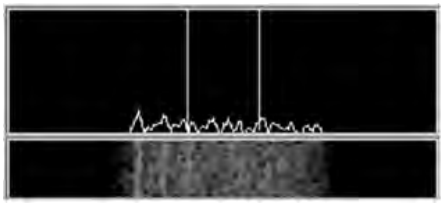
# Receiver Configuration

## *decoder audio level*

- Decoder audio level
  - Band noise 5% of full-scale
  - Maximum dynamic range
  - Weak signal decode
- Note 500 Hz IF filtering
  - Decoder optimum



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# Call Sign Stacking

## *"Slow Down to Win"*

- Sailboat racing analogy:
  - Pinwheel effect at mark-rounding
- Let pile-up continue 1-3 seconds after getting 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

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# 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

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# Call Sign Stacking

## *skip 2 phases*

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

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# Call Sign Stacking

***tail-ender***

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



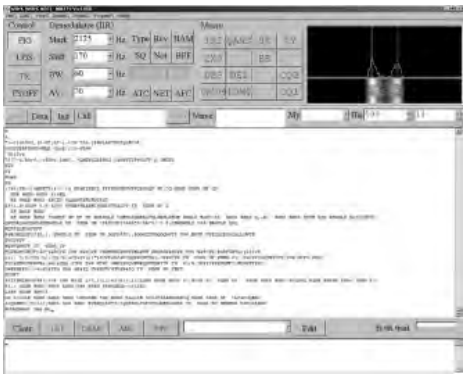
# Call Sign Stacking

***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

# Multiple Decoders

***MMTTY***



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

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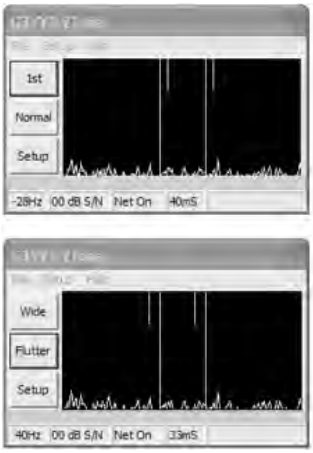
# Multiple Decoders

***2Tone***




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

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# Multiple Decoders

***GRITTY***


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



# Multiple Decoders

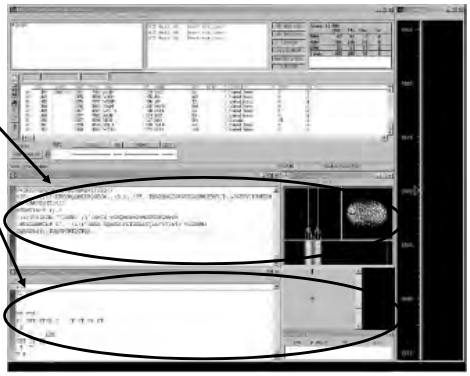
***hardware MODEM***




# 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



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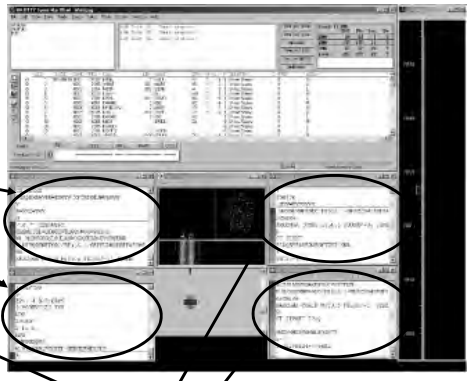
ICOM

# Multiple RTTY Decoders

## *multiple MMTTY profiles*

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



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16/56

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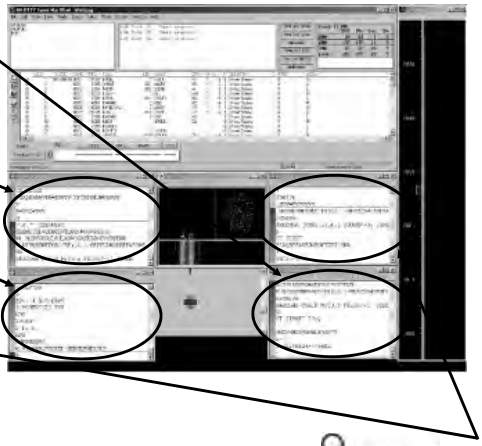
# Multiple Decoders

## *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"



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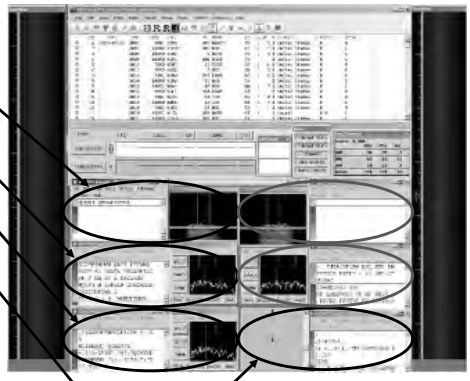
# Multiple Decoders

## *SO2V*

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



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# Multiple Decoders

## *Tone choices for monitoring*

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

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# SO2V

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
     - Left-click call from 2nd RTTY window into VFO-B Entry Window
   - Two ways to transmit on VFO-B:
     I. A<>B, work the mult, A<>B
     II. SPLIT, work the mult, un-SPLIT, resume running
       - Requires “wire-OR’d” FSK or AFSK and two transmit RTTY windows
         - WriteLog Shared Com Port obviates the wire-OR
       - K3/WriteLog invokes SPLIT when VFO-B call is clicked

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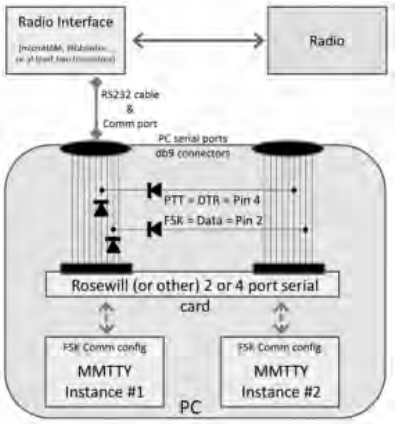
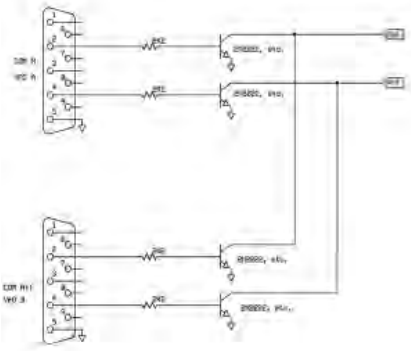
# SO2V

## *Wire-OR FSK/PTT*




**Serial Signals (K8UT)**

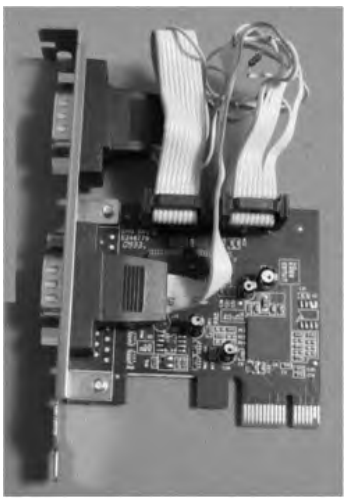


**FSK/PTT Signals (W0YK)**



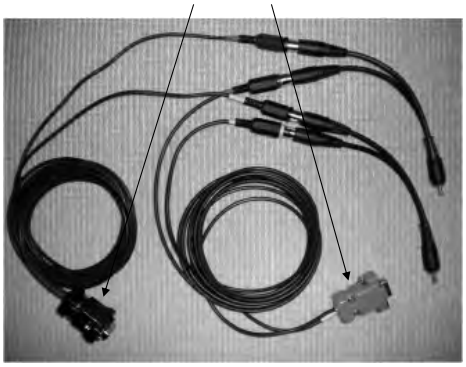
# SO2V

## *Wire-OR FSK/PTT*



**Serial Signals (K8UT)**

Circuitry built into
DE9 hood



**FSK/PTT Signals (W0YK)**

# SO2R

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

*No time to watch TV or read spy novels!*

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# SO2R

***"M2" configuration***


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# SO2R in the NA Sprint

***maximize TX duty cycle***

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

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# SOnR

***> 2 radios***

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

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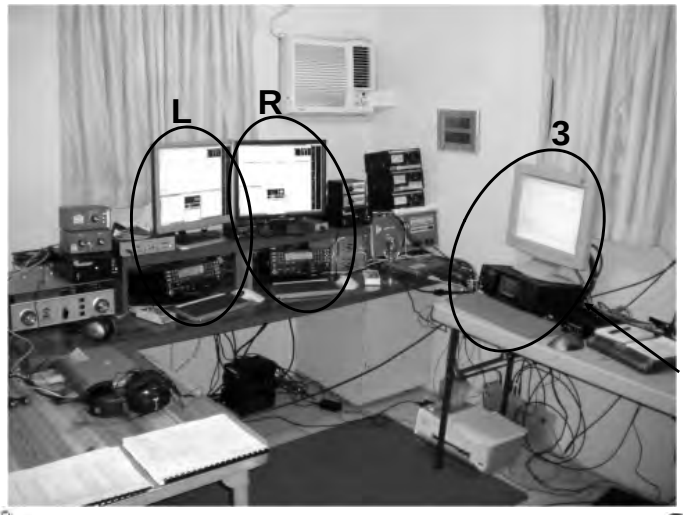
# SOnR

***Multi-Multi configuration***






# AFSK vs. FSK

***which is better?***

- First and foremost, a “religious belief”
  - Personal preference, enthusiastically advocated!
- Both are equally high quality on the air, if …
  - They are configured and adjusted properly
- Telegram:
  - AFSK can achieve high quality with any radio
  - FSK minimizes unintended consequences
    - Only K3 has acceptably narrow TX bandwidth

# AFSK vs. FSK

***comparison***

| 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 or PTT | • PTT |
| • Audio cable *(a'la FT8, JT65/9, PSK31)* | • Com port FSK/PTT keying cable |
| • Must use high tones | • Can use low tones |
| *NET (automatic TX tone control)* | *Eliminates:* |
| *Less bandwidth (depends on setup)* | *audio level adjust* |
| | *disabling speech proc.* |
| | *erroneous sound keying* |
| *Easier cabling; NET* | *Less pitfalls* |

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# FSK Bit Timing Issues

- Issues
  1. Bit jitter (variation of bit length)
  2. 45 instead of 45.45 baud( 22.22 vs. 22.00 msec/bit)
- Caused by *Windows* OS:
  1. Task Scheduler injects delays between bits
  2. API interface limited to sending integer parameters
- Increased receive error rate
  - Adequately loud, but incorrectly printed characters
  - Wasted time on fills

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# FSK Bit Timing Issues

## *bit generation*

- Software FSK
  - Bit transitions generated in a *Windows* program:
    - MMTTY EXTFSK/EXTFSK64
    - 2Tone FSK
    - WriteLog Rittyrite Software FSK
- Hardware FSK
  - Bit transitions generated outside of *Windows*:
    - Hardware modem
    - UART on Serial I/O card or USB-Serial adapter
    - Micro-controller: FSKit, TinyFSK, RpiFSK
    - Psuedo-FSK via AFSK

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# FSK Bit Timing Issues

## *software FSK*

- Bit transitions generated in a *Windows* program
- Com port signal toggled: TxD, DTR or RTS
- Windows Task Scheduler interrupts bit stream
  - Other programs which need CPU cycles
  - User operations, e.g.:
    - Mouse movements
    - Starting a program
    - Interacting with a program
  - Average deviation close to zero
  - Some instantaneous deviations of a few msec.

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# FSK Fit Timing Issues

## *software FSK solutions*

- High performance PC
  - Reduces, doesn't eliminate, bit jitter
    - Extent of timing variation
    - Frequency of timing variation
  - Minimize the number of other running programs
- Use hardware FSK
  - May have another timing problem
    - 45 instead of 45.45 baud (22.22 vs. 22.00 msec.)

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# FSK Bit Timing Issues

## *hardware FSK*

- Bit transitions generated outside of *Windows*:
- 5-bit words sent to hardware bit generator
- Some UARTs don't go below 110-600 baud
  - Modern Serial cards and USB-Serial adapters
    - Clock divider optimized for a higher speed range
- UARTs that handle 45.45 baud
  - Windows API integerizes 45.45 baud to 45
    - Bits are 22.22 msec instead of 22.00
    - Minor impact on receive error rate

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# FSK Bit Timing Issues

## *hardware FSK solutions*

- Use another hardware FSK alternative:
  - Hardware MODEM (ST-8000, DXP38, PK232, Kam ..)
  - FSKit by K4DSP (PCBs no longer available)
  - TinyFSK (Mortty kit for $18)
  - Pseudo-FSK
    - FSK keying circuits driven by AFSK
      - Jitter-free AFSK[1] without the adjustment issues
      - DIY solutions: FLdigi, 2Tone
- Use AFSK ☻

*[1] AFSK tone timing uses soundcard clock, independent of windows*

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# RTTY Transmit Bandwidth

## *unnecessary QRM*

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

*Why hurt yourself AND QRM close-by stations?*

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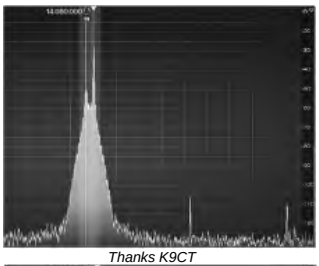
# RTTY Transmit Bandwidth

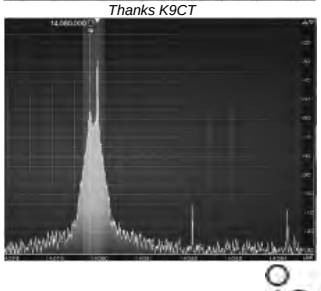
## *AFSK*

MMTTY - AFSK
- No filtering
- Flex 6000 @ 60 W



*Thanks K9CT*

MMTTY - AFSK
- Default 48-tap TX BPF
- Flex 6000 @ 60 W



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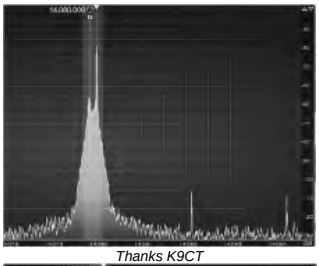
# RTTY Transmit Bandwidth

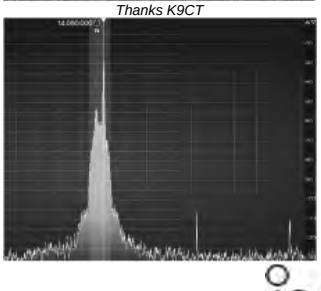
## *AFSK*

MMTTY - AFSK
- Default 48-tap TX BPF
- Flex 6000 @ 60 W



*Thanks K9CT*

MMTTY - AFSK
- 512-tap TX BPF
- Flex 6000 @ 60 W



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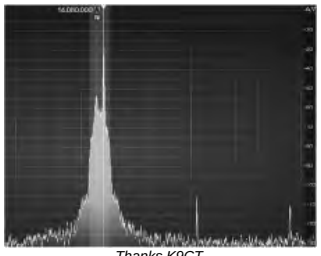
# RTTY Transmit Bandwidth

## *AFSK*

MMTTY - AFSK

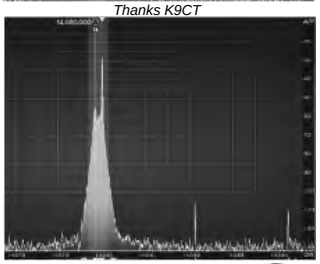
- 512-tap TX BPF
- Flex 6000 @ 60 W



*Thanks K9CT*

2Tone - AFSK

- Default “AM” setting
- Flex 6000 @ 60 W



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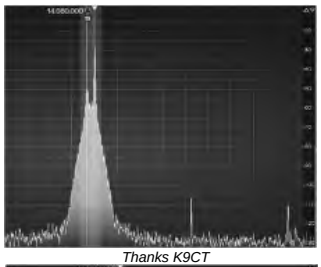
# RTTY Transmit Bandwidth

## *AFSK*

MMTTY - AFSK

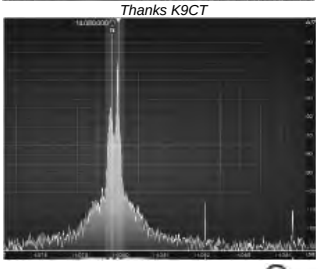
- Unfiltered
- Flex 6000 @ 60 W



*Thanks K9CT*

2Tone - DOOK

- Default “AM” setting
- Flex 6000 @ 60 W



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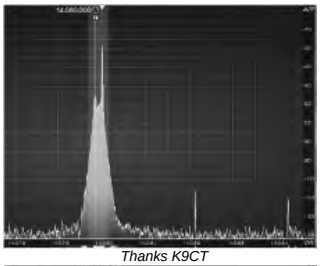
# RTTY Transmit Bandwidth

## *AFSK*

2Tone - AFSK

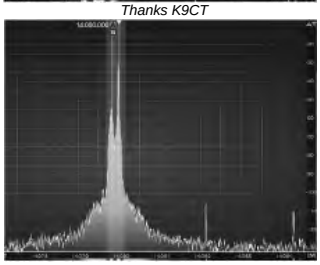
- 512-tap TX BPF
- Flex 6000 @ 60 W



*Thanks K9CT*

2Tone - DOOK

- Default “AM” setting
- Flex 6000 @ 60 W



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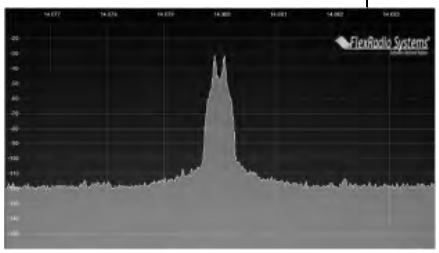
# RTTY Transmit Bandwidth

## *PA IMD impact on AFSK bandwidth*

MMTTY - AFSK

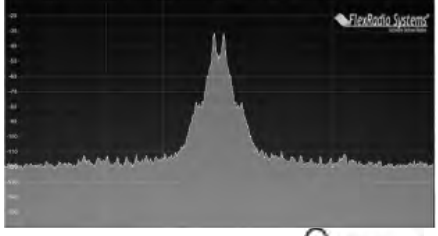
- 512 Tap TX BPF
- K3 @ 1 mW




*Thanks K0SM (http://www.frontiernet.net/~aflowers/k3rtty/k3rtty.html)*

MMTTY - AFSK

- 512 Tap TX BPF
- K3 @ 100 watts

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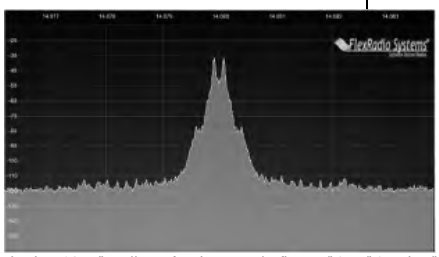
# RTTY Transmit Bandwidth

## *MMTTY AFSK filter vs. K3 AFSK filter*

MMTTY - AFSK

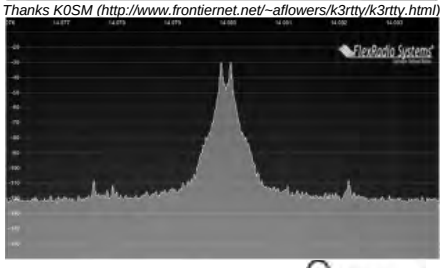
- 512 Tap TX BPF
- K3 @ 100 watts




*Thanks K0SM (http://www.frontiernet.net/~aflowers/k3rtty/k3rtty.html)*

MMTTY - AFSK

- No MMTTY filter
- K3 AFSK filter
- K3 @ 100 watts

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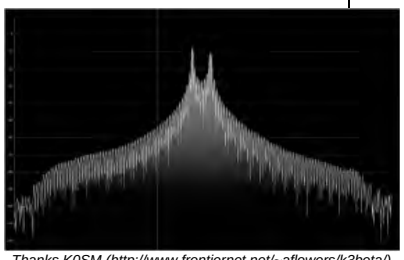
# RTTY Transmit Bandwidth

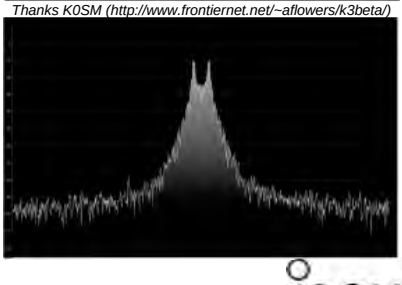
## *FSK*

- Old K3 FSK bandwidth
  - No waveshaping
  - < DSP281 firmware
  - Typical of all radios
  - 50 watts



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

- New K3 FSK bandwidth
  - Optimal DSP filter
  - DSP281 firmware, March 2013
  - Lobby other mfrs



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# RTTY Transmit Bandwidth

***recommendation for minimum QRM***

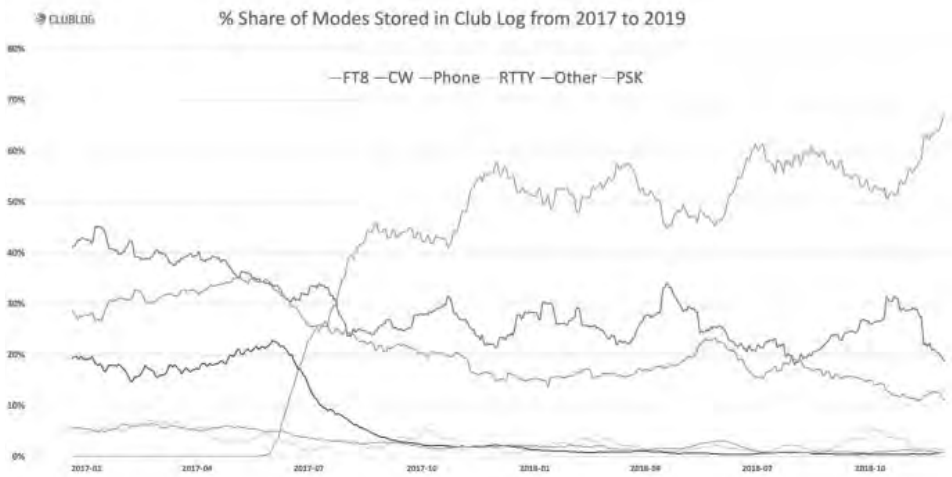
| FSK | AFSK |
|---|---|
| 1) K3, or | 1) K3 or Flex |
| 2) QRP with other radios | a) Enable K3 AFSK filter |
| 3) Otherwise, use AFSK | b) 2Tone DOOK or AFSK |
| | c) MMTTY 512-Tap |
| | 2) Other radios |
| | a) 2Tone DOOK or AFSK |
| | b) MMTTY 512-Tap |



# Resources

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

# Clublog QSOs by Mode

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# FT8 Contest Technology Future

- TU, NW
- Multi-streaming transmission (Fox-Hound DXped.)
- RTTY replacement, or additional mode?
- Synchronous vs. asynchronous Tx/Rx cycles?

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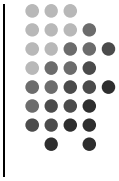
# FT8 Contest Technology Future



- **TU, NW**
  - **CQ RU K1ABC FN42**
    ***K1ABC W9XYZ 579 WI***
  - **W9XYZ K1ABC R 589 MA**
    ***K1ABC W9XYZ RR73***
    ***K1ABC G3AAA 559 0013***

    **5 cycles; 34 Q/hr**
  - **TU; G3AAA K1ABC R 569 MA**
    ***K1ABC G3AAA RR73***
    ***K1ABC P43A 599 2145***

    **2 cycles; 120 Q/hr**
  - **TU; P43A K1ABC R 599 MA**
    ***K1ABC P43A RR73***
    ***K1ABC K9CT 579 IL***

    **2 cycles; 120 Q/hr**

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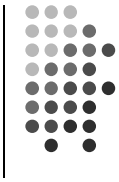
# FT8 Contest Technology Future



- TU, NW
- **Multi-streaming transmission (Fox-Hound DXped.)**
  - **Many Foxes, many Hounds (DXped: 1 Fox, many Hounds)**
  - **Moderate incoming rate (DXped: very high incoming rate)**
  - **Split freq. problematic (DXped: split freq. feasible)**
  - **Therefore:**
    - ***Multi-signal or single-signal multi-partner?***
      - ***Multi-signal: Signal voltage/n → Signal power/$n^2$***
    - ***Limit to 2 or 3 or n streams?***
    - ***Run or S&P per stream?***
      - ***Run vs. S&P could be dynamic per QSO partner***
      - ***Run & S&P mixed within stream***

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# FT8 Contest Technology Future

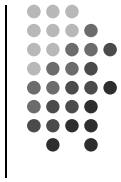
- TU, NW
- Multi-streaming transmission (Fox-Hound DXpeditioning)
- **Additional mode or RTTY replacement?**
  - ***Choice:***
    - ***Exploit inherent multi-channel strengths, or***
    - ***Reduce Tx cycle time by widening BW and lowering sensitivity***
  - ***How much QSO rate is needed?***
    - ***Service rate >> incoming rate***



# FT8 Contest Technology Future

- TU, NW
- Multi-streaming transmission (Fox-Hound DXpeditioning)
- **Additional mode or RTTY replacement?**
- **Synchronous vs. asynchronous Tx/Rx cycles?**
  - ***0, 15, 30 and 45 seconds vs. operator initiated like RTTY***

# Synchronous vs. Asynchronous



## Synchronous

- *multi-streaming*
- *SO2R "lockout"*
- *signal density*
- *better decoding*
- *auto sequencing*
- *QRM immunity*
- *even/odd cycle usage*
- *no "doubling"*

## Asynchronous

- *higher rate?*
- *no clock sync*
- *no time lost for unsync'd clocks*
- *no decoding time lost each Tx cycle*
- *high CPU demand at end of each Rx cycle*
- *easier integration with contest loggers*

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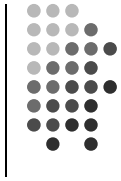
# FT8 Contest Rules Future



- **Multi-channel → Assisted/Unlimited?**
- **How much automation?**
  - **Operator initiate each QSO?**
  - **Or, allow maximum automation and allow SO to run a MM?**
- **Multi-mode digital contests?**
  - **CW/SSB/"Digital" or CW/SSB/RTTY/FT8 modes?**
- **100 watt limit?**
- **Participation determines which mode(s) prevail**

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# Conclusions

- **FT8 is controversial**
  - ***Explosive adoption threatens RTTY***
  - ***Fear of robotic, unattended operation***
  - ***Threatening to many "legacy" hams, but more appealing than CW/SSB/RTTY to new hams***
- **FT8 has instantly entrenched itself as:**
  - ***A primary amateur mode***
  - ***The pre-eminent digital DXing mode***
- **Will contest rules let FT8 be all it can be?**
- **Will FT8 subsume RTTY in digital contesting or become an additional mode? *(Contest participation will determine)***
- **Multiple digital modes in a single contest:**
  - \+ **Increases overall participation**
  - \- **Dilutes per-mode participation**
  - = **Net?**

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# Resources

- **WSJT-X 2.0 web site with download link:**
  **https://physics.princeton.edu/pulsar/k1jt/wsjtx.html**
- **WSJT-X 2.0 Quick-Start Guide:**
  **https://physics.princeton.edu/pulsar/k1jt/Quick_Start_WSJT-X_2.0.pdf**
- **MSHV web site:**
  **http://lz2hv.org/mshv**
- **FT8 Roundup web site with tutorial:**
  **https://www.rttycontesting.com/ft8-roundup**
- **ARRL FT8 Press Release:**
  **http://www.arrl.org/news/ft8-to-be-permitted-in-2019-arrl-rtty-roundup**

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# CTU Presents

**Contesting & Station Optimization**

**Tim Duffy, K3LR**

**CTU Chairman**

## ConTest University Update

- **13th year for Dayton CTU**
- **Icom has supported CTU - ALL 13 YEARS!**
- **Over 7000 students have now attended CTU**
- **CTU Live Stream thanks Icom America & Digital Dorsey!**
- **Strategic Partnerships with the NCDXF & YASME**
- **Support the vendors that support CTU**
- **CTU YouTube and slide decks available on web**
- **N9RV Contesting Terminology – updated for 2019**

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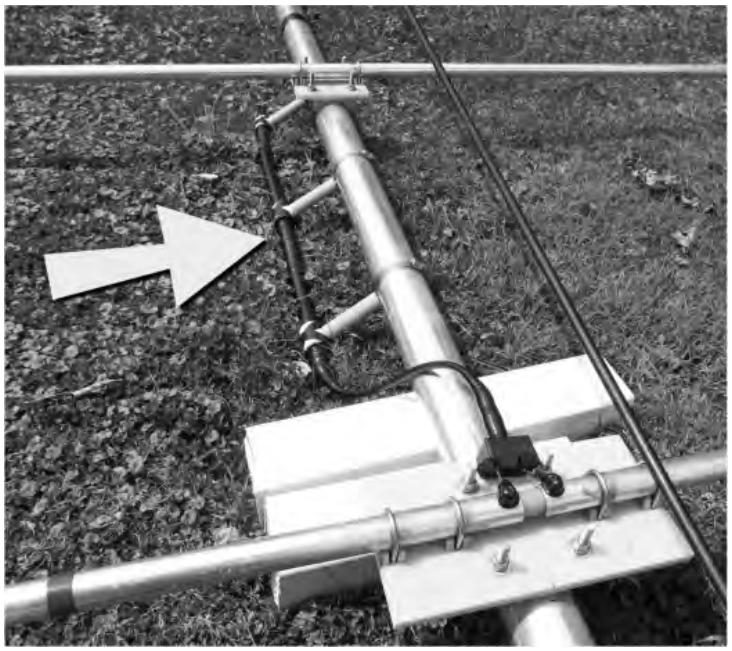

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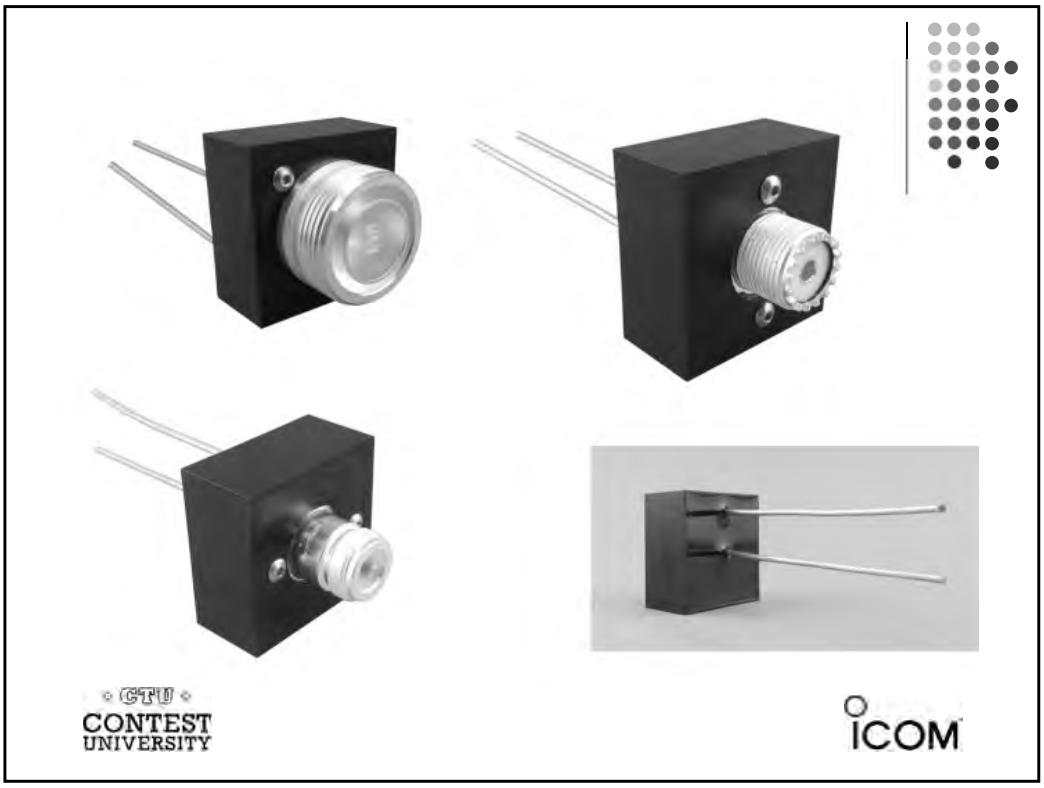
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*shown assembled


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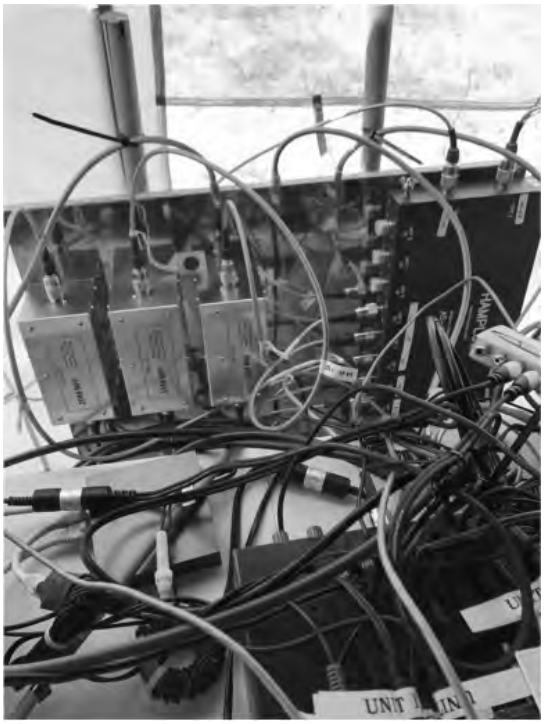

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DEX Ferrite cores
Color coded

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Thick 1 inch wide – indoor use only

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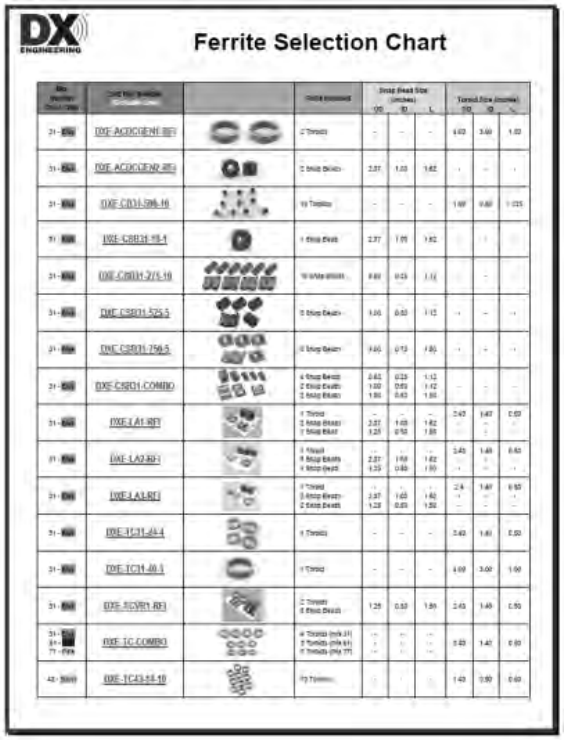

DX ENGINEERING

## Ferrite Selection Chart

| Mix Number / Color Code | Part Number | | Parts Included | Snap Bead Size (inches) OD | ID | L | Toroid Size (inches) OD | ID | L |
|---|---|---|---|---|---|---|---|---|---|
| 31 - Blue | DXE-ACDCGENF-RFI | | 2 Toroids | - | - | - | 1.63 | 0.80 | 1.00 |
| 31 - Blue | DXE-ACDCGENZ-RFI | | 2 Snap Beads | 2.87 | 1.65 | 1.82 | - | - | - |
| 31 - Blue | DXE-CB31-586-16 | | 16 Beads | - | - | - | 1.89 | 0.80 | 1.125 |
| 31 - Blue | DXE-CSB31-15-1 | | 1 Snap Bead | 2.87 | 1.65 | 1.82 | - | - | - |
| 31 - Blue | DXE-CSB31-275-10 | | 10 Wide Beads | 0.80 | 0.53 | 1.12 | - | - | - |
| 31 - Blue | DXE-CSB31-525-5 | | 5 Snap Beads | 1.06 | 0.63 | 1.12 | - | - | - |
| 31 - Blue | DXE-CSB31-756-5 | | 5 Snap Beads | 1.06 | 0.73 | 1.85 | - | - | - |
| 31 - Blue | DXE-CSB31-COMBO | | 4 Snap Beads<br>2 Snap Beads<br>3 Snap Beads | 0.63<br>1.02<br>1.06 | 0.23<br>0.63<br>0.63 | 1.12<br>1.12<br>1.85 | - | - | - |
| 31 - Blue | DXE-LA1-RFI | | 1 Toroid<br>3 Snap Beads<br>1 Snap Bead | -<br>2.87<br>1.23 | -<br>1.65<br>0.63 | -<br>1.82<br>1.85 | 2.40<br>-<br>- | 1.40<br>-<br>- | 0.63<br>-<br>- |
| 31 - Blue | DXE-LA2-RFI | | 1 Toroid<br>4 Snap Beads<br>1 Snap Bead | -<br>2.87<br>1.23 | -<br>1.65<br>0.63 | -<br>1.82<br>1.85 | 2.40<br>-<br>- | 1.40<br>-<br>- | 0.63<br>-<br>- |
| 31 - Blue | DXE-LA3-RFI | | 1 Toroid<br>3 Snap Beads<br>2 Snap Beads | -<br>2.87<br>1.23 | -<br>1.65<br>0.63 | -<br>1.82<br>1.85 | 2.4<br>-<br>- | 1.40<br>-<br>- | 0.63<br>-<br>- |
| 31 - Blue | DXE-T-31-44-4 | | 4 Toroids | - | - | - | 2.40 | 1.40 | 0.63 |
| 31 - Blue | DXE-TC31-44-1 | | 1 Toroid | - | - | - | 2.40 | 1.40 | 0.63 |
| 31 - Blue | DXE-XCVR1-RFI | | 2 Toroids<br>6 Snap Beads | 1.25 | 0.63 | 1.85 | 2.40 | 1.40 | 0.63 |
| 31 - Blue<br>61 - Red<br>77 - Grey | DXE-TC-COMBO | | 4 Toroids (mix 31)<br>3 Toroids (mix 61)<br>6 Toroids (mix 77) | -<br>-<br>- | -<br>-<br>- | -<br>-<br>- | 2.40 | 1.40 | 0.63 |
| 43 - Black | DXE-TC43-88-10 | | 10 Toroids | - | - | - | 1.40 | 0.80 | 0.60 |

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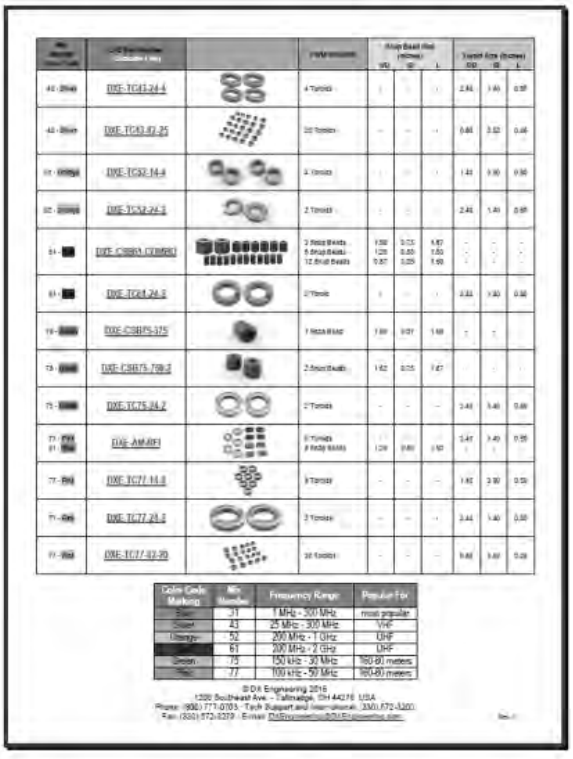

| Color Code Marking | Mix Number | Frequency Range | Popular For |
|---|---|---|---|
| Blue | 31 | 1 MHz - 300 MHz | most popular |
| Black | 43 | 25 MHz - 300 MHz | VHF |
| Orange | 52 | 200 MHz - 1 GHz | UHF |
| Red | 61 | 200 MHz - 2 GHz | UHF |
| Green | 75 | 150 kHz - 30 MHz | 160-80 meters |
| Grey | 77 | 100 kHz - 50 MHz | 160-80 meters |


1200 Southeast Ave. - Tallmadge, OH 44278 USA
Phone: (800) 777-0703 - Tech Support and International: (330) 572-3200
Fax: (330) 572-3279 - E-mail: DXEngineering@DXEngineering.com

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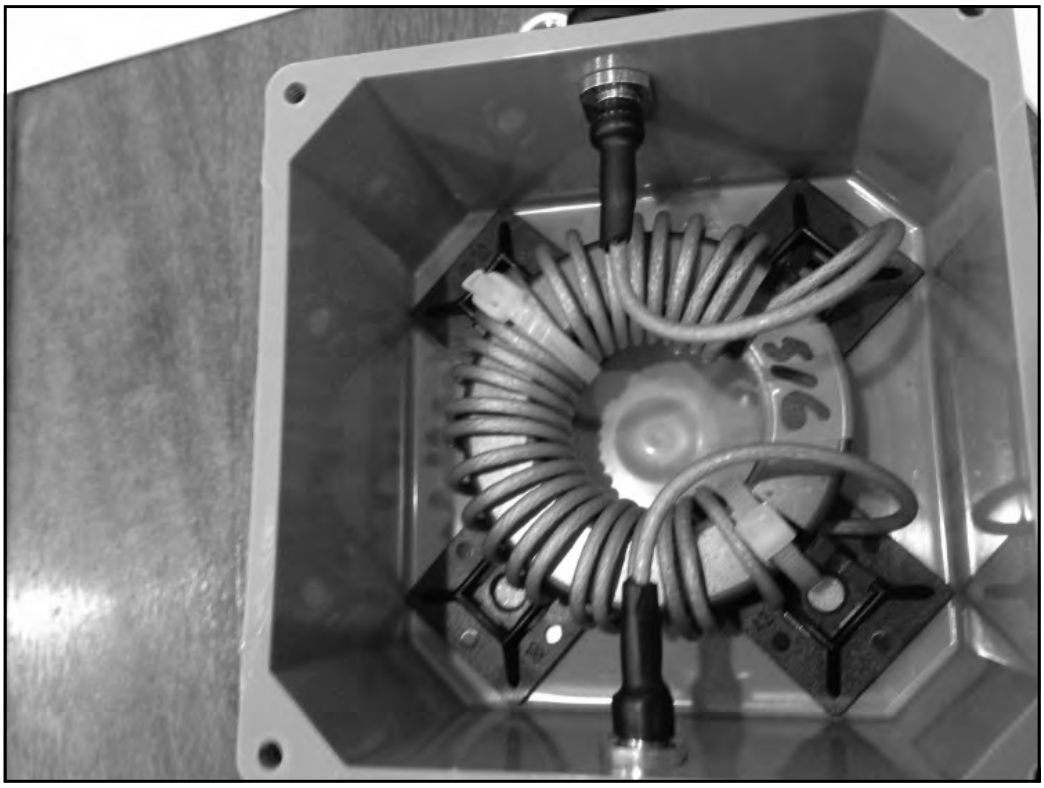
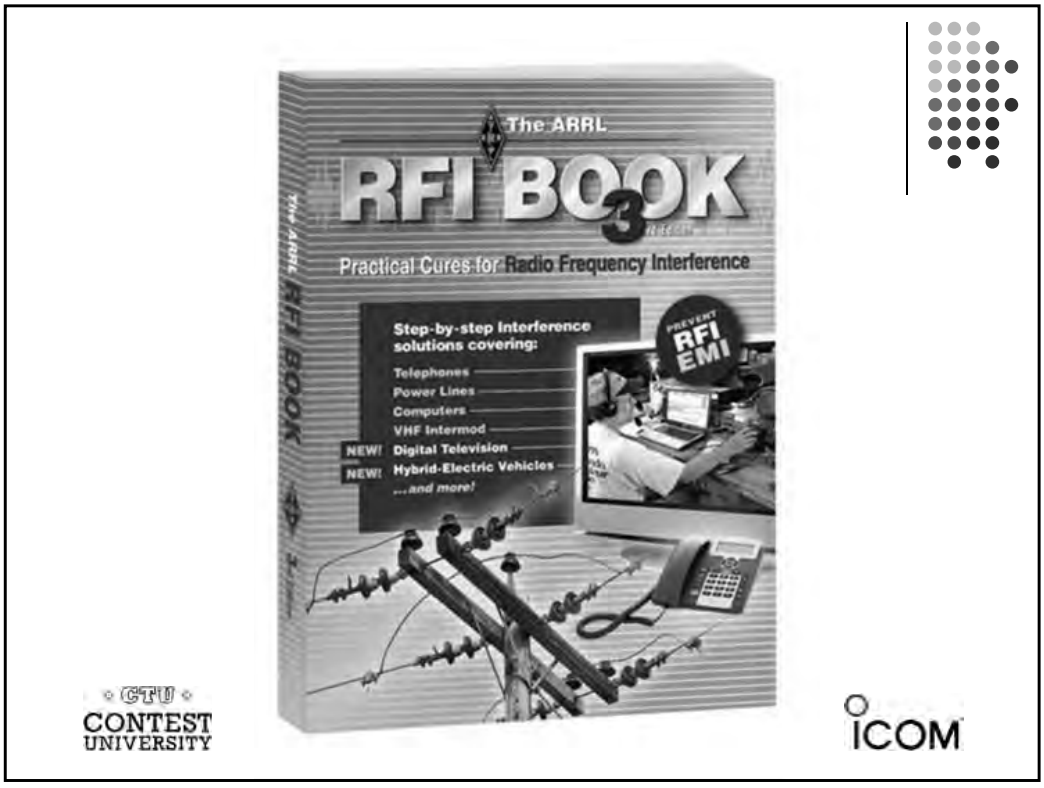
TIM




The ARRL
RFI BOOK
3
Practical Cures for Radio Frequency Interference
Step-by-step interference solutions covering:
Telephones
Power Lines
Computers
VHF Intermod
NEW! Digital Television
NEW! Hybrid-Electric Vehicles
...and more!
PREVENT RFI EMI
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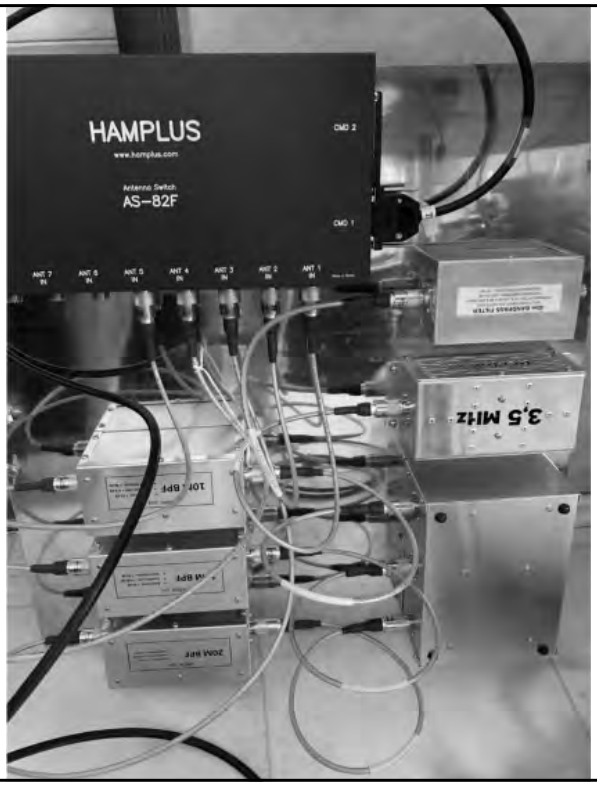


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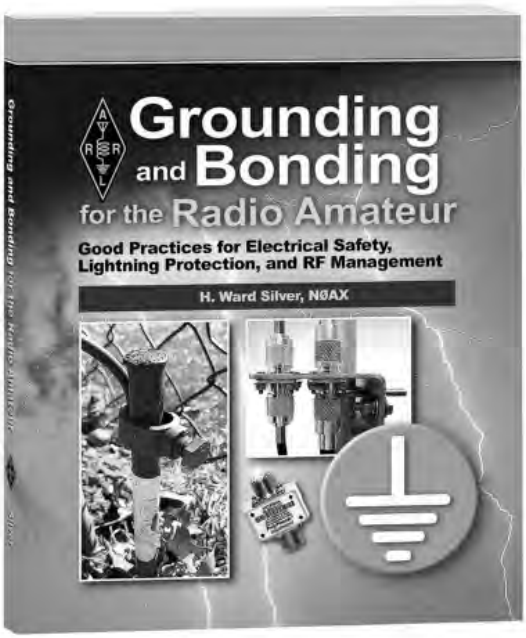


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Resources
http://k9yc.com/2018Cookbook.pdf

http://www.yccc.org/Articles/W1HIS/CommonModeChokesW1HIS2006Apr06.pdf

https://www.youtube.com/watch?v=JHs46k3TxsU&t=0s&index=4&list=PLRSwUN4qr1LpbfLclNG6-aO8hnglHAE1Y

https://www.contestuniversity.com/wp-content/uploads/2018/05/CTU2018_Grounding-and-Bonding-for-the-Little-Pistol-and-Medium-Gun-N0AX_v1.pdf

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High Quality RG-400 double shield

Teflon – aircraft grade 50 ohms

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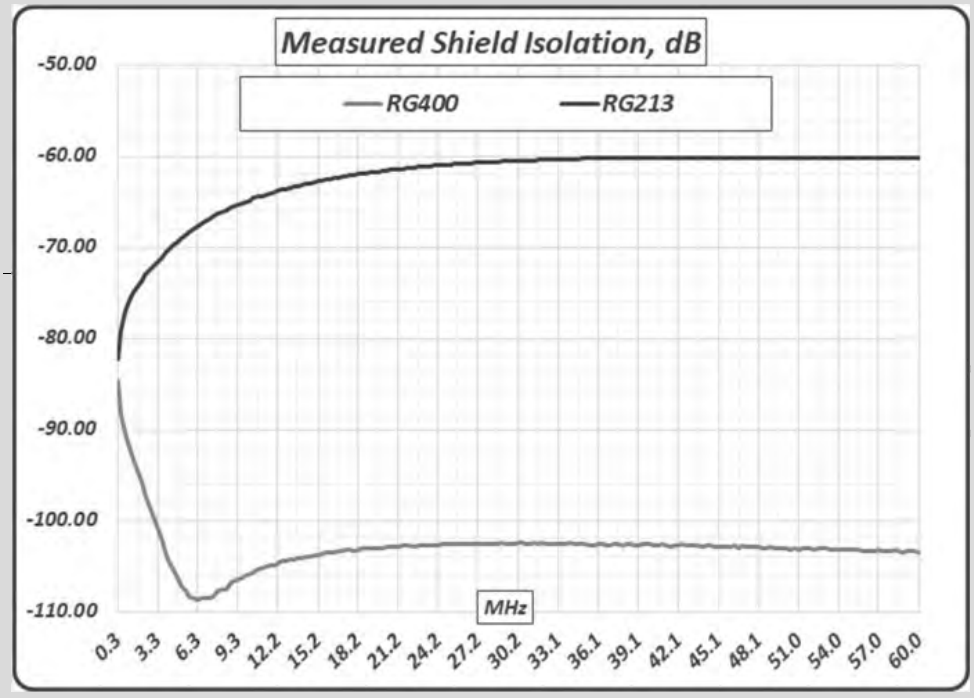
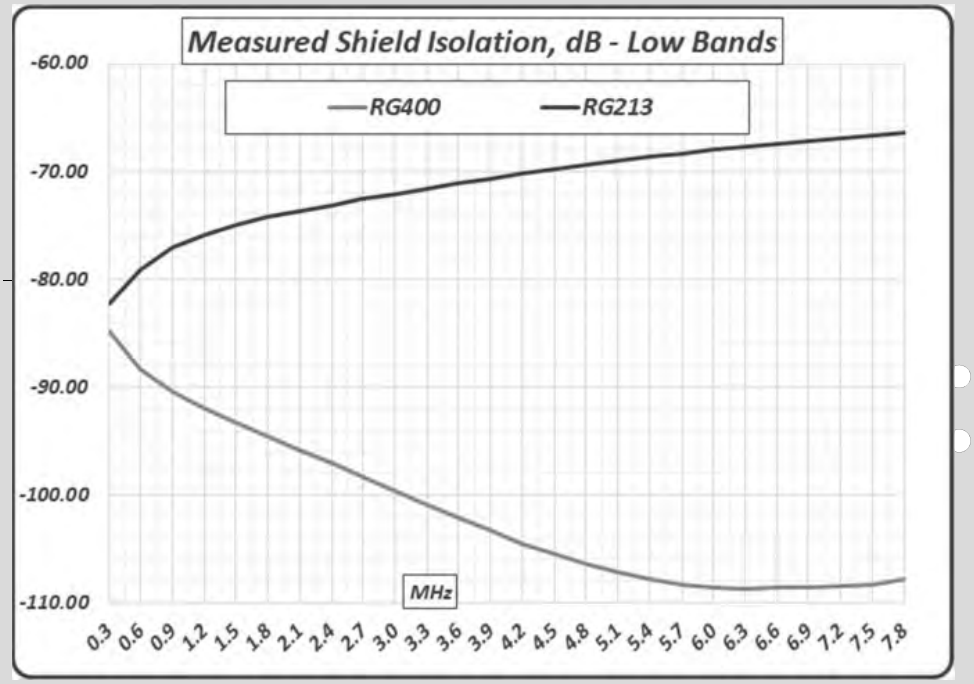
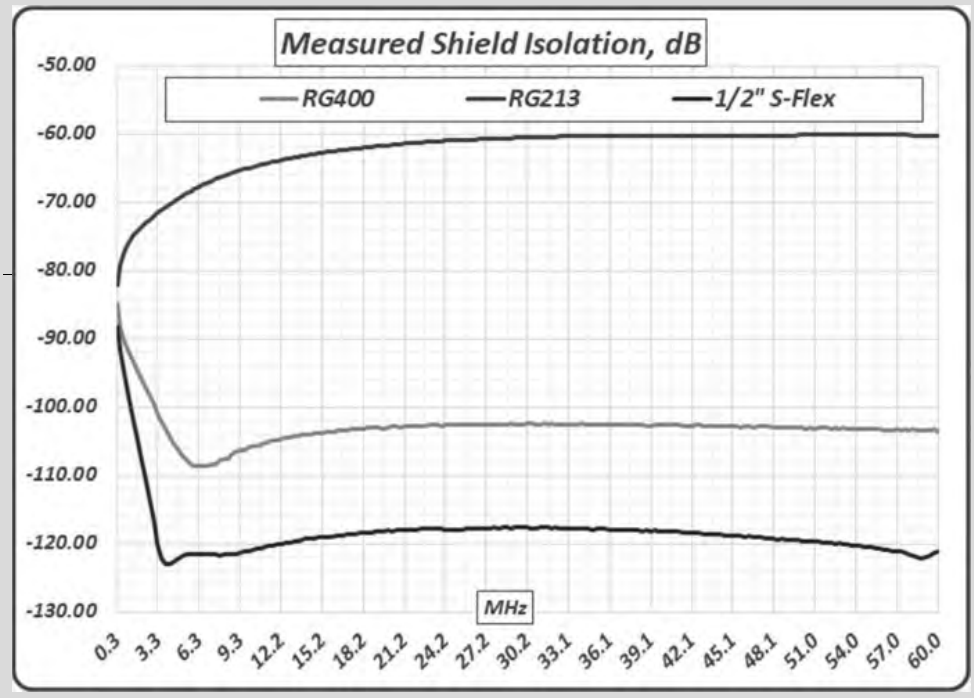
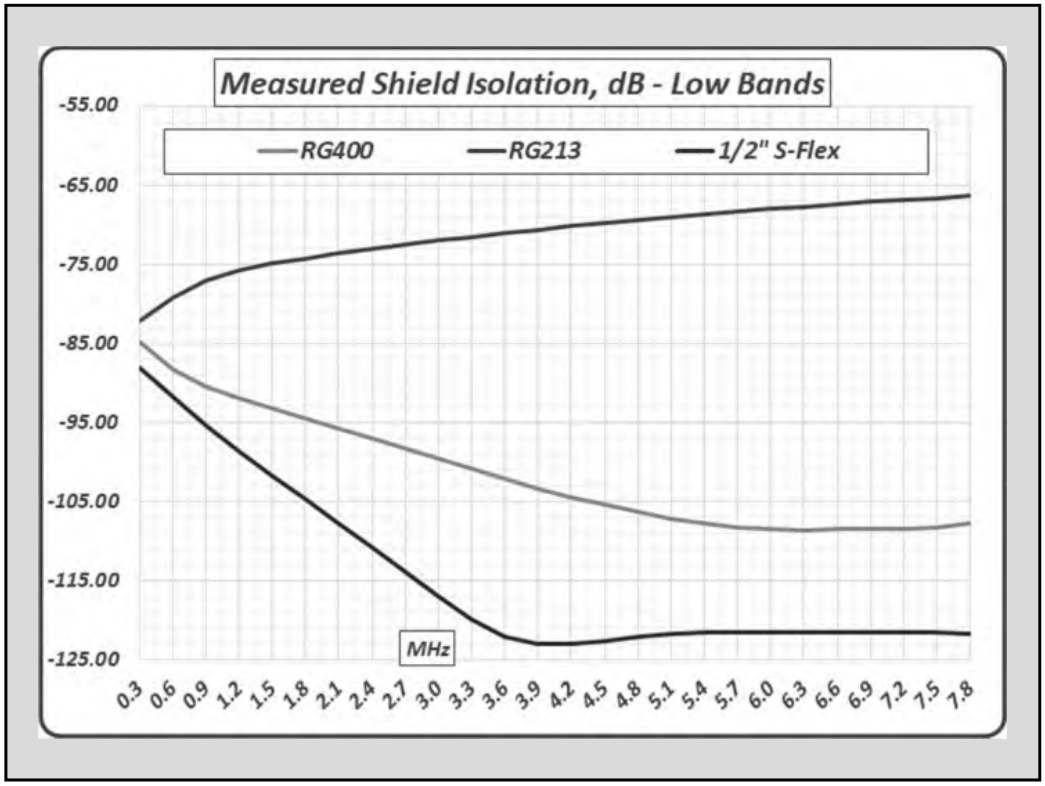
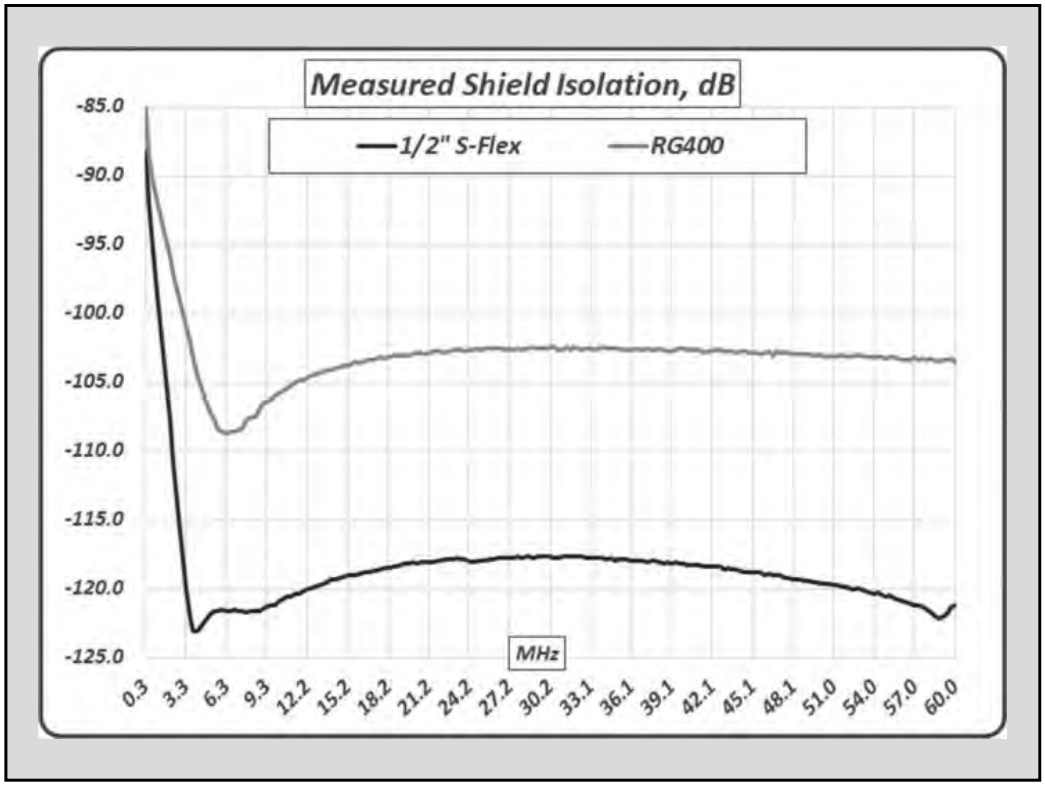
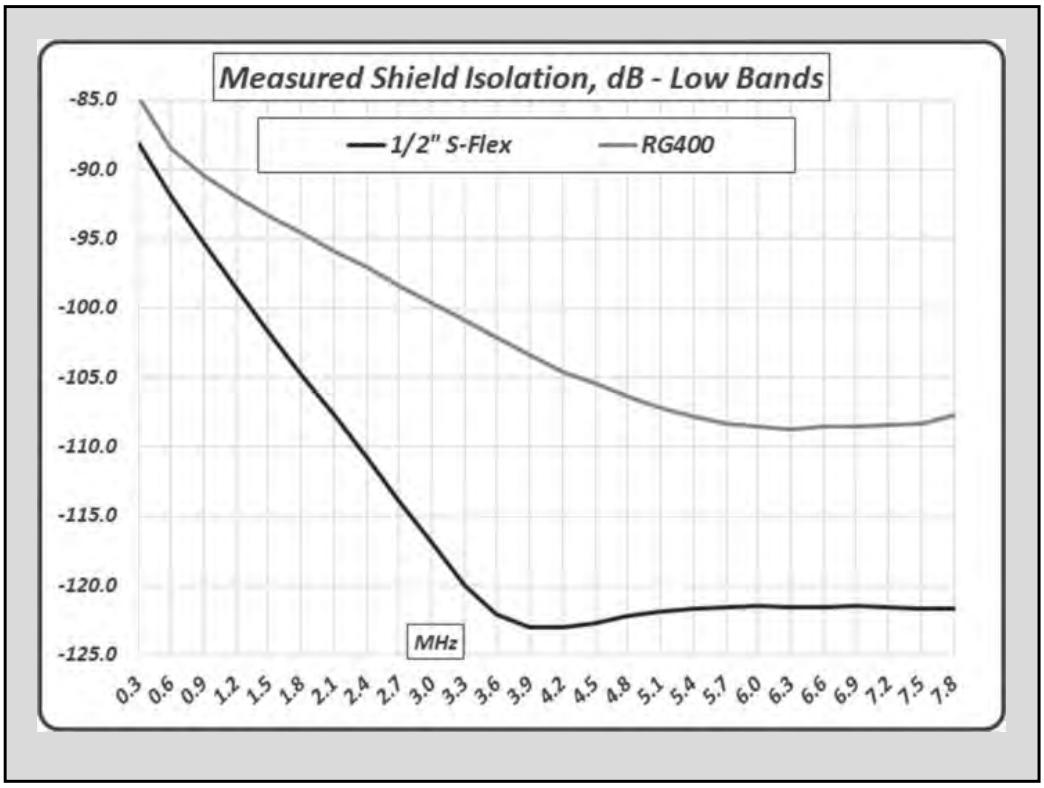


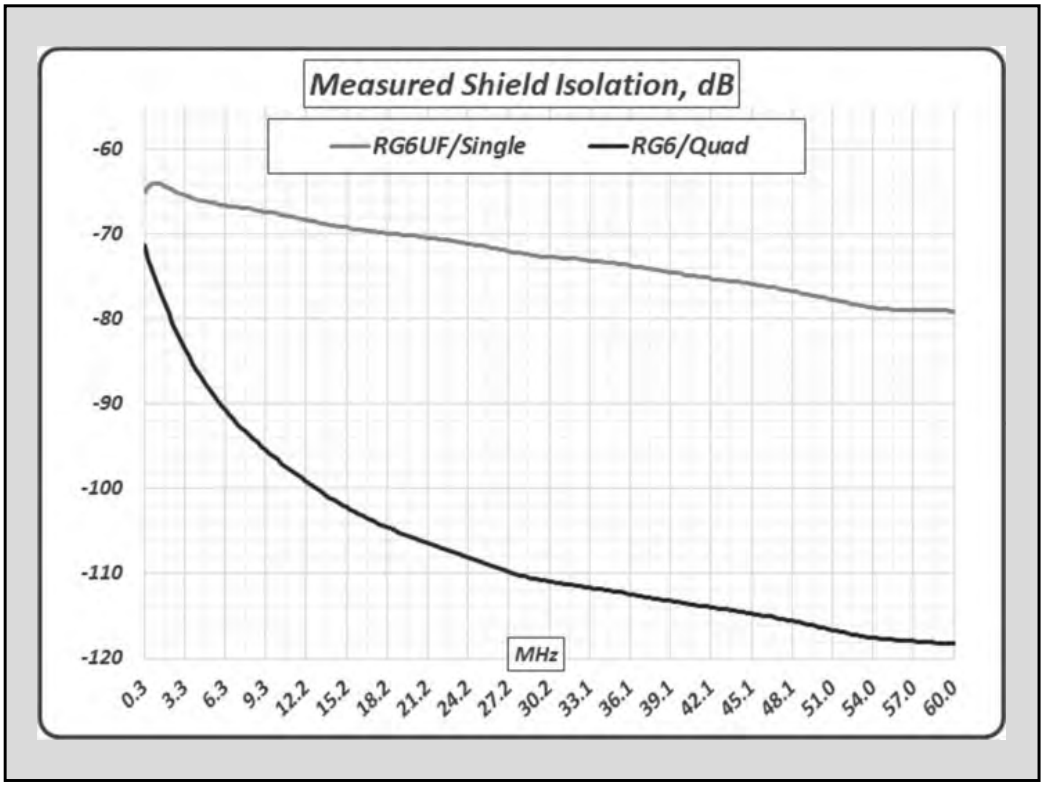

Measured Shield Isolation, dB - Low Bands
RG400
RG213
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
MHz
0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3.0 3.3 3.6 3.9 4.2 4.5 4.8 5.1 5.4 5.7 6.0 6.3 6.6 6.9 7.2 7.5 7.8

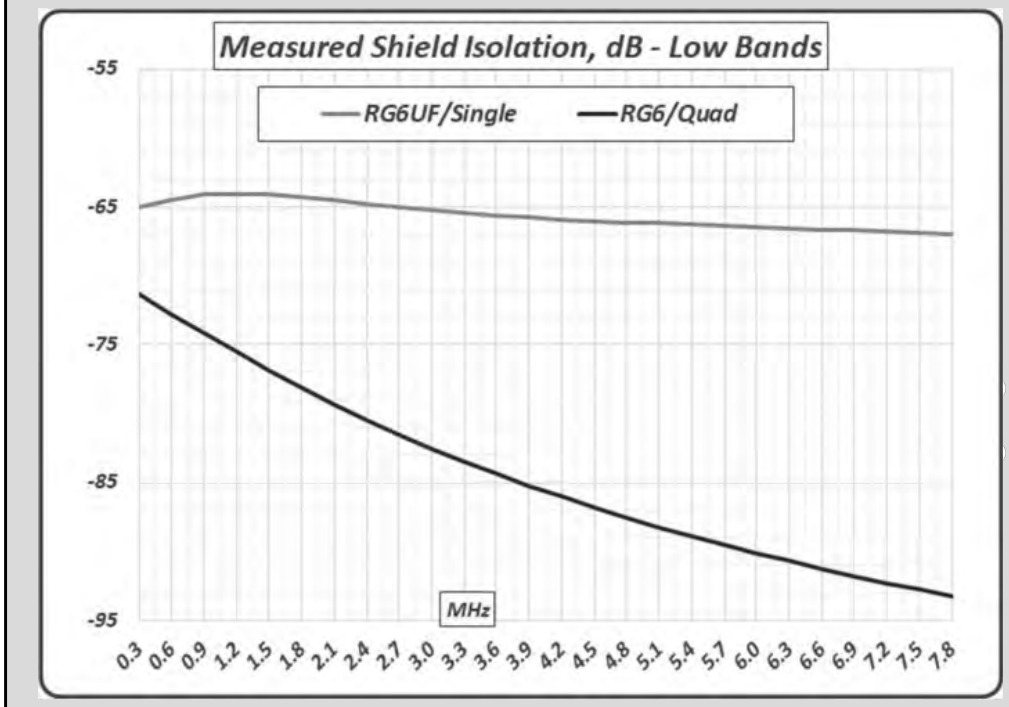

Measured Shield Isolation, dB
RG400
RG213
1/2" S-Flex
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
-120.00
-130.00
MHz
0.3 3.3 6.3 9.3 12.2 15.2 18.2 21.2 24.2 27.2 30.2 33.1 36.1 39.1 42.1 45.1 48.1 51.0 54.0 57.0 60.0


Measured Shield Isolation, dB - Low Bands
RG400
RG213
1/2" S-Flex
-55.00
-65.00
-75.00
-85.00
-95.00
-105.00
-115.00
-125.00
MHz
0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3.0 3.3 3.6 3.9 4.2 4.5 4.8 5.1 5.4 5.7 6.0 6.3 6.6 6.9 7.2 7.5 7.8


Measured Shield Isolation, dB
1/2" S-Flex
RG400
-85.0
-90.0
-95.0
-100.0
-105.0
-110.0
-115.0
-120.0
-125.0
MHz
0.3 3.3 6.3 9.3 12.2 15.2 18.2 21.2 24.2 27.2 30.2 33.1 36.1 39.1 42.1 45.1 48.1 51.0 54.0 57.0 60.0


Measured Shield Isolation, dB - Low Bands
1/2" S-Flex
RG400
-85.0
-90.0
-95.0
-100.0
-105.0
-110.0
-115.0
-120.0
-125.0
MHz
0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3.0 3.3 3.6 3.9 4.2 4.5 4.8 5.1 5.4 5.7 6.0 6.3 6.6 6.9 7.2 7.5 7.8


Measured Shield Isolation, dB
RG6UF/Single
RG6/Quad
-60
-70
-80
-90
-100
-110
-120
MHz
0.3 3.3 6.3 9.3 12.2 15.2 18.2 21.2 24.2 27.2 30.2 33.1 36.1 39.1 42.1 45.1 48.1 51.0 54.0 57.0 60.0


Measured Shield Isolation, dB - Low Bands
RG6UF/Single
RG6/Quad
-55
-65
-75
-85
-95
MHz
0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3.0 3.3 3.6 3.9 4.2 4.5 4.8 5.1 5.4 5.7 6.0 6.3 6.6 6.9 7.2 7.5 7.8


MODEL NCC-2
DX ENGINEERING
A dB
BALANCE
B dB
PHASE
RTR
Main On
Norm
Main On
POWER
Off
On
Option
CH A
CH B
PHASE
Rev
BAND
MAIN ANT IN
CH A RX ANT IN
CH B RX ANT IN
RADIO
MAIN ANT OUT
RADIO PTT
ACC PTT
12-21 Vdc
MADE IN USA
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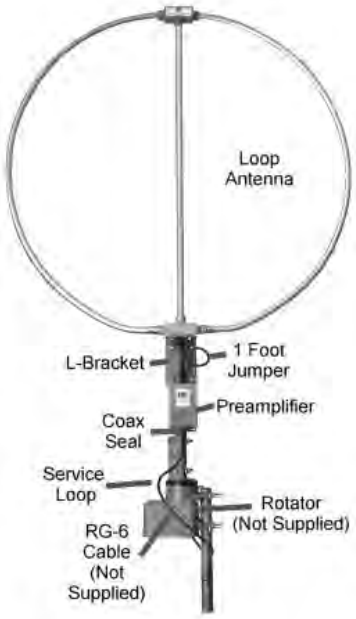


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# Details on the test location and methodology

- Two different 200'+ antenna towers in a high RF location (specifically AM broadcast band)
- Measurements taken with a Tektronix RSA306B Spectrum Analyzer and a custom made DXE current probe
- Sweeps recorded with the current probe on ½" Superflex hardline before and after the installation of the DXE bead baluns
- Average and maximum sweeps were recorded and displayed here to confirm that these are not transient RF
- Attenuation used to keep 'before' tests from overloading SA

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# Details on the test location and methodology

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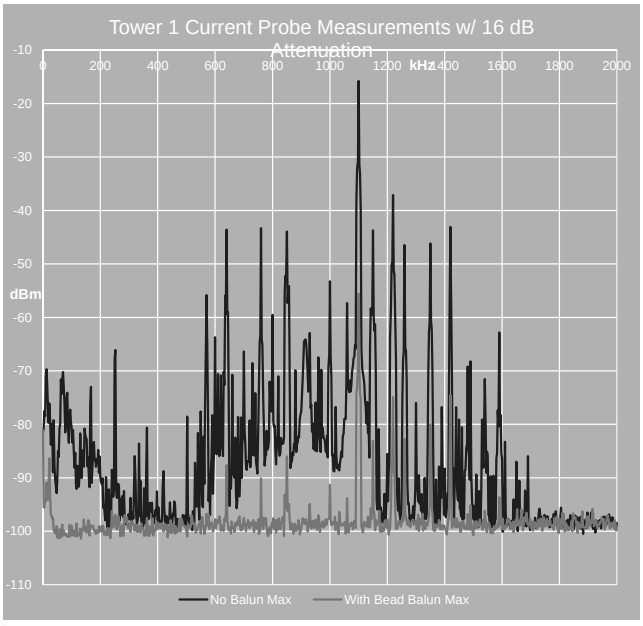


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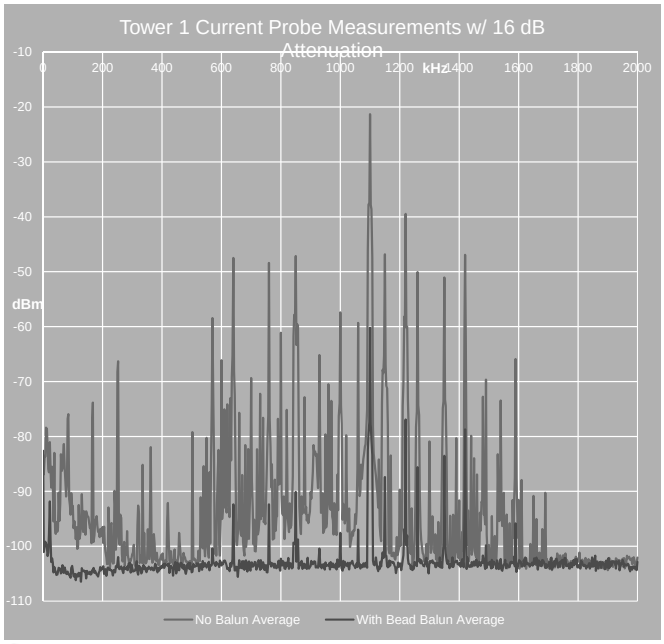


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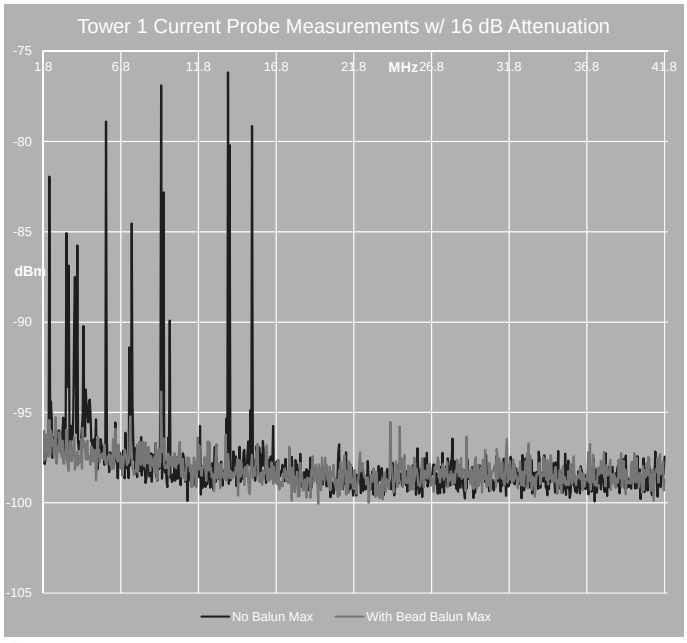


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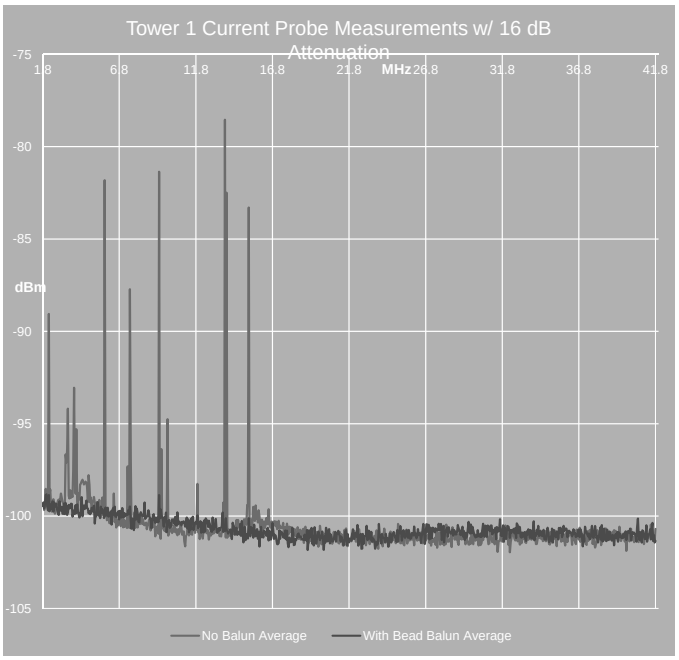
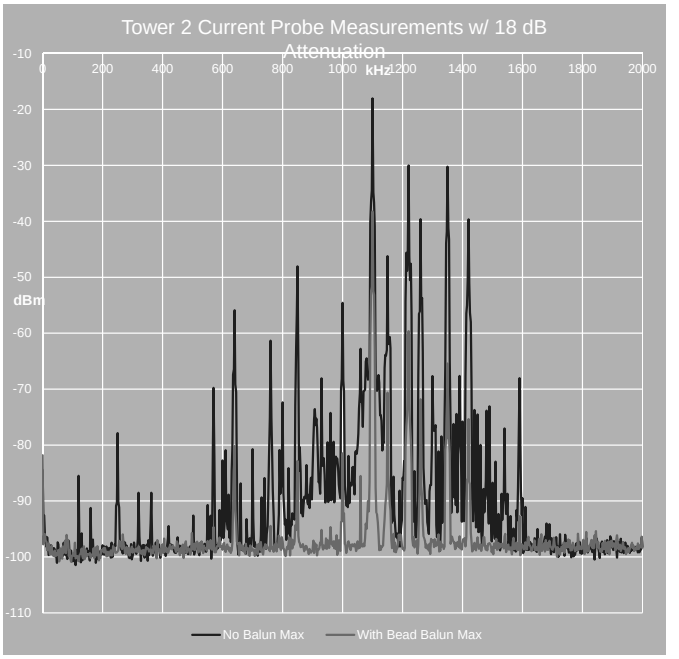
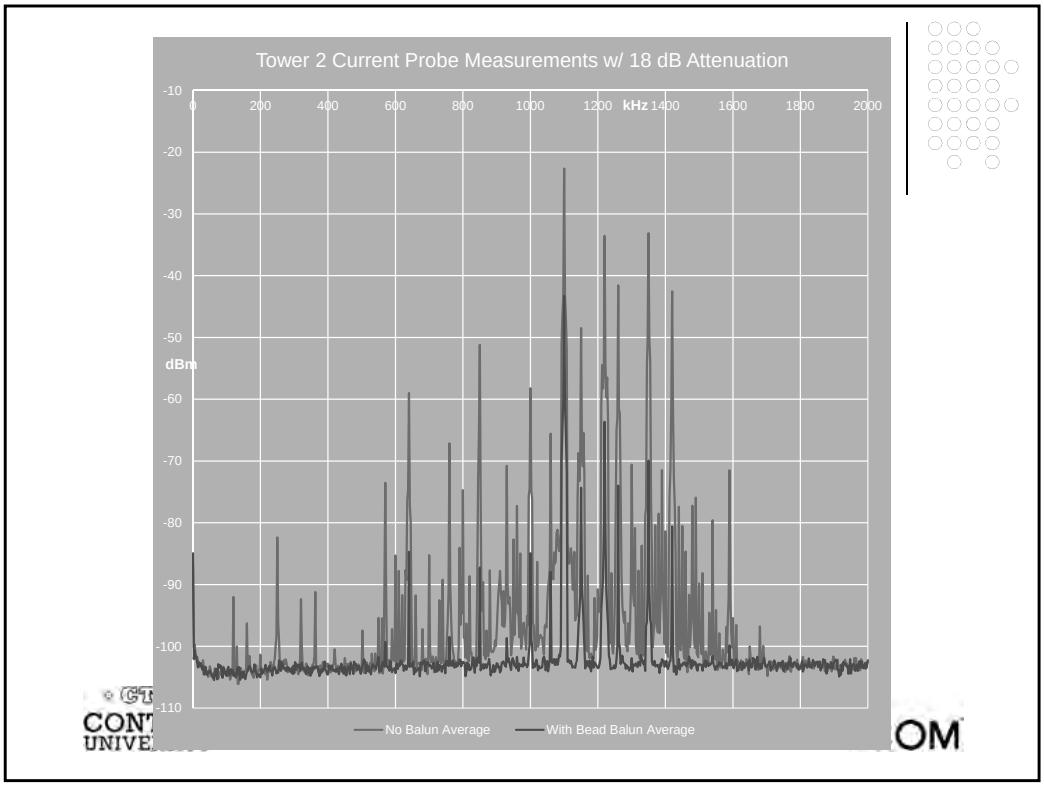
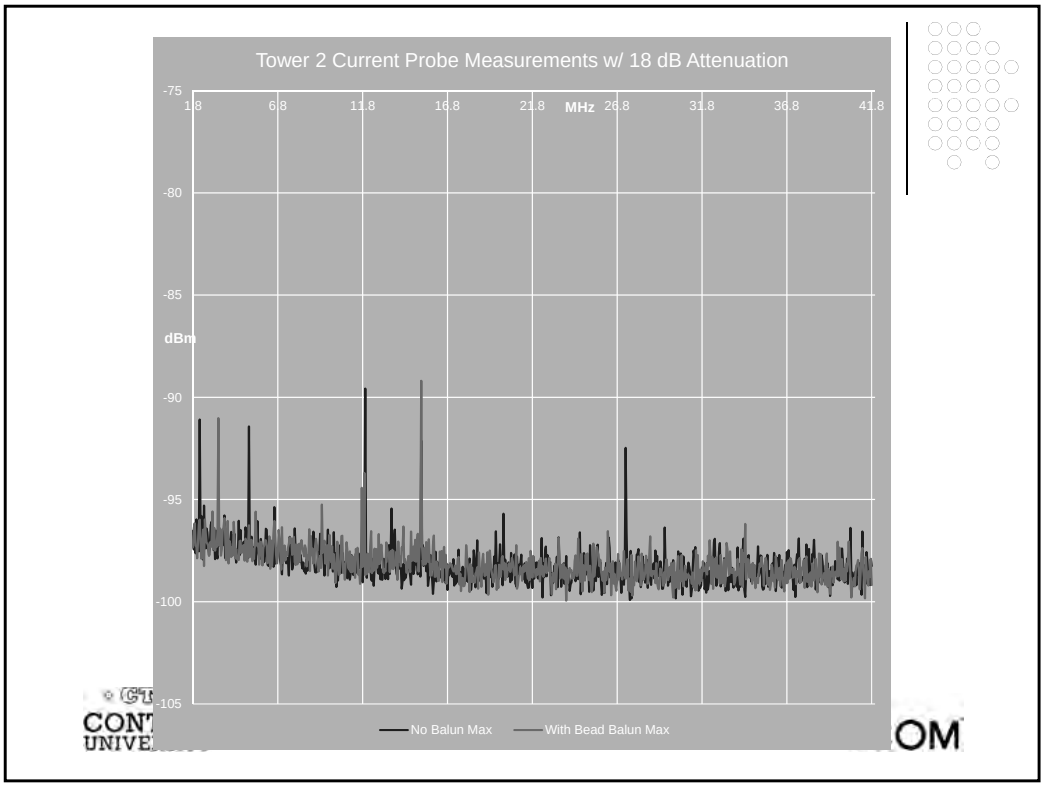
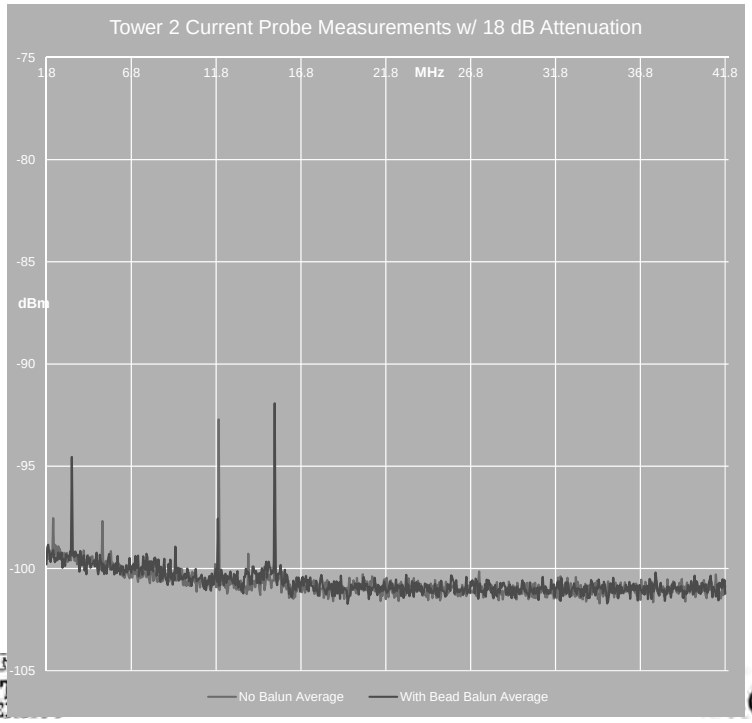

Tower 1 Current Probe Measurements w/ 16 dB Attenuation
-75
-80
-85
dBm
-90
-95
-100
-105
1.8
6.8
11.8
16.8
21.8
MHz
26.8
31.8
36.8
41.8
No Balun Average
With Bead Balun Average


Tower 2 Current Probe Measurements w/ 18 dB Attenuation
-10
-20
-30
-40
-50
dBm
-60
-70
-80
-90
-100
-110
0
200
400
600
800
1000
kHz
1200
1400
1600
1800
2000
No Balun Max
With Bead Balun Max


Tower 2 Current Probe Measurements w/ 18 dB Attenuation
-10
-20
-30
-40
-50
dBm
-60
-70
-80
-90
-100
-110
0
200
400
600
800
1000
1200
kHz
1400
1600
1800
2000
No Balun Average
With Bead Balun Average


Tower 2 Current Probe Measurements w/ 18 dB Attenuation
-75
-80
-85
dBm
-90
-95
-100
-105
1.8
6.8
11.8
16.8
21.8
MHz
26.8
31.8
36.8
41.8
No Balun Max
With Bead Balun Max




# Having Fun with Contesting

- **Be the best example of a model contest operator**
- **Share your contesting passion with others (Youth!) – help THEM put up or fix an antenna. Please be SAFE!**
- **Get on the air and operate. Teach others how to operate in a contest.**
- **Have an open heart to all who are willing to learn – encourage and send congratulations emails.**
- **Be active in your local club – not just Field Day. Join, pay dues and contribute your time and experience!**

# Tower Safety

Tim Jellison W3YQ/KL7WV

# Hazards

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

## Safety procedures

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

## Always use a full-body harness

- And here’s why…

- https://www.youtube.com/watch?v=0Fnb4dzVJdg

If 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

Even if you will not be using a fall arrest lanyard, a full-body harness aids in rescuing you from the tower should that become necessary.

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

## Climbing method for Rohn towers

- Use two positioning lanyards, one of which will always be around the tower at any time.

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

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

And above all, when climbing follow all safety rules!

# NO SK's

## 2018 / 2019 Rig Contest Comparisons
## +
## Hybrid Architecture Explained

Rob Sherwood
NCØB

Lots of good RX but transmitters lagging

Sherwood Engineering

- **What is important in a Contest Environment?**
- We need Good Dynamic Range to hear weak signals in the presence of near-by strong signals.
- In a DXpedition the pile-up is typically:
- CW signals “Up 2” or SSB signals “Up 5 to 10”
- Contests – DX pile-up, it is the same problem
- You need a better receiver for CW than for SSB.
- **What is the weak link today? Transmitters!**

## State-of-the-Art in Dynamic Range today

- Close-in dynamic range (DR3) > 100 dB
- Reciprocal Mixing (RMDR) > 115 dB

- Rigs with DR3 96 dB or greater:
- Icom IC-7851, Flex 6000 &  Elecraft K3S
- Icom 7300/7610
- Kenwood TS-890S top RMDR performer
- Apache 7000DLE
- None are RMDR (phase noise) limited

## What is new since last year?

- Kenwood TS-890S
- Hybrid architecture
- Best RMDR I have ever measured
- Single receiver, unlike TS-990S
- Shipped in time for October CQWW SSB

- Yaesu FTdx-101D Announced
- Hybrid architecture
- Dual receivers
- Didn’t ship in time for CTU book publication.

## Kenwood TS-890S

- The weak point of the TS-990S was phase noise in the LO (local oscillator).
- Likely only a problem in high RF environments
- This limitation is 100% corrected in the new TS-890S.
- To get accurate RMDR measurements I had to purchase several Wenzel low-noise crystal oscillators.
- However measuring dynamic range (DR3) was not an issue.

## TS-990S vs. TS-890S Comparisons

| RIG | TS-990S | TS-890S |
|---|---|---|
| ● 20 kHz dynamic range: | 111 dB | 106 dB |
| ● 2 kHz dynamic range: | 87 dB* | 105 dB |
| ● 20 kHz RMDR: | 116 dB | 131 dB^ |
| ● 2 kHz RMDR: | 89 dB | 127 dB^ |

* (phase noise [RMDR] limited)

^ (measured on 40 meters, Wenzel oscillator)

## Yaesu FTdx-101D numbers

- Hopefully a sample will be available for lab testing before CTU 2019.
- Contest evaluation will have to wait for the 2019/2020 contest season.



## Rigs run at NC0B during this past season

| | |
|---|---|
| CQ WW SSB October 2018 | TS-890S 15 & 20m* |
| CQ WW SSB October 2018 | IC-7610 40 & 80m |
| ARRL 160m CW Dec 2018 | TS-890S & IC-7610 |
| ARRL 10m December 2018 | TS-890S & IC-7610 |
| W1BB Top Band Dec 2018 | TS-890S & IC-7610 |
| CQ WW 160 CW Jan 2019 | IC-7610 |

* 20 meters was the “money band”, but with good Qs on 15 meters. I missed any 10m openings. (IC-7300)

## How did the rigs stack up?

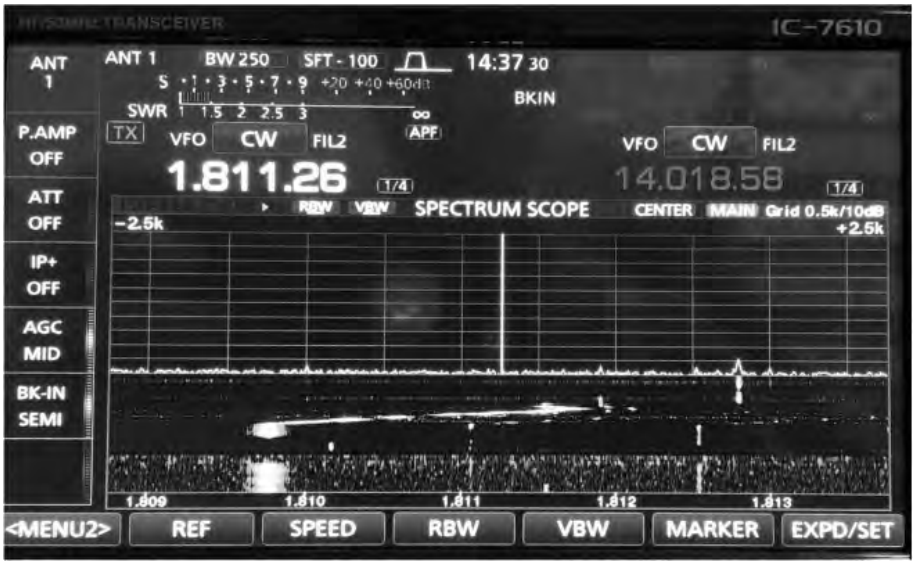
- While CQWW SSB is important, adjacent-channel splatter dominates over rig differences.
- ARRL 160m & 10m CW were good tests.
- DSP & APF selectivity excellent on both.
- I spent much more time on the new TS-890S.
- Ran both with semi-break-in at 26 wpm.
- NR & NB the Icom wins
- Waterfall the Kenwood wins hands down, at least the way I operate S&P CW.

## For me the Kenwood waterfall makes the radio

- If you are “running”, I doubt the scope/waterfall make much difference.
- For the S&P operator, CW or SSB, Kenwood “thought out-of-the-box” from my perspective.
- The following show the differences in the waterfall as you tune the radio to the next station to work.

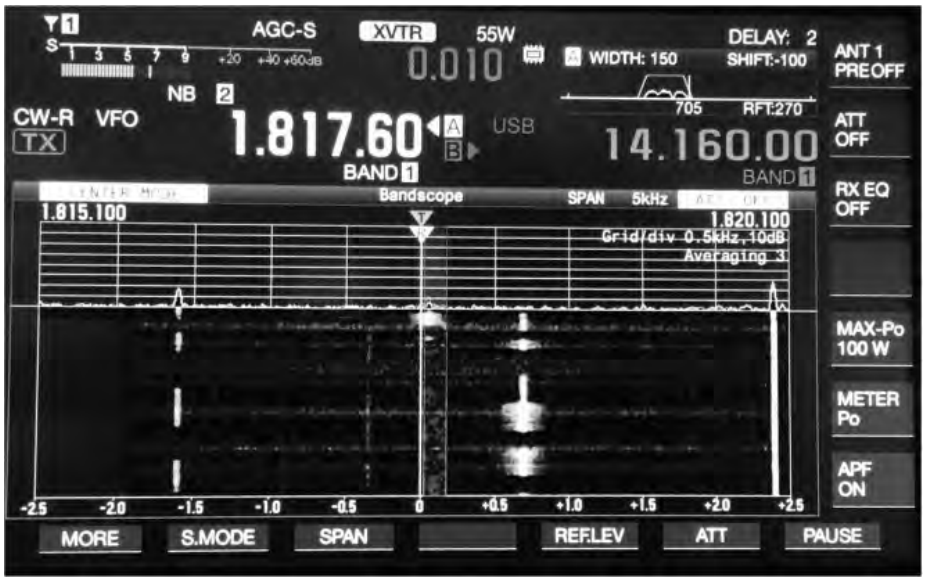
My workaround: use band scope with averaging OFF

## Icom waterfall slewing issue while tuning



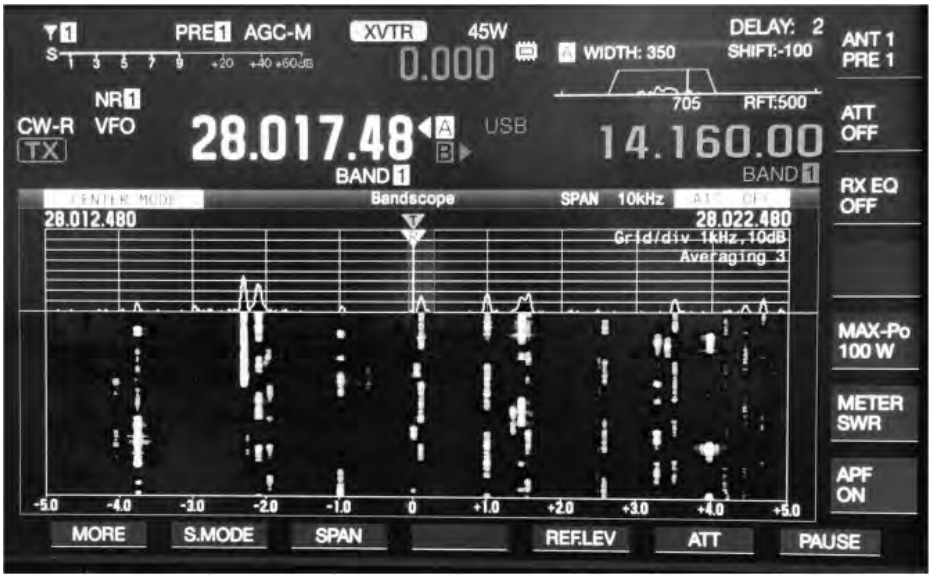

Whole waterfall shifts, but leaves a blank space

## Kenwood waterfall while tuning



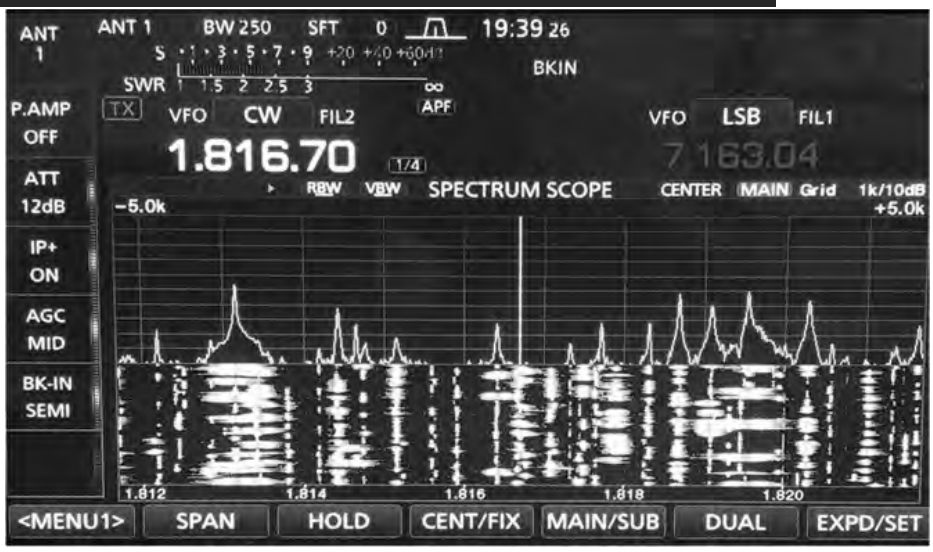
Over 20 stations in 10 kHz (ARRL)

## The 10m band Saturday afternoon




Over 30 stations in 10 kHz IC-7610

## CQWW 160m CW Friday 7:40 PM



## The year of the hybrid legacy & DS SDR radios

- Examples Legacy: K3S & Ftdx-5000, down conversion
- Examples Direct Sampling: Apache, Flex & Icom
- Dayton 2018 displayed a combination of the two.
- Main RF/IF chain: mixer, roofing filter, mixer, DSP
- Display: Direct Sampling after the first mixer but before the roofing filter
- Best of both world?  In some cases.
- Pure direct sampling SDR (DS SDR) requires the operator to manage net receiver gain more carefully.
- With a down-conversion radio with a roofing filter you can be careless!

## Why is direct sampling gain important?

- Field Day, a ham 1 mile away, or a multi-multi contest station is a tough RF environment for a direct sampling radio.
- In effect the roofing filter bandwidth is the entire band.
- A tracking preselector helps only a little.
- More helpful on 160m, almost none on 10m
- Keep the preamp OFF, and use input attenuation or RF gain to control overload.

## When is Attenuation a Win – Win Scenario?

- Note: If band noise is reading upscale on your S meter, then add attenuation.
- You lose NOTHING in terms of sensitivity!
- I set AGC threshold about 6 dB or so above band noise for least “contest fatigue” and lowest chance of overload on ANY radio.
- Attenuation at night on 40, 80 and 160m is a given, assuming you are listening on your transmit antenna. 12 dB 40/80, 18 dB 160m

Some are only CW oriented

## Contest features desirable today

- QSK, or at least click-free semi-break-in
- APF to reduce band noise and fatigue
- Bandscope & waterfall spectrum display for S&P operation and for multipliers
- Efficient User Interface
- Rock solid connection to logging program
- For most, at least some kind of external manual controls for computer-controlled rigs.
- DJ Console, as an example for Apache

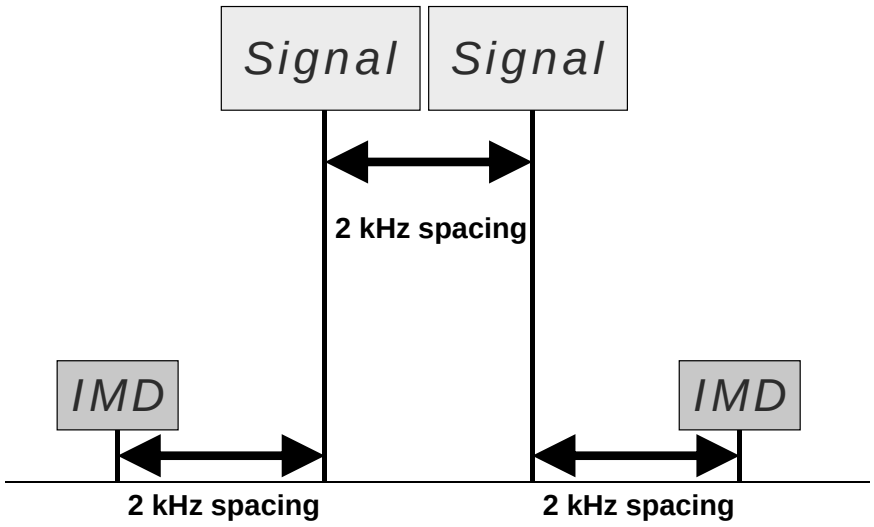
## Time for the numbers

- What do these state-of-the-art numbers mean?
- How do we cope with a more typical radio?
- We can optimize the performance of an 85 dB radio we own, and it can be perfectly adequate.

## What does dynamic range mean?

- Two equal signals are fed into the receiver.
- Third-order IMD is dominant.
- Level increased until distortion = noise floor
- This level vs. the noise floor = dynamic range
- Defined in QST & *hr magazine* 1975
- Noise floor = -128 dBm, test signals = -28 dBm
- -128 dBm minus -28 dBm = 100 dB
- Dynamic Range (DR3) = 100 dB

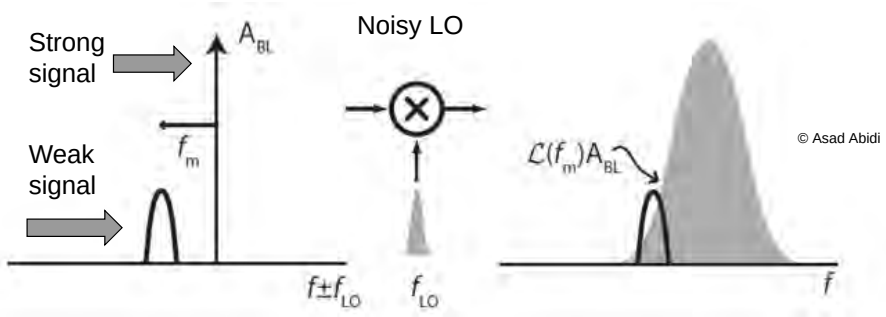
## *Third Order IMD to Measure Dynamic Range*




## A note on phase noise / RMDR

- Reciprocal Mixing Dynamic Range (RMDR)
- Only since late in 2013 has the ARRL consistently emphasized the importance of good phase noise performance (RMDR).
- Read Bob Allison's sidebar April 2012 QST & latest update May 2016 QST for details.

## Reciprocal mixing puts LO noise on top of weak signal




Noisy local oscillator (LO) transfers its noise to the strong out-of-passband signal and on top of the weak signal we are trying to copy.

## RMDR often dominates over DR3

- Only a few “legacy” transceivers, plus direct sampling SDR radios have RMDR > DR3.

- Kenwood TS-890S the new king of RMDR
- Elecraft K3S or K3 w/ new synthesizer
- Hilberling PT-8000A
- Icom IC-7850, IC-7851, IC-7610 & IC-7300
- Flex 6000 series, old and new
- Apache ANAN series

## Luckily we can live with 85 dB radios

- What performance is usually good enough?
- From the advent of “up-conversion” radios around 1979 (TR-7) until 2003 with the Orion I, all we had were 70 dB DR3 radios at 2 kHz.
- These were barely adequate on SSB and not acceptable on CW in DX pile-ups or contests.
- If we operate our 85 to 90 dB radios properly, they perform well in most environments.
- Most of the time our radios are not stressed to their limits.

Close-in 2-kHz Test @ 500 Hz BW

## Dynamic Range of Top 18 Transceivers

| | | |
|---|---|---|
| Elecraft K3S | 106 dB | |
| Icom 7851 | 105 dB | |
| Kenwood TS-890S | 105 dB | |
| Hilberling | 105 dB | |
| Elecraft KX3 | 104 dB | |
| ANAN-7000DLE | 103 dB | |
| FTdx-5000D | 101 dB | |
| Flex 6600 / 6600M | 99 dB | (16 dB preamp ON) |
| Flex 6700 (2017) | 99 dB | (Preamp OFF) |
| Icom 7610 | 98 dB | |
| Icom 7300 #2 | 97 dB | (IP+ ON, high serial number) |
| Flex 5000 | 96 dB | |
| Elecraft K3 | 95 dB | (Original Synthesizer) |
| Orion II | 95 dB | |
| Icom 7300 #1 | 94 dB | (IP+ ON, low serial number) |
| Orion I | 93 dB | |
| TS-590SG | 92 dB | |
| Ten-Tec Eagle | 90 dB | |

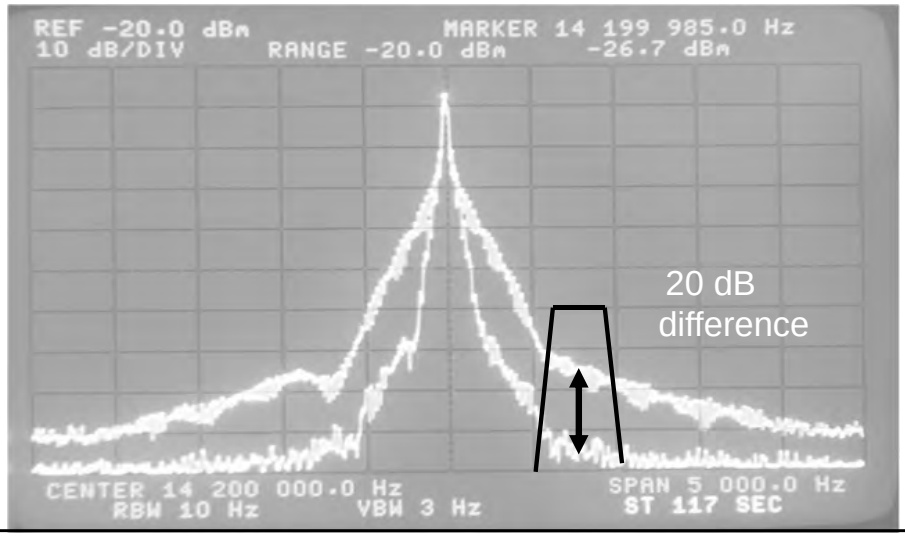
## Why is higher DR3 needed on CW?

- Transmitted bandwidth of an adjacent strong signal may be the limit, not receiver overload.
- A CW signal is about 1 kHz wide at -60 dB.
- An SSB signal is about 10 kHz wide at -60 dB.
- A CW pile-up may overload your receiver.
- On SSB, splatter will likely dominate before the receiver dynamic range is exceeded.

You can select 1 msec on many rigs !!!!

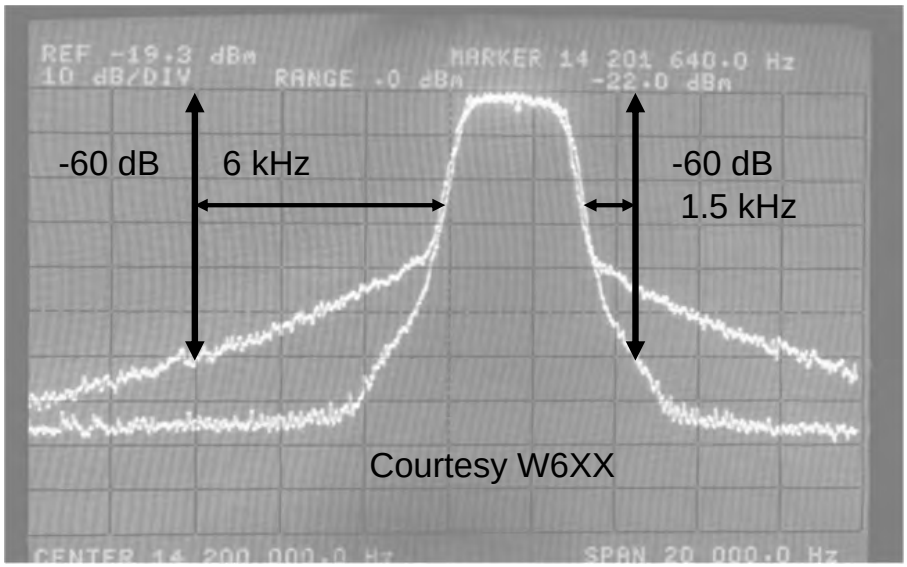
## Spectrum of CW Signal on HP 3585A Analyzer

Comparison of 3 msec vs 10 msec rise time



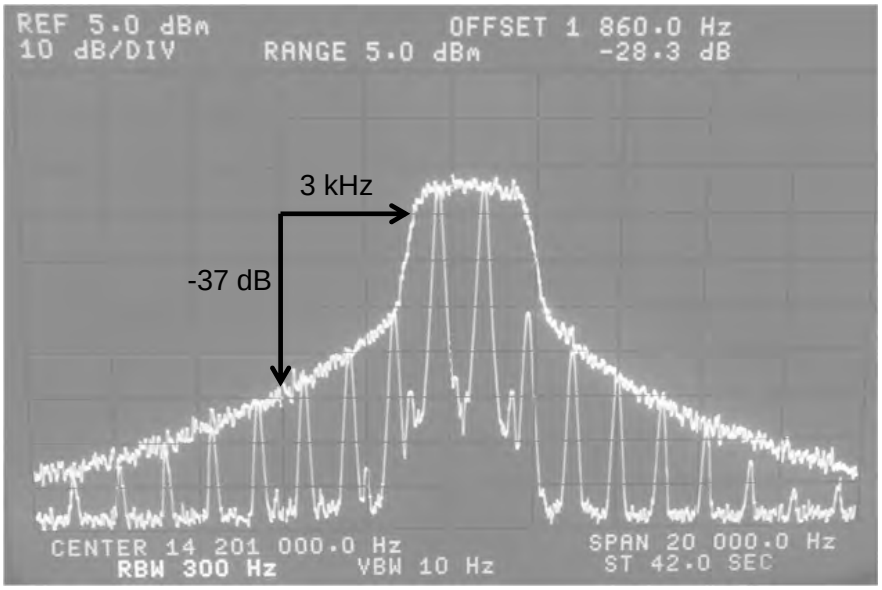
Apache PureSignal similar to class A

**White Noise Mk V Class A vs. K3 Class B @ 75 Watts**




How Wide Is Your Signal ?

Comparison 2-Tone vs. Noise Intermodulation Bandwidth



## How do we optimize what we have?

- While we might own a 100 dB DR3 radio, many of us have somewhat less performance.

- A TS-590SG is a 92 dB radio @ 2 kHz.
- N2IC wins contests with two TS-590 radios.
- Consider dynamic range a “window” of performance that can be moved around in absolute level by properly using your attenuator or preamp.

## What is often the limit today?

- Receivers have drastically improved in the past 10 years.
- Transmitter cleanliness: No Improvement !*
- Transmitted splatter, transmitted broadband noise, and CW key clicks are now usually the limit today.
- During January CQWW 160m CW, one station had key clicks at least 1.6 kHz wide running an FTdx-5000MP.

* Apache PureSignal the exception on SSB

## Transmitted noise

- We have 3rd order IMD splatter “noise”
- Rigs where you can “turn on” key clicks!
  (Rise time can be set to 1 millisecond!)
- Rarely mentioned “transmitted noise”
- I believe only Icom even mentions transmitted noise in their ad copy.
- We need to be a good neighbor.

Noise hopefully falls off with spacing

## Broadband noise comparisons 100 watts

| Rig | 10 kHz dBc/Hz | 100 kHz dBc/Hz |
|---|---|---|
| K3S | -141 | -143 |
| IC-7851 | -129 | -138 |
| IC-7610 | -128 | -142 |
| Flex 6400 | -122 | -139 |
| IC-7300 | -121* | -124 * |
| FTdx-3K | -120* | -121 * |
| TS-890S | -119 | -139 |

- * Note: Noise hardly falls off at all. Likely a problem on Field Day with two stations on the same band.

Low drive amps are an issue

## Noise gets worse at 30 watts output

| Rig | 10 kHz dBc/Hz | 100 kHz dBc/Hz |
|---|---|---|
| K3S | -132 | -140 |
| IC-7851 | -123 | -133 |
| IC-7610 | -122 | -127 |
| Flex 6400 | -120 | -137 |
| FTdx-3K | -117 | -117 |
| TS-890S | -115 | -135 |
| IC-7300 | -110 | -116 |

Do you have a multiplier station besides your run station?

Broadband noise matters.

There is a trade-off. The rig may be cleaner from an IMD splatter standpoint at 30 to 50 watts, but the composite noise is worse.

## ARRL noise measurements inconsistent

- How transmit noise is measured is important.
- Two types of noise exist: Phase and Amplitude
- ARRL only measures Phase Noise.
- I measure true “Composite Noise”.
- “Composite noise” measures both types !
- Some rigs have minimal AM noise.
- Other rigs have lots of AM noise.
- Of 7 rigs in my list, only the K3S and FTdx-3K data match up with the ARRL data.
- This measurement issue needs to be resolved.

## Solid-state Linear Amps not so Linear

The ARRL published a compendium of tube-type linear amplifier odd-order distortion performance copyright 1997.

All the amps had third-order IMD down between 40 and 50 dB below PEP.

A recent review in QST of a popular solid-state amp listed third-order IMD down only 30 dB, with no comment on this value.

Another new amp measured only 27 dB on 10 and 6 meters !

30 dB is 6 to 10 dB worse than the cleaner transceivers in use today.

The cleanest transmitter I have ever owned was the Collins 32S-3.

Transmitters have gotten worse, and now solid-state amps are worse.

We have wonderful receiver performance today, not so much our transmitted signal. This problem adds to QRM.

## What is the bottom line?

- On the lower bands at night, use of your receiver attenuator is usually appropriate.
- There is no point in band noise reading upscale on your S meter.
- A preamp is generally NOT needed on 20 meters.
- A preamp would ***never*** be needed at night on 40 meters and below, assuming the transmit antenna is used on receive.

## My caution about preamp usage !

- With a superhet, like a K3S or TS-890S, you can often get away with improper usage of a preamp due to the narrow roofing filters. Most signals on the band will be rejected by the roofing filter. Overload is unlikely.
- A direct sampling radio in effect has a roofing filter (BPF) of at least the bandwidth of the whole band.
- Running a preamp when there is zero reason to do so just asks for the ADC to be driven into overload.

  (OVF display for an Icom 7610/7300)

## How do we evaluate & optimize a transceiver?

- 160 – 40m receivers are too sensitive at night.
- Make the most of the radio's dynamic range by properly using the attenuator, and using the preamp only when necessary on the high bands.
- Published dynamic range can be misleading, depending on how it is measured. This could be a complete presentation on its own.
- It is a numbers game today!
- Get feedback from successful contesters.
- What works for them?

http://www.NC0B.com

# Sherwood Engineering

Videos from past CTU presentations

CTU 2013 through 2018  (Select desired year)

http://www.contestuniversity.com/videos

# Glossary – by Patrick Barkey, N9RV

**10-minute rule**

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

Categories: contest specific concept, operating classification,

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

**175 mile radius**

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

Categories: contest specific concept, log checking and reporting

See Also:

**2BSIQ**

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

Categories: operating technique, operating software/hardware,

See Also: Dual-CQ

**3830**

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

Categories: log checking and reporting

See Also:

**4-square**

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

Categories: station hardware

See Also: Receive antennas

**ADIF**

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

Categories: operating software/hardware

See Also:

**AFSK**

Audio Frequency Shift Keying is a RTTY mode where two audio tones are fed into the Mic or auxiliary audio input to the SSB transmitter to create the two RTTY RF frequencies.

Categories: general

See Also:

**Assisted**

Assisted is an "overlay" category that is interpreted in most contests as meaning that use of spotting information delivered from internet or packet radio based networks which give real-time information on frequencies and call signs of stations in the contest is allowed. It is a single operator overlay -- most multi-operator categories already allow spotting assistance.

Categories: operating classification

See Also: SOA, unassisted

**Band change rule**

A rule which restricts band changes for certain multi-operator categories in some contests. A band change rule says that a station can, say, only make 8 band changes per hour. Note that moving to a band to work something, and then returning counts as two band changes.

Categories: contest specific concept

See Also: 10-minute rule, MS, M2

**Band Decoder**

A band decoder either operates through hardware or software to switch station hardware (e.g., antennas, filters) based upon the band selection of the radio. They are a fundamental part of most top tier stations.

Categories: station hardware

See Also:

**Band Edge**

The band edge generally refers to the lowest (or highest) frequency in the band where one can legally operate within the limits of his/her license. For US operators, for example, this would be approximately 21200.4, say, for 15 (USB), but

would be about 7127 or so for 40 (LSB). The reverse is true for the upper band edge – e.g., on USB on 15 meters the practical limit for transmit frequency is approximately 21448. The lower band edge is sometimes desirable for US operators who are running since QRM from other W stations can only be on one side of your signal.

Categories: operating technique, ethics,

See Also:

**Band Map**

A graphical, real time display of stations arranged by frequency presented by most popular contest software. The map is either populated by telnet/packet spots from clusters and skimmers, and/or may be filled in using data entered by the user. Most software allows users to then click on stations on the map to be taken directly to the frequency the station is reported to be on. Stations listed on the map are color coded – with new multipliers distinctly noted. (Stations previously worked may not be listed at all). The accuracy of these maps is only as good as the data used to construct it – errors in callsigns are frequently encountered. Use of band maps (or packet/telnet and skimmer spots) are not permitted for Single Operator Unassisted categories.

Categories: operating software/hardware

See Also:

**Beacon**

Fixed, automated transmitters which transmit signals (typically CW) continuously to allow operators to check propagation. These transmitters are located around the globe and on HF are mostly found on bands such as 10 meters above 28.1 mHz. They typically use low power and omni-directional antennas. It can be good operating strategy to tune to these stations during contests to learn when propagation might support QSO's even if activity and thus stations in the contest are not heard

Categories: operating techniques

See Also: RBN

**Bip/Bop**

A hardware switching arrangement for stacked yagis or other all driven antenna arrays that allows the operator to select both in phase (BIP) or both out of phase (BOP) operation. The latter can be dramatically better for very high angles of radiation..

Categories: station hardware

See Also: Stack, Yagi, phasing

**Blind skimmer**

A mode of operation for a CW skimmer that disables the decoding of callsigns as well as the integration with internet spots. In this blind mode, the operator only sees (potentially) a waterfall display showing recent historical activity across the band as with a panadaptor. Blind mode is legal for single operator, unassisted entrants in most major contests.

Categories: contesting hardware/software

See Also: skimmer, panadapater, spots, SOAB, SOA

**Breakdown**

The disaggregation of one's contest score into QSO's and multipliers worked, usually separately tallied for each band (or even additionally, for each hour).

Categories: log checking and reporting

See Also:

**Buffers**

To account for latency and jitter, most systems allow for an amount of 'buffering' or 'storing up' packets as they arrive, so that a momentary big swing in either latency or jitter won't interrupt the flow of conversation. Too many buffers introduces extra time and can make transmit / turnaround times grow to be an annoyance in contest situations

Categories: remote radio

See Also: Latency, Jitter

**Bust**

A bust is a QSO that is incorrect in some way -- the callsign or exchange was inaccurately recorded. May also refer to spots which are incorrect.

Categories: log checking and reporting, ethics,

See Also: Spot

**Cabrillo**

Cabrillo is a very flexible and generalized computer file format that is supported for score reporting by all modern contest software. Most contests have moved to require that electronic log submissions provide contest logs in this format. In most cases contest software will do this automatically.

Categories: log checking and reporting

See Also:

**Category 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:

**CODEC**

CODE then DECODE. This is the software that puts audio from an analog form into a digital form, and reverses the process on the other end of a link. It is how we send audio over the internet. Without this, VOIP would not be possible.

Categories: remote radio

See Also: VO IP

**Cty.dat**

Cty.dat, or sometimes wl_cty.dat, also known as a "country file." is the computer file containing the lookup information that translates prefixes of callsigns into country and/or zone multipliers. Software would use this file, say, to tell you that N9RV counts as a W, and is in CQ zone 4 (or ITU zone 6). Since worldwide prefixes are frequently in a state of flux, an up-to-date country file is always desirable. More recent country files also contain data that may help determine a station'szone. Such information can be inaccurate and in all cases operators should gather such information from the contest exchanges themselves.

Categories: operating software/hardware

See Also: Mult, Exchange

**Deadline**

The latest day that logs can be submitted to the contest sponsor to be included in the competition.

Categories: log checking and reporting

See Also:

**Digital Voice Keyer**

Hardware which digitally records one's voice for CQ's, contest exchanges and other frequently spoken information. The recording is played back using keystrokes defined by software (or by pushing a button for a stand alone box), thus saving the operator the fatigue of doing it manually. Most modern software uses computer sound cards for this purpose. Older software used specially designed cards (e.g., the DVP by K1EA, the W9XT card) or even a stand alone box.

Categories: operating software/hardware

See Also:

**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.

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:

**IP address**

The Internet Protocol uses numbers as addresses to find machines on the internet. It is analogous to a telephone number

Categories: remote radio

See Also: UDP, IP address

**ISP**

Internet Service Provider. This is the company that provides your connection to the internet.

Categories: remote radio

See Also: IP address

**Jitter**

This is the change of the latency over time. It is a particular problem on radio remote control, as the difference in latency can make it difficult to adjust the system which has settings to account for latency. If it changes a lot, you will probably experience some audio dropouts.

Categories: remote radio

See Also: Latency

**K3**

A popular HF transceiver available from Elecraft that is used by many contesters.

Categories: station hardware

See Also:

**Keyboard focus**

An attribute of contest software that controls more than one radio at a time. Keyboard focus is the particular radio that your keyboard is entering information for. This is the "active radio" for purposes of logging. If the software is well designed, keyboard focus will flow naturally between radios as the situation requires. In a two radio situation where radio 1 is on 40 meters and radio 2 is on 20 meters, while your radio 2 is CQing your keyboard focus should probably be on radio 1, and vice versa.

Categories: operating software/hardware

See Also: SO2R

**LAN**

Local Area Network. This refers to any device that is attached to your router, in your home system. Via wired or wireless connections, that is your local network

Categories: remote radio

See Also: Router, WAN

**Latency**

All of this travel between 2 machines over the internet takes time, and the time delay in internet parlance is referred to as latency

Categories: remote radio

See Also: WAN

**LCR**

An acronym for Log Checking Report. A report from the contest sponsor to each individual competitor that details the scoring adjustments to their submitted contest log, reflecting dupes, busted calls, NIL's and other errors. The LCR is very useful as a means of improving your accuracy in future contests.

Categories: general, ethics,

See Also: bust, dupe, NIL

**Lid**

A lid, generally, is someone whose operating behavior shows a lack of awareness, competence or consideration for other amateurs.

Categories: general, ethics,

See Also:

**Lockout**

A means of preventing two transmitters from keying or transmitting simultaneously. A hardware lockout accomplishes this task by inhibiting the transmit/key line on the different radios with a lockout circuit. A software lockout does the same thing using software. This prevents the station from violating the rules of the contest. E.g., it could prevent a multi/multi station from having more than one transmitted signal on the same band, or it might prevent a single operator station from transmitting simultaneously on multiple bands.

Categories: operating software/hardware, ethics

See Also:

**Long Path**

A situation where HF propagation exists between two stations in the inverse direction of the great circle heading. “Beaming long path” means pointing your antenna 180 degrees different from the “short path,” or great circle heading, for a particular station. Long path propagation, for example, might allow a North Carolina station to work a station in Hong Kong on 10 meters in the morning by beaming southeast. Depending on the season of the year and the propagation on any particular day, this can be an extremely effective event in a DX contest, allowing for long distance QSOs not possible during short path openings. Gray line QSOs, for instance, are frequently long path. Learning and checking the long path openings, in terms of times, bands and geographies, from your QTH can be very valuable for increasing your multipliers and contest scores in DX contests.

Categories: general, operating technique

See Also: gray line, skew path

**M2**

Shorthand for the multi-operator, two-transmitter category offered in some contests. This is a relatively new category that was intended to allow greater flexibility that older single transmitter categories, but with less hardware requirements than the open ended multi transmitter category.

Categories: operating classification

See Also: MS, MM

**Master.dta**

The master.dta, or "master database" file is a collection of so-called "known good calls" -- e.g., call signs of stations that have been worked in previous contests. It can be used as an operating aid with most contest software to suggest complete calls when only partial information is copied over the air.

Categories: operating software/hardware

See Also:

**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

**Moving Multipliers**

An operating technique where one asks over the air for a station who is a multiplier (e.g., a new country, state or section) to move (QSY) to a different band so that an additional multiplier can be added to one's score. To be done successfully, there must be propagation between the stations on the new band, and the asking station must be able to move quickly. It is not good contest etiquette to ask a CQ-ing station with a pileup to move bands, but even rare DX that comes back to your own CQ's is fair game for this technique. For contests like SS and WPX that only count multipliers once (instead of once per band) this does not apply.

Categories: operating technique

See Also:

**MS**

The multi-operator, single-transmitter category found in many contests has evolved to have different definitions in individual contests. Once understood as a "one transmitted signal" category, its exceptions and specific band change rules make it among the most complex, yet most popular, categories.

Categories: operating classification

See Also: 10-minute rule, band change rule

**Mult**

Most, but not all, contests compute the final score as the product of (i) QSO points and (ii) a tally of zones, countries, prefixes or other unique characteristics. Since they impact the score multiplicatively, this second item is called the multiplier. For example, in the SS contest, the multiplier is the number of unique ARRL sections worked (maximum of 80). Thus when a new (e.g., unique) section is worked, it has a greater impact on the final

Categories: contest specific concept, operating technique,

See Also:

**Mult station**

The station in a multi-transmitter environment that is working only mulitpliers -- new countries, zones, or prefixes, depending on the contest. This usually entails tuning and answering others who are calling CQ.

Categories: contest specific concept

See Also: S&P, Run station

**Multiplier**

See the discussion under mult above.

**Multiplier Bell**

A frequently used motivational device for multioperator contests. The sound of a bell going off in a room of operators when a new multiplier is worked by one of them manning different radios is familiar to many successful multi-operator stations.

Categories: operating technique

See Also:

**NCJ**

National Contest Journal. A bi-monthly magazine devoted to contesting published by the ARRL. NCJ was originally begun by a group of independent contesters (the first editor was K0TO) in the 1970s, and is responsible for the introduction and growth of the popular Sprint and North American QSO Party contests.

Categories: general

See Also: sprint

**NIL**

Not-in-log. A deduction made by the contest sponsor that refers to the situation where a contact claimed by one station is not confirmed by a record in the second station's log. In most cases an NIL results for you when there is nothing even "close" to your call in the other station's log at the time you claimed the contact.

Categories: log checking and reporting

See Also:

**Off-by-1**

A "one off" call is a call that differs by one character -- W9RV, N7RV, and N9RE are all one off calls for N9RV.

Categories: log checking and reporting

See Also: SCP

**Over the Horizon (OTH) Radar**

High power radar systems deployed in the HF spectrum that can cause broadband, intense interference to contest and other communications. Recently OTH radar QRM has been particularly bad on 40 meters, and occurs when there is propagation over the north pole.

Categories: general

See Also:

**Off-time**

Off-time is the amount of time during the contest period that a station is off the air -- no listening or transmitting taking place. Some contests (e.g., Worked All Europe, ARRL SS) require that single operator entrants take a minimum amount of off time. Off time lengths are usually restricted to a minimum block size (30 minutes in SS, for example).

Categories: contest specific concept, operating technique,

See Also: Rubber clocking

**Online scoreboard**

A web site that delivers real-time score information of participants in a contest, such as those at cqcontest.net . In most cases these scoreboards are designed to seamlessly interface with contest software at participating stations so that one can see at a glance the relative standings of the competitors in any category. Participation in live scoreboards is gaining popularity, but some have questioned whether or not the use of such information during a contest is consistent with unassisted operation.

Categories: operating hardware/software

See Also: unassisted

**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:

**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:

**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:

**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:

**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: 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

**Sprint**

A short contest that emphasizes frequency agility. The original Sprint contest is the North American Sprint, held in February and September of each year, sponsored by the National Contest Journal. The most unique aspect of Sprint contests is the QSY rule – when a CQing station receives a response, they must QSY and leave the frequency to the calling station at the end of the QSO. Thus sprint contests do not allow the "running" of stations on a single frequency that is characteristic of most other contests.

Categories: operating classification, operating technique,

See Also:

**Stack**

A stack generally refers to two or more yagi antennas which are pointed in the same direction, aligned vertically on a tower or mast, and fed (typically) in phase to increase gain and better control the take-off angle of the antenna system's forward lobe.

Categories: station hardware

See Also: Bip/Bop

**SteppIR**

A commercially manufacturer yagi which works on multiple bands. The antenna elements consist of hollow fiberglass tubes which support a conductive ribbon that is adjusted in length with microprocessor controlled motors.

Categories: station hardware

See Also Yagi

**Stub**

Coaxial stubs are specific lengths of coax (generally, but not always, integer multiple of a quarter wavelength on the design frequency) which are used as impedance transformers for matching, attenuation, or other purposes. In a multi-transmitter environment, stubs are frequently used to reduce inter-station interference by nulling harmonics or other kinds of frequency passing/rejection.

Categories: station hardware

See Also:

**Super check**

Super check is another term for super check partial, as described above.

Categories: operating software/hardware

See Also: SCP

**SWL**

A station that only listens and does not transmit. This may be because the operator is not licensed to transmit. There is a long tradition of short wave listening (SWL) enthusiasts who compete for awards in a manner very much like amateur radio.

Categories: general

See Also:

**TCP/IP**

Transmission Control Protocol / Internet Protocol. This is how the internet does what it does. Developed by the Department of Defense in the 1970's to communicate between defense sites, it has grown into what we call The Internet. It delivers 'packets' of information, using an address, from one point on the network to another, which is now worldwide.

Categories: remote radio

See Also: UDP, IP address

**UBN**

An acronym for "unique, bad, not-in-log" which became slang for a log checking report.

Categories: log checking and reporting

See Also: LCR

**UDP**

Uniform Datagram Packet. The type of packet used to control a remote radio and send audio. These provide the fastest transmission time between 2 points. No error correction and highest priority. The other type you will see in nomenclature is TCP. This is an 'error corrected' packet, and one which can take a 'back seat' to other VIP packets. Not good for 'real time' applications.

Categories: remote radio

See Also: TCP/IP

**Unassisted**

Unassisted is the opposite of assisted, in that the use of spotting information delivered from internet or packet radio networks that is allowed in the latter is not allowed. It is a single operator overlay -- most multi-operator categories already allow spotting assistance.

Categories: operating classification

See Also: assisted, SOA

**Unique**

A claimed contact that is unique to all of the submitted logs in a particular contest. Such calls are much more likely to have been incorrectly copied.

Categories: log checking and reporting

See Also:

**Unique+1**

A unique+1 is a call that is (i) "one off" from a unique call and (ii) is a call of someone who was active in the contest. If you claimed contact with N9RU, and no one else in the contest worked N9RU, it is a unique. If N9RV was active in the contest, that is a unique+1. (N9RD might also be a U+1 if he was active).

Categories: log checking and reporting

See Also:

**Unlimited**

Unlimited means the same as assisted -- e.g., spotting network assistance is allowed.

Categories: operating classification

See Also: Assisted, SOA, SOU

**VOIP**

Voice Over Internet Protocol. Audio travels over the internet using this technique.

Categories: remote radio

See Also: TCP/IP, IP address

**WAN**

Wide Area Network. This refers to the network beyond your router, outside of your home. In general, this can be called the internet.

Categories: remote radio

See Also: Router

**Waterfall Display**

A useful mode of a panadaptor which gives an animated depiction of band activity over the chosen frequency range. In a waterfall display, received signals show up as solid points at a spot on a horizontal display that indicates their frequency. The pattern of the points gives visual information about what kind of signal it is – e.g., a carrier, a station sending CW or some other mode.

Categories: station hardware

See Also: Panadaptor

**WRTC**

World Radio Team Championship. Begun in 1990 at the World Cup Games in Seattle, the WRTC is a unique competition that occurs approximately every four years in July coincident with the IARU contest. WRTC assembles the competitors – two-person teams drawn from the top operators worldwide – in a single physical area, using identical antennas and power levels, to present a more level playing field in the competition. WRTC's have been held on three continents and in five different countries. WRTC 2018 will be held in Germany.

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

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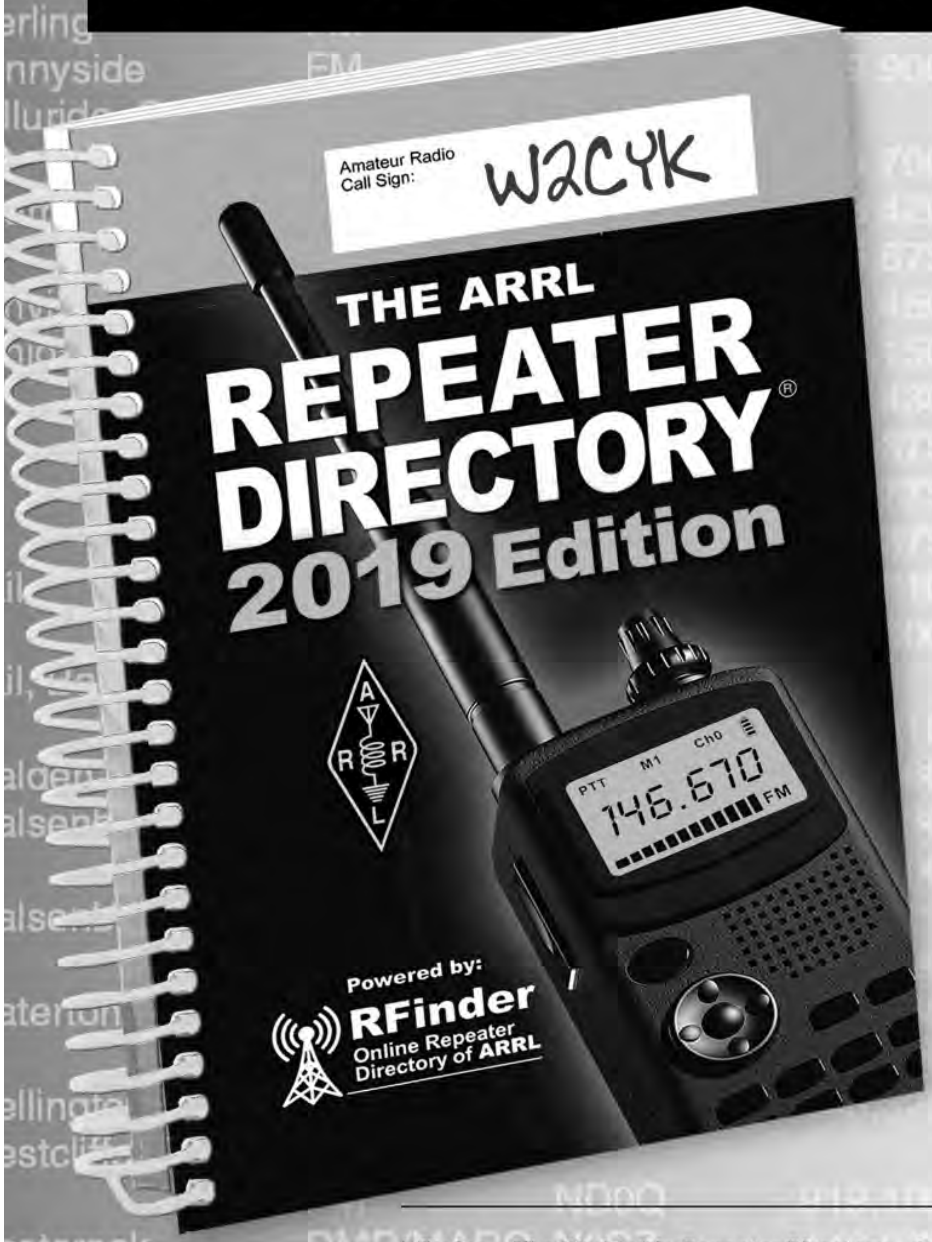


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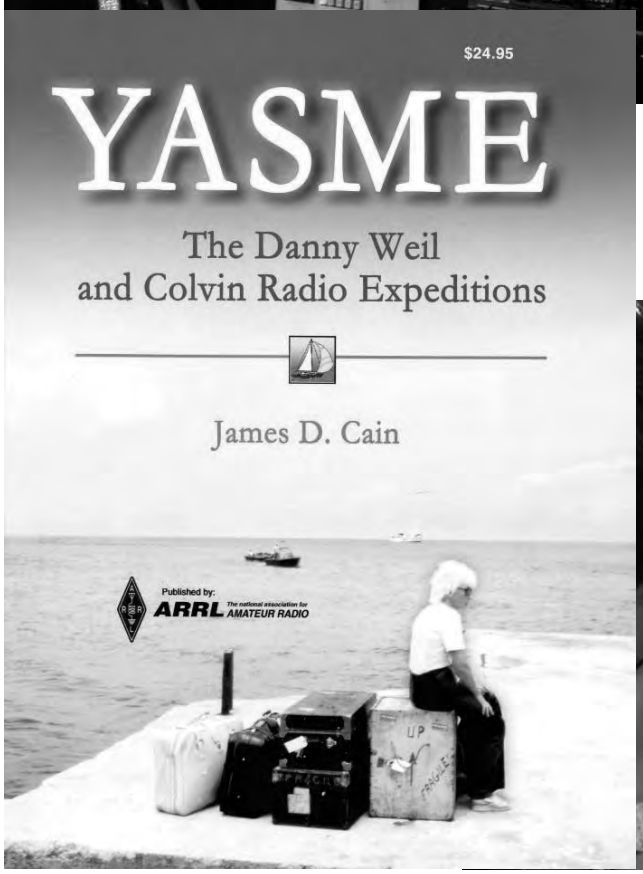


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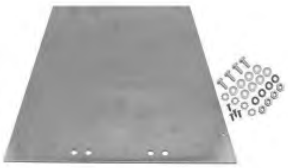

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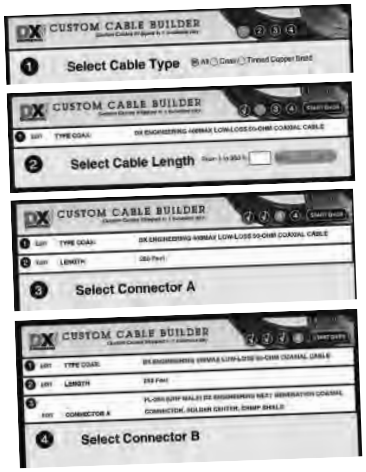


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