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Dayton Contest University

May 17, 2012

Crowne Plaza Hotel

Dayton, Ohio

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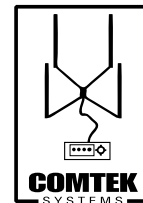
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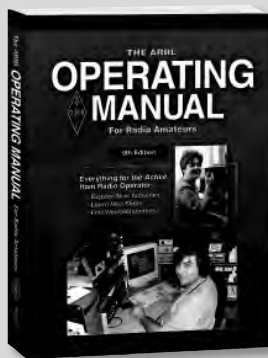
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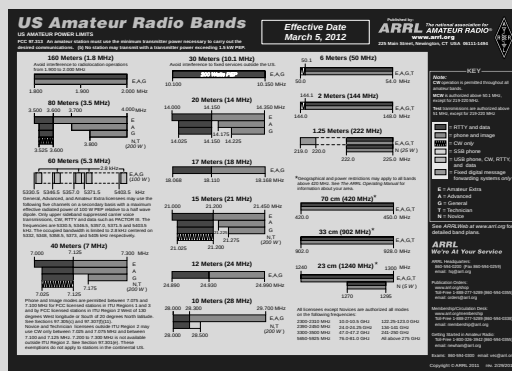
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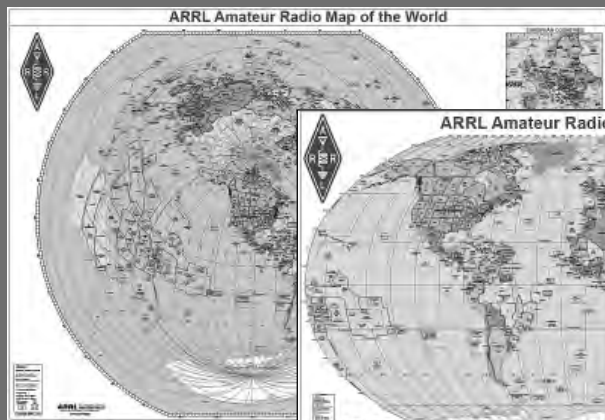
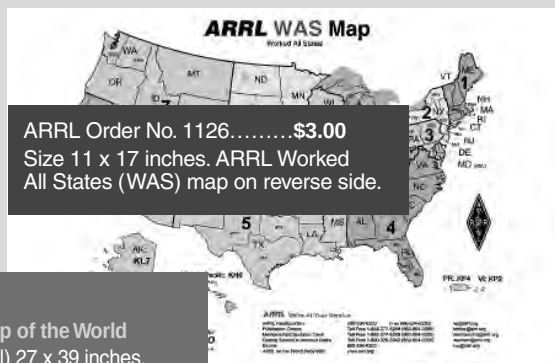


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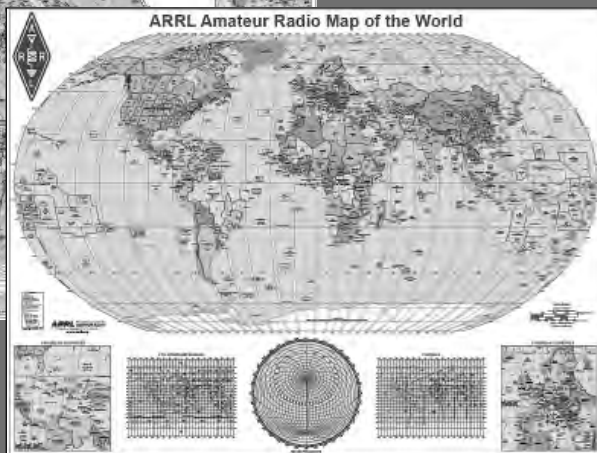
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**CONTEST
UNIVERSITY**

May 17, 2012
Crowne Plaza Hotel
Dayton, Ohio USA

First Edition

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Welcome

On behalf of the Board of Directors (K1DG, N9JA and K1AR) and the 15 Professors of Dayton Contest University 2012 we are pleased to extend a warm welcome to you!

This is the 16th Contest University. Six have been held here in Dayton, one in South America (Brazil 2011) and nine in Europe (England, Germany and Italy). CTU Finland 2012 will be this July.

Over 20 presentations are available here at Dayton Contest University 2012. They are the work product of many hours of hard effort by your Professors and the CTU staff (special thanks to W9ZRX, W3TX, N9RV and K1SO).

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. SuperBertha.com, CQ Magazine, ARRL, DX Engineering and INRAD 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, this is a work in process for all of us. I ask that you be patient with us as we work out any problems. I also ask for your helpful support as we move forward to more Contest Universities in the future. Learn, enjoy and encourage! Very 73!

Tim Duffy K3LR CTU Chairman

2012 Dayton Contest University – COURSE OUTLINE – 7:00 AM to 5:00 PM

7:00 ALL SALON A & B – Registration and Buffet Breakfast – 60 minutes

8:00 ALL SALON A & B – Welcome to CTU 2012 – K3LR – 10 minutes

8:10 ALL SALON A & B – The Spirit of Contesting – It Matters! – N6TR – 40 minutes

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

SALON A – Short Vertical RX antennas + Feedline Chokes – W8WWV

SALON B – Small Station Projects & Contest Operating Strategies – NØAX

SALON C/D – Tower Safety, Proper Load Design and Maintenance – K7NV

HARDING – 2012 VHF Contesting – W5ZN

10:00 ALL CONTEST SNACK – 15 minutes sponsored by SuperBertha.com

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

SALON A – Small Station Design for Single Operator Contesting – K2RD

SALON B – Why Some Antennas Work Better Than Others – W3LPL

SALON C/D – Contesting from Outside of the USA – XE1KK

HARDING – Setting Up for RTTY Contesting – WØYK

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

SALON A – Contest Clubs. Starting, Revitalizing and Growing – W5WZ

SALON B – Feedlines, Feedpoints, Transformers, Connectors and Grounds – W3LPL

SALON C/D – The Reverse Beacon Network and CW Skimmers – N6TV

HARDING – Operating a RTTY Contest – WØYK

12:15 ALL SALON A & B – CONTEST LUNCH – 45 minutes

1:00 ALL SALON A & B – Eye Ball Sprint – K1DG – 10 minutes

1:15 ALL SALON A & B – Enriching Your Contest Experience – K3LR – 25 minutes

***1:45 CONTEST SESSION by REQUEST to RERUN** – Attend ONE of 4 sessions – 50 minutes

*SALON A – As determined by vote

*SALON B – As determined by vote

*SALON C/D – As determined by vote

*HARDING – As determined by vote

2:40 CONTEST GROUPS #1 Attend ONE of 4 sessions – 30 minutes

SALON A – Top Band Contesting, Sweepstakes and the CW Sprint Chat – N6TR and NØAX

SALON B – Propagation during 2012 – what's ahead. Q&A – W3LPL

SALON C/D – Logging Program Discussion – N6TV

HARDING – VHF Contest Discussion – W5ZN

3:15 CONTEST GROUPS #2 Attend ONE of 4 sessions – 30 minutes

SALON A – DX and Expedition Contesting Q&A – XE1KK

SALON B – Rotors and Mechanical Ideas for Antennas Q&A – K7NV

SALON C/D – Station Design Q&A – K2RD and K1DG

HARDING – RTTY Contest Discussion – WØYK

3:45 ALL CONTEST SNACK – 15 minutes sponsored by SuperBertha.com

4:00 ALL SALON A & B – 2012 Contest Radio Performance – NCØB – 50 minutes

4:50 ALL SALON A & B – CTU 2012 Wrap Up and Surveys – K3LR – 10 minutes

*** 1:45 PM CONTEST SESSION by REQUEST to RERUN**

Students will vote for 4 topics/classes (during lunch) that they missed and would like to have presented again – the top 4 by vote – will RERUN in this time slot

Contest University Professor Bios

Greg Ordy, W8WWV

Greg was first licensed as WB9CTH in 1969 at the age of 15. Active through high school and college, amateur radio went on the back burner while he obtained a BS and MS in Computer Engineering and worked in the field of digital simulation software and several small businesses. The itch for amateur radio soon returned, and over the last 20 years he has been refining his HF station. His main interests include phased arrays, antennas for the lower HF range, antenna measurements, and antenna modeling.

Frank Donovan, W3LPL

Frank's contesting career began in 1959 as a 12 year old at the Providence Radio Assn, W1OP/1, ARRL Field Day two miles from his home in Providence, RI. Soon afterwards, he began to build a small contest station on 1/10 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. Immediately after college, U.S. Air Force 2nd Lieutenant Frank Donovan's first military assignment was working with PVRC member W3GN and his multi-multi mentor, W4BVV. W3LPL finished first place USA single operator in four CQ WW CW and four ARRL CW DX contests from 1973-78. His first multi-multi experience was with the 1974 PJ9JT CQ WW CW team. W3LPL multi-multi teams started with a small entry in the 1978 CQ WW Phone DX contest. During the 1982 ARRL Phone DX Contest, two incredible long nights of 10 meter JA runs unexpectedly produced our first USA multi-multi win. Our multi-multi teams have completed nearly one million QSOs and achieved 45 first place USA finishes (so far) out of 133 consecutive entries (without a single missed entry) in the CQ WW and ARRL DX Contests.

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 evolved from DXing to contesting as his early learning came from multi-multi experience at KØRF. 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 three times, and the world SOHP record in CQ WPX RTTY, having broken that record five times and the world SOHP record in 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. This is his fourth year at CTU delivering the two RTTY presentations.

Ward Silver, NØAX

Ward has been an active tester since before receiving his Novice license in 1972, participating with his high school club friends as WAØWBJ and WBØDQI. He credits contesting and later DXing as guiding his early interests in ham radio and propelling him to a career in Electrical Engineering. Ward is the Lead Editor of the ARRL Handbook and the ARRL Antenna Book. He also serves as a Contributing Editor to the ARRL Publications Department and consults on a variety of projects and programs in the ARRL Contest Branch. He is a founder of the World Radiosport Team Championships and is a member of the YASME Foundation Board of Directors. Ward is the author of all three ARRL License Manuals and the Q&A Study Guides and you will find his byline in the popular Wiley "for Dummies" series; Ham Radio, Two-Way Radios and Scanners, and Circuitbuilding Do-It-Yourself. Outside of ham radio, Ward plays the mandolin, dabbles in digital photography, and enjoys camping and canoeing.

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 5 WRTC events, winning one gold and two bronze medals. He is 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 Chairman of the WRTC2014 Organizing Committee.

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 single op, breaking his record set in 1996. In 2001 he won first place, single op in the ARRL UHF Contest, setting a new Delta Division record and placed 2nd in the Rover category for that contest in 2000. In June 2009 Team W5ZN entered the Limited Multi-op category with a 6th place finish. W5ZN also has HF contest interests as a regular in the ARRL 160 Meter Contest and ARRL International DX Contest – CW. In 2006 in the ARRL DX Contest he set a new 80 meter record for the W5 call area that held until 2009. In 2010 his claimed score reclaims that record. Joel was President of the American Radio Relay League from 2006 until 2010. More about Joel can be found at w5zn.org

Rob Sherwood, NCØB

Rob was licensed 1961 as novice and general at age 14. Moved to Colorado 1969 after college, and worked for KOA radio as a tech and transmitter / maintenance engineer from 1969 - 1987. Started Sherwood Engineering 1974 offering Drake R-4C mods, and then started testing receivers and publishing the results in 1976. In a way, invented the concept of a CW roofing filter for a multi-conversion radio in 1976 to fix the R-4C. He has published several articles in "ham radio magazine", and has had the pleasure of speaking at Ham Conventions at Dayton, New Orleans, YCCC, WØDXCC, W9DXCC, and will speak at two Texas conventions in 2010. Started building my dream ham station on 10 acres in rural Colorado in 2007, presently with 5 towers and 7 mono-band Yagis.

Tim Duffy, K3LR

Tim has been an active contest operator for 40 years. Over 100 operators have been a part of the K3LR Multi Multi DX contest efforts since 1992. He 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 20 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 30 years. He is a founding member and past multi year President of the North Coast Contesters. K3LR serves as chairman of Contest University (6 years) and the Dayton Contest Dinner (20 years), chairman of the Top Band Dinner – as well as coordinator of the Contest Super Suite (27 years) in Dayton. He is founder and moderator of the popular RFI Reflector (RFI@contesting.com). Tim has been on team USA at WRTC - four times. Tim serves on the board of directors of the World Wide Radio Operators Foundation as Vice Chairman and the Radio Club of America (RCA) on the executive committee. Tim was elected to the CQ Contesting Hall of Fame in 2006. He was honored with the Barry Goldwater Amateur Radio award by the RCA in 2010.

Larry "Tree" Tyree

Tree's contesting career started in 1968 operating a CD Party as WB6ZVC. He spent many a field day with the West Valley Amateur Radio Club, WA6LXN, as seen in the movie Ham's Wide World. Eventually, Tree ended up operating contests from W6DGH (now N6AA) and

multi-ops at K6RR. In 1977, he teamed up with Jim Gouras WB6JOS (now an SK) and operated many contests from his station in Ventura County. Tree moved to Oregon in 1984 and founded the Boring Amateur Radio Club. He is the author of the TR Log software program and has written software perform log checking for most major contests. Currently, he checks about 12 contests a year and was the chief log checker for the WRTC in Brazil. He spends his non-contest time either chasing new countries on 160 meters (currently he has 238) or the rare openings on six meters. He has placed in the top ten of the CW Sprint more times than he can count and holds the QSO record with 428 QSOs. Recently, he has placed top ten in both modes of Sweepstakes from KL7. Tree's first CTU presentation of the Ethics class was during the Friendship Radio Games in Khabarovsk, Russia in August 2011.

Kurt Andress, K7NV

Kurt's station is not a *Big Gun* station, nor is it even a *Little Gun* station, it's more like *Field Day* that happens all year round, and has provided him with an abundant opportunity to enjoy Amateur Radio. "A little station that is a lot of fun is way better than a little station that is no fun!" Learning about station building and contest operating has been fun for K7NV. There are so many challenges to be addressed in building a station that will provide the capabilities you desire for maximizing your enjoyment, and so many different ways to deal with them. The things that Kurt has done are just what one guy did with what was available, and is subject to continuous change. Kurt is a fabulous CW contest operator and master station builder.

Scott Dickson, W5WZ

Scott was first licensed at the age of 26. Nine months later, Scott was first exposed to contesting during Field Day 1998 and was immediately addicted. Having no real contest mentors, he crawled along with contesting, with best performances being mostly section level. After attending Contest University in 2007, a whole new world of contesting began. In 2008, a Contest Super Suite discussion among some Louisiana hams kindled the spark that led to the formation of the Louisiana Contest Club in August 2008 with Scott as one of the five charter members. Scott has also designed and built a capable SO2R station at his home in Ouachita Parish, Louisiana. For the 2010 CQ WW SSB contest, Scott and fellow LCC members undertook a first ever M/M HP effort from W5WZ with 4 transmitters, placing 11th in the USA. Scott has also participated in multi-op efforts from W5WMU, K5ER, and K8AZ. As the father of 4 children, when not contesting or improving the station, he and his wife Sharon, KW5MOM, spend much of their time parenting their son Delton, KF5GDK, age 14; and daughters Jordan, KF5GDJ, age 12; Laurel, KF5KAJ, age 11; and Logan, KF5MTH, age 9. Laissez les Contest roulez!"

Ramon Santoyo, XE1KK

Ramón enjoys contesting both single op and multi op. Some contest calls that he has repeated endlessly on selected weekends are HC8N, HC8A, XX9C, ES9C, K3LR, XE1RCS, FP/VE7SV, VE7SV, CE4CT, A31KK, 4C2X among others. He was captain of Team Mexico in WRTC-2006 using PW5U. An avid traveler he has visited (as of today) 121 DXCC entities and operated from a third of them.

Bob Wilson, N6TV

N6TV aka "TV Bob" is an active CW contester and Win-Test supporter. Licensed almost 40 years, Bob competed at the World Radiosport Team Championship (WRTC) in San Francisco (1996), Slovenia (2000), and Moscow (2010). He earned numerous Top Ten finishes in the CW NA Sprints from his home station in Silicon Valley, a small suburban lot with a single tower loaded with monobanders. Bob was an early adopter of the Perseus SDR and CW Skimmer, and has recently been analyzing signal reports using data from the Reverse Beacon Network (RBN). He voluntarily supports Win-Test users via the Win-Test Reflector, and also helps update the documentation. He

participated with K2KW's original "Team Vertical" group (6Y4A, 4M7X), and has been a member of the multi-op teams at HC8N, K3LR, and W7RN.

Ira Stoler, K2RD

Licensed at age 16 as WN2RDO/WB2RDO in 1965 in Brooklyn, NY. First serious contest entry was CQWW 1968. Spent the mid 80s in Albany, NY with numerous top ten finishes in SO categories in major DX contests. Frequently operated with K2TR multi team as well. 1992-2002 operated from Fairfield, CT with mini multi/2 in DX contests with several top ten placements. Moved west to SF area in 2002 and joined K6IDX/W6OAT multi/2 team. Built small city lot home station in San Carlos, CA participating in most major contests. Hold several county records and numerous top ten SO finishes in California QSO Party. Prefers CW but active on SSB and RTTY. Still loves contesting after 45 years!

2012 CONTESTING RELATED EVENTS

May 16 - Wednesday night - Contest Super Suite at the Crowne Plaza opens for the first of 4 nights at 7 PM in the Harding Ballroom. Hosted by Contest University. CTU 2012 Registration is from 8 PM to 10 PM. 10:30 PM Pizza Party sponsored by Contest University 2012. <http://contestsupersuite.com>

May 17 - Thursday all day – Dayton Contest University 2012 at the Crowne Plaza – 2nd floor. CTU Registration starts at 7 AM. <http://www.contestuniversity.com>

May 17 - Thursday 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). 10:30 PM QSL Wings and Pizza Party in the Harding Ballroom sponsored by K8CC, K3WW and K3LR. <http://www.contestsupersuite.com>

May 18 - Friday - Antenna Forum at HARA Arena
2:30 p.m. – 4:45 p.m. Room 1 Moderator: Tim Duffy, K3LR

“Enhancing the Performance of the K9AY Receiving Loop Array” - Dr. Richard C. Jaeger, K4IQJ

“Tower Climbing – Safety and Rescue” - Phil Theis, K3TUF

“Revisiting the W6NL Two Element 40 Meter Moxon Antenna – A Tale of Two Models” - Tony Brook-Fisher, K1KP

“Sun Spot Cycle 24 Update” - Carl Luetzel Schwab, K9LA

May 18 - 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). 10:30 PM “Spurious Emission Band” Live in the Harding Ballroom. 11 PM Pizza Party sponsored by the Potomac Valley Radio Club (PVRC). <http://contestsupersuite.com>.

May 18 – Friday night - 23rd Annual Top Band Dinner at the Crowne Plaza – Presidential Ballroom. 7:30 PM - Tickets in advance from <http://topbanddinner.com>.

May 19 - Saturday - Contest Forum at HARA Arena
12:30 p.m. – 2:15 p.m. Room 1 Moderator: Doug Grant, K1DG

"How to use CW Skimmer and RBN to Advantage" - Bob Wilson, N6TV

"T6MO - Combat Zone Contesting & more" - Eric Hall, K9GY/T6MO

"Challenges of Building an Arctic Contest Station" - Teemu Korhonen, SM0W

"What's Happening With Cycle 24?" - Carl Luetzel Schwab, K9LA

May 19 - Saturday evening - 20th Annual Dayton Contest Dinner hosted by North Coast Contesters at the Crowne Plaza – Presidential Ballroom. Dinner Speaker is Larry “Tree” Tyree, N6TR. Space is limited. Details and tickets are available at <http://www.contestdinner.com>

May 19 - Saturday 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) with a 11 PM Pizza Party sponsored by the Yankee Clipper Contest Club (YCCC). <http://contestsupersuite.com>. Harding Ballroom.

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CTU Presents

The Spirit of Contesting
It Matters!
Larry "Tree" Tyree, N6TR



How many wolves do you see?



What people have said

- Alex - I found 9
- Chryztine - I only found 11
- Elizabeth - I found 12
- Kelz - I found 11 quickly – it was easy
- Telsha – I can only find 2
- I saw 10 But the 10th looks messed up
- Bacon - I found 12 :)
- James - I found 38 after 43 hours studying it..
- Alex - I have this pic on my wall at home. there are 12
- Samad – I found 13
- Alyssa – I found 16
- Nicky - There is only ten. You guys are recounting the same ones.
- I found 15-16 I may have recounted one. Be sure to look through shadows as well, They are there and I am sure that there is more that we can't distinguish.



Definition of this word “Ethics”

The rules of conduct recognized as appropriate in respect to a particular class of human actions or particular group, culture, etc.

- “Appropriate” depends on your experience and values.
- “Particular Group” is ham radio contest operators.
- “Culture” provides a wild card that can be influenced by your environment (friends, club, country).
- Your “ethics” drive your behavior when other people are not looking.



Purpose & Scope of this class.

- Promote a discussion of what ethical behavior is 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.



CONTEST
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Why do we play games?

- Game
 - A contest with rules to determine a winner
 - An amusement or pastime
 - Fun!
- Games of skill are a means of exploring one's own capabilities.
- Games encourage the player to look at, understand, and experience things.
- Games teach people lessons about themselves and possibly the world, and allow such insights to be passed on to others.

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What unusual game is this?

- Entrants keep their own score (honor system)
- Complex rules govern scoring
- Individuals and "team" entries permitted
- Some events include off-times
- Winners of the top-level event often invest \$50k or more and travel to favorable locations
- An on-line network helps participants increase their scores
- Spectators don't find it particularly interesting
- Results are published for all to see.

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Is this Radio Contesting? NO....

Birdwatching!

Birders keep track of "life lists" of bird species seen ("DXCC")

Audubon started the "Christmas Day Bird Count" in 1900.

Competition got serious after an innocent comment in the book Wild America, when Roger Tory Peterson wrote: "*My year's list at the end of 1953 was 573 species*"

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Radio contesting vs. birding

	Contesting	Birding
Premier Event	CQWW, WRTC	Big Year
Smaller event	Sprint	Big Day
Spotting	DX Cluster	Birdingonthe.net
Travel	Zone 9, 10, 33...	Migratory paths
Book/Movie	"To Win the World"	"The Big Year"
Conventions	Dayton, Visalia	Annual, moves around

They have pileups, too!



Why do we do radio contests?

- FUN !!!
 - Self Improvement
 - Personal Satisfaction
 - ~~Financial Rewards~~
 - Peer Recognition
- Internal
- External

What is this peer recognition?

- You are recognized by others by the sum total of your achievements in the common area of interest.
- Achievements are your results and how you went about achieving those results.
- Your recognition is strongly influenced by what other people say about you.

Peer Recognition Examples

- 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.
- John had someone feeding him call signs.
- Larry operated with a broad signal to push the QRM away.

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

Any negative recognition will have a severe impact on your reputation.



Why do ethics matter?



Hank Aaron
755 Home Runs



Barry Bonds
762 Home Runs



Ethics in Contesting

- Choosing to do the right thing even when no one is looking
- And with SDR technology, people *are* looking at what happens on the air
- Unenforceable rules move into the category of ethics



Explaining Radio Contesting to a non-ham (or non-contester)

“We operate for 4/24/48 hours, log all the stations we contact, and see who can make the most contacts in the most states, countries”

“How do you know who won?”

“We send our logs to the sponsor, and they check them”

“How do you prevent cheating?”



A contrast of ethics



Abraham Lincoln
("Honest Abe")



Richard Nixon
("Tricky Dick")



How do we know what to do?

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



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

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



A suspicious single-op "XY1Z" log Band changes every 5 minutes

QSO: 28000 PH 2011-03-05 1430 XY1Z	59 K	NSGBM	59	PA	1
QSO: 28000 PH 2011-03-05 1431 XY1Z	59 K	AC4TO	59	FL	1
QSO: 28000 PH 2011-03-05 1431 XY1Z	59 K	K1RY	59	DE	1
QSO: 28000 PH 2011-03-05 1432 XY1Z	59 K	NLUR	59	VT	1
QSO: 28000 PH 2011-03-05 1433 XY1Z	59 K	NOPW	59	OH	1
QSO: 28000 PH 2011-03-05 1434 XY1Z	59 K	K4FX	59	NC	1
QSO: 21000 PH 2011-03-05 1435 XY1Z	59 K	NE3F	59	PA	1
QSO: 21000 PH 2011-03-05 1436 XY1Z	59 K	W8PJ	59	PA	1
QSO: 21000 PH 2011-03-05 1436 XY1Z	59 K	W2VJ	59	NY	1
QSO: 21000 PH 2011-03-05 1437 XY1Z	59 K	K1RX	59	NH	1
QSO: 21000 PH 2011-03-05 1437 XY1Z	59 K	NHFE	59	MA	1
QSO: 21000 PH 2011-03-05 1438 XY1Z	59 K	NHGA	59	MA	1
QSO: 21000 PH 2011-03-05 1439 XY1Z	59 K	KEFO	59	NY	1
QSO: 28000 PH 2011-03-05 1440 XY1Z	59 K	W1XW	59	MA	1
QSO: 28000 PH 2011-03-05 1440 XY1Z	59 K	W2J1	59	NJ	1
QSO: 28000 PH 2011-03-05 1441 XY1Z	59 K	W3EKL	59	MD	1
QSO: 28000 PH 2011-03-05 1441 XY1Z	59 K	K0VXU	59	KS	1
QSO: 28000 PH 2011-03-05 1442 XY1Z	59 K	K1UG	59	PA	1
QSO: 28000 PH 2011-03-05 1443 XY1Z	59 K	VW4LL	59	GA	1
QSO: 28000 PH 2011-03-05 1443 XY1Z	59 K	KT4ZB	59	GA	1
QSO: 28000 PH 2011-03-05 1445 XY1Z	59 K	KM4RK	59	SC	1
QSO: 28000 PH 2011-03-05 1445 XY1Z	59 K	VELYX	59	NS	1
QSO: 21000 PH 2011-03-05 1446 XY1Z	59 K	K2RW	59	NJ	1
QSO: 21000 PH 2011-03-05 1447 XY1Z	59 K	ND8L	59	OH	1
QSO: 21000 PH 2011-03-05 1448 XY1Z	59 K	KF5HVL	59	TX	1
QSO: 21000 PH 2011-03-05 1448 XY1Z	59 K	K1AC	59	NH	1
QSO: 21000 PH 2011-03-05 1449 XY1Z	59 K	WE1H	59	VT	1
QSO: 28000 PH 2011-03-05 1450 XY1Z	59 K	K1AR	59	MA	1

GREEN: 10M
RED: 15M



Compare times to logged stations' logs (BOLD: mismatch)

QSO: 28000 PH 2011-03-05 1430 XY1Z	59 K	N3GBM	59	PA	1	1428
QSO: 28000 PH 2011-03-05 1431 XY1Z	59 K	AC4TO	59	FL	1	
QSO: 28000 PH 2011-03-05 1431 XY1Z	59 K	K1RY	59	DE	1	1431
QSO: 28000 PH 2011-03-05 1432 XY1Z	59 K	N1UR	59	VT	1	
QSO: 28000 PH 2011-03-05 1433 XY1Z	59 K	N0FW	59	OH	1	1435
QSO: 28000 PH 2011-03-05 1434 XY1Z	59 K	K4FX	59	NC	1	
QSO: 28000 PH 2011-03-05 1435 XY1Z	59 K	NE3F	59	PA	1	
QSO: 21000 PH 2011-03-05 1435 XY1Z	59 K	W8FJ	59	PA	1	1433
QSO: 21000 PH 2011-03-05 1436 XY1Z	59 K	W2VJ	59	NY	1	
QSO: 21000 PH 2011-03-05 1437 XY1Z	59 K	K1RX	59	NH	1	1438
QSO: 21000 PH 2011-03-05 1438 XY1Z	59 K	N4TZ	59	IN	1	
QSO: 21000 PH 2011-03-05 1438 XY1Z	59 K	N1PGA	59	MA	1	
QSO: 21000 PH 2011-03-05 1439 XY1Z	59 K	KFZO	59	NY	1	1442
QSO: 21000 PH 2011-03-05 1440 XY1Z	59 K	W2JJ	59	NJ	1	
QSO: 28000 PH 2011-03-05 1440 XY1Z	59 K	W3EKL	59	MD	1	
QSO: 28000 PH 2011-03-05 1441 XY1Z	59 K	K0XUJ	59	KS	1	1442
QSO: 28000 PH 2011-03-05 1442 XY1Z	59 K	K03G	59	PA	1	
QSO: 28000 PH 2011-03-05 1443 XY1Z	59 K	W4JLL	59	GA	1	
QSO: 28000 PH 2011-03-05 1443 XY1Z	59 K	K1ZBL	59	SA	1	1447
QSO: 28000 PH 2011-03-05 1445 XY1Z	59 K	VE1YX	59	NS	1	
QSO: 21000 PH 2011-03-05 1445 XY1Z	59 K	K2RW	59	NS	1	1443
QSO: 21000 PH 2011-03-05 1447 XY1Z	59 K	NDBL	59	OH	1	
QSO: 21000 PH 2011-03-05 1448 XY1Z	59 K	KF5VL	59	TX	1	
QSO: 21000 PH 2011-03-05 1448 XY1Z	59 K	K1AC	59	NH	1	1452
QSO: 21000 PH 2011-03-05 1449 XY1Z	59 K	W1EH	59	VT	1	
QSO: 28000 PH 2011-03-05 1450 XY1Z	59 K	K1AR	59	MA	1	

Reorder the original log

QSO: 28000 PH 2011-03-05 1430 XY1Z	59 K	N3GBM	59	PA	1	1428
QSO: 28000 PH 2011-03-05 1431 XY1Z	59 K	AC4TO	59	FL	1	
QSO: 28000 PH 2011-03-05 1431 XY1Z	59 K	K1RY	59	DE	1	1431
QSO: 28000 PH 2011-03-05 1432 XY1Z	59 K	N1UR	59	VT	1	
QSO: 21000 PH 2011-03-05 1436 XY1Z	59 K	W8FJ	59	PA	1	1433
QSO: 28000 PH 2011-03-05 1434 XY1Z	59 K	K4FX	59	NC	1	
QSO: 28000 PH 2011-03-05 1435 XY1Z	59 K	NE3F	59	PA	1	
QSO: 28000 PH 2011-03-05 1435 XY1Z	59 K	N0FW	59	OH	1	1435
QSO: 21000 PH 2011-03-05 1437 XY1Z	59 K	W2VJ	59	NY	1	
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QSO: 21000 PH 2011-03-05 1438 XY1Z	59 K	N4TZ	59	IN	1	1438
QSO: 21000 PH 2011-03-05 1438 XY1Z	59 K	N1PGA	59	MA	1	
QSO: 21000 PH 2011-03-05 1439 XY1Z	59 K	KFZO	59	NY	1	
QSO: 28000 PH 2011-03-05 1440 XY1Z	59 K	W2JJ	59	NJ	1	
QSO: 28000 PH 2011-03-05 1440 XY1Z	59 K	W3EKL	59	MD	1	
QSO: 28000 PH 2011-03-05 1441 XY1Z	59 K	K0XUJ	59	KS	1	1442
QSO: 21000 PH 2011-03-05 1449 XY1Z	59 K	W1YW	59	MA	1	1442
QSO: 28000 PH 2011-03-05 1443 XY1Z	59 K	K03G	59	PA	1	
QSO: 21000 PH 2011-03-05 1446 XY1Z	59 K	W4JLL	59	GA	1	1443
QSO: 28000 PH 2011-03-05 1445 XY1Z	59 K	K1ZBL	59	SA	1	
QSO: 28000 PH 2011-03-05 1445 XY1Z	59 K	VE1YX	59	NS	1	1447
QSO: 28000 PH 2011-03-05 1445 XY1Z	59 K	KMARX	59	SC	1	
QSO: 21000 PH 2011-03-05 1447 XY1Z	59 K	NDBL	59	OH	1	
QSO: 21000 PH 2011-03-05 1448 XY1Z	59 K	KF5VL	59	TX	1	
QSO: 21000 PH 2011-03-05 1449 XY1Z	59 K	W1EH	59	MA	1	
QSO: 28000 PH 2011-03-05 1450 XY1Z	59 K	K1AR	59	MA	1	1452
QSO: 21000 PH 2011-03-05 1448 XY1Z	59 K	K1AC	59	NH	1	

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 (*16 comments*).
- Self-spotting or asking other stations to spot you is not allowed.
- Only the entrant's callsign may be used to aid the entrant's score.

Essence of Unwritten Rules

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

Examples of Unwritten “Rules”

- Making pre-arranged schedules
- Asking friends to work you ... only
- Asking for frequency of Mults (VY1?)
- Frequency holding by friends
- Working friends with club calls
- Calling multipliers on the phone
- Having others “help” with your single op effort

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”...

More Unwritten “Rules”

- No log washing
- “Research” using QRZ.com, Spot history, 3830 reports, LoTW
- Using utilities to analyze and correct the log
- Recording the contest and replaying to change log entries
- Don’t ask others who they worked
- Don’t email stations you think you worked
- No rubber clocking

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

A Tale of Two Golfers



Brian Davis
#2 in Verizon Heritage Tournament
Voluntarily took penalty for a violation
2nd place...\$400k less than #1
Widespread congratulations



Tiger Woods
#4 in Masters Tournament
"I came to win and didn't"
Nobody felt sorry



Peer Pressure

- Social pressure by members of one's peer group to take a certain action, adopt certain values, or otherwise conform in order to be accepted.
- 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."



From "The Code of Birding Ethics"

- If you witness unethical birding behavior, assess the situation, and intervene if you think it prudent. When interceding, inform the person(s) of the inappropriate action, and attempt, within reason, to have it stopped. If the behavior continues, document it, and notify appropriate individuals or organizations.



Applying Positive Peer Pressure

- Be aware of your motives
 - Is it personal or professional?
 - 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



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

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
- Leave
- Send a note to the contest sponsor and FCC

Why do we do radio contests?

- FUN !!!
- Self Improvement
- Personal Satisfaction
- Peer Recognition
- Make your enjoyment of contesting be about the journey, not the destination

If a plaque is THAT important to you...3 options

- Call a local awards shop and buy one
- Cheat in an undetectable way
- Request a customized plaque with asterisk



“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 if you just give in! And it keeps getting easier”



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
3. I will not modify my log after the contest by using additional data sources to correct callsign/exchange errors.
4. I will accept the judging and scoring decisions of the contest sponsor as final.
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.



Contest code of Ethics, expanded

1. I will learn and obey the rules of any contest I enter, including the rules of my entry category.
No cluster if not permitted, no second op for single ops, off-times per rules, correct output power
2. I will obey the rules for amateur radio in my country.
Power, frequency limits, licensing
3. I will not modify my log after the contest by using additional data sources to correct callsign/exchange errors.
When it’s over, it’s over



Contest Code of Ethics, expanded pt. 2

4. I will accept the judging and scoring decisions of the contest sponsor as final.
No whining on CQ-Contest, no lawsuits (or threats)
5. I will adhere to the DX Code of Conduct in my operating style (see dx-code.org).
Listen, listen, listen; only call when you can hear the station; never trust the cluster (copy the call!)...





Contest Code of Ethics, expanded pt. 3

6. I will yield my frequency to any emergency communications activity.

Contesting is a game. Emergencies are real life.

7. I will operate my transmitter with sufficient signal quality to minimize interference to others.

Mic gain below 10; amp not overdriven

www.wvrf.org



“All the guys at the top are cheating”

- Not “all” of them – in fact, it is a very small minority
 - 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!
- Nobody says this about cheaters:
 - “(Brian Davis’) honor, character, and integrity were of much higher standard than most, not allowing him to accept anything less than truly ‘winning’ the tournament.” – *Golf blog*
 - “What Davis lost on the course will be regained in his reputation for his honorable act” – *Tournament director*



The RIGHT way to do contesting

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

“Everything in moderation...except for fun. Have *LOTS* of that!”



Acknowledgments

- Much of this material was originally prepared by Randy Thompson, K5ZD, Ken Adams, K5KA (SK) and Doug Grant, K1DG.
- Analogies with birding originally developed by Dick Norton, N6AA.
- Note – the “Poisson d’Avril” is not really a contest.



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*

CTU Presents

Short Vertical RX Antennas and Feedline Chokes

by

Greg Ord, W8WWV



Introduction

- Antenna arrays consisting of 2 or more vertical elements are one of the many alternatives used to improve lower HF band (e.g. AM, 160m, 80m) reception.
- Other common receiving antennas include: Beverage, K9AY, EWE, Flag, Pennant, etc, and arrays of those *building blocks*.



Introduction (2)

- Because the challenge to reception on the lower bands is usually overcoming noise with an improved signal to noise ratio, as opposed to simply higher gain, the *directivity* of the antenna is a key parameter.
- Arrays are a good solution that provides a more focused pattern – a pattern with higher directivity.

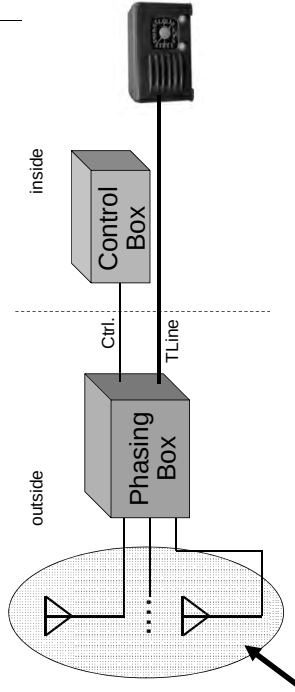


Introduction (3)

- The omni directional vertical, as an array building block (element), has no inherent directional bias, and rotating the array electrically is straightforward (assuming a symmetric ground layout!).
- Since gain is not a critical parameter, receiving verticals are usually *short* (relative to the canonical $\frac{1}{4}$ wavelength) to simplify installation **and** reduce *mutual coupling*.
- Mutual coupling is the interaction (via reradiation) between nearby elements, and in receiving arrays (passive & active), the (unstated) assumption is that mutual coupling can be ignored.
- That is an important design simplification that is usually **never** true in transmitting arrays. Always be aware of when you can and cannot ignore it.



Typical Array Configuration



- The primary focus of this presentation is the vertical antenna portion of the array.

Vertical Types

- There are two types of verticals in common use in receiving arrays.
 - **Passive**
 - **Active**
- They are *remarkably different* in how we should think about them and use them.

Vertical Types (2)

- For both types, it is necessary for the correct operation of the phasing network that we supply signals on the transmission lines that are matched to the line Z_0 (often 75 Ohms). The lines are *run flat*. This demands that the elements produce Z_0 output.
- With transmit arrays, following the complex current through the feed system is essential because current flowing in an element produces radiation. Line usually never *run flat*. Since the elements in a receiving array produce Z_0 (e.g. $75 + j0$) signals, it doesn't matter if we are talking about voltage or current downstream, since both are in phase, and simply have a ratio of 75. A voltage perspective is common.
- Another important array assumption is that each vertical produce the same signal level (magnitude and phase) when placed in the same RF field. They are the **same** and electrically identical. Our job at the antenna is to work hard to make them the same.

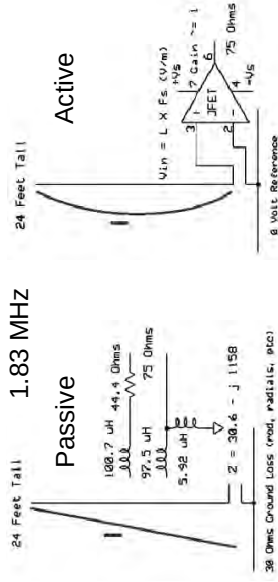
Passive Vertical Antennas

- Current Fed (fed at the current maximum), low impedance.
- Impedance matching is used to achieve Z_0 ; LC, LR, LL, etc.
- It's common to talk about and create *resonance* ($X = 0$).
- Narrowband (Z_0 output for a small frequency range)
- Ground systems sink current, and along with the matching network components determine the element losses (and gain).
- Similar to transmit verticals in many ways, except for the fact that the short length reduces mutual coupling to a negligible level.
- Mutual coupling is almost always important in transmitting arrays and must be included in the phasing system design. Receiving arrays assume negligible mutual coupling and Z_0 input signals.

Active Vertical Antennas

- Voltage fed (fed at the voltage maximum), high impedance.
- Impedance matching is achieved by a high (~megaOhm) input impedance active buffer that converts a voltage into a Zo impedance signal. The buffer requires a power supply, often via a Bias Tee.
- The high input impedance of the buffer implies that almost no current flows out of the antenna (in the perfect (∞Z) world, none does).
- Ground systems provide a zero volt reference to the buffer. Almost no current flows in the ground system because of the high impedance buffer.
- Resonance (in the antenna) is not necessary for useful operation.
- Broadband (Zo impedance) can be maintained for many MHz).
- Mutual coupling is even lower than in a passive vertical of the same length (antennas can be longer and closer together without trouble).
- Conceptually similar to a *voltmeter* (measure without loading down). The antenna can be considered to be a *probe* or *sampler* of the electromagnetic field passing by.

Comparing the Two Types



- Current maximums will occur in the middle of a conductor, voltage maximums will occur at the ends. A high impedance connection is as good as an end (like an antenna trap, for example). It's as good as floating.
- From this point forward, the focus will be on the short active receiving antenna.

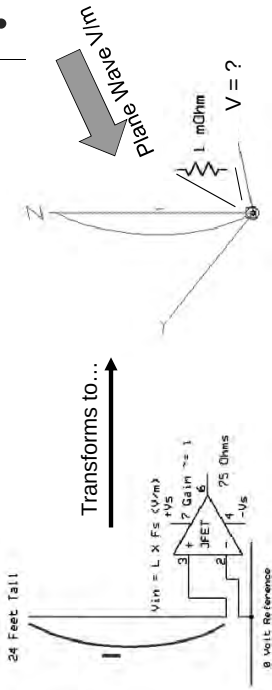
Plane Wave Modeling

- Antenna modeling in NEC uses *Sources* to *excite* the antenna at one or more points *on Wires*.
- Sources are complex, with a magnitude and phase, and are either voltage or current Sources.
- Patterns, gain, and other parameters, as well as Source impedance(s) are computed as a function of frequency.
- Although the perspective taken is largely that of transmission, a consequence of the antenna reciprocity theorem makes the results valid for reception (same pattern, same gain, etc).

Plane Wave Modeling (2)

- The NEC engine has always supported a second perspective.
- That perspective has the antenna stimulated by a plane wave that arrives from a specified direction, elevation, and polarization, with a specified field strength (V/m). (one ideal signal)
- This is an alternative to the usual Source excitation.
- The only modeling shell/GUI that I am aware of that supports this feature is EZNEC/Pro.
- If you are willing to directly work with NEC card decks, plane wave modeling can be done in NEC-2.

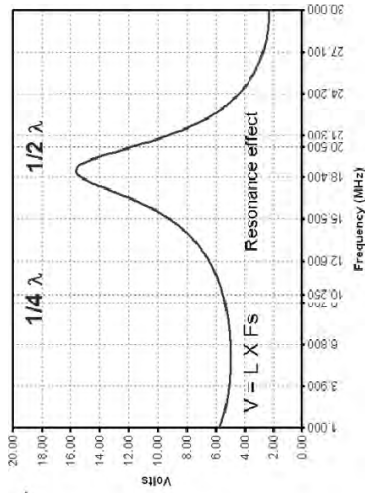
Plane Wave Modeling (3)



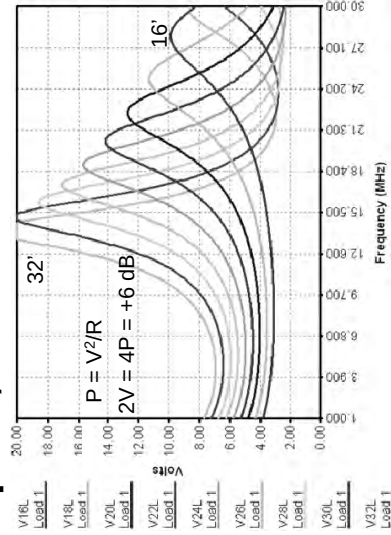
- Plane Wave modeling is very helpful in analyzing aspects of active high impedance antennas. (normal Source modeling is also needed (e.g. patterns))
- A high value Load resistor can be inserted in place of the buffer. The complex voltage at the resistor terminals is the voltage that will be supplied to the buffer.

Example 1; 24' Vertical

- 24' tall, 1" OD, 1 mOhm Load, wave 1 V/m, 20 deg. elevation, 50 KHz steps.
- Program flow: EZNEC/Pro -> LBDXView (5th ed. ON4UN CD)



Example 2; 16' - 32' Verticals



Example 2; Analysis

- So long as you are operating below the resonance region, the antenna output voltage will be an approx. linear function of its length. $V = L \times F_s$.
- Twice the length, twice the voltage, +6 dB. Half the length, half the voltage, -6 dB.
- While getting close to resonance increases the voltage output (gain), it will also increase the mutual coupling. Consider a typical Yagi with $\sim 1/2$ wavelength floating parasitic elements. It works because of mutual coupling.
- In an array, don't ever forget the importance of **sameness**. I try to keep individual errors under 1%.

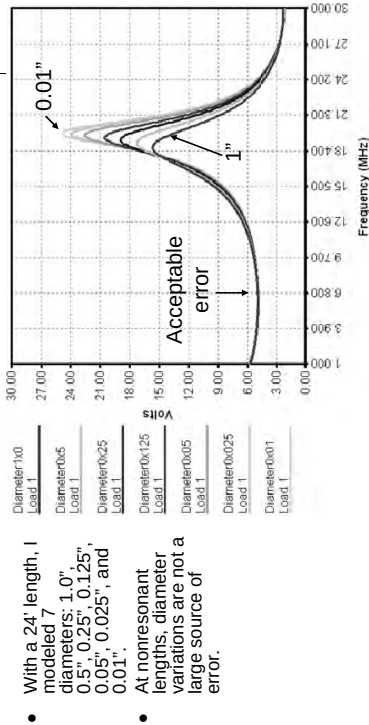


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Example 3; Antenna Diameter

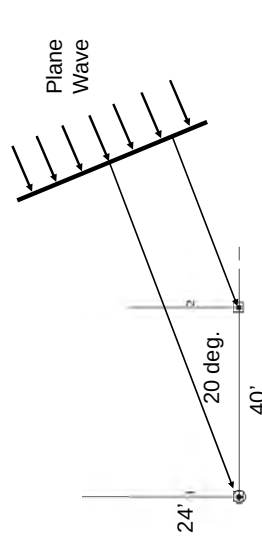


- With a 24' length, modeled 7 1.0" diameters: 1.0", 0.5", 0.25", 0.125", 0.05", 0.025", and 0.01".
- At nonresonant lengths, diameter variations are not a large source of error.

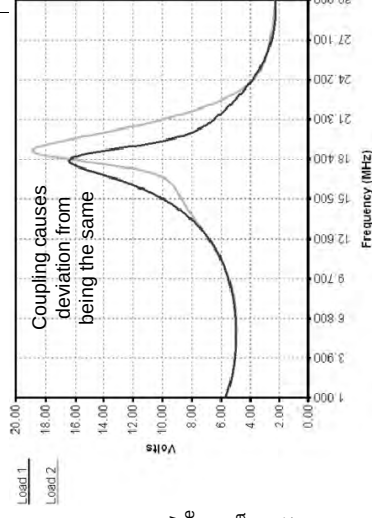
Example 4; Mutual Impedance

- In this application, mutual coupling/impedance can be ignored so long as the complex voltage out of an antenna is due *exclusively* to the plane wave. No antenna *sees* another nearby antenna.
- Both magnitude and phase matter. As before, I like to keep the error under 1%.
- Consider two identical but nearby verticals. Their magnitudes should be the same, and the phase shifts should be due to the ground separation and arrival angles. When those conditions are not true, they are interacting, and the array performance will probably be compromised (not anticipated in the phasing box design). In this example, the arrival azimuth is end fire, elevation is 20 degrees.
- This example also gives us a chance to look at phase shifts as well as voltage magnitudes.
- Mutual coupling effects can also be determined in normal Source modeling as a shift away from self impedance.

Example 4 (2); Mutual Impedance



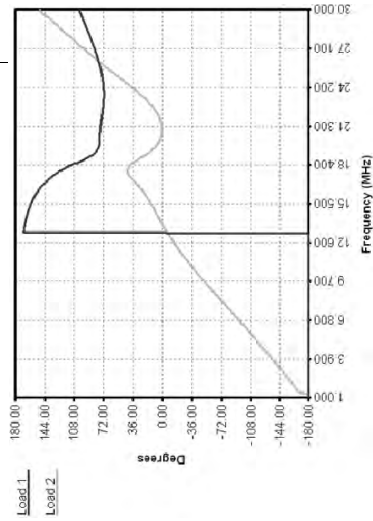
Example 4 (3); Mutual Impedance



- Voltage Magnitude comparison.
- Up through ~13 MHz, the pair of 24' verticals with 40' ground distance show little magnitude deviation.
- We could add the results of a single vertical to be 100% sure we aren't being influenced. (but we are not)

Example 4 (4); Mutual Impedance

- Voltage Phase comparison.
- The phase data follows a relative value convention in NEC, which can make it a little tricky to interpret. Let's subtract the two values to remove some confusion.

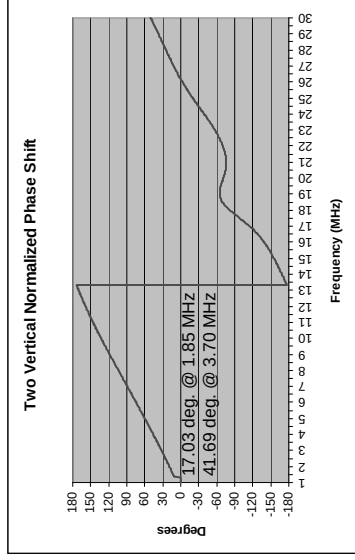


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Example 4 (5); Mutual Impedance

- A little less confusing!
- At 1.85 and 3.7 MHz, the modeled phase shifts equal the computed.
- A deviation from a straight line is a sign of concern.
- Clearly something bad is happening near the $\frac{1}{2}$ wavelength resonance.



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Example 4 (6); Mutual Impedance

- While it would always be best to model the layout and dimensions of a specific array to determine if there is a mutual impedance problem, I have modeled enough examples to suggest the following *rule of thumb*.
- So long as the verticals are no longer than $\frac{1}{8}$ wavelength at the highest frequency of operation, you can put them as close together as you want and consider them to be independent with negligible coupling.
- For example, 31 feet to extend up to 4.0 MHz.
- This assumes the high impedance active end feed so that the element is effectively floating, and while current flows within it, no current flows out of it. We are simply sampling the end voltage, and the scattered energy is not enough to be detected.

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Base Shunt Capacitance

- With a high impedance port, stray shunt (parallel) capacitance can be an impossible to avoid issue.
- It provides a sneak path around the buffer. The voltage can be dragged down, finding a preferred path to ground.
- Active verticals have at least two sources of stray capacitance.
 - Buffer Circuitry and Packaging (~ 5 to 20 pf)
 - Antenna Mount Construction (up to ~ 80 to 100 pf)

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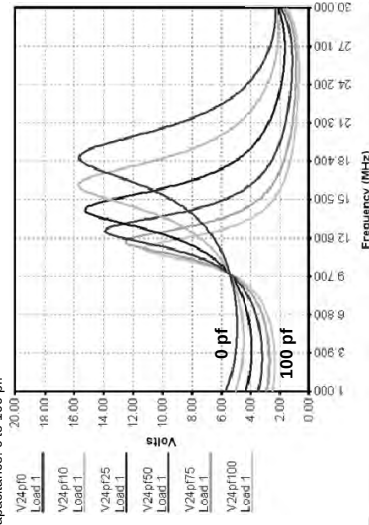
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Base Shunt Capacitance (2)



Base Shunt Capacitance (3)

- 24" tall, 1" OD, 1 mOhm Load, wave 1 V/m, 20 deg. elevation, 50 KHz steps.
- Vary Capacitance: 0 to 100 pf.

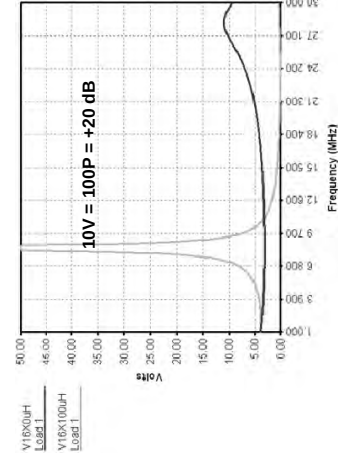


Base Shunt Capacitance (4)

- Increasing the shunt capacitance lowers the $\frac{1}{2}$ wavelength resonant frequency.
- The voltage output, where we care (1 – 4 MHz), for 100 pf, dropped by a factor of 2, or -6 dB of gain.
- The problem is not so much the loss of gain, but rather trying to maintain *sameness* (1% errors) in the elements.
- For that reason, the verticals should be constructed as identically as possible – to make the base capacitance the same, or as close as possible, for each vertical.

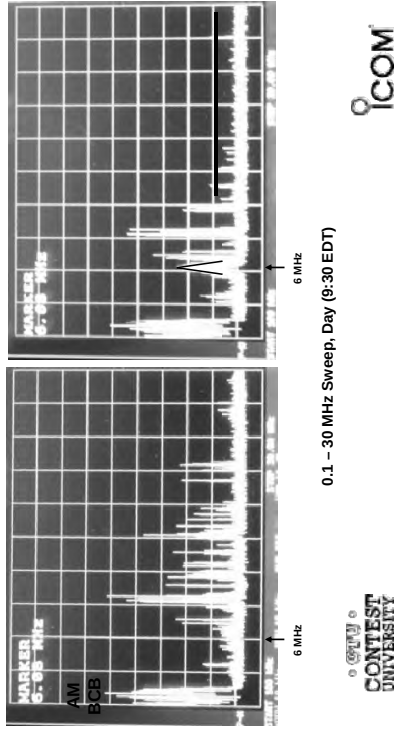
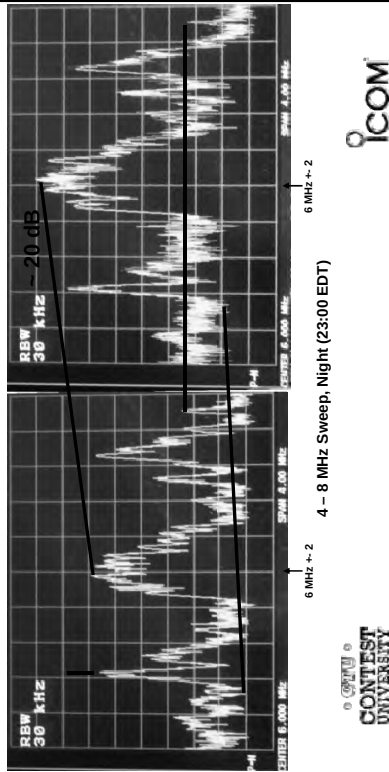
Series Inductance

- The response of the active antenna can be changed by adding a Series base inductor.
- The $\frac{1}{2}$ wavelength resonance is lowered in frequency.
- **Somewhat dangerous in an array**, since the gain tolerances will not be 0.1dB (1%) without work, (phase too)
- E.g.: .16' vertical, 100 uH.
- I really didn't believe a 20 dB gain spike, so I needed to measure it.
- A 100 uH RF choke was used because it was convenient, and below self resonance.
- Good for making a narrower band vertical with a ton of gain.

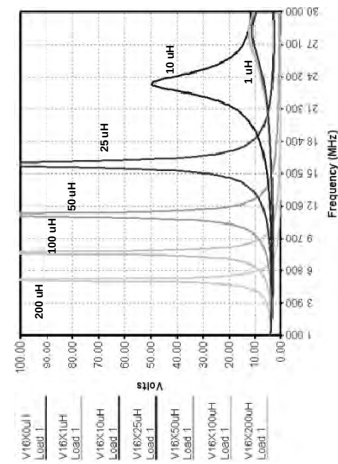


Two 16' verticals with an A/B Switch

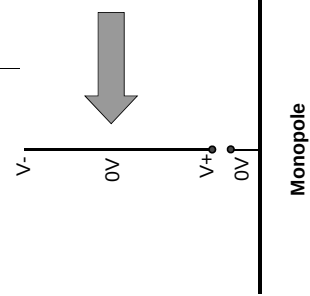
16' Vertical **With 100 uH**



- Larger inductance lowers the frequency but also narrows the response.
- Trade off length and inductance to achieve a desired response.
- **Use in an array is problematic** due to rapid rates of change in magnitude and phase near the peaks.
- The target has been to hold errors < 1%.
- Adding series inductance does not appear to change the mutual coupling level.
- If you want some real fun, move the location of the inductor further up!

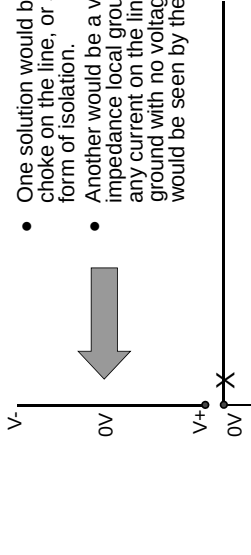


- In the case of a high impedance voltage fed monopole, the role of “ground” is to provide a stable zero volt RF (local) reference.
- It is not the *other half of the antenna*, and not a point where we want to encourage RF current to flow.
- Low is the other half of the buffer input.
- Low loss ground systems are not important.
- Any change in the reference point voltage will enter the buffer.
- Radials, ground rods, and mounting poles can all be used.
- What they need to be is stable, and not carry an RF-voltage potential.
- Radials need not be long, but they should be symmetrical so as to not be acting like a net antenna.
- We want only the antenna to provide signal energy, not the ground reference system.



The Role of Ground (2)

- Be sure to know how the transmission line to the phasing box is being treated, and that it is not acting like a single long antenna wire.

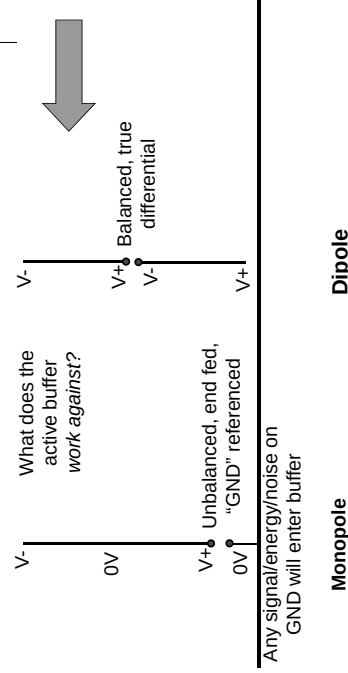


- One solution would be an RF choke on the line, or some other form of isolation.
- Another would be a very low impedance local ground so that any current on the line goes to ground with no voltage drop that would be seen by the buffer.

Vertical Dipole

- Establishing a true zero volt ground reference across the array area can be a challenge.
- Ground rods, mounting poles, or radial systems can be real work and time consuming to install. Once installed, they are somewhat permanent and yet more work to relocate, and hard to tweak.
- One alternative is to use a balanced vertical dipole that does not reference ground at all.
- Combined with a portable base, antenna experimentation, tweaking, and painless seasonal setup and removal becomes very easy.
- The only inconvenience is running the transmission line up though the bottom tube to aid in decoupling the line from the antenna. This is a common issue with vertical dipoles.

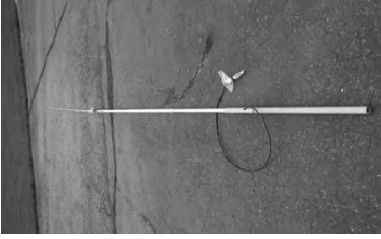
Vertical Dipole (2)



Vertical Dipole (3)



Vertical Dipole (4)



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Low Pass Signal Filtering

- Active vertical antennas tend to have a wide bandwidth with a signal peak at the frequency of $\frac{1}{2}$ wavelength resonance (previous slides).
- In the multiple transmitter contest environment, this can create a problem if energy from the higher bands (40m, 20m, etc.) enters the array and creates *artifacts*, such as overload, IM products, pumping, etc. Another good word is *crud*. You know it when you have it.
- The usual solution is some form of filtering.
- Since there are active devices right at the antenna base, we would like to install filtering before we get to their doorstep. One per antenna.
- Filters usually alter the magnitude and phase response of even the desired signal.
- The concern, as always, is antenna *sameness*, and that the filter does not introduce phasing errors while doing its job.
- The filter ports are also a bit unusual in this application, since there is a high impedance buffer on one side, and a highly reactive short vertical on the other.

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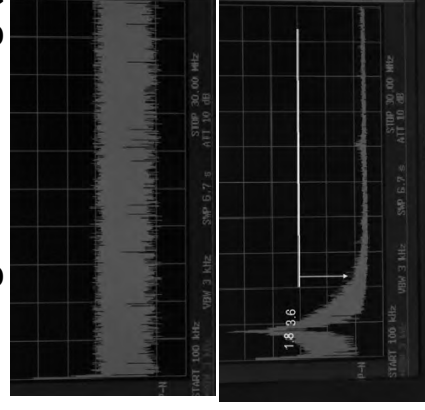
Low Pass Signal Filtering (2)

- After detecting some contest *crud*, effort was put into looking at filter solutions that preserved the phasing of the array while knocking down the crud to the point where it was not a problem after hours and hours of contesting.
- Solutions were found, but I must admit, I can't fully explain how they work at this point!
- They involve using hand selected RF chokes. The filtering appears to rely upon a combination of the chokes, the antenna length, and the base capacitance. While the base capacitance and buffer input are relatively stable, the antenna impedance is a function of frequency, and the RF chokes are self resonant, which is hardly stable.
- The level of filtering is in the range of 10 to 20 dB, which would normally be considered a poor filter. But, for removing the *crud*, they do the job.
- A test jig was set up using a noise source, antenna impedance simulator, filter, and spectrum analyzer (0.1 to 30 MHz) connected to the output of a high impedance buffer.

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Low Pass Signal Filtering (3)



No Filter

Filter

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Low Pass Signal Filtering (4)

- An interesting aspect of the filter is that it increases the antenna gain at the low frequencies. So, in addition to filtering at and above 40m, there are a few dB of additional gain on 160 and 80m.
- But, as can be seen from the spectrum analyzer, it's necessary to control the filter response to make sure it's the same (from filter to filter) on 160 and 80 m.
- I will write up this information when I figure out exactly how the filter works, especially in the context of the whole antenna.
- Another idea is to select vertical lengths that are not $\frac{1}{2}$ wavelength on a higher band (avoid resonance).

Feedline Chokes

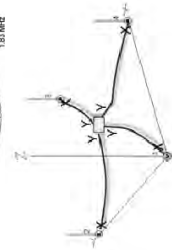
- Where is my antenna? (72°/240°) (108°/996°)
- Transmission lines, control cables, any conductor, can act like an antenna and carry *antenna currents*. Another term is *common mode currents*.
- The currents can cause problems by reradiation to nearby antennas, and/or, direct connection to antennas, transmission lines, or grounds that are really not low impedance grounds.
- The problem is exacerbated when the lines are resonant.
- The two conditions to be aware of are lines $\frac{1}{4}$ wavelength long with a high impedance on one end and a low impedance on the other, and, a $\frac{1}{2}$ wavelength line with a high impedance on both ends. Both of these situations encourage RF current flow. (one is a grounded $\frac{1}{4}$ wavelength and the other is a floating $\frac{1}{2}$ wavelength dipole)
- When a line is acting like an antenna, and we wish that it weren't, we have two tools that can be used to discourage resonance – chokes and grounds.
- A choke adds a high impedance point; a ground, assuming it's a quality ground, adds a low impedance point.
- When correctly applied, the problem can be reduced or eliminated. Turn resonance into anti-resonance. Often times a matter of degree, not absolutes.

Feedline Chokes (2)

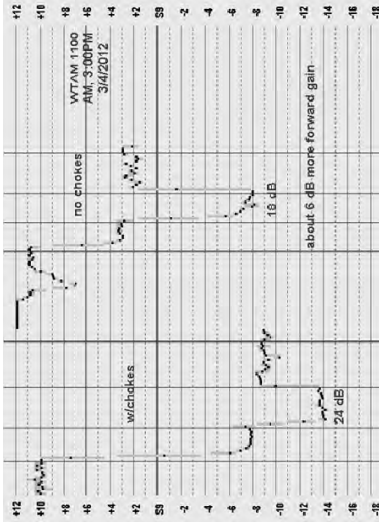
- Chokes every $\frac{1}{4}$ wavelength down a line are very effective in breaking up resonance. The thinking process is similar to the old days of adding insulators to metal tower guy lines.
- But, if we have chokes every $\frac{1}{4}$ wavelength, at twice the frequency the chokes are $\frac{1}{2}$ wavelength apart, and that's exactly resonant!
- This leads to the realization that it is possible for chokes or grounds to make a problem worse, or fix a problem on one band while making it worse on another.
- If you have a receiving array that is not performing up to expectations, experimenting with chokes on the various lines can pay big dividends.
- Consider both ends of a cable as well as breaking up lengths longer than $\frac{1}{4}$ wavelength on the frequency you are evaluating. Look at all cables, not just transmission lines. DC control cables can be choked with standard RF chokes.
- I tend to cut up a 1000' box of RG-6 into a set of useful lengths and then use as many as needed to span some distance, adding chokes between sections.
- Lines between the elements and the phasing box almost always need to be the same length, but not a specific length. This only applies to lines that are run flat (SWR = 1). That's usually the case in receiving arrays, but not transmitting.

Feedline Chokes (3)

- Example: 4 Square.
- Phasing selected to create side and rear nulls. Good for testing, since nulls fall in 3 of the 4 directions.
- By dumb luck, nearly aligned with local AM radio station.
- Chokes already installed at "X".
- What is the difference with chokes installed at "Y"?
- Feedlines about 60 feet long.
- No grounding anywhere.



Feedline Chokes (4)



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Feedline Chokes (5)

- Used *S Meter Lite* program to capture signal levels.
- In addition to improving side and rear nulls, the chokes at the phasing box caused the overall array output to **drop** by about 6 dB.
- Less unwanted antenna! This is good news!
- Although the output level was down, the signal to noise ratio was improved, and array performance clearly went up on all bands.

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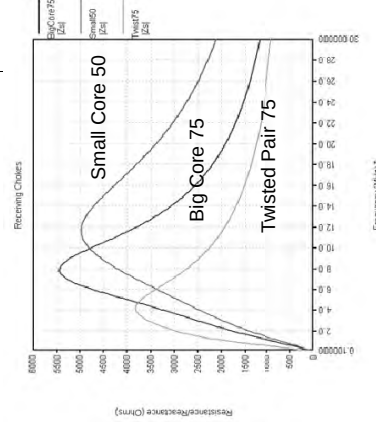
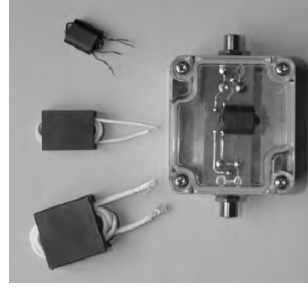
Feedline Chokes (6)

- Design/construction follows ideas and concepts used on other transmission line/cable chokes.
- Little power is involved because these are used only for reception.
- If used on lines running to the elements, **sameness** matters and should be verified. Avoid impedance bumps and make internal lines the same length.
- Mix 73 BN-73-202 with 75 Ohm twisted pair, Mix 43 BN-43-3312 with RG-178 (50 Ohms), Mix 43 BN-43-7051 with RG-179 (75 Ohms).
- Clamp on chokes can certainly be used, but I personally find them not as effective (5 to 6 turns needed), and cumbersome.

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Feedline Chokes (7)



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Conclusions

- I think in terms of minimizing the phasing errors in an array, and what is the required tolerance to keep individual errors under 1%. While that may sound strict, there are so many places where you can introduce error that if you are not vigilant, you can easily drop way too much performance on the ground – drop by drop by drop.
- **Sameness** is usually far more important than target values.
- High impedance buffers create floating sections of antenna with a current maximum in the middle, and voltage maximums on the ends. Voltage peaks occur at the $\frac{1}{2}$ wavelength points.
- If you avoid frequencies where the antenna is naturally approaching resonance ($\frac{1}{4}$ to $\frac{1}{2}$ wavelength), the length of the antenna directly determines the voltage output. $V = L \times F$ s.
- Doubling the length of the antenna results in 6 dB of additional gain. Reducing the length by $\frac{1}{2}$ drops the gain by 6 dB.

Conclusions (2)

- If you want to ignore mutual coupling, keep the vertical length under $\frac{1}{8}$ wavelength at the highest frequency of operation, ~31 feet at 4.0 MHz.
- Antenna diameter is not an important parameter except near resonance.
- Antenna length/construction should always be carefully controlled and made the same.
- Base shunt capacitance lowers voltage output and can create magnitude errors even for antennas that otherwise appear to be the same. Strive for **sameness**, resorting to trimmer capacitors if necessary.
- Series inductance alters the antenna response, and is a great way to increase gain at the expense of bandwidth. But, controlling the gain and phase shifts to preserve **sameness** is hard.
- For unbalanced end fed ground referenced verticals, ground rods, mounting poles, and radials all make acceptable grounds. I've used 8 radials each 10' long without problems.
- If your array is not exhibiting the expected performance, experiment with chokes on each end of every line, and in the middle of long lines. Check every band that is important to you.

CTU Presents

**Small-Station Projects and
Contest Operating
Strategies**

Ward Silver, NØAX








Overview

- Example Projects to Spark Ideas
 - Audio, Receiving, Transmitting
 - Antennas
- Strategic Principles
 - S&P and CQing
 - Attacking A Pileup – From Each End
 - Off-time Management
 - Different Contest Types






Sparking Ideas

- Think in terms of continuous improvement
- Bang for the buck
- Dollars per dB
- Note things that bug you – then fix them
- Keep records
- Share stories
- Don't be afraid to experiment (a little)






Projects are Personal

- Each station has different needs
- Depends on operator preferences
- Different contests have different needs
- Look for commonality
- Lots of easy projects are not complicated!
- Your irritations are your inspirations




Station Audio

- Low-hanging fruit
- Headphones
 - High-quality
 - **Comfortable**
 - An extra pair of different phones
 - Noise-canceling headphones
- Lower shack noise levels
- Check rig fidelity and audio settings
- Remove high-frequency hiss

Station Audio Project

- The **Buddy Box**
- For one or two operators
 - Share two audio sources
 - One or two operators
- Good for SO2R
- Good for two-operators on one band
- Excellent for training

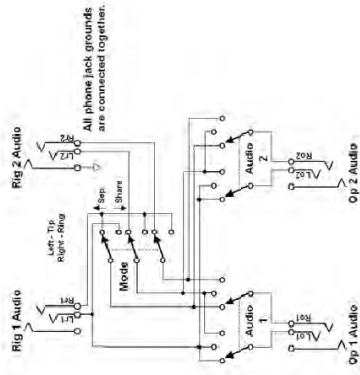
The Buddy Box



The Buddy Box



The Buddy Box



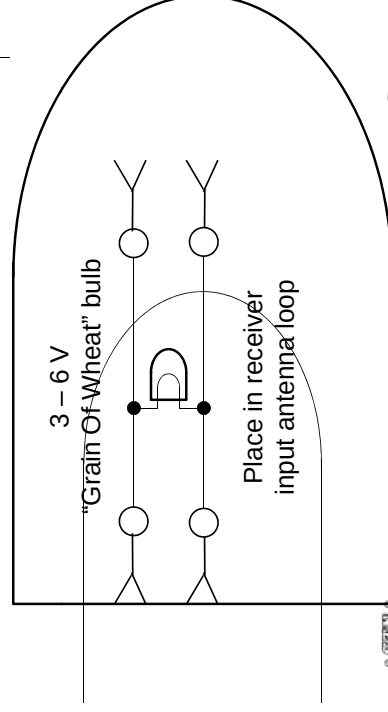
The Buddy Box

- DP3T switches
- Digi-Key
- Mouser
- Make switches strong and big
- Pay attention to grounding

Receiver – Front-End Saver

- Protect sensitive input
- Particular problem when SO2R
- Front-End Saver
- KD9SV makes an active protection device
- <http://www.radiobooks.com/products/fes.htm>
- Make your own!

Receiver – Front-End Saver



Receiver – Front-End Saver

- Do NOT use diodes
 - Harmonic generation
- Use a socket for the light bulb
- Have spare bulbs on hand

Broadcast-Reject Filter

- Reduce overload and out-of-band noise
- Wetherhold, "BC-Band Energy – A Rejection Filter" *QST* Feb 1978
- Can easily be scaled up to 150 watts

Transmitting Projects

- Microphone switchbox by N1GY
 - mysite.verizon.net/cpthaines/id19.html
 - Uses printer data switch box (cheap!)
- Voice memory keyer controller by G4IFB
 - www.g4ifb.com/html/ts850_mod.html#VoiceKeyer
 - Each radio is somewhat different

Transmitting Projects

- Transmitting band-pass filters
- "Field Day Filters" by **W3NQN**
- Wetherhold, "Clean up your signal with band-pass filters--Part I," *QST* May 1997.
- Wetherhold, "Clean up your signal with band-pass filters--Part II," *QST* June 1997.

Bandpass Filters

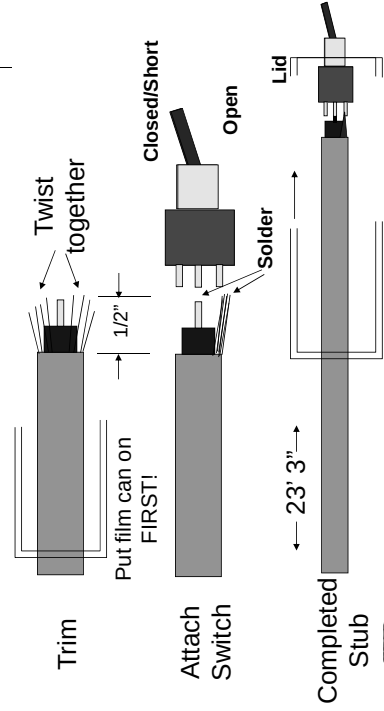


www.k8gu.com/w3nqn/index.html

Field-Day Stub

- One coaxial stub with a switch at the end
- Switch changes null from 20/10 to 40/15
- 23' 3" stub with a toggle switch at one end
- If made from RG-58, might even fit INSIDE a radio (K6LL WRTC trick)
- 7.075, 14.150, 21.225, and 28.300
- Silver, "Experiment #22 – Stubs" QST, Nov 2004

Field-Day Stub



Antenna Projects

- "Temporary" antennas ☺
- Second-radio antennas
- Receive antennas
- Targeted transmit antennas

Seekrit Weapon – Low Dipoles

- 80 meter dipole, 10-20' off the ground
- Omni-directional
- High angle
 - NVIS – a fancy name for “crappy low dipole”
- Big signal in 200-300 mile range

Project Ideas

- Your contest club's web site and past newsletters
- *National Contest Journal* back issues
- *New Antenna Book* and *ARRL Handbook*
- 3830 entries and comments
- ARRL Soapbox entries (arrrl.org/soapbox)
- CQ-Contest, Topband, TowerTalk, Amps reflectors (www.contesting.com)

Strategic Principles

- Devise strategic principles for each contest
- Apply them in **YOUR** circumstances
- Study contest rules and scoring
- Combine with propagation
- Evaluate with respect to your strengths and weaknesses
- Continually re-evaluate

Search and Pounce

- Learn when to S&P – rate-driven
- Grab low-hanging fruit – multiplier sweep
- Day 1 and Day 2 can be very different!
- Beware of the Spotted Rate Constrictor
- Contrarian S&P strategy
 - Up or down?

Speed Search-and-Pounce

- Use VFO-A and VFO-B
- Set radio for “one-touch” button activation
- Allows high-speed band coverage
- Great for a one-pass multiplier sweep



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



CQ-ing For Mid-Sized Stations

- Timing
 - Being the first on a band
 - Being the last on a band
- Don't fight with giants – move
 - High in the band is perfectly OK!
 - Position yourself where you can be heard
- Know your rate goal and thresholds
- Good calling technique (and audio) is crucial



Attacking A Pileup as a Caller

- Think “opportunity cost”
- Assess the worth of the target
- Assess the size of the pileup
- Is propagation improving or decaying?
- Contrarian strategies
 - Avoid zero beat
 - Varying timing



Attacking A Pileup as a CQ-er

- Rhythm
- Watch for rate decay
- Maximize each minute
 - Grab loud, fast, easy callers
 - Phonetics not always necessary
- Move listening frequency around on CW
- Minimize back-and-forth

Off-Time Management

- Know the rules!
- Don't get cute – big penalty for mistakes
- Study past logs to find the right times
 - Link to rate goals and thresholds
 - Plan for propagation
- Leave yourself room to maneuver
- Be realistic about your sleep needs & cycles

Different Contest Types

- Domestic versus DX
- Multiplier Types
 - Single/Multi-band, Geographical, “Novelty”
- Single or Multiple Contacts Allowed
 - Sweepstakes vs NAQP
- Different durations
 - Weekend vs One-day vs Sprints

Strategy Summary

- No plan survives contact with the enemy
 - Adjust according to principles
- Maximize benefits defined by contest type
- Set goals to stretch yourself a bit
- Utilize your and your station's strengths
- Keep it fun!

CTU Presents

Towers

Safety
Maintenance
Proper Load Design
By Kurt Andress, K7NV



Tower Safety

Climbing Harness - Your Most Important Asset

Use a **Full Body** harness with fall protection!

- A comfortable harness with all straps padded, all pads removable for washing
- Back D-Ring for connecting Fall Arrest Lanyards
- Chest D-Ring for connecting to tower safety cable
- Harness shown is **DBI-SALA Exofit XP** with Removable Seat



Tower Safety

Fall Arrest (FA) Lanyards The Goal is Fulltime Connection to Tower

- Dual FA lanyards connect to the D-Ring on the back of the harness
- At least 1 Gorilla Hook is connected to the tower or mast at all times
- Lanyard constructed to absorb shock at the end of a fall
- Lanyard shown is the **DBI-SALA Shockwave 2** with 2 1/4" gate aluminum Gorilla Hooks



Tower Safety

Positioning Lanyards

- These lanyards connect to D-Rings on harness waist belt, and wrap around or thru the tower to hold climber near the tower while climbing or working
- Having one long adjustable, and one short lanyard is very useful
- Always use lanyards with locking hooks
- **Kline 5295L 4'-6'** is shown above
- **Tractel 36"** is shown below



Tower Safety Head Protection



- Always wear head protection!**
- Hard Hats or Helmets are required for climbers and ground crews
 - Chin straps prevent loss of helmet
 - 4-point straps are more secure than 2-point straps
 - "Petzel Vertex 2 Vent" Climbers Helmet with adjustable vents is shown below

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Tower Safety Tool Management



- Select lightweight fabric tool pouches that will fit harness waist belt
- Multiple pouches allow efficient sorting & access of tools
- Tool weights are comfortably carried thru the harness to body
- Only carry the minimum tools required, to reduce fatigue, the rest go in the work bucket
- Inexpensive Husky brand tool pouches (available at Home Depot) are shown

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Tower Safety Climbing With Dual Fall Arrest Lanyards



- One lanyard is always connected to tower leg, not bracing
- Attach 1st lanyard overhead
- Climb up to overhead lanyard
- Attach 2nd lanyard overhead
- Remove and stow 1st lanyard
- Climb up to overhead lanyard
- Procedure is reversed when descending
- Positioning lanyard around tower reduces upper body fatigue

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Tower Safety Lanyard Use When Working



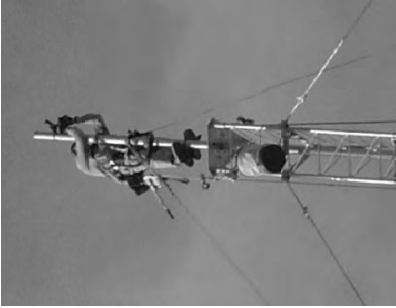
- One **FA Lanyard** is connected overhead to arrest a fall
- A **Positioning Lanyard** is wrapped around or thru the tower to hold climber in position

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Tower Safety

Short Lanyard Use



- **Short Positioning Lanyard** is wrapped around the mast 1 or 2 Times
- It holds climber securely, in close to the structure so he can work with both hands
- The **Fall Arrest Lanyard** is also connected to the mast

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Tower Safety

The Right Climbing Rig Is The Safest One!



- The proper equipment provides climber comfort, safety & peace of mind
- The combination reduces climber fatigue, and allows more efficient work
- Climber fatigue is a dangerous aspect of tower work, it must be minimized

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Tower Safety

Some Basic Rules for Doing Tower Work

- The Climber is in charge, has best view of what is going on
- If more than one climber are on tower, only one of them should direct ground crews and equipment operators
- Ground Crews are responsible for prep and actions when requested by climber & must notify climber of potential problems but not take action until the climber agrees
- Do not climb alone, have someone on-site to call for emergency assistance if required
- Do not climb crank-up towers without blocking all sections
- Be thoughtful and take your time, safety is paramount
- **Tower work is not a race.... it is an Art Form!**

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Tower Maintenance

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Tower Maintenance

For Crankup Towers

- Perform inspections every 6 to 12 months
- Check tightness of tower base bolts
- Inspect cables for fraying and corrosion, lubricate as Req'd
- Make sure cables are wound properly around winch drum
- Check winch lubricant level, look for leaks
- Check winch mounting fastener tightness
- Inspect cable sheaves and bearings for wear, check axle bolt tightness
- Raise and lower tower, checking for smooth movement, and make sure limit switches are operational



Tower Maintenance

For Guyed Towers

- Perform inspections every 6 to 12 months
- Check condition of guy anchors and guy connection hardware and turnbuckle safety cables
- Check guy grips for unraveling, and/or cable clip tightness At ground level
- Check guy tensions with gage and tower plumb & straightness, adjust as necessary
- Climb and check guy connections on tower and guy grips for unraveling



Tower Maintenance

For All Towers

- Perform inspections every 6 to 12 months
- Check tightness of rotator mounting bolts
- Check mast clamp fastener tightness
- Check tightness of all boom to mast mounting hardware
- Lubricate tower top bearing when appropriate
- Check bearing mounting fastener tightness
- Inspect turning loop cables for abrasion and secure attachment to tower and mast/antenna
- Check cable run down tower for secure bundling and/or attachment to tower or tower supports



CTU Presents

Proper Tower Loading



Tower Loading

We Start With A Correctly Engineered Tower Design

**BUYERS GUIDE
STANDARD DESIGNS - 55G
90MPH REV. G [3 SECOND GUST]
70MPH REV. F [FASTEST MILE]**

Rohn Tower Design

- We need to understand what all these numbers mean
- The Allowable Areas are Effective Projected Area (EPA)

Tower Loading

Another Tower Design Example

Structural Analysis: Self-Supporting Triangular Crank-Up Tower

Tower Model: TX472

Design Code: IBC 2006 (TIA-222.4)

Basic Wind Velocity: 90 mph 3 second gust, 76 mph fastest mile

Ice: None

Max Allowable Antenna Wind Load (lbs)	107
Max Allowable Wind Thrust (lbs)	200
Max Allowable Antenna Wind Area (sq. ft.)	6.1
Max Allowable Antenna Wind Area (sq. ft.)	3.5

(All Round Members)
(All Flat Members)

Note: The maximum antenna values shown above include the antenna, router, and any other items placed at the top of the tower. For purposes of these calculations the antenna was placed 1 ft. above the top of the tower.

9. This tower analysis is based the antenna being installed at a height of one foot above the top of the tower. The wind load of the antenna(s) shall not exceed the load shown in these calculations. The Owner of the tower shall assume full liability for verification of the antenna loading.

Tower Loading

Obtaining The Correct Areas to Load Towers

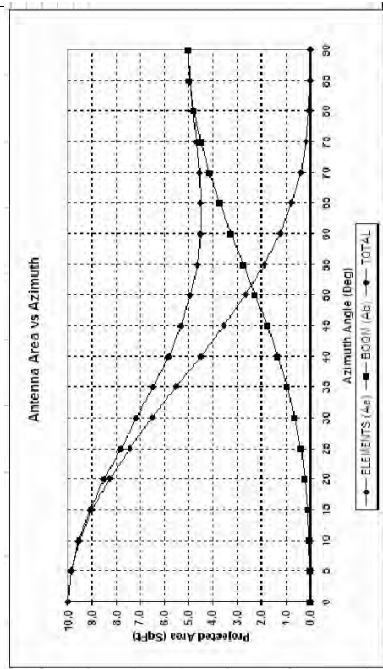
- When we load towers, we put things on them that have areas, when exposed to the wind, apply forces on the tower
- The **Projected Area** of an object is **PA = Length x Width** or the Area of its profile
- The **Effective Projected Area** is **EPA = PA x Cf**
- Cf** is a pseudo **Drag Coefficient** which accounts for the cross-sectional shape and aspect ratio (length/width) of the item
- Cf** is a value that is provided by the Tower Design Specification

Tower Loading

EPA Calculation Examples

- In the Design Spec **TIA-222 Rev F & G**, used for the tower designs just shown, the values for **Cf** are as follows:
Cf = 2.0 for long flat members
Cf = 1.2 for long cylindrical members
- The **EPA** for a 2" Dia (.166 Ft) x 15 Ft mast is:
PA = .166 x 15 = 2.5 SqFt **EPA = 2.5 x 1.2 = 3.0 SqFt**
- For a yagi antenna built with round tubing, the **Max PA** is either **PA(elements)**, or **PA(boom)** whichever is greatest
 If the **Max PA = 10.0 SqFt**
 then **Max EPA = 10.0 x 1.2 = 12.0 SqFt**

Yagi Antenna Projected Areas



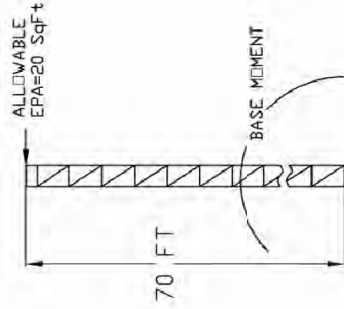
PA(EI's)= 10.0 Sf PA(Boom) = 5.0 Sf PA(Min) = 4.5 Sf @ 65 Deg

Tower Loading

We Start With A Hypothetical Tower Design

- We can put 20 SqFt (Sf) EPA @ 70 Ft
- But, we will do something different
- So, we calculate a **Base Moment** using a wind pressure of 20 Lbs/Sq Ft
20 Psf x 20 Sf = 400 Lbs of Force
400 Lbs x 70 Ft = **28000 Ft-Lbs**
- We can't exceed this value when we put our things on the tower!

This Method is explained in the ARRL Antenna Handbook ,19th – 21st Editions



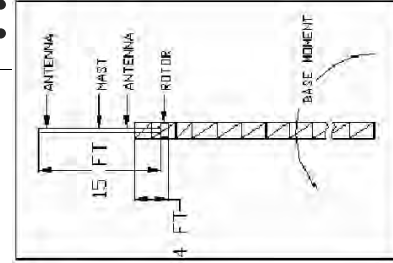
Tower Loading

We Don't Install What The Tower Design Specified

- We usually put a mast & rotor and some antennas up there
- They will all have their own EPA's and be at different heights than what was designed
- We will calculate the **Base Moment** for each thing we put on the tower and make sure the **Total is ≤ 28000 Ft-Lbs**

Let's go put some things on the tower!

And see what happens.....

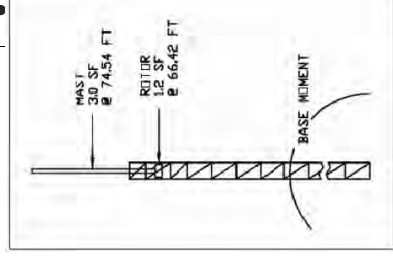


Tower Loading

We Put a Mast & a Rotor in the Tower

- This is what has happened:
20.0 Sf 28000.0 Ft-Lb
-3.0 - 4472.3
-1.2 -1594.1
15.8 Sf 21933.6 Ft-Lb
- But, we really only have 15.67 Sf left of the original 20 Sf, due to the change in Base Moment

Let's put an antenna up there!
And see what happens.....



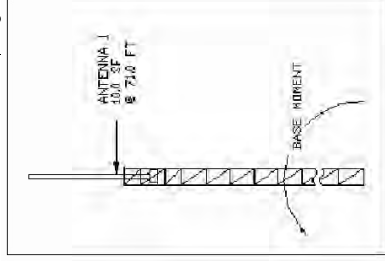
Tower Loading

We Install the First Antenna Above The Tower Top

- Here is where we are now

15.8 Sf	21933.6 Ft-Lb
-10.0	-14200.0
5.8 Sf	7733.6 Ft-Lb
- But, we really only have 5.52 Sf left, due to change in Base Moment
- We'll put a 2nd antenna 1 Ft below the top of mast. The area available for that antenna is:

$$7733.6 \text{ Ft-Lb} / (80.83 \text{ Ft} \times 20 \text{ Psf}) = 4.78 \text{ Sf}$$



Tower Loading

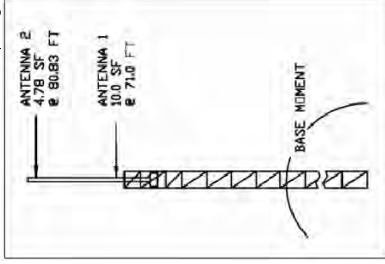
We Install the Second Antenna Above The Tower Top

- Here is where we are now

5.8 Sf	7733.6 Ft-Lb
-4.78	-7733.6
1.02 Sf	0.0 Ft-Lb
- We lost 1.02 Sf of Starting Area because things were higher than 70 Ft

What Was Installed

- Total Area = 18.98 Sf 94.9%
- Antenna Area = 14.78 Sf 73.9 %



Tower Loading

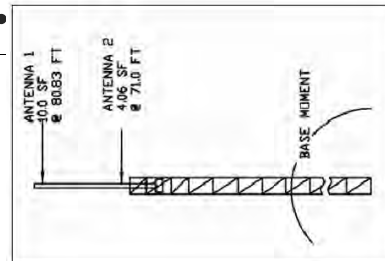
What If We Change The Antenna Placements?

- We Get This

20.0 Sf	28000 Ft-Lb
-18.26	-28000
1.74 Sf	0 Ft-Lb
- We lost 1.74 Sf of Starting Area because the large antenna was higher, making the 2nd one smaller

What Was Installed

- Total Area = 18.26 Sf 91.3%
- Antenna Area = 14.06 Sf 70.3 %



Tower Loading

Conclusions

- We can determine what we can mount on our towers safely, without overloading them
- We need to use the correct EPA Values and Methods to do that
- All installations need to be reviewed by a competent engineer before purchasing & installing the equipment

CTU Presents

2012 VHF Contesting

Joel Harrison, W5ZN



**This is a University so.....
Let's Start with a Test!**



True or False?

- I can't win a VHF contest unless I live in New England or on the east coast.

- K5UR Arkansas June 1987 – 1st Place Single-op
- WB5IGF Arkansas June 1996 – New Single-op Record
- W5ZN Arkansas June 1998 – New Single-op Record
- WA8WZG Ohio January 1999 – New Multi-op Record
- WA8WZG Ohio January 2000 – New Multi-op Record
- N5QGH Texas August 2000 – New Rover Record
- W5ZN Arkansas August 2001 – First Place Single-op
- K2DRH Iowa Multiple VHF Contests – Low Power Category
- W5ZN Arkansas June 2011 – First Place Limited Multiop



True or False?

- You can't make a consistent 2 meter contact greater than ~100 miles.
 - 70% are >100 miles. WSJT >500 miles
- I can't be competitive unless I have 1500 watts and a large antenna array.
 - K2DRH



Station Basics

- **6 Meters**
 - Radio or transverter is fine
 - 50 watts is great, 100 watt is outstanding
 - 3 element antenna at 30 ft is good
- **2 Meters**
 - Radio or transverter is fine
 - >50 watts
 - 13 element beam @ ~50 ft



Station Basics

- **222 – 432 MHz**
 - >50 watts
 - 16 element & 25 element @ ~50 ft
 - Boom length
- **902 MHz & Up**
 - >10 watts
 - Loop yagis & parabolic (dish) antennas

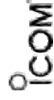
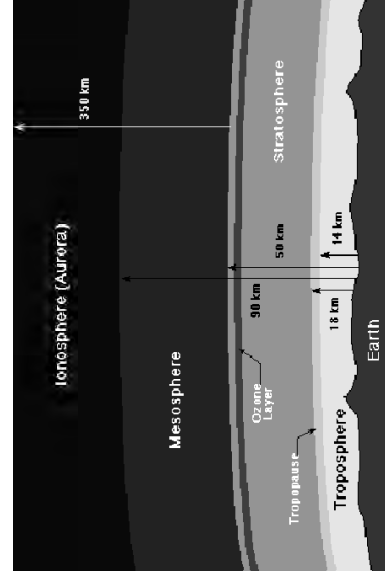


Propagation

- Sporadic E – “Es”
- Tropospheric Ducting – “Tropo”
- Meteor Scatter – “MS”
- Aurora – “Au”
- Earth-Moon-Earth – “EME”

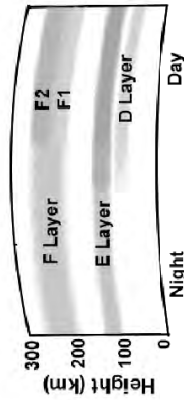


Propagation



Propagation

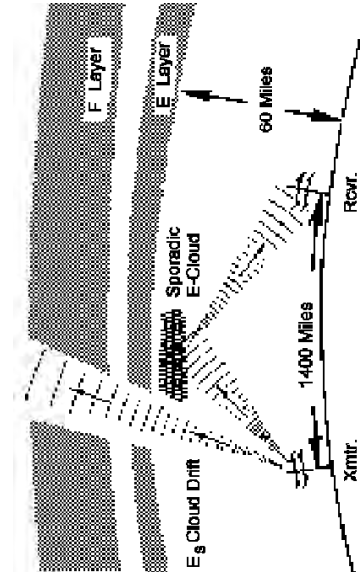
At night the E layer and F layers are present. During the day, a D layer forms and the E and F layers become much stronger. Often during the day the F layer will divide into F1 and F2 layers.



Propagation – Es

- **Sporadic ionization of the E-Layer**
 - Peaks May–July, Possibly generated by lightning
- **50 & 144 MHz, possibly 222 MHz**
 - Single-hop optimum range 900-1300 miles, maximum range 1350-1500 miles
 - Double-hop optimum range 2000-2600 miles, maximum range 2750-3100 miles
- **Peak time during daylight hours & early evening**

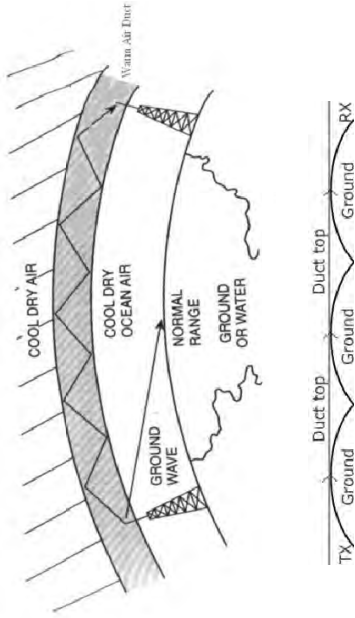
Propagation – Es



Propagation - Tropo

- **Natural atmospheric ducts that form due to temperature inversion and can shuffle VHF and UHF radio waves long distances**
 - All bands
 - Any time, but mostly warm weather months
 - January – WA8WZG / W5ZN Path
 - The famous “California-Hawaii Duct”

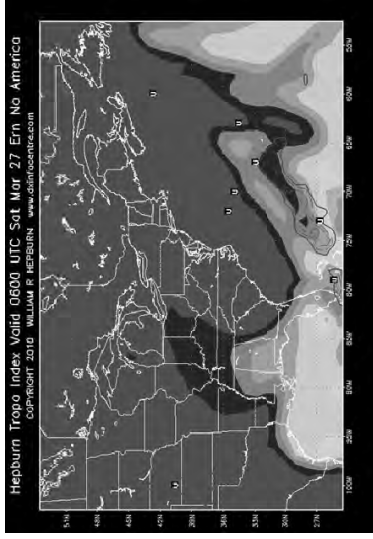
Propagation - Tropo



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Propagation - Tropo



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Propagation - Tropo

APRS VHF Propagation Map



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Propagation - Tropo

APRS VHF Propagation Map



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"Holy Crap!!!!"

- KX9X

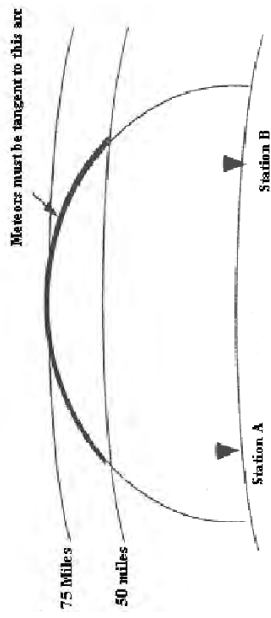
Major tropo opening

Propagation – MS

- Meteor scatter is the reflection of radio waves from the ionized trails from meteors burning up in the upper atmosphere.
- Meteors burn up in the upper atmosphere at a height of around 65 miles.
- This may be used to make QSOs up to about 1400 miles

Propagation – MS

Reflection will occur when the trail is oriented as shown



Propagation – MS

- Excellent for 50 & 144 MHz, possible at 222 MHz
- Very Predictable Paths
 - Best times between midnight & approx 9 AM
 - Peak during “showers” – Anytime with high speed procedures like WSJT

Propagation - Au

- The Aurora Borealis is caused by charged particles from the magnetosphere.



- Bottom edge is typically 60 miles altitude & extends over a very large range

Propagation - Au

- Acts as a reflective curtain to radio waves
- The reflected wave is very distorted and CW signals are very raspy. Report = 5-9-A
- Not predictable. Possible with K index >5
- Both station antennas north toward aurora
- *Very Rare during VHF contests*

Propagation - EME

- Moon is used as a passive reflector
- Available anytime you have a common moon with the station you wish to contact
- Requires special skills, techniques & equipment
- *Used in VHF contests to beef up multipliers*

Noise

- Internet Routers can be a significant noise source at VHF that can populate the band
 - Multiple carriers of relatively constant amplitude but with modulation (Birdies)
 - Broadband trash

Noise

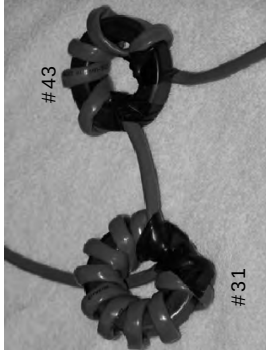
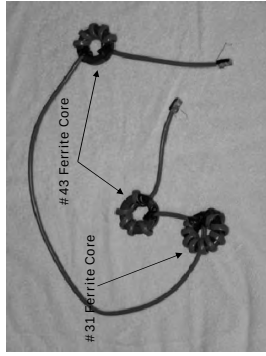
The Grim Reaper of noise
is *not* your friend!!



- Sky Noise
- Atmospheric Noise
- Line Noise
- Other man-made noise

Noise

- Internet Router noise can be significantly reduced or eliminated



Shielded CAT5 cable and connectors can help

Equipment

- Antennas
- Receive Preamplifiers
- Amplifiers
- Radios
- Transverters

Equipment - Antennas

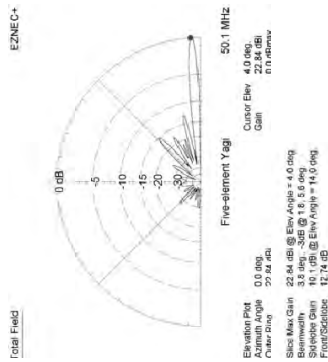
- VHF antennas are small in comparison to HF antennas
- Boom lengths can be large, 30' to 50', but elements length & diameter is much smaller
- Antenna stacking for added gain is much easier at VHF

Equipment - Antennas



7x7x7 50 MHz Array at W5ZN

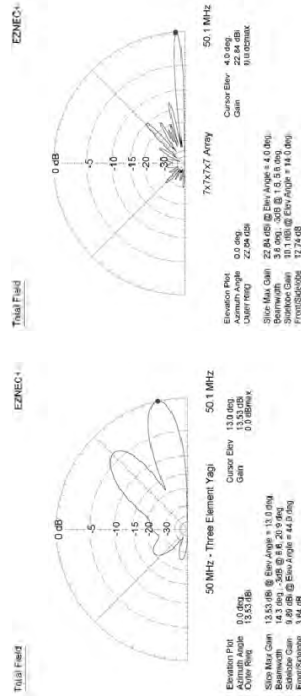
Equipment - Antennas



7x7x7x7 Array of 50 MHz Antennas 30 ft Boom – 102' total height



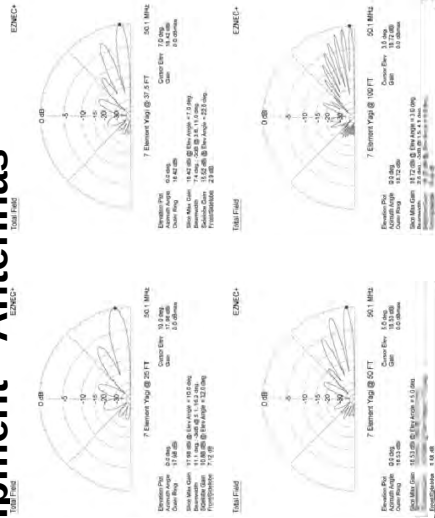
Equipment - Antennas



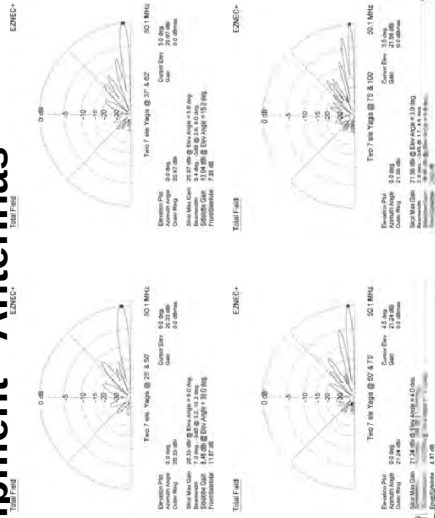
Single 3 element @ 20ft



Equipment - Antennas



Equipment - Antennas



Equipment - Antennas

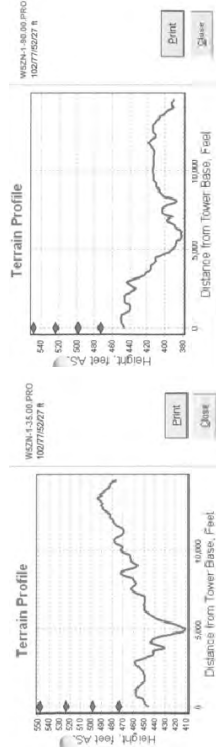
HFTA

- Terrain analysis works for 50 MHz
- Elevation angle statistics may not be accurate
 - Based on IONCAP/VOACAP which are only accurate up to 30 MHz



Equipment - Antennas

HFTA

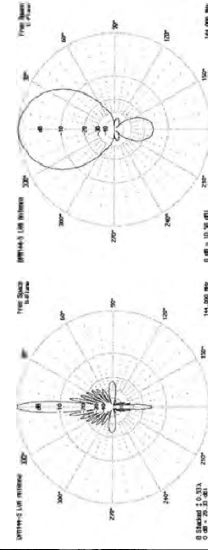


35° Beam Heading – 4 Antennas

90° Beam Heading – 4 Antennas



Equipment - Antennas



H-Plane Pattern

E-Plane Pattern

2 Meter 144LVA

5x5x5x5x5x5x5



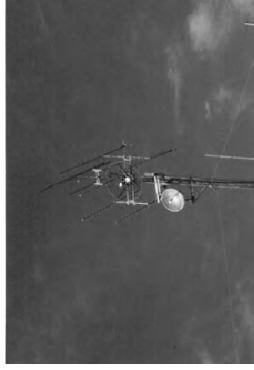
Equipment - Antennas

Major Metropolitan Areas Covered with 144LVA from W5ZN:

- St. Louis
- Indianapolis
- Chicago
- Milwaukee



Equipment - Antennas



Stacking is easy for UHF/Microwave antennas

8 Band Array – 222 MHz thru 10 GHz

Equipment - Receive Preamps

- You do **NOT** need a preamp just because:
 - You “think” you do
 - Your ham buddy that you “think” is an authority on the subject told you so!
- **LEARN ABOUT SYSTEM NOISE FIGURES!**
 - Don't rely on someone else's assumed judgment
 - What will a preamp actually do when you add it to the line?

Equipment - Receive Preamps

- Preamp is not needed unless your receiver has a really bad noise figure
- What is a “bad” noise figure??
 - Total system noise figure depends more on antenna & sky temperature – they will dominate & you can't change them
- At VHF and above, gain is **NOT** as important as a low noise figure

Equipment - Receive Preamps

- Assume $T_{ant} = 3000^{\circ}K$
- If RX nf is 20 dB and you add a preamp with only 12 dB gain but it's nf is 2 dB you will improve your system nf by 10 dB!
- If RX nf is 10 dB and you add a preamp with 25 dB gain but it's nf is 10 dB you will improve by 0 dB and cause other problems.

Equipment - Receive Preamps

RX Noise figure (nf) to Noise Factor (NF)

$$\frac{nf (db)}{10} \text{ Inv Log}$$

Noise Factor to Temp (K) = $NF - 1 \times 290$

Total System Temp = $T_{ANT} + T_{RX}$

Improvement (dB) = $10 \log \frac{T_{temp 1}}{T_{temp 2}}$

Equipment - Receive Preamps

- **50 MHz**
- Not needed unless your radio is really deaf
 - New radios like Flexradio SDR's and K3 do need a preamp!!!!
- **144 MHz**
- Recommended for radios, DEMI xvttrs are FB
- **222 & 432 MHz**
- STRONGLY recommended
- **902 & Above**
- *Mandatory!*

Equipment - Amplifiers

- Before you sink a lot of money into a high power amplifier, learn the real facts about "gain"!
- Only needed if you want to enter the high power category
- There are no "multiband VHF/UHF amplifiers
- Outstanding gain can be achieved by stacking antennas

Equipment - Radios

- The VERY BEST radio for VHF contesting is

?

Equipment - Transverters

- Provide low noise receive front ends
- Provide transmit RF
- Combined with a high end transceiver makes an outstanding system

Rovers



N5AC Rover
Antenna Restricted at Home



W5ZN Rover

Rovers



Six compact Rover Stations

Vehicle not included!

Contest Strategy

- Once you decide what you want to do, you must fully understand what will be required to achieve that objective.
- How many points do I need?
 - How many Q's? How many grids (multipliers) ?
- What equipment do I need.
- When are the prime propagation times to particular areas

Contest Strategy

- **Determine what others are accomplishing**
 - Evaluate top 10 scores for past 10 years
- **Its not all about making the most QSO's**
 - Maximize grid multipliers
- **Get Rovers out to dead grids**

Contest Strategy

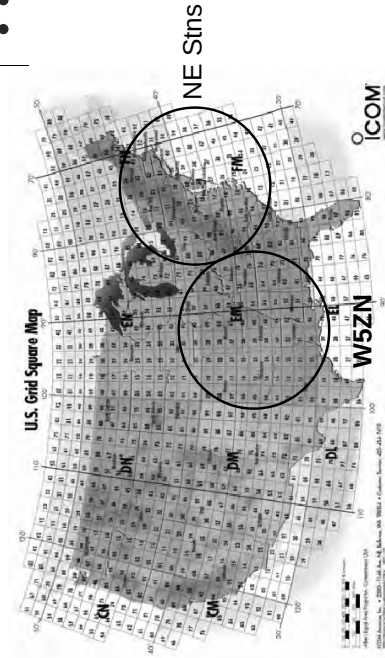
How To Maximize Your Score



Night time Satellite Photo Reveals Population Density

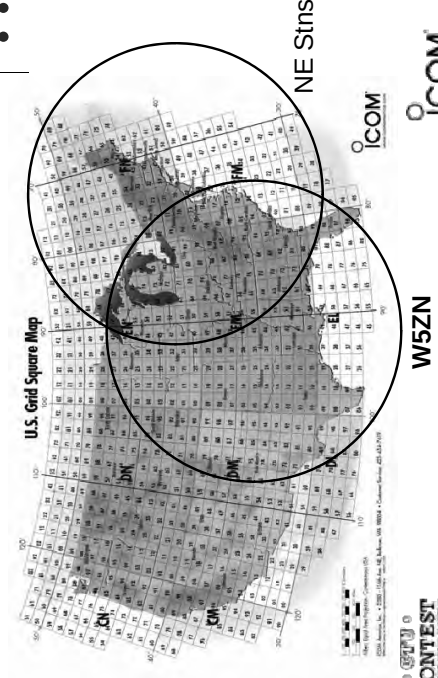
Contest Strategy

Grids Within 500 Mile Radius



Contest Strategy

Sporadic E 1000 mi Radius



Contest Strategy

How Do I Activate Dead Grids?

- **Rovers**
 - Assembled Your Own Rover stations
 - 50 MHz thru 10 GHz, one with 24 GHz
- Recruit & Train Operators
- Analyzed routes
 - Maximize grids, minimize travel time

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Contest Strategy

Planning Rover Routes



W5ZN Rover Routes

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Contest Strategy

Prime Operating Times

- **6 Meters**
 - Daylight hours, early evening
 - ***PRIORITY band when it is open***
- **144 MHz & Up**
 - Anytime
- **Sunday Morning – DO NOT MISS**
- **Midnight to 5 AM – DEAD!!!**
 - Have your rovers positioned
 - Meteors & EME with JT Modes

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Contest Strategy

Prime Operating Times

**NO DEAD TIME
ALLOWED**

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Contest Strategy

How Do I Increase Q Totals?

- **2 Meter FM**
 - FM is NOT a four-letter word
 - The Q's count and can add up nicely
 - Excites the local club and introduces them to contesting
 - They get to be a part of the big winning team!
 - Give a presentation at the local club, most new hams have an HT.



Other Important Points

- **The Same Principles for HF Apply to VHF**
 - Tower & Electrical Safety
 - Station Ergonomics
 - Physical Fitness
 - **ETHICS !!!**
 - A system of moral values and motivation based on right and wrong
 - "The rules are black and white, we make them gray!"
K5ZD, CTU Dayton 2009



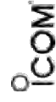
Other Important Points

- **Can't Buy Me Love! – Beatles, 1964**
 - You cannot buy a contest victory
 - Money can buy nice equipment & antennas but it will not teach you how to operate & apply them effectively
 - You **must** study & learn propagation
 - You **must** study & learn antennas
 - You **must** study & learn equipment
 - You **must** study & learn when & where to be at the right time



Where Can I Learn More?

- VHF Conferences & Microwave Update
 - Central States VHF Society (CSVHFS)
 - Northeast Weak Signal Society (NEWS)
 - Southeast VHF Society (SEVHFS)
 - Western States Weak Signal Society (WSWSS)
 - Microwave Update Conference
- Not "traditional" hamfests
- Publish proceedings (compilation of technical papers)



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Contesting from a City Lot

Ira Stoler, K2RD



Contesting From A City Lot

- Definition: City Lot
- Operating Considerations
- Station Design Considerations
- Summary
- References



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Definition: City Lot

- Either literally a “city lot” - or small single tower station.
- QTH with no room for a full sized 80 meter dipole!!
- A few examples ...



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WB2RDO - Brooklyn, NY - 1970



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QTH: WB2RDO – Brooklyn, NY (26'X100')



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Implemented by an exuberant
16 year old

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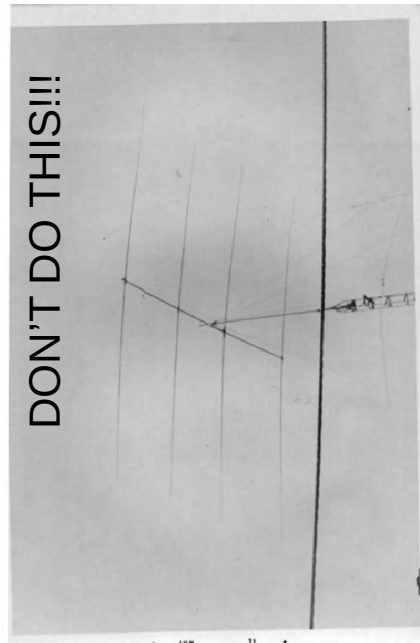
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DON'T DO THIS!!!

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Fairfield, CT



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San Carlos, CA



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QTH: K2RD/6 – 2012 (50'X160' [antennas in 50'X100' area])



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Hexbeam @ 60' 80/40 inverted vee



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Modern-Day Limitations

- You may be limited by Covenants, Conditions & Restrictions (CC&Rs).
- You may be limited by the size of your lot.
- You may be limited by a lack of funds.
- Your options may be limited by spousal aesthetic restrictions (as in "That's ugly,").

Source: NGBV/ARRL – DXing From a City Lot – 2007

Noise!!! More later




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Operating

- Develop a Mission for your Contesting
- Contesting is about having fun.
- Be realistic.
- Don't underestimate what you can do.
- Goals
 - Win the category for:
 - My section
 - My state/call area
 - My country
 - The world
 - Beat my previous score.
 - Beat my friend
 - Contribute to my club's effort
 - Work DX or fill in needed band/modes for awards
 - DX is often easier to work in a contest than in Tuesday afternoon's packet pileup.




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Operating (2)

- Contest and category selection.
 - Expectations
 - Don't try and compete head-to-head with the "big boys"!
 - Geographic location.
 - CQWW 160 from W6 - not so good!
 - All Asia - Lot's better.
 - Don't forget state QSO parties.
 - Even small stations can be highly sought after.
 - Are you rare?
 - State
 - County
 - Prefix

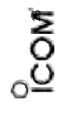



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Operating (3)

- Experiences
 - K2RD/1 SO and M/2
 - Fairfield, CT
 - 2L Triband Quad @ 50' and wires for 40-160
 - K2RD/6 SO and M/S
 - 2L Hexbeam for 20-10 @60' and wires for 40-160
 - Very different contesting emphasis
 - K2RD/1 (Fairfield, CT)
 - DX Contests
 - K2RD/6 (San Francisco Bay Area)
 - Domestic contests
 - CQP
 - SS
 - WPX
 - All Asia etc.

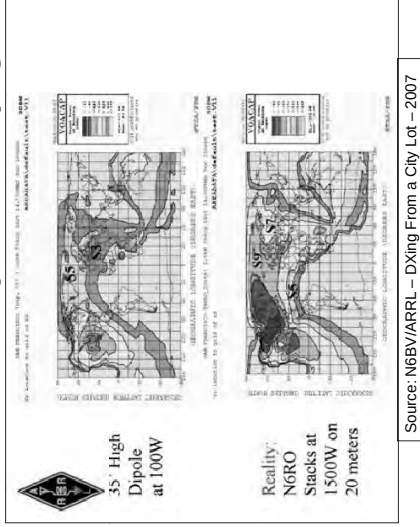



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Operating (4)

- Operating Techniques
 - Running vs. S&P
 - Use the whole band. Going high in the band can be very productive.
 - S&P from the top down early in contests.
 - Don't be an "Alligator" – Know your Rx capability
 - Use your logging program's S&P Memory – Band Map
 - Keep an eye on easing of pileups for multipliers
 - Smart beats loud, often (especially on CW).
 - Assistance (Take every advantage consistent with your goals/category)
 - Packet
 - Skimmer
 - ...
 - Propagation - HAVE a band plan
 - Try to visit a Big Gun / Multi
 - Invaluable learnings
 - i.e. the occasional 8PM 10M opening to HS from West Coast

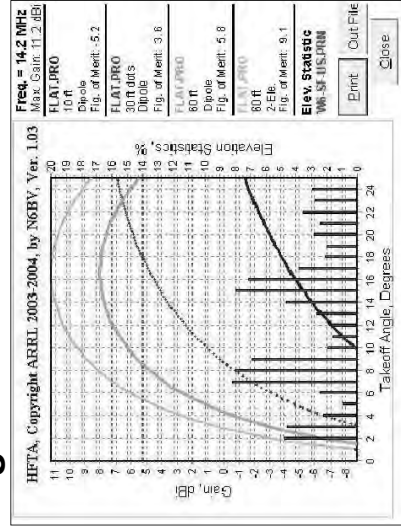
While on the Subject of Propagation



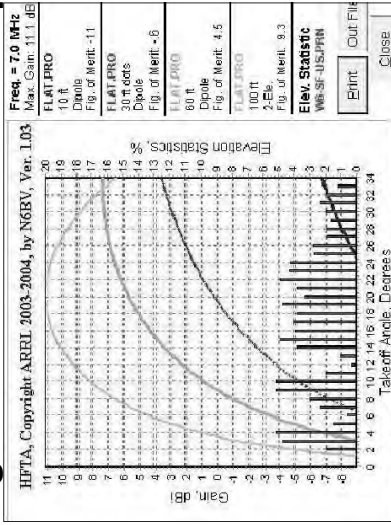
Station Design Considerations

- Antennas
 - Best you can.
 - Height really matters!!! (See HFTA later)
 - Flexibility
 - Triband Quad @ (K2RD/1)
 - Separate feed lines and lots of filtering for M2 / SO2R
 - Multiband beam w/triplexer
 - Verticals
 - Radial strategy
 - Lots of short ones
 - Bend them
 - Personal experience
 - HF-2V (+ 160)
 - F-12 Tornado V12

Height Matters: 20M Example



Height Matters: 40M Example



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Antennas (2)

- Compromise where necessary.
- Example:
 - 88 foot linear loaded 80m inverted vee only a dB or so down from full size
 - Reference: "The K4VX Linear-Loaded Dipole for 7 MHz" (July 2002 QST)
- Try the unconventional.
 - K2RD/6 80/40 inverted vee works on 160?!?!? It shouldn't!
 - Use antenna tuner but BE CAREFUL
- Simple wires hung from trees do work.
 - K2RD/1 was a G5RV in the trees for 2 years of contesting fun
- As many as you can.
- Stick a multiband vertical off in a corner

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Antennas (3)

- Remember receiving, especially on LF bands.
 - Loops, active antennas, etc.
- Know your location. Take advantage.
 - Use HFTA
 - Example: K2RD/6 "magic ground" (see photo)

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"Magic Ground" (K2RD/6)



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Antennas (4)

- Check with your municipality.
 - Zoning
 - Know about it before you start.
 - Must Read: K1VR –Antenna Zoning (see references)
 - Freestanding tower vs. Roof tower
 - Hexbeam on the chimney!!!

Antennas (5)

- Antenna measurement tools are very important in limited space situations.
 - MFJ-259B
 - Antenna scopes
 - A picture is worth a thousand adjustments
 - Antennas in non-optimal configurations are hard to predict.

Station Design Considerations (2)

- Equipment
 - Best radio(s) you can afford
 - Bandscope
 - Find the open band early
 - Automate
 - Antenna switching
 - DVK/Memory Keyer/Computer
 - QRO if you can
 - If you can't do 1500w, 500w will help over 100w.
 - 500w is 7dB better than 100w
 - 1500w is less than 5dB better than 500w

Environmental Challenges (1)

- RX Noise Management
 - Very challenging in city environment.
 - Find and fix what you can.
 - Tricks to hear weak ones.
 - Rx antennas (magnetic loops, active antennas)
 - Noise cancelers (MFJ and other mfgs)
 - Reference: "Identifying, Finding, and Eliminating Power Line and Other Man Made Noise Sources" K2RD/NCCC 2006 (Attached)

K3RFI with 300 MHz Rx



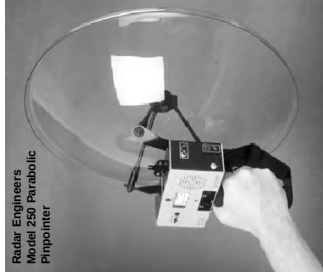
The Radar Engineers Model M330 is a professional grade Mini RFI Locator

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K3RFI with Ultrasound Dish Rx



Source: "Identifying, Finding, and Eliminating Power Line and Other Man Made Noise Sources" K2BDNCCC

<http://www.rfiservices.com/>

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What He Was Looking At



Source: "Identifying, Finding, and Eliminating Power Line and Other Man Made Noise Sources" K2BDNCCC 2002 (Attached)

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Environmental Challenges (2)

- Neighbor Relations
 - Don't surprise neighbors on contest weekend.
 - Let the neighbors get used (visually) to your antenna(s) before operating.
 - Sell Ham Radio in advance
 - Know when the Super Bowl like events are happening
 - Be helpful on RFI
 - Why did my Ham-M jam???

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Station Design Considerations (3)

- General Station Design Still Applies
 - Ergonomics supports "Time In Chair"
 - "TIC" drives score
- Increasingly attractive alternative:
 - Think REMOTE!

Summary and Conclusions

- Lot's can be done on small lot with limited antennas.
- Good engineering really works.
- You have to be able to hear them to work them.
- Persistence
- So ...
 - Pick your niche (goals and strategy)
 - Focus outside (antennas and noise elimination)
- Have fun!

Reference Material

- "Dxing From a City Lot" 2007 Pacificon Presentation
 - N6BV/ARRL (attached)
- "The K4VX Linear-Loaded Dipole for 7 MHz"
 - July 2002 QST - <http://www.af2cw.com/license/dipole.pdf>
- "Antenna Zoning for the Radio Amateur"
 - By Fred Hopengarten, K1VR
 - www.antennazoning.com
- "Identifying, Finding, and Eliminating Power Line and Other Man Made Noise Sources"
 - K2RD/NCCC 2006 (attached)
- "Anybody Can Do A Multi-2! –Simple antennas – closely packed!"
 - K2RD/YCCC 2000 (attached)
- <http://www.arrl.org/power-line-noise-mitigation-handbook-for-naval-and-other-receiving-sites>

Questions?

CTU Presents

Antennas for Contesting How They Do What They Do

Frank Donovan
W3LPL



6 dB of “Free” Ground Gain on 80 through 10 Meters

- Horizontal polarization produces 6 dB of “free” ground gain on 80-10 meters even over relatively poor soil
 - unless you cannot install your antenna at the needed height
- What if you can't install a horizontal antenna at the needed height?
 - Four square verticals produce useful gain and significantly reduced radial system loss because power is distributed among four verticals and their associated radials
 - Use a properly designed and installed four-square vertical array
 - at least 32-64 shallow buried $\frac{1}{4}$ wavelength radials on each vertical



Competitive Antennas for Domestic Contests

- A horizontal dipole or inverted-V dipole for 80 meters
 - 35 - 70 feet high produces competitive results at 500 miles or more
 - 100 feet or higher produces competitive results at 1000 miles or more
 - A dipole 70 to 100 feet high is a very competitive single antenna
- A horizontal dipole and a small 2 element Yagi for 40 meters
 - 25 - 50 feet high produces competitive results at 500 miles or more
 - 70 - 100 feet high produces competitive results at 1000 miles or more
 - A good choice is a dipole at 50 feet and a small Yagi at 100 feet
- A small triband Yagi for 20, 15 and 10 meters
 - A small Yagi 50 feet high produces competitive results at 1500 miles
 - A small Yagi 80-100 feet high is excellent for 1500 miles or more
 - two stacked triband Yagis at 40 and 80 ft produces excellent results



Competitive Antennas for 160 Meter DX

- A full size vertical or inverted-L is almost always more effective for DX than a horizontally polarized antenna (>99%)
- Major factors affecting vertical antenna performance:
 - nearby towers over 80 feet high will severely degrade 160 meter vertical antenna performance
 - at least 32-64 shallow buried 125 foot radials makes the difference between an excellent antenna and a disappointing antenna
- Very effective low noise directive receiving antennas
 - Beverages, loops, and arrays of short verticals



Vertically Polarized Antennas for 160 Meters

- Horizontal polarization is rarely effective on 160 meters
- If possible, use a full size quarter wave vertical
 - install at least 120 feet from all tall towers (over 80 feet tall)
 - use much more than 120 feet of spacing for best performance
- An Inverted-L vertical can also be very effective
 - with as little as 40 feet vertical (but more is better...)
 - can be supported from a tower or trees
- Use at least 32-64 shallow buried 125 foot radials
- What if buried radials are impossible?
 - use at least two (preferably four or more) elevated 125 foot radials
 - or the K2AV Folded Counterpoise Antenna (search on Google)



Competitive Antennas for 80 Meter DX

- A horizontal dipole at least 70 feet high
- Or a full size vertical or inverted-L
 - only if you install at least 32-64 shallow buried 65 foot radials
- Major factors affecting vertical antenna performance:
 - nearby towers over 40 feet high will degrade 80 meter vertical performance
 - at least 32-64 shallow buried 65 foot radials makes the difference between an excellent antenna and a disappointing antenna
- Very effective low noise directive receiving antennas
 - Beverages, loops, and arrays of short verticals



Vertically Polarized Antennas for 80 Meters

- An 80 meter four square vertical array is very competitive with high horizontal arrays and is an excellent receiving antenna
- Four square verticals produce gain and significantly less loss in the radial system because power is distributed among four verticals and their associated radials
- install at least 140 feet from all other towers
 - more spacing from other towers will significantly improve performance
- install at least 32-64 slightly buried 65 foot radials on each vertical



Competitive Antennas for 40 Meter DX

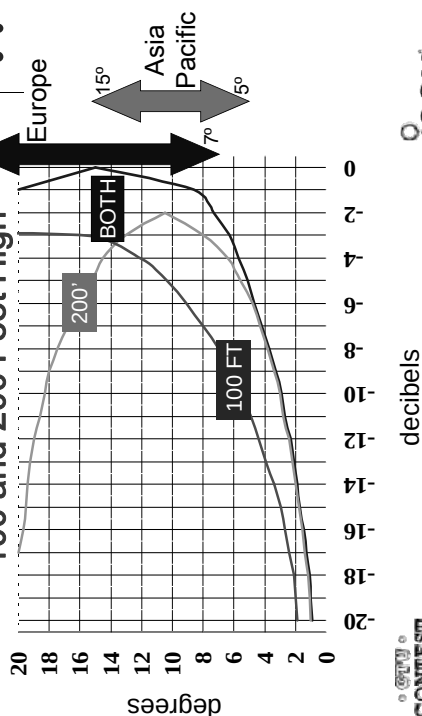
- Horizontal antennas are always the best choice
 - at least 70 to 100 feet high
 - otherwise use a four-square vertical array with extensive radials
- 2 element Yagi 70 to 100 ft high
 - very significant improvement over a horizontal dipole
 - a Cushcraft XM-240 is very cost effective
- Full size 3 element Yagi 100 to 140 feet high
 - will compete at the highest levels
 - but don't underestimate the high cost and complexity of the effort
- Very effective low noise directive receiving antennas
 - Beverages, loops, and arrays of short verticals



Four Square Verticals for 40-10 Meters

- A 40 meter four-square vertical array is a good alternative when a horizontal antenna isn't possible
 - if a horizontal antenna can't be installed at least 50 feet high
 - a four-square vertical is a good antenna for a second radio
 - a four-square vertical is also an excellent receiving antenna
- A 20, 15 or 10 meter four-square vertical is a useful alternative when a horizontal antenna isn't possible
 - if a horizontal antenna can't be installed at least 30 feet high
 - a four-square vertical is a good antenna for a second radio
 - a four-square vertical is also an excellent receiving antenna

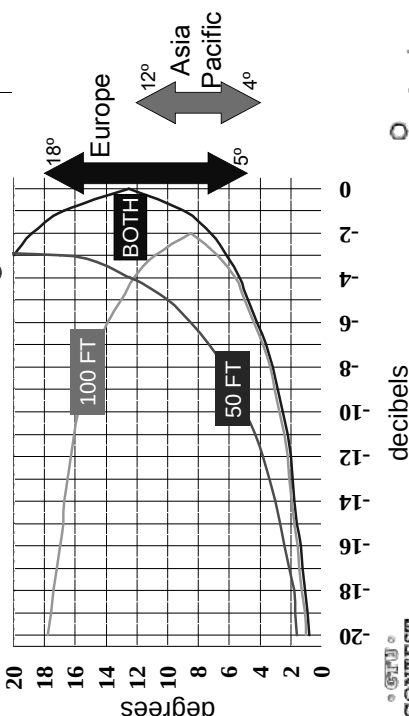
Stacked 3 Element 40 Meter Yagis 48 Foot Booms 100 and 200 Feet High



Competitive Antennas for 20 Meter DX

- Horizontal antennas are always the best choice
 - if you can install your antenna at 35 feet or higher
 - otherwise use a four-square vertical array with extensive radials
- Small triband Yagi or a small 2 element Yagi or quad
 - a small Yagi 50 to 70 feet high will produce good results
- Full size triband Yagi or 3 element monoband Yagi
 - a full sized tribander or monoband Yagi 60 to 90 feet high will produce competitive results
- Stacked monoband Yagis or large triband Yagis
 - stacked full sized tribanders or Yagis on a 100-120 foot tower (or 150 to 200 ft for three Yagis) will compete at the highest levels
 - stack switching (a "stackmatch") provides high payoff at low cost

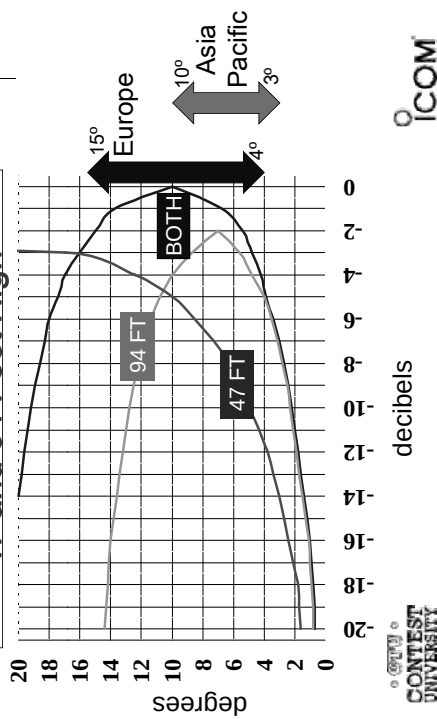
Stacked 5 Element 20 Meter Yagis 48 Foot Booms 50 and 100 Feet High



Competitive Antennas for 15 Meter DX

- Horizontal antennas are always the best choice
 - if you can install your antenna at 25 feet or higher
 - otherwise use a four-square vertical array with extensive radials
- Small triband Yagi or a small 2 element Yagi or quad
 - a small Yagi 35 to 50 feet high will produce good results
- Full size triband Yagi or 3 element monoband Yagi
 - a full sized tribander or monoband Yagi at 50 to 70 feet high will produce competitive results
- Stacked monoband Yagis or large triband Yagis
 - stacked full sized tribanders or Yagis on a 60 to 90 foot tower (or 120 to 140 ft for three Yagis) will compete at the highest levels
 - stack switching (a "stackmatch") provides high payoff at low cost

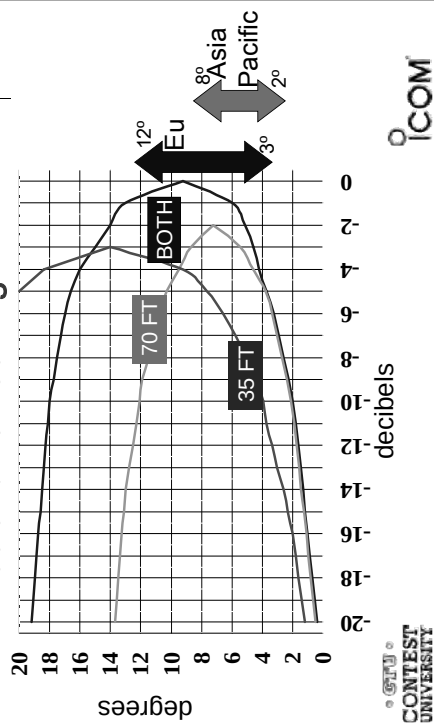
Stacked 6 Element 15 Meter Yagis 48 Foot Booms 47 and 94 Feet High



Competitive Antennas for 15 Meter DX

- Horizontal antennas are always the best choice
 - if you can install your antenna at 20 feet or higher
 - otherwise use a four-square vertical array with extensive radials
- Small triband Yagi or a small 2 element Yagi or quad
 - a small Yagi 30 to 50 feet high will produce good results
- Full size triband Yagi or 3 element monoband Yagi
 - a full sized tribander or monoband Yagi at 40 to 70 feet high will produce competitive results
- Stacked monoband Yagis or large triband Yagis
 - Stacked full sized tribanders or Yagis on a 50 to 70 foot tower (or 80 to 120 ft with three Yagis) will compete at the highest levels
 - stack switching (a "stackmatch") provides high payoff at low cost

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





Low Loss Coaxial Cables for Competitive Contesters

- Reduce the loss in your coaxial cables to improve the competitiveness and reliability of your station
- Andrew Heliax or CATV hardline reduces the loss and improves the reliability of cables longer than 100 feet
 - RG-213 and other flexible jacket coaxial cables are very susceptible to physical damage and water intrusion
 - even a pin hole produced by a lightning strike can quickly result in a high loss cable
 - protection of cables and connectors physical damage and water intrusion is critical
- Test and inspect your low loss cables and connectors before major competitive contests

CTU Presents

Contesting from Outside of the
USA

Ramón Santoyo V., XE1KK
xe1kk@xe1kk.net



The goal of this presentation



The goal of this presentation

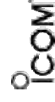
To invite you to operate a contest
from outside of the USA*

* Or your own country



The goal of this presentation

**WARNING: Contesting from
other countries is addictive**



Index

- A few reasons to contest from abroad
- Pre contest considerations
- Considerations during the contest
- Post contest considerations



1. A few reasons to contest from abroad



1.1 The other side of the pileup

- Usually you will work endless pileups
- Even rare DX stations will call you
- You will work your friends back home
- 100 watts in DX sounds like 1,000 at home



1.2 In contest is nice to be rare!



#



Rare for DXers is not the same for Contesters



1.2 In contest is nice to be rare!



≠



Rare for DXers is not the same for Contesters

And that is very good news!



1.3 Set a new contest record

- Rare and exotic entities generate big pileups and winning scores
- There are many records to be broken or to be established
- Research is the way to define your destination



1.4 It can be as simple as you want

- You don't need to take tons of equipment
- You don't need to make 10,000 QSOs
- You need to find where you will make the biggest impact
- And then enjoy the pileups and have fun!

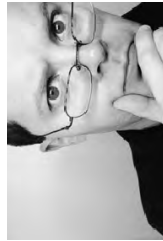


2. Pre contest considerations



2.1 Where shall I go?

Previous records, budget, entry visas, licensing, place to operate, SO or MO?, shall I lead?, should I join a local team?, can I take my radio?



4 webpages to help you decide

- CQWW.com
- Worldwide Information on Licensing for Radio Amateurs by OH2MCN
- DX Holiday
- FareCompare Map

CQWW.com



Current CQWW Phone records waiting for you

Continent	Band	Call	QSO's	Year
NA	20 HP	YN1LH	93	1964
SA	15 HP	CP5FP	339	1970
EU	10 HP	GD3AIM	296	1969
AF	20 HP	A22GV	203	1987
AS	AB LP	XX9BB	120	2008
OC	20 LP	VR2DS (3D2)	387	1963

Current CQWW CW records waiting for you

Continent	Band	Call	QSO's	Year
NA	40 HP	OX3CS	17	1974
SA	80 HP	PZ1AH	256	1970
EU	10 QRP	TF4MA	24	2001
AF	10 Assisted	EA8OM	7	2009
AS	20 HP	VS9OC (A4)	145	1965
OC	10 LP	KH2EI	72	1991

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CQWW AB LP records desperately waiting for you*

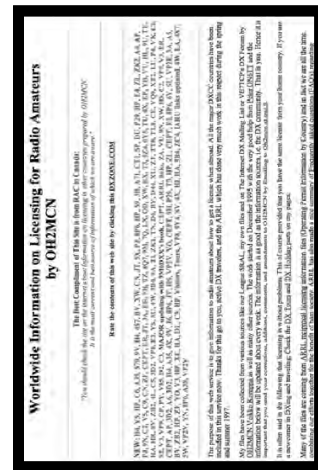
Phone	CW
Guatemala	Trinidad & Tobago
Saint Barthelemy	Guyana
Galapagos	Cape Verde
Suriname	Georgia

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* Empty records

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WILRA by OH2MNC

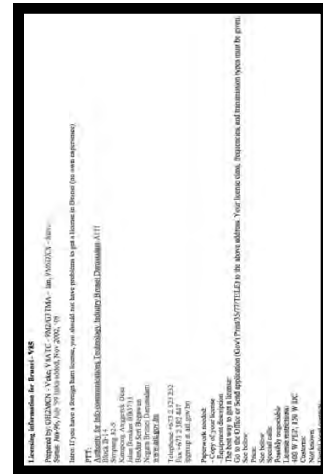


<http://www.qsl.net/oh2mncn/license.htm>

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<http://www.qsl.net/oh2mncn/license.htm>

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2.2 The team



“The very best part of this hobby is the PEOPLE you meet and the long time close friendships that happen as a result of the common interest in Amateur Radio.”

Tim Duffy, K3LR

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Questions about the team



- Do I like the team?
- Does the team likes me?
- Can we communicate?
- Do I like their way of contesting?

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In SO you still have a “team”*

	Who	Helped with
	Paul, A35RK	License, hotel, flight and local information
	Héctor, XE2K	Portable antenna advice
	Joaquín, XE1R	Pre contest pilot station, news bulletins and moral support
	Bernie, W3UR	News bulletin

* They may not be aware that they are part of the “team”

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CQWW Phone 2009

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2.3 The goal



Do we all agree on this contest goal?

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2.4 The leader



Like it or not the boss...
is the boss!

2.5 My role



Do I understand what is my role?

2.6 The license

- Be 100% sure to have a legal license in hand
- Your country rules doesn't apply elsewhere
- Illegal operations severely damage contesting

Dura lex, sed lex!

2.6 The license

- Read the license fine print
- US, CEPT & IARP licenses have exceptions
- When in doubt contact the local IARU society

The law is harsh, but is the law!

2.7 Join the local IARU society



Make your operation theirs

The International Amateur Radio Union

Since 1925, the Federation of National Amateur Radio Societies
Representing the interests of Two-Way Amateur Radio Communication



Head Office: 10, rue de la Paix - 1000 Brussels - Belgium
Tel: +32 (0) 2 512 11 11 - Fax: +32 (0) 2 512 11 12

Member Societies

ALBANIA Albanian Amateur Radio Association (AARA)

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Chairman: Dajana Osmi, ZAI2

Secretary: Nilda Doda, ZAI2

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Last updated: 14 Jan 2011

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Chairman: Mohamed Aoudia, 7X2MA

President: Mohamed Aoudia, 7X2MA

Secretary: Aïf Benagha, 7X2BO

IARU liaison: Secretary

Last updated: 21 Aug 2006

2.8 Invite the locals



Either to be part of the team or just for a visit

Be inclusive!

2.9 Take presents for the locals



2.10 Tell the world about it



Make sure the world will look for you!

3. Considerations during the contest

3.1 Safety first!

XE2D at 4C2X, ARRL VHF QSO Party 2007



Beware of the elements!

3.2 Be a nice contest partner

- Look, listen and learn
- Ask questions and don't lecture
- Propose, don't impose
- Be patient and always smile

3.3 When in Kuwait do as the 9Ks do



Eat the local food, learn a few
words in their language

...and when in Argentina do as the LUs do



LU4DXL40E - LUB6ADXAY8A - LU5DX - LUJFRRLTIF - LUJFAMIL02F - LUJAE

Participate in the pre/post
contest activities

3.4 Make your best effort



And have a very good time!

4. Post contest considerations

4.1 Upload your log



Consider you were a rare DX for many and they need your QSL card!



4.2 Tell your story



Make a presentation,
write an article

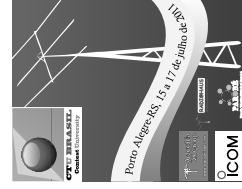


4.3 Elmer interested amateurs

- Provide them information and support
- Encourage him/her to contact DX friends
- Or invite them to your next contest venture



4.4 Promote and support contesting!



...because this way you are promoting
amateur radio and international friendship





4.5 Plan your next contest

- Analyze your contest score
- Add what you learned to the equation



4.5 Plan your next contest

- Analyze your contest score
- Add what you learned to the equation
- ... and start the process all over again



CTU 2012 Presents

Setting Up for RTTY Contesting
Ed Muns, W0YK



2/58

The Cynics Say ...

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



RTTY Contesting Setup

- What is RTTY?
- How do I set it up?
- Radios
- Loggers: N1MM, WriteLog, Win-Test
- Part 2: “Operating a RTTY Contest”

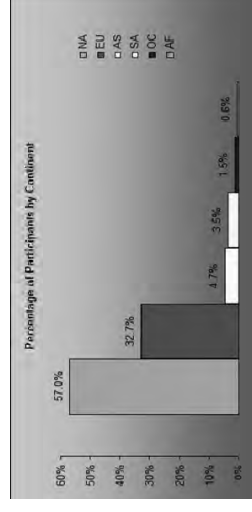


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RTTY Contesters

2010 survey



- 825 participants; 13 questions
- conducted in February 2010



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What is RTTY?

compared to CW

- | | |
|---|---|
| CW | RTTY |
| <ul style="list-style-type: none"> • One RF carrier • Local audio pitch • On or off <ul style="list-style-type: none"> • key up is data 0 • key down is data 1 • Morse code <ul style="list-style-type: none"> • typically 25-40 wpm | <ul style="list-style-type: none"> • Two RF carriers 170 Hz apart (<i>Space & Mark; Shift</i>) • Local audio tones • One on and other off <ul style="list-style-type: none"> • Space is data 0 • Mark is data 1 • Baudot code <ul style="list-style-type: none"> • constant 60 wpm (or 45.45 Baud) |

What is RTTY?

Space & Mark

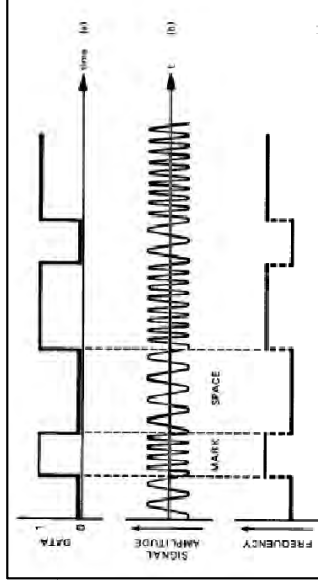
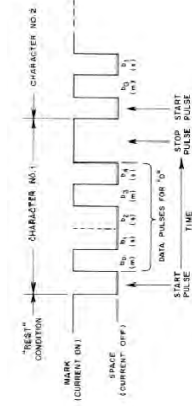


Figure 1. FSK modulation. Binary data (a) frequency modulates the carrier to produce the FSK signal (b) which has the frequency characteristics (c).

What is RTTY?

45.45 Baud = 60 WPM



- Asynchronous character stream
 - 1 bit Start pulse (Space)
 - 5 bits of data (character code)
 - 1, 1.5 or 2 bits Stop pulse (Mark)

What is RTTY?

code history

- ~~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 (1967)
 - 7-bit ITA5 code

Code	Character
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

What is RTTY?

Figures Shift

- The *LTRS* and *FIGS* characters do not print
 - The code for the characters "Q" and "I" 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* **KI** *FIGS* **7** *LTRS* **GUO** space *DE* space **K** *FIGS* **4** *LTRS* **GMH**
- Why do we care to understand this?
 - If a burst of static garbles the *LTRS* or *FIGS* character, then what prints after that is from the wrong set until the next *LTRS* or *FIGS* character appears

What is RTTY?

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
 - Explained in "Operating an RTTY Contest"

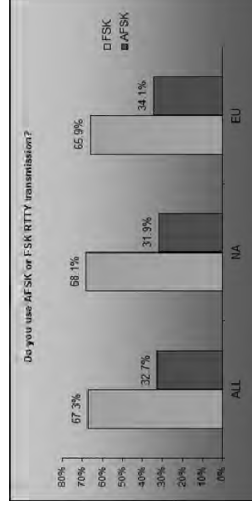
What is RTTY?

audio tones

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

AFSK vs. FSK

2010 survey



- AFSK has been overtaken by FSK since it first appeared in radios, circa 1990

What is RTTY?

AFSK vs. FSK

Two methods of transmission:

- AFSK (Audio Frequency Shift Keying)
- inputs audio tones to SSB transmitter via:
 - Mic input, or
 - Auxiliary audio input. e.g., Line In
- FSK (Frequency Shift Keying)
- 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

- Indirect (tones → Mic input)
- Any SSB radio (esp. legacy)
- SSB (wide) filtering
- Dial = sup. car. frequency
- VOX
- Audio cable (same as PSK31)
- Must use high tones
- NET (automatic TX tone control)

- Easier hook-up; NET

FSK

- Direct (like CW keying)
- "Modern" radios
- RTTY (narrow) filtering
- Dial = Mark frequency
- PTT
- COM FSK keying cable
- Can use low tones
- No audio level adjust
- No disabling speech proc.
- No erroneous sound keying
- Less pitfalls



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What is RTTY?

summary

- Uses 5-bit Baudot ... er ... 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 Shift
 - optional UnShift-On-Space (UOS)
- AFSK vs. FSK transmission (receiving is the same)
 - Radio dial frequency differences
 - 100% duty cycle!



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How Do I Set it Up?

overview

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

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

How Do I Set it Up?

RTTY decoder/encoder

- RTTY ***receive*** decoder converts printed characters from the two RTTY frequencies
- CW and SSB receive audio is converted to typed characters by our ears/brain/hands
- (CW decoders are also available, similar to RTTY decoders, but seldom used)
- RTTY ***transmit*** encoder converts typed characters (or messages) into the two RTTY frequencies
- Transmitted CW is converted from text by our brain/hand with the aid of a key and/or keyer
- Transmitted SSB is converted from text by our brain/mouth via a microphone

(CW software keyers and SSB DVKs are also used, similar to RTTY encoders)

How Do I Set it Up?

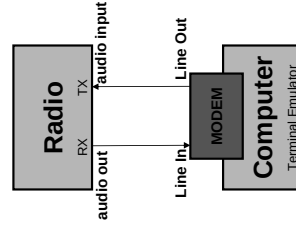
decoder/encoder terminology

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

How Do I Set it Up?

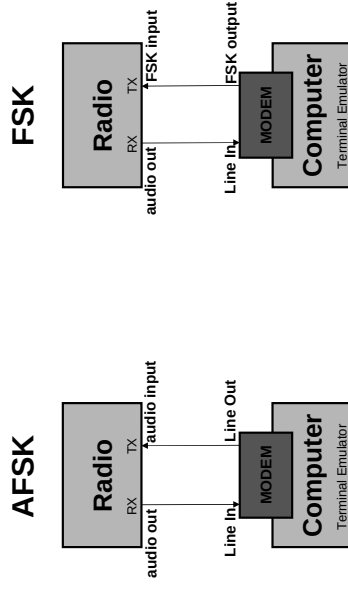
hardware MODEM

AFSK



How Do I Set It Up?

hardware MODEM



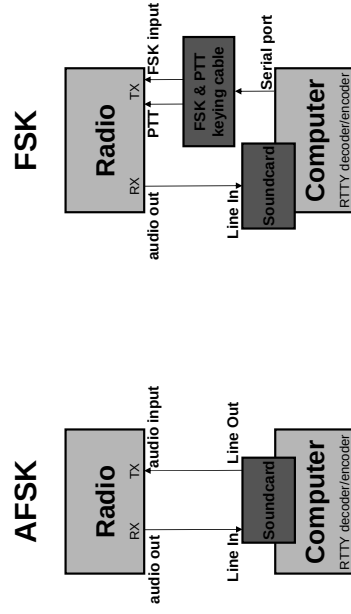
How Do I Set It Up?

hardware MODEM



How Do I Set It Up?

software application & soundcard



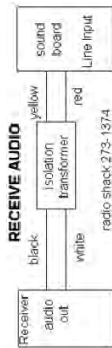
How Do I Set It Up?

audio isolation

- Avoid ground loops & hum, especially on PC
- 1:1 audio isolation on
 - RX output
 - TX Mic input (AFSK only)
- Alternatives:
 - R/S 273-1374 transformer → homebrew cable
 - W2IHY iBox
 - Commercial RTTY interfaces
 - K3

How Do I Set It Up?

homebrew audio isolation



radio shack 273-1374



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How Do I Set It Up?

W2IHY iBox audio isolation



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How Do I Set It Up?

commercial interface audio isolation



Rascal



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How Do I Set It Up?

radio audio isolation

K3 audio isolation IN - LINE - OUT



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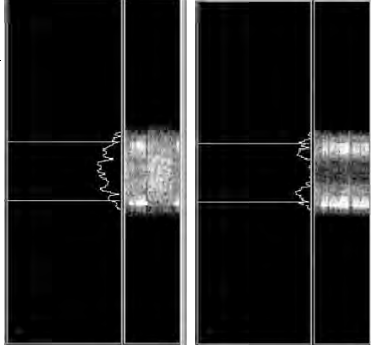
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How Do I Set It Up?

radio IF filtering

- PC Audio isolation
- Transformer
- Commercial interface
- Some radios (K3)
- Narrow filters
- 250-300 Hz
 - Roofing & DSP
- Tone filters
 - Icom Twin Peak Filter
 - K3 Dual-Tone Filter
- Audio filtering
- JPS NIR-10/12
- Timewave DSP-599zx
- Modern DSP rigs



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How Do I Set It Up

AF filtering

- PC Audio isolation
- Transformer
- Commercial interface
- Some radios (K3)
- Narrow filters
- 250-300 Hz
 - Roofing & DSP
- Tone filters
 - Icom Twin Peak Filter
 - K3 Dual-Tone Filter
- Audio filtering
- JPS NIR-10/12
- Timewave DSP-599zx
- Modern DSP rigs



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How Do I Set It Up?

soundcard levels

- Adjust levels in Windows Volume Control
(or, in *MMTTY Options/Soundcard ...*)
- Use isolation transformer
- Avoid over-drive
- Mute other inputs and outputs
- RX audio goes to LINE IN (or, MIC w/pad)
- *Options/Soundcard input level*
- TX AFSK audio (mic) comes from LINE OUT
- *Options/Soundcard output level*
- Turn off radio compression (speech proc.)

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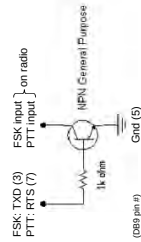
How Do I Set It Up?

PTT vs. VOX

- AFSK uses VOX (or PTT); FSK uses PTT
- PTT by:
 - Computer control via Serial COM port
 - Footswitch (*not recommended*)
- FSK to use semi-break-in in the future?

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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? commercial interfaces

RASCAL



RIGblasters



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How Do I Set It Up? commercial interfaces

Vendor	Model	Price	PC int/c	PTT	Soundcard	Level ctrl	FSK	CW	Winkey	Voicer	Radio int/c
Generic (with K3)	(3) 3.5mm to audio cables	\$ 40	-	-	-	-	-	-	-	-	-
Bucom	Bucom	\$ 100	-	-	-	-	-	-	-	-	-
Bucom	Rascal GLX	\$ 75	Serial	✓	-	-	-	-	-	-	-
Tigertronics	SL-1+	\$ 60	auto	✓	-	-	-	-	-	-	-
Tigertronics	USB	\$ 110	USB	✓	-	-	-	-	-	-	-
MFJ	1275B	\$ 95	Serial	✓	-	-	-	-	-	-	-
MFJ	1275	\$ 140	Serial	✓	-	-	-	-	-	-	-
Mountain Radio	RIGblaster Nomic	\$ 60	Serial/USB	✓	-	-	-	-	-	-	some
Mountain Radio	RIGblaster Plug & Play	\$ 120	USB	✓	-	-	-	-	-	-	some
Mountain Radio	RIGblaster Plus II	\$ 160	USB	✓	-	-	✓ or CW / or FSK	-	-	-	some
Mountain Radio	RIGblaster Pro	\$ 200	Serial/USB	✓	-	-	✓ or CW / or FSK	-	-	-	some
Mountain Radio	RIGblaster Pro	\$ 300	Serial/USB	✓	-	-	✓ or CW / or FSK	-	-	-	some
Navigator	Navigator	\$ 417	USB	✓	-	-	✓	-	-	-	✓

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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?

microHAM interfaces

Model	Price	PC In/Le	PTT	Soundcard	Level ctrl	FSK	CW	WinKey	Voice	Radio In/Le	902R
USB Interface II	\$ 179	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓
USB Interface III	\$ 225	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓
Digi KEYER II	\$ 389	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓
microKEYER II	\$ 479	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓
micro2R	\$ 369	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓
MK2R	\$ 899	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓
MK2R+	\$ 999	USB	✓	✓	✓	✓	✓	✓	✓	✓	✓



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How Do I Set It Up?

summary - receive

1. Use appropriate receiver IF and AF filtering.
2. Receiver Audio Out (via isolation) to ...
 - MODEM Audio In:
 - Set level so band noise is just above threshold
 - OR
 - MMTTY via Soundcard Line In (or Mic In with pad):
 - Enable soundcard Line In (or Mic) input, disable/mute other inputs
 - Increase level so band noise is just above threshold



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How Do I Set It Up?

summary - AFSK

1. Turn off speech processor in radio; enable VOX
2. Connect radio's Line In (Mic In with pad) via isolation to:
 - MODEM Audio Out
 - Set radio Mic level to just reach peak power output
 - OR
 - Soundcard Line Out
 - Enable soundcard WAV output, disable/mute other outputs
 - Increase WAV level and/or radio Mic level to just reach peak power output



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



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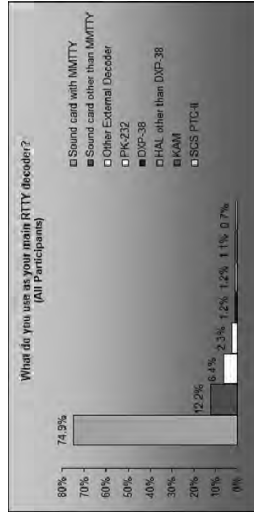


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Decoders

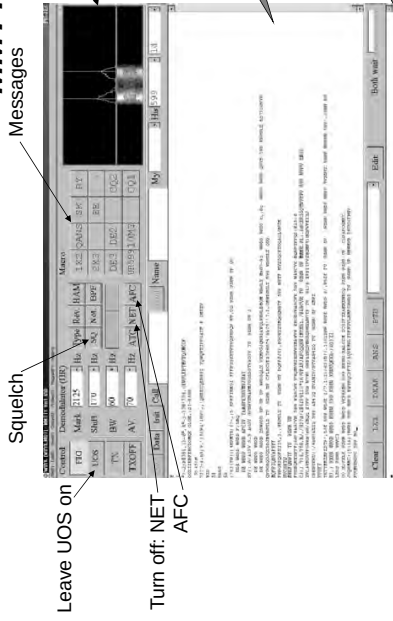
2010 survey



- 87% use soundcard decoding/encoding
- 86% of soundcard users run MMTTY

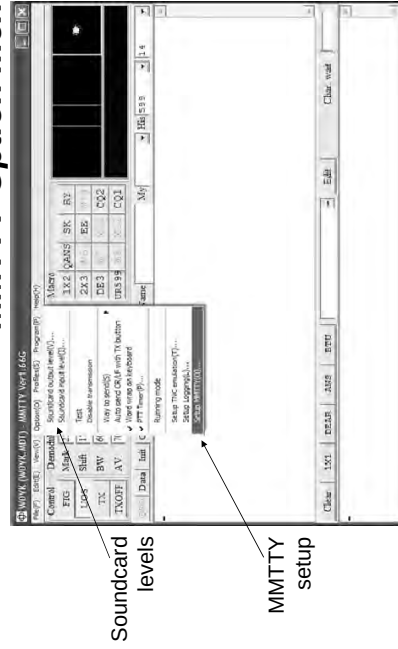
How Do I Set It Up?

MMTTY Messages



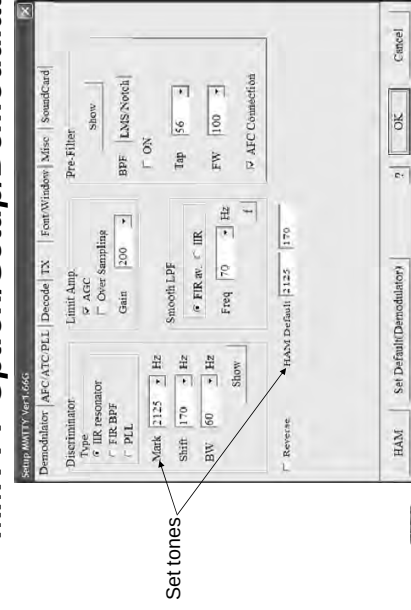
How Do I Set It Up?

MMTTY Option menu



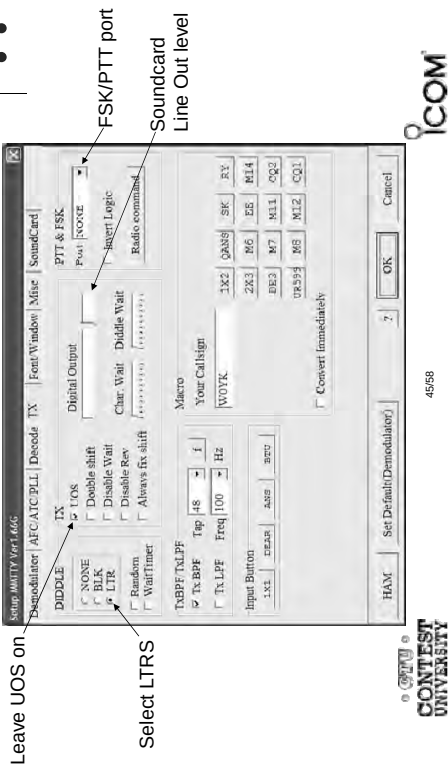
How Do I Set It Up?

MMTTY Option/Setup/Decoder/Modulator



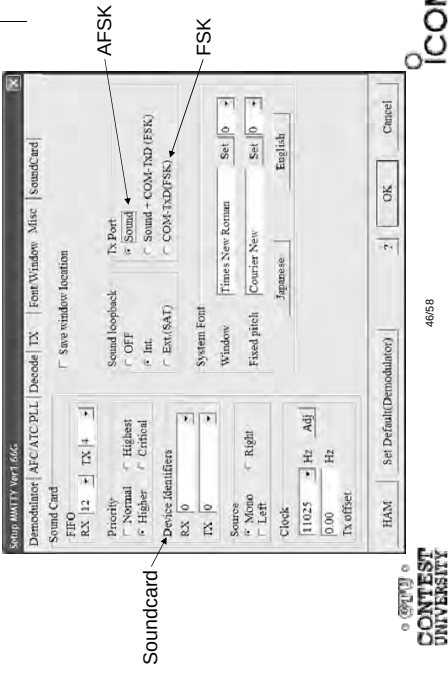
How Do I Set It Up?

MMTTY Option/Setup/TX



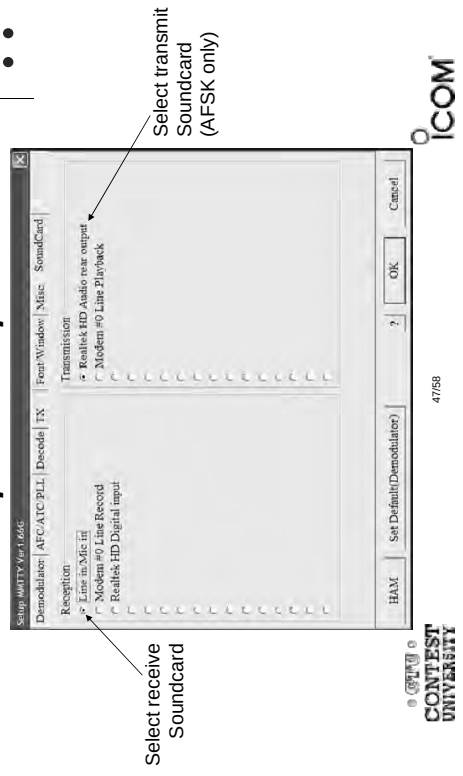
How Do I Set It Up?

MMTTY Option/Setup/Misc



How Do I Set It Up?

MMTTY Option/Setup/SoundCard



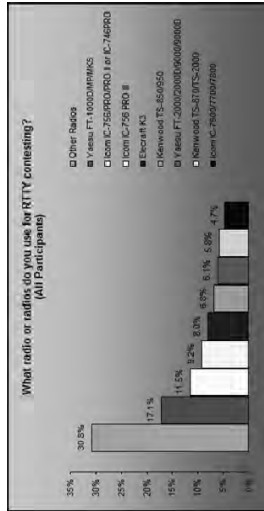
How Do I Set It Up?

MMTTY userpara.ini

- **userpara.ini** file (in MMTTY program directory) stores parameter defaults
- There is a section for each profile, e.g.,
 - [Defined]
 - Name=Standard RTTY
- In each section (profile) make sure:
 - NET and AFC are off [NET=0, AFC=0]
 - UOS and TXUOS are on [UOS=1, TXUOS=1]
 - Other parameters are set so that they do not have to be changed every time you load MMTTY or that profile

RTTY Radios

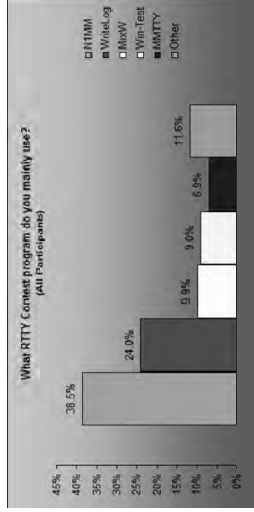
2010 survey



- Icom 756Pro series most popular
- Elecraft K3 growing rapidly

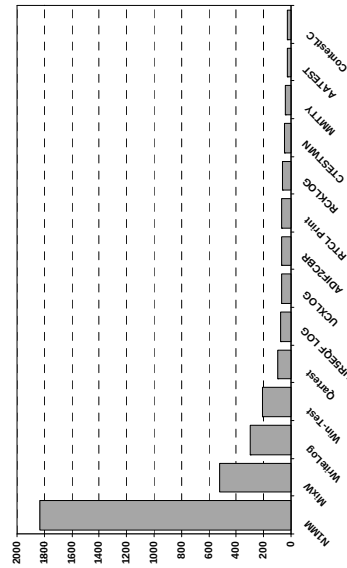
RTTY Contest Loggers

2010 survey



- MixW ahead of Win-Test
- MMTTY used stand-alone

2012 CQ WPX RTTY 3550 submitted logs



RTTY Contest Loggers

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

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



RTTY Contest Loggers

	N1MM	WriteLog	Win-Test
MMTTY	☺	☺	☺
- other decoders	some	☺	none
Call sign acquisition	☺	☺	☺
Contests supported	☺	☺	fewer
Advanced RTTY	~	~	none

- All three are entirely adequate for basic RTTY contesting
- Use the logger you are already familiar with for CW & SSB



5368



RTTY Contest Loggers

relative ratings

- 13 features compared
- Rated 0 to 5
- Simplifying assumption: features equally weighted
- All three score '5' on:
 - MMTTY integration
 - Stateful Enter key (ESM: Enter Sends Message)
 - Accelerator keys
 - QRV message parameter
- Another 9 advanced RTTY features distinguish these loggers



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RTTY Contest Loggers

relative ratings

N1	WL	WT	Logger
4	5	4	• RTTY window readability
4	5	0	• Multiple decoders
4	5	0	• multiple MMTTY decoders
5	0	0	• ESM mouse control
4.5	5	0	• SO2V
3	5	3	• M2 SO2R configuration
3	5	5	• Key re-mapping
5	5	3	• Call sign stacking
5	2	5	• Sprint modes
37.5	37	20	Overall



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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 (second std audio cable from radio to PC)
 - FSK (keying cable or commercial interface)
- Integrate MMTTY with logging software
- Enhance later
 - Audio isolation (highly recommended)
 - Commercial interface
 - Advanced setup: SO2V, SO2R, multiple decoders, ...



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Resources

- www.rttycontesting.com
- Tutorials and resources (beginner to expert)
- Writelog/MMTTY
- rtty@contesting.com
- Email reflector
- RTTY contesting networking
- Q&A
- Software web sites
- mhhamsoft.amateur-radio.ca/ (MMTTY)
- n1mm.hamdocs.com/vtkf-index.php (N1MM Logger)
- www.writelog.com (Writelog)
- www.win-test.com (Win-Test)
- Software Reflectors
- mmitty@vahogroups.com (MMTTY)
- N1MMLogger@vahogroups.com (N1MM Logger general)
- N1MMLogger-Digital@vahogroups.com (N1MM Logger RTTY & PSK)
- writelog@contesting.com (Writelog)
- support@win-test.com (Win-Test)



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Operating a RTTY Contest

- RTTY considerations
- Optimize message buffers
 - UnShift On Space (UOS or USOS)
 - Space vs. Hyphen
- Accelerator keys; Stateful Enter key (ESM); key re-mapping
- Super Check Partial & Pre-Fill
- "Slow down to win" (call sign stacking)
- Multiple decoders
- SO2V, SO2R, SOnR
- Logging Software: N1MM Logger vs. Writelog vs. Win-Test
- Ergonomics



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CTU Presents



Contest Clubs
*Starting, Revitalizing &
 Growing*
Scott Dickson, W5WZ



About W5WZ

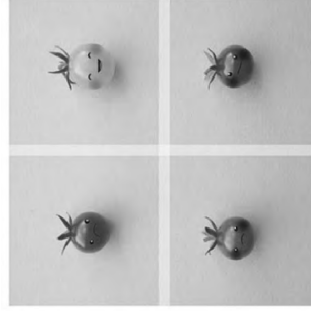


- 1st licensed 1997 at age 26
- 1st contest - Field Day 1998
- 2nd contest IARU 1998 – 1st place LA
- CTU attendee - 2007, 2008, 2009, 2010, 2011
- Charter member LCC
- Operated at K5ER, W5WMU, KN5O, K8AZ, & K5QE



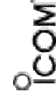
Disclaimer:

- I've got the microphone
- You are a captive audience
- At least one of us is going to have fun!



My Assignment:

- Try to keep you awake
- Have you believe that I'm an expert
- Stimulate YOUR thought processes to improve contesting in your sphere of influence



Your Assignment:

- Participate today and always
- Engage with thoughtful questions
- Respond with meaningful answers
- Most of all, become enthusiastic!
 - HAM RADIO is STILL MAGIC!
 - HAM RADIO is STILL FUN!
 - YOU can be the SPARK that IGNITES FIRES

Contest Clubs

- What are they?
- Who can join them?
- Where are they located?
- When should I join one?
- Why should I join one?

Is this a contest club?



- Do you ever feel really different from those around you?

Or is this a contest club?



- Do rookie contesters sometimes feel out of place among veteran contesters?

A Contest Club Is:

- Groups of ham radio licensees that have united for one or more of several purposes:
- To score big in club-centric contests
- To improve operator skills & techniques
- To improve technical station building skills
- To have camaraderie with other fanatics
- To provide encouragement, competition, teamwork, enthusiasm, tall tales, awards, etc.



Who Can Join a Contest Club?

- Anyone with the desire!
- Most contest clubs have open membership, others are “invitation only”
- Some have a geographical boundary to comply with certain contest rules (i.e. the club circle).
- Others will allow “at-large” membership.



Where Are Contest Clubs?

- Contest clubs are found throughout the US and around the world.
- Here are 2 internet look-up sites:
- <http://www.arrl.org/find-a-club>
- <http://www.contesting.com/links/results?text=contest+clubs>



When Should I Join One?

- The sooner you join a contest club, the better! As the saying goes, time's a wastin'!
- “Old age is like everything else. To make a success of it, you've got to start young.”
Theodore Roosevelt
- If you ain't going forward, you are getting left behind!



Why Should I Join One?

- Join for the pool of knowledge
- Encouragement
- Competition
- Teamwork
- Enthusiasm
- Tall tales
- Awards
- Friendship (remember the cat, owls & penguins!)

Starting a Contest Club

- No – secret recipe
- No – one-size fits all
- Yes – 3 or more hams with united goals
- Yes – Any skill level
- Yes – Any contesting activity
- Yes – Bring fun to the table

Here's How LCC Did it: And it begins... Sort of...

- Discussing contesting at the general interest ham club meeting was a bust
- No logging software experts
- No contest strategy or technique experts
- Only antenna advice
>single tri-bandner up high

The Quest Begins



- K5ER & W5WZ sought to have Louisiana contesters become more active.
- LA already had many recognized contest ops:
 - Multi-Op at W5WMU
 - RTTY champion & CQ Hall of Famer AA5AU
 - M/2, M/S group W5RU

Birth of LCC, via NapCAD

- The REAL benefit of coming to Dayton & CTU happens in the Super Suite!



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Possible Goals for a club

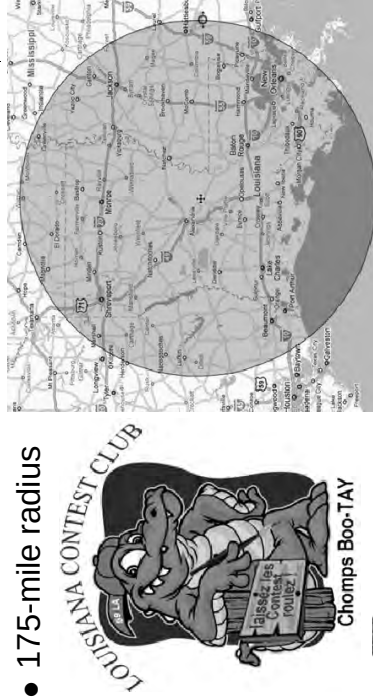
- To promote the fun, satisfaction and competitive thrill of radio contesting
- To assist members in the development of their operating and technical skills
- To foster increased friendly competition and sportsmanship
- To become a competitive force in club competition of amateur radio contests

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LCC on the Map

- 175-mile radius



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Some Challenges for Clubs

- Distance
- Density
- Possible Solutions
 - Website
 - E-mail reflector
 - Skype / video conference / webinars

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Revitalizing a Contest Club

- Fresh ideas are important
- Here is a visual example of a tired idea that needed a fresh approach. The result is stunning!



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Revitalizing a Contest Club

- Try something new!
- If it doesn't work the first time, don't give up
- If it still doesn't work, try something else



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Growing a Contest Club

- One is the tried-and-true "home-grown" method!



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Growing a Contest Club

- Like a garden, it requires food, water, & warmth
- IMHO, a Contest Club should be:
 - Intellectually stimulating to the members
 - Fulfill a need of the individual members
 - Technical mentoring
 - Operating technique coaching
 - Provide camaraderie (think about the good ol' boys hunting club)

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Growing a Contest Club

- Recruiting – it can be easy!
 - Seek out hams who already enjoy contesting
 - Look in the line scores for testers in area
 - Notice who is often active, not necessarily the winner
 - Parse the SCP database for calls in your area
 - Invite hams to participate with you
 - Single-op coaching at first may be best
 - Multi-op events
 - Be willing to encourage
 - Teach by example (which, by the way, requires the learner to be with you)



Summary

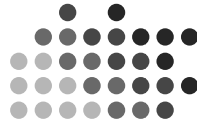
- Contest Clubs are a great resource
 - Not the organization
 - The members – YOU are the true resource
 - Give back to contesting
- Discover the need
- Fill the need
- Have fun doing it



CTU Presents

Coaxial Feed Lines for Competitive Contesting

Frank Donovan
W3LPL

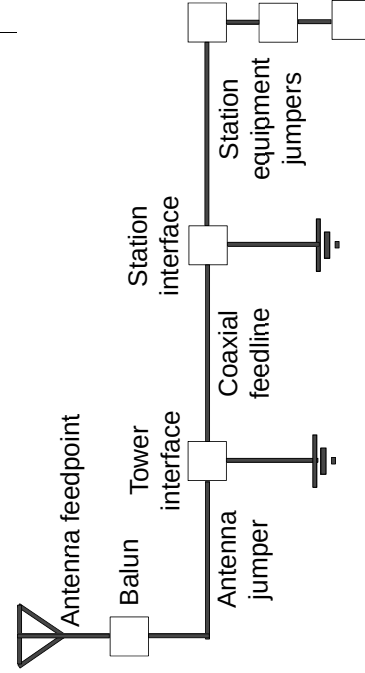


Coaxial Feedlines Often Make or Break Competitive Performance

- How well you select, install, waterproof and maintain your coaxial feed lines and connectors can make or break the competitive performance of your contest station
- Cross-station interference in multi-operator stations is often caused by inappropriate coaxial cable and connector choices and installation practices



Coaxial Feedline System Reference Model



Coaxial Feedline Investment Considerations

- The selection, installation and maintenance of your feedline(s) should be among your most important investments when developing your competitive station
- Is a better grade of coaxial cable worth the additional cost?
- Is attention to the many details of installation and maintenance worth the extra effort?
- Yes
 - If you want trouble free low loss feedlines for 25 years or longer
- No
 - If you don't mind the expense and disappointment of catastrophic failure



Coaxial Feedline Environmental Considerations

- Constant exposure to wind, ice, water, condensation, heat, cold, ultra-violet radiation and lightning strikes
- The jacket of RG-213 and LMR-400 coaxial cables is easily damaged during feedline installation, antenna installation, tower maintenance, wind and lightning strikes
 - Never use 9913 or similar "water hose" or any other air or foam dielectric flexible coaxial cable except Davis RF Bury-Flex
- Heliax and CATV hardline are highly resistant to environmental damage and provide 25 years of service
 - If no installation errors are made



Coaxial Feedline Single Operator Stations

- Feedline loss, environmental issues and maintenance are the most important feedline concerns for single op stations
 - Andrew LDF4-50A 50 ohm Heliax and connectors are commonly available at hamfests and eBay for ~ \$1.00/foot
 - Less than 1 dB of loss on 10 meters for lengths up to 300 feet
 - If flexible coaxial cable must be used, Davis RF Bury-Flex is an acceptable alternative for single operator stations only, at about the same price. Never use other types of foam dielectric flexible coaxial cable
 - Non-flooded coax such as RG-213 and LMR-400 has a short service life in the harsh environment of a tower and cannot be directly buried or laid on wet ground



Coaxial Feedline Multi-Op and SO2R Stations

- Andrew LDF4-50A Heliax is an ideal choice for lengths up to
 - 300 ft on 10 meters, 400 ft on 20 meters, 600 ft on 40 meters
- Eliminate the common cross-station RFI sources:
 - Use Heliax to avoid RFI caused by the dissimilar metals in the aluminum foil and tinned braid shields of Bury-Flex cable
 - Signal coupling between RG-213 single braid shielded coaxial cables when they are bundled or run together in conduits
 - Avoid nickel plated connectors and avoid connector adapters
 - If you must use adapters, use only brand name silver plated adapters, never use nickel plated adapters



Coaxial Feedline Multi Tower Stations

- Feedlines longer than 300 feet are commonly used in multi-tower stations
 - Andrew LDF5-50A Heliax is an ideal choice for lengths up to
 - 500 feet on 10 meters
 - 750 feet on 20 meters
 - 1000 feet on 40 meters
 - Be cautious of the windload and weight (including ice load) of large Heliax cables



Coaxial Feedline Installation on a Tower

- Wind, ice, water, condensation, heat, cold, ultra-violet radiation and lightning strikes are important concerns
 - If any of these issues are unusually severe in your environment, implement additional protective measures
- Feedlines must be firmly fastened to the tower at least every to five feet to protect them from wind and ice damage
- Protect plastic tie-wraps from ultra-violet radiation

Tower Interface

- Feedlines must be bonded to the top and bottom of your tower to protect them from coaxial cable jacket damage caused by cable-to-tower arcing during lightning strikes
- An good ground system must be connected to the tower base to prevent kiloamp lightning currents from flowing down the feedline shields into your station
- Feedline connectors should be carefully placed and waterproofed so that water cannot not flow down the cables into the connectors

Coaxial Feedline Connectors

- The most common choices are N and UHF connectors
- Insignificant loss in both N and UHF connectors at HF
- Insignificant difference in the VSWR of N and UHF connectors at HF
- High quality silver plated UHF connectors provide much greater center pin mating force than N connectors
 - Eliminates cross-station interference and connector failures from unreliable N connector center pin mating force
 - Avoid saving a few dollars on cheap unbranded hamfest connectors
- Avoid use of adapters, but if necessary be sure they are name brand silver plated adapters, not nickel plated
- Always use a wrench to install UHF connectors

Coaxial Feedline Amphenol 83-1SP PL-259 Connector



Mouser Electronics part number 523-831SP
<http://www.mouser.com/MobileCatalog.aspx?page=1369>

This is not the place to save money

Coaxial Feedline 83-1SP Connector Installation



<http://www.k3lr.com/engineering/pl259/>

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An Unconventional but Superb Method



Coaxial Feedline Connector Waterproofing



Cover the connectors with two 50% overlapped layers of Scotch 130C stretched to 50% of its original width

Cover the Scotch 130C with two 50% overlapped layers of Scotch 33

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Coaxial Feedline Buried Coaxial Cables

- Direct Burial
 - Use only direct burial rated coaxial cable
 - Andrew Heliax or Davis RF Bury-Flex
 - PVC jacketed coaxial cable should never be direct buried
- PVC conduit
 - Use oversized conduit with plenty of room for pulling cables
 - Use sweeps, not sharp right angle PVC connectors
 - Include appropriate methods to drain moisture buildup
 - Prevent water and vermin intrusion at the conduit entries
 - Use only Heliax In multi-op or SO2R stations,
 - Bundled single shielded cables can cause cross-station RFI

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Antenna Feedpoint Jumper

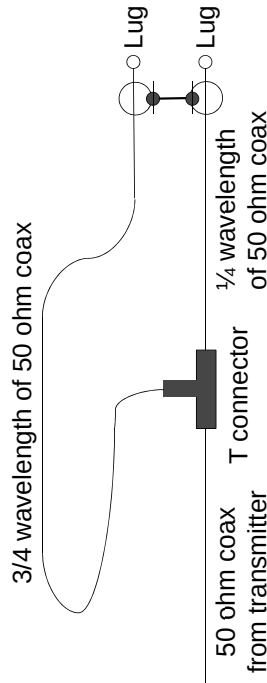
- Your antenna feedpoint jumper is exposed to the most extreme environmental conditions in your station
- Carefully avoid having the jumper rub or pull against your tower
 - Rotators with more than 360 degrees of rotation make this extremely difficult to achieve
- Name brand, high quality RG-213 is a good choice
 - 95% shield, solid dielectric, black UV resistant jacket
- Replace the jumper at least once every ten years and whenever you discover abrasion or damage during inspections

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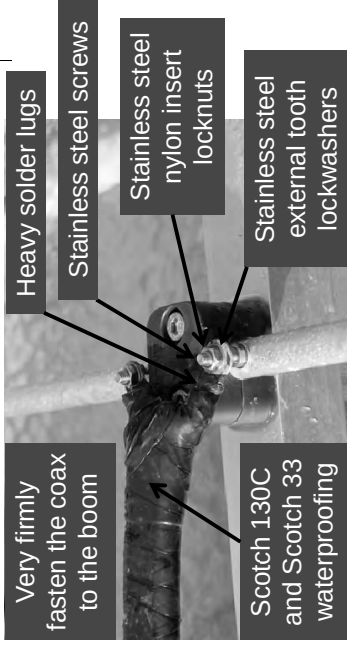
Balun

A Very Effective 50 Ohm Single Band Balun



<http://www.qsl.net/i0jx/balun.pdf>

Antenna Feedpoint Waterproof and Shakeproof Connection



Station Interface

- The station interface should be located as close as possible to the outside wall of your building
- Establish a single point ground at the station interface to strip lightning currents off of the coaxial cable shields
- Lightning protectors should be installed at the station single point ground
 - never at the tower base

Station Equipment Jumpers

- RG-213 is much more practical than Helix cable
- RG-223 and RG-400 are good choices for small diameter coax
- Eliminate cable, connector and adapter related cross-station interference in SO2R and multi-operator stations
 - Never bundle coaxial cables
 - avoids cross-cable signal coupling in single shield coaxial cables
 - use double shielded coax if you must bundle your coaxial cables
- Use UHF connectors and not N connectors for much better center pin contact pressure
 - Use only high quality Amphenol 83-1SP silver plated connectors
- To eliminate signal leakage, use the K3LR technique to install PL-259s and avoid use of adapters

Feedline Preventive Maintenance Inspections

- Well before your next competitive contest:
 - Inspect all indoor and outdoor coaxial cables and connectors for evidence of damage, cuts, cracks or moisture intrusion
 - Especially at the tower base and the antenna feedpoint jumpers
 - If in doubt, totally remove the connector for detailed inspection
 - Verify that all connectors inside and outside the station are wrench tight



Feedline Preventive Maintenance Measurements Inside Your Shack

- Immediately after installation, make a record of the following measurements at the hamshack end of every feedline:
 - VSWR across the entire band(s)
 - Feedline resistance
 - typically either a fraction of one ohm or megohms
 - TDR and/or VNA plots if you own a VNA and/or TDR
- Well before your next competitive contest, verify that the measurements have not changed and are not erratic
- Any change better or worse requires detailed investigation



CTU Presents

The Reverse Beacon Network

and

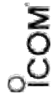
CW Skimmer

by N6TV
n6tv@arrl.net



Overview

- What is CW Skimmer?
- What is the Reverse Beacon Network?
- How does it work?
- What can the RBN do for *me*?
- How can I help?
- What's next?



It all starts with one developer

- Alex Shovkoplyas, VE3NEA
(b. 1965, ex-UR5EMI, in Canada since 1998)



VE3NEA and XYL

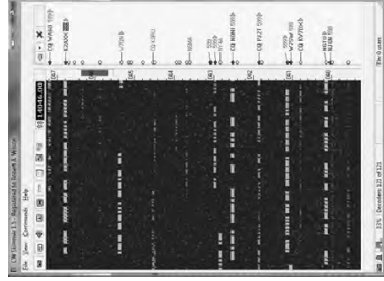


- ## 2. Omni-directional, multi-band



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- Works with many SDRs
- Decodes *multiple* CW signals in real time
- Can monitor *entire* CW band
- Waterfall Display
- Uses MASTER.DTA
- Telnet Server (emulates a DX Cluster)

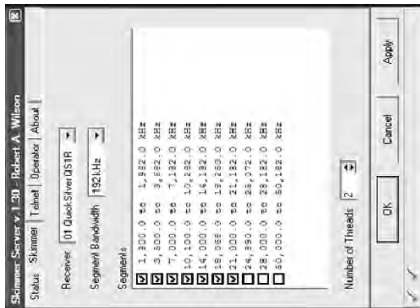


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Skimmer Server by VE3NEA



- Only supports QS1R SDR
- Decodes multiple CW signals in real time
- Monitors *multiple bands* with single SDR
- No Waterfall Display
- No MASTER.DTA
- Telnet Server

**Telnet server
(localhost port 7300)**

- Emulates a DX Cluster Node

DX de	NTU-B =	14089.6	UPHRE	29 dB	31 UPM	2350
DX de	NTU-B =	14089.5	Y40B	35 dB	31 UPM	2350
DX de	NTU-B =	14089.4	Y40B	35 dB	31 UPM	2350
DX de	NTU-B =	14087.9	N5RA	58 dB	28 UPM	2350
DX de	NTU-B =	14084.4	NEUM	56 dB	28 UPM	2350
DX de	NTU-B =	14081.2	N5J3	55 dB	31 UPM	2350
DX de	NTU-B =	14080.4	W2FL	15 dB	28 UPM	2350
DX de	NTU-B =	14082.2	W2FL	18 dB	27 UPM	2350
DX de	NTU-B =	14082.2	W2FL	15 dB	31 UPM	2350
DX de	NTU-B =	14082.2	W2FL	15 dB	31 UPM	2350
DX de	NTU-B =	14089.2	W2J3P	15 dB	31 UPM	2350
DX de	NTU-B =	14082.5	W0WR	20 dB	28 UPM	2350
DX de	NTU-B =	14082.5	W0WR	20 dB	28 UPM	2350
DX de	NTU-B =	14082.4	W6CR	27 dB	29 UPM	2350
DX de	NTU-B =	14085.6	W0YB	25 dB	29 UPM	2350
To	de SATHIER	1409522	C1atched on	25 dB	29 UPM	2350
To	de SATHIER	1409522	C1atched on	25 dB	29 UPM	2350
To	de SATHIER	14089.1	N5RM	25 dB	28 UPM	2350
To	de SATHIER	1409522	C1atched on	25 dB	29 UPM	2350
DX de	NTU-B =	14083.4	W4GE	17 dB	29 UPM	2350
DX de	NTU-B =	14083.4	W4GE	17 dB	29 UPM	2350
DX de	NTU-B =	14083.6	N2LU	16 dB	28 UPM	2350
DX de	NTU-B =	14082.7	N4GS	11 dB	28 UPM	2350
DX de	NTU-B =	14089.6	Y40B	35 dB	31 UPM	2350

Reports Signal to Noise ratio, CW Speed, CQers

What is the Reverse Beacon Network (RBN)?

- Uses *any* CW signal as a beacon
- Multiple CW Skimmers world-wide record signal strength (S/N ratio in dB) and CW speed (WPM)
- A free “Aggregator” program forwards CW Skimmer spots to a central server
- Central server distributes spots via web page and public telnet servers

How do spots get to the RBN server?



Who created and maintains the Reverse Beacon Network?

- Pete Smith, N4ZR:
- Hosted by
dxwatch.com
(PY1NB)



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Who created the Aggregator software?

- Dick Williams, W3OA:



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What can the RBN do for me?

- Use as main spotting network for CW contests (far more spots, with smaller pileups)
- Fill up your band map
- Shows where *you* are being heard (spotted by ...)
- Compare your signal to the competition (post-contest)

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Accessing the RBN

1. telnet.reversebeacon.net port 7000
(DX Spider software)
SH/DX call/sign
2. arcluster.reversebeacon.net port 7000
(V6 AR-Cluster software)
SH DX call=call/sign
3. <http://www.reversebeacon.net>

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Filtering Spots (method 1)

- telnet.reversebeacon.net port 7000
- accept/spots by_zone 1,3,4,6,7,31 and not by wz7i
- http://www.dxcluster.org/main/filtering_en.html#toc1
- arcluster.reversebeacon.net port 7000
- set dx filter spottercty=K or call=N6TV
- <http://www.ab5k.net/ArcDocsVer6/UserManual/ArcDx.htm>

Filtering Spots (method 2)

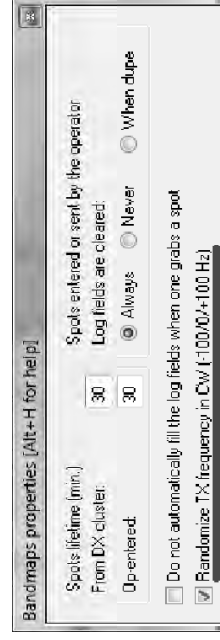
- Use CCUser by VE7CC to log in to your preferred node, program filters for you
- Tutorial:
 - <http://reversebeacon.blogspot.com/2010/11/using-rbn-telnet-server-brief-tutorial.html>
- Reference:
 - <http://www.bcdxc.org/ve7cc/default.htm#download>

Some nodes combine RBN and “normal” (human) spots

- dx.w9zrx.net port 7373 (AR Cluster)
- dx.n7tr.com port 7373 (AR Cluster, but pre-filters to show only spots from Zones 3 and 4)

How to improve your chances in a Skimmer-generated pileup

- Use XIT or the “randomize TX” feature of your logging program to call a bit off frequency.



Using www.reversebeacon.net

- Great for post-contest analysis
- Plot signal strengths
- Raw data files can be downloaded / analyzed
 - Millions of spots archived

www.reversebeacon.net main

Where was I heard?

[illegible]

1. Select a comparison date
10/01/2011

2. Select a Reverse Beacon
Europe

North America

- AA4VU 354 spots
- K4TTU 505 spots
- K3MM 59.06 spots
- K0NG 372 spots
- K4SWE 657 spots
- KB9AMG 181 spots
- KC0VKN 877 spots

Add

[illegible]

REVERSE BEACON NETWORK

welcome | **new aggregator** | **filters** | downloads | about | contact us

download raw data

Welcome to our new website!

The Reverse Beacon Network is a great idea. Instead of beacons actively transmitting signals, the RBN is a network of software and computers that receive signals and report what stations they hear, when and how well.

If you already know HF > VHF >

So why should you care? You can see band openings in real time. You can call a quick report from your phone or even from a car. You can find out who's listening near you, and how so. VHF+ >

HF/CW

The newest Aggregator Version 2.1 is now available. After downloading here's a section "What's New"

Check out our blog!

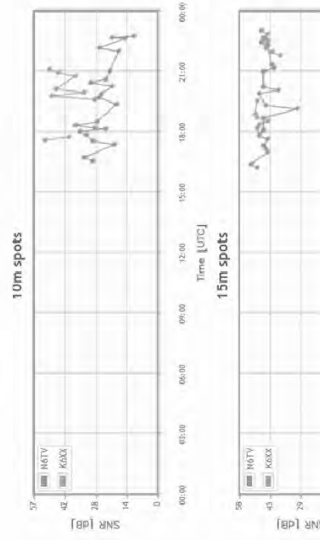
Aggregator 2.1 - new insight for Skimmer ops

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And the winner is ... K6XX!

Spots for N6TV K6XX at K3MM



Raw data downloads

REVERSE BEACON NETWORK

welcome | [join](#) | [get spots](#) | [skimmers](#) | [downloads](#) | [about](#) | [contact us](#)

Raw data download

Data from the RBN spot search. Simply use the int. create your filter! on the filename.

This data files then viewed by opening in Excel. Idea: Export that on busy days the amount of data will be huge. For example, on Saturday during the 2010 ASRL DX contest, the RBN produced a full daily data set. c. HF

The only thing that you can do is to export the data to a file. You can also use the controls below.

Click on the year. collapse all month. VHF+ / CW

2012

January 1.8/3.5/7MHz
February 01 Wedn 14/21/28MHz
02 Thurs 10/18/24MHz
03 Fri

20120201.70
20120202.00
20120203.00

1000000000

Raw data is text file, Comma Separated Values

```
callsign,de_pfx,de_cont,freq,band,dx,dx_pfx,dx_cont,mode,db,date
OL5Q,OK,EU,3543.8,80m,IV3UHL,I,EU,CQ,29,2011-11-26 00:00:00
OE3DIA,OE,EU,3543.8,80m,IV3UHL,I,EU,CQ,24,2011-11-26 00:00:00
VK6IA,VK,OC,28028.4,10m,W6YI,K,NA,CQ,14,2011-11-26 00:00:00
ON5KO,ON,EU,7005.5,40m,K2QMF,K,NA,CQ,40,2011-11-26 00:00:00
ON5KO,ON,EU,7005.5,40m,K2QMF,K,NA,CQ,40,2011-11-26 00:00:00
N4ZR,K,NA,7011.7,40m,ON5NS,ON,EU,CQ,22,2011-11-26 00:00:00
N4ZR,K,NA,7020.6,40m,S50R,S5,EU,CQ,40,2011-11-26 00:00:00
N4ZR,K,NA,7023.40m,NQ4I,K,NA,CQ,56,2011-11-26 00:00:00
WA7LNM,K,NA,7051.5,40m,YR1C,YO,EU,CQ,15,2011-11-26 00:00:00
```

Total World-Wide RBN spots, 2011 CQ WW:
3,268,434 (18.9 spots per second)

How to be easily spotted by a CW Skimmer

- Send everything at the same consistent speed
- Do not use “++” and “-” to speed up/slow down
- Call CQ or TEST and send your call twice
- CQ N6TV N6TV
- Use proper spacing
- Don't send by hand and rush everything together
- Change freq. slightly to get spotted again

How can I help?

- Set up an SDR, feed Skimmer Spots to the RBN, using the Aggregator program
 - Especially needed from outside Europe/USA
- Call a bit off frequency

What's Next?

- Aggregator improvements to eliminate bad spots (perhaps a "voting" system)
- VE3NEA is attempting:
 - RTTY/PSK Skimmer
 - SSTV Skimmer
- But he says "Not close to completion"
- Not attempted:
 - SSB Skimmer

What's Next?

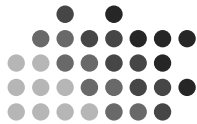
- Dayton Contest Forum
- Live Demo (?)
- Scoring the Skimmers

For more information

- <http://www.reversebeacon.net>
- <http://www.bcdxc.org/ve7cc/default.htm#download>
- <http://www.dxatlas.com/CwSkimmer>
- <http://www.dxatlas.com/SkimServer>
- [http://www.srl-llc.com/ \(QS1R\)](http://www.srl-llc.com/ (QS1R))
- <http://microtelecom.it/perseus/>
- [http://www.pixelsatradio.com/product/shortwave-magnetic-loop-antenna/ \(RF Pro-1B\)](http://www.pixelsatradio.com/product/shortwave-magnetic-loop-antenna/ (RF Pro-1B))
- <http://www.grz.com/db/n6tv>

CTU 2012 Presents

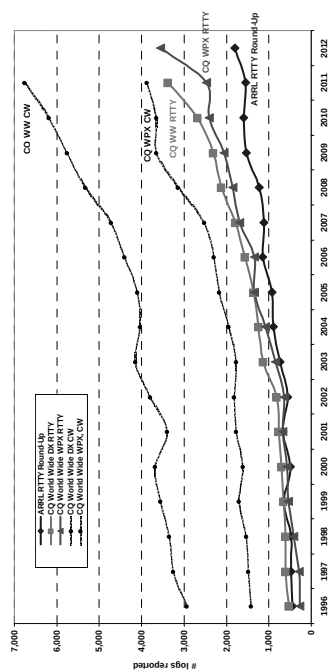
Operating a RTTY Contest
Ed Muns, W0YK



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Three Largest RTTY Contests



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200

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Lots of RTTY Contests

> two/month

- **Biggies (7)**
 - CO WW RTTY (last weekend in September)
 - CQ WPX RTTY (2nd weekend in February)
 - ARRL RTTY Roundup (1st weekend in January)
 - BARTG (3rd weekend Jan, 3rd weekend March)
 - 75 Baud (April & September)
 - WAE RTTY (2nd weekend in November)
- **NCJ contests (4)**
 - NAQP RTTY (3rd Sat. in February, 2nd Sat. in July)
 - Sprint RTTY (2nd Sat. in March & October)
- **Other popular RTTY contests (20)**
 - Ten-Meter RTTY (1st Sat. in December)
 - JARTS, Makrothen, SARTG (2)
 - 15 others

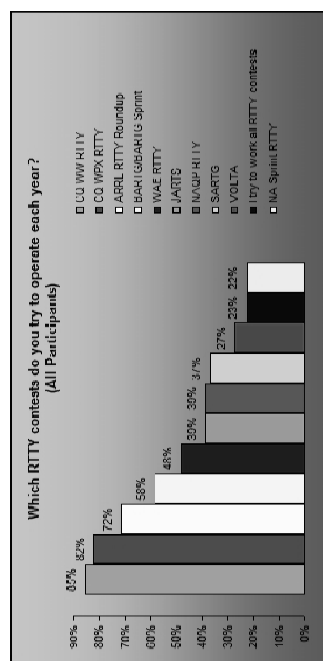
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300

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Contest Popularity

2010 survey



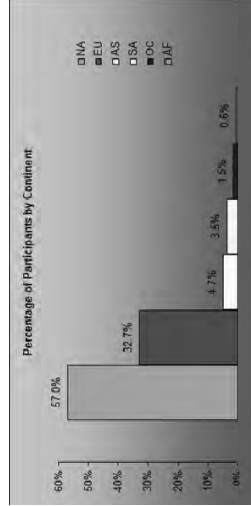
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400

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RTTY Contesters

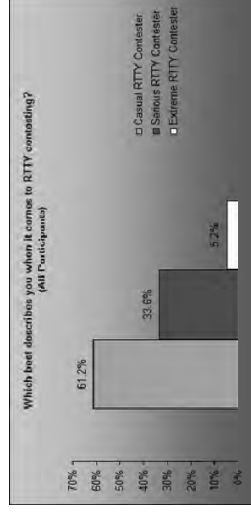
2010 survey



- 825 participants; 13 questions
- conducted in February 2010

RTTY Contesters

2010 survey



- The percentage of Casuals is much higher than shown, because few took the survey

RTTY Contesters

contester styles

- Casual
 - New
 - Exercising station
 - Chasing awards
 - majority of participants ... and slower operating
- Serious
 - High rates; snappy QSOs; no chit-chat
 - minority of participants ... faster operating (and easily annoyed by slower operating!)

RTTY Contesters

contester types

- "Gentleman RTTYers"
 - RTTY is the gentleman's *mode* (160 is the gentleman's *band*)
- RTTY contest junkies
 - Years of experience; many different contests
- New contesters
 - Many with extensive PC skill
- Multi-Mode contesters
 - Strong growth

What Makes a Great RTTY Contester?

- Contester who happily logs casual callers
- Uses CW & SSB techniques where useful
- 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
- Applies learning back to CW & SSB



9/90



Giving Back

- Open logs
- Allows others to learn
- Raises level of competition
- Sharing
- Improves operating quality and skill
- Raises level of competition
- Growing the sport
- “Lighthouse”: AA5AU & www.rttycontesting.com



10/90



The Cynics Say ...

- “RTTY is a pain to set up and get working.”
... *it's really not too difficult! (see first presentation)*
- “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



11/90

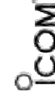


Operating a RTTY Contest

- RTTY considerations
- Optimize message buffers
 - UnShift On Space (USOS or UOS)
 - Space vs. Hyphen
- Accelerator keys; stateful Enter key (ESM); key re-mapping
- Super Check Partial & Pre-Fill
- Callsign stacking (“slow down to win”)
- Multiple decoders
- SO2V, SO2R, SOnR
- Logging Software: N1MM Logger vs. WriteLog vs. Win-Test
- Ergonomics



12/90



RTTY Considerations

Much like CW and SSB, except:

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

RTTY Sub-Bands

- 10 meters: 28080-28100, during contests 28060-28150
- 15 meters: 21080-21100, during contests 21060-21150
- 20 meters: 14080-14100, during contests 14060-14150
 - JA: 14070-14112
- 40 meters: 7025-7050 and 7080-7100, during contests 7025-7100
 - JA: 7025-7045
 - EU: below 7050
- 80 meters: 3580-3600, during contests 3560-3600
 - JA: 3520-3530 and 3599-3612
- 160 meters: No RTTY contesting

RTTY Sub-Bands

don't QRM!

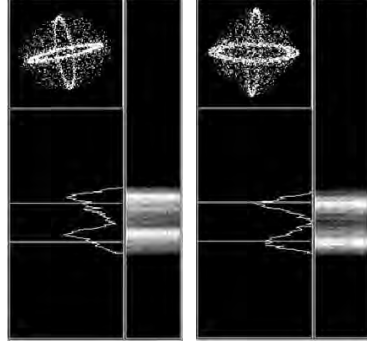
- Avoid PSK-31 operations near:
 - 28120, 21070, 14070, 7070 and 3580
- Avoid the NCDXF beacons:
 - 21150 and 14100

- More details:

www.aa5au.com/gettingstarted/rtty_subbands.htm

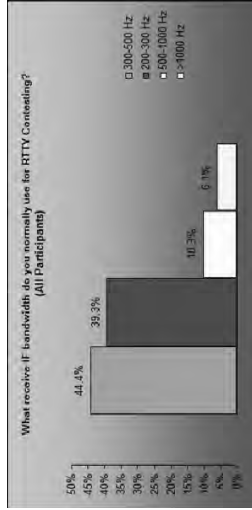
Receiving

- Set RX audio level
 - noise just above baseline
- Use narrow filtering
 - CW filters < 500 Hz
- Learn to tune by ear
 - practice with eyes closed
 - get within 10-20 Hz
- Use "low tones"
 - less fatigue



IF Bandwidth

2010 survey



- Like FSK, narrow IF filtering for RTTY appeared in radios in the early 1990s

Tips

“All I receive is gibberish!”

- “Upside-down”
- Reverse Mark & Space in software
- LSB vs. USB
- Figures vs. letters
- TOO=599, WPIR=2084
- Shift-click to convert, or
- Look at top two rows
- Mic/Line In, level, muting, tones, flutter



Tips

“They never answer me!”

- “Upside-down”
- FSK polarity switch in radio
- AFSK mode, LSB vs. USB
- MMTTY AFC & NET
- AFC & NET are on by default!
(and every time you choose a profile!)
- Change defaults in USERPARA.INI
- Radio mode, tones, FSK interface, AFSK: Mic & SC level & speech processor

More Tips

- Transmit when others stand-by
- Add his call at end of exchange in pile-ups
- Recommend RIT, but if you use AFC/NET ...
- AFC only for running, not S&P
- Use AFC/NET for S&P (only avail. with AFSK)
- Mode-independent skills, e.g.,
- Bandmap usage
- QS~~0~~4
- Roving mult: “Squat & Shoot” (Cajun-speak!)

and ... More Tips

- 100% duty cycle ... *caution!*
- Practice
 - During frequent RTTY contests
 - NCCC Thursday night practices
- Multi-Ops
- SO2V & SO2R
- LoTW

Basic RTTY Contest QSO

- 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

RTTY Messages

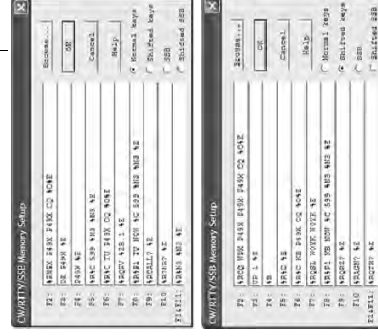
- Short, as with CW/SSB
- No extraneous info
- 599 (not 5NN) once
- Serial number twice
- Space (not hyphen)
- Omit 'DE'
- RTTY chars (%R, %E)

www.rttycontesting.com/rttymessages.htm

RTTY Messages

optimize

- Modular
 - Chaining
 - Group logically
 - Supports a cadence



2500

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RTTY Messages

formatting

CW/RTTY/SSB Memory Setup

F2: \$RMPX P49X P49X CQ \$QZ

F3: DE P49X \$Z

F4: P49X \$Z

F5: \$R4C 599 \$N3 \$N3 \$Z

F6: \$R4C TU P49X CQ \$QZ

F7: \$RQZV \$ZB.1 \$Z

F8: \$R4P1 TU NOW \$C 599 \$N3 \$N3 \$Z

F9: \$RCALL? \$Z

F10 \$R2NR? \$Z

F15F11: \$R4N3 \$N3 \$Z

Normal keys

Shifted keys

SSB

Shifted SSB

OK

Cancel

Help

ICOM

2090

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RTTY Messages

efficiency

CW/RTTY/SSB Memory Setup

F2: \$RMPX P49X P49X CQ \$QZ

F3: DE P49X \$Z

F4: P49X \$Z

F5: \$R4C 599 \$N3 \$N3 \$Z

F6: \$R4C TU P49X CQ \$QZ

F7: \$RQZV \$ZB.1 \$Z

F8: \$R4P1 TU NOW \$C 599 \$N3 \$N3 \$Z

F9: \$RCALL? \$Z

F10 \$R2NR? \$Z

F15F11: \$R4N3 \$N3 \$Z

Normal keys

Shifted keys

SSB

Shifted SSB

OK

Cancel

Help

ICOM

2700

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RTTY Messages

special

CW/RTTY/SSB Memory Setup

F2: \$RMPX P49X P49X CQ \$QZ

F3: DE P49X \$Z

F4: P49X \$Z

F5: \$R4C 599 \$N3 \$N3 \$Z

F6: \$R4C TU P49X CQ \$QZ

F7: \$RQZV \$ZB.1 \$Z

F8: \$R4P1 TU NOW \$C 599 \$N3 \$N3 \$Z

F9: \$RCALL? \$Z

F10 \$R2NR? \$Z

F15F11: \$R4N3 \$N3 \$Z

Normal keys

Shifted keys

SSB

Shifted SSB

OK

Cancel

Help

ICOM

2890

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Operating

personal

CW/RTTY/SSB Memory Setup

F2: \$RQZV P49X P49X CQ \$QZ

F3: UP 1 \$Z

F4: \$Z

F5: \$R4C \$Z

F6: \$R4C \$Z P49X CQ \$QZ

F7: \$RQZV \$ZB.1 \$Z

F8: \$R4P1 TU NOW \$C 599 \$N3 \$N3 \$Z

F9: \$RCALL? \$Z

F10 \$R2NR? \$Z

F15F11: \$R4N3 \$N3 \$Z

Normal keys

Shifted keys

SSB

Shifted SSB

OK

Cancel

Help

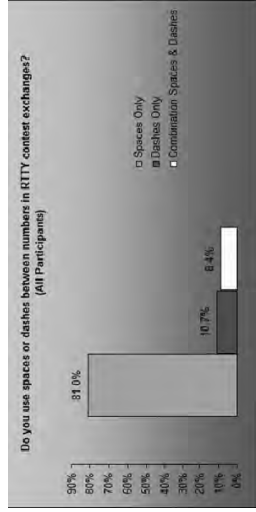
ICOM

Interim Summary

- Predominantly casual RTTY contest participants
- RTTY sub-bands; 10-80 only; avoid PSK & beacons
- Narrow (CW) receive filtering
- Common problems
 - "Upside-down" or reversed Space/Mark (and, 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 (e.g., MMTTY AFC & NET); propagation flutter
- Messages ("macros")
 - Short, ~~6N1~~ exchange twice, Space delimiter

Space Delimiters

2010 survey



Space Delimiters

*UnShift On Space**
*UOS or USOS

TX RX	599	123	123	599	On	On
UOS on	f599	f123	f123	f599	On	On
UOS on	x100	x123	x123	x100	On	On
UOS off	f599	f123	f123	f599	—	—
UOS off	x100	x123	x123	x100	On	On
UOS on	f599	QUE	QUE	f599	On	On
UOS off	f599	123	123	f599	On	On
UOS off	f599	123	123	f599	On	On

f: FIGS character
t: LTRS character

Garbled copy

- Protocol that provides some noise immunity for shift characters by:
 - forcing the Letters set after a received Space
 - sending a FIGS character after a Space when the next character is in the Figures set
- MMTTY:
 - RX UOS and TX UOS can be independently enabled or disabled

Space Delimiters

UOS and a noise hit

TX RX	599	123	123	599	On	On
best case	f599	f123	f123	f599	On	On
UOS on	x100	x123	x123	x100	On	On
UOS on	f599	f123	f123	f599	On	On
UOS off	x100	x123	x123	x100	On	On
UOS off	f599	f123	f123	f599	On	On
UOS on	x100	QUE	QUE	x100	On	On
UOS on	f599	123	123	f599	On	On
UOS off	x100	QUE	QUE	x100	On	On
UOS off	f599	123	123	f599	On	On

f: FIGS character
t: LTRS character

Garbled copy

- Turning on UOS for both RX and TX is the best hedge:
- Most other stations will be that way
 - MMTTY default; 78% of survey respondents use MMTTY
 - With only one noise hit, at least one of the important exchange elements is received properly

Typing

[illegible]

- CONTEST**
UNIVERSITY



Super

- | | | |
|-------|-------|-------|
| XYZAB | AA5AU | XYZAB |
| XYZAB | 9Y1VC | 9N6TT |
| XYZAB | W5UKM | XYZAB |

TTY contests

- **CLU •**
CONTEST
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-TRS

- **CTU** •
CONTEST
UNIVERSITY



Super

XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	W5UKM	XYZAB

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XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	W5U73	XYZAB

XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	95U3A	XYZAB

WriteLog

Win-Test

Pre-Fill

“Danger, Will Robinson!”

- Pre-fill is a ***typing aid*** using prior log data
- Each logger is unique:
 - N1MM: Call History Lookup File (text file)
 - User-created with Excel from prior logs
 - WriteLog: Pre-fill File (ADIF file)
 - User-created with text editor from prior ADIF logs
- Win-Test: Database File
- Provided for specific contests by the Win-Test team
- **Log what you receive!**



37/90



Disciplined QSO Flow

- Standard keystroke (or mouse) sequences for:
 - Normal contact in Run mode
 - Normal contact in S&P mode
 - Repeats/Fills (in either mode)
 - QSO phase skip & tail-enders (in Run mode)
- Each sequence is executed the same way hundreds (thousands) of times during the contest
- Avoid deviations and special sequences



38/90



The 4 Phases of a QSO

- Normal Run mode flow:
 1. Enter or F1 (CQ)
 - repeat
 - AGN?
 2. pile-up
 3. Insert or ' (grab call sign, send exchange)
 - Send fill(s)
 4. receive exchange
 - check pre-fill, click their exchange
 - AGN? or NR? or QTH? or NAME?
- Normal S&P mode flow:
 1. CQ
 - repeat
 2. Enter or F4 (mycall)
 3. receive exchange
 - check pre-fill, click their exchange
 - AGN? or NR? or QTH? or NAME?
 4. Enter or F5 (send exchange)
 - send fill(s)
- 1. find next CQ
- optionally send F7 (QRV message)



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Callsign 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 before sending TU/CQ message



40/90



Callsign Stacking

skip 2 phases

Normal

1. WPX P49X P49X CQ, or TU P49X CQ
2. K3LR K3LR K5ZD K5ZD
3. K3LR 599 2419 2419 K5ZD 599 2420 2420
4. TU 599 842 842 TU 599 1134 1134

Shortened

1. (skip CQ)
2. (skip pile-up)
3. K3LR TU NW K5ZD 599 2420 2420
4. TU 599 842 842 TU 599 1134 1134



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Callsign Stacking

tail-ender

Normal

1. WPX P49X P49X CQ, or TU P49X CQ
2. K3LR K3LR
3. K3LR 599 2419 2419 K5ZD 599 2420 2420
4. TU 599 842 842 TU 599 1134 1134

Shortened

1. (skip CQ)
2. (skip pile-up)
3. K3LR TU NW K5ZD 599 2420 2420
4. TU 599 1134 1134



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Callsign Stacking

- 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 rate

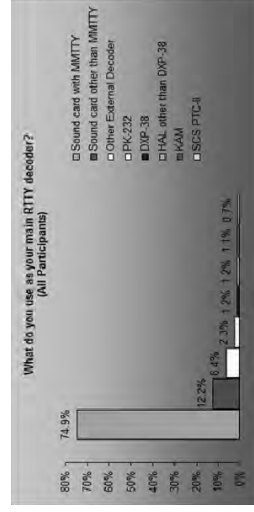


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RTTY Decoders

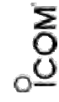
2010 survey



- 87% use soundcard decoding/encoding
- 86% of soundcard users run MMTTY

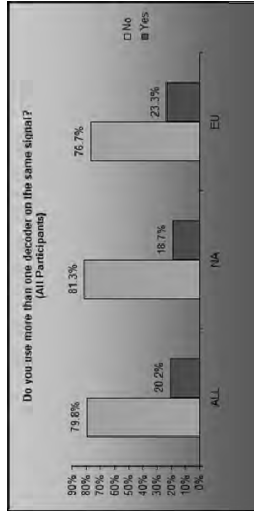


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Multiple RTTY Decoders

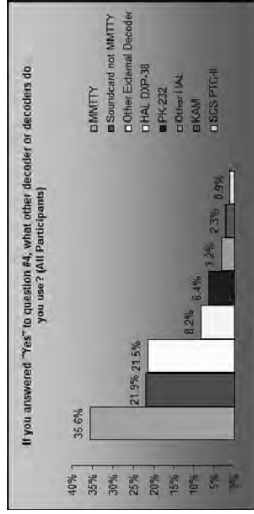
2010 survey



- 20% use multiple decoders

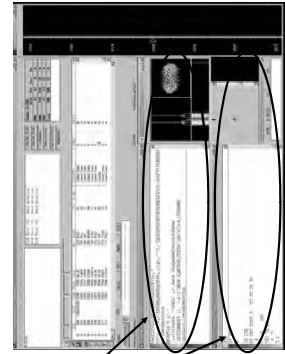
Multiple RTTY Decoders

2010 survey



Multiple RTTY Decoders

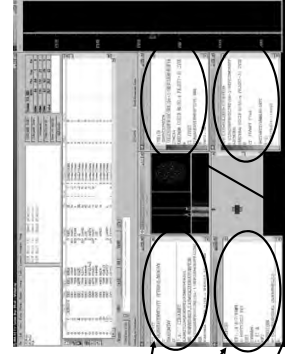
MMTTY & DXP38-WriteLog



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

Multiple RTTY Decoders

multiple MMTTY profile windows

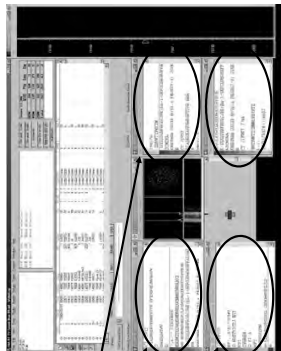


- Parallel decoding
- same audio stream
- switching takes too long
- Multiple profile windows
- Standard
- Fluttered signals
- Fluttered signals (FIR)
- Multi-path
- hyper sensitive
- EU1SA
- AA6YQ-FIR-512
- weak signals in QRN

Multiple RTTY Decoders

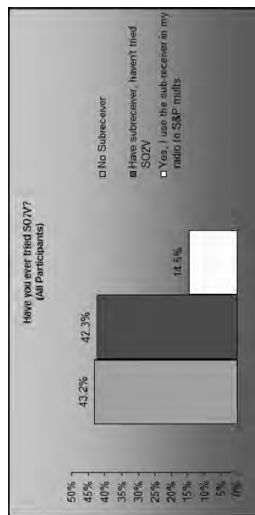
two IF bandwidths

- 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 profiles
 - AA6YQ-FIR-512
 - Dual Peak Filter
 - "Matched filter"



SO2V

2010 survey



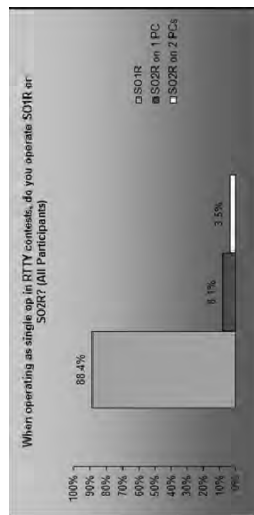
- Almost 15% have tried SO2V

SO2V

- If Assisted and running on VFO-A, then
 - A<>B
 - Click spot, tune, ID station, work station
 - A<>B, resume running
- Or, setup decoder windows on A and B
 - Radio must have two true receivers
 - Monitor both frequencies simultaneously with right/left channels of sound card
 - Right-click call call from 2nd RTTY window into VFO-B Entry Window
- Two ways to transmit on VFO-B:
 - A<>B, work the mult, A<>B
 - SPLIT, work the mult, SPLIT, resume running
 - Requires "wire-OR'd" FSK or AFSK and two transmit RTTY windows
 - K3WriteLog invokes SPLIT when call is right-clicked

SO2R

2010 survey



- 12% operate SO2R
- 30% of SO2R users use 2 PCs

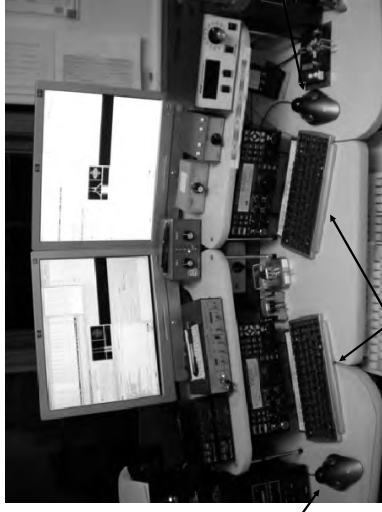
SO2R

- 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
- Two networked computers:
 - Eliminates PC focus swapping
 - RTTY doesn't require much typing
 - Mini-keyboards ideal for RTTY
 - 2 x SO2V for picking up mults on run band
 - Easily extendible to SO4R

No time to watch TV or read spy novels!

SO2R

M2 configuration



Left-hand Trackball

Right-sized Keyboards

SO2R in the NA Sprint

- 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 quickly (within a minute), find a clear frequency and duel CQ
- After a QSO swap VFOs on that radio, search for up to a minute, then resume dueling CQ
- Don't waste time trying to work the "couplet" ... CQing is OK in Sprint!

SOnR

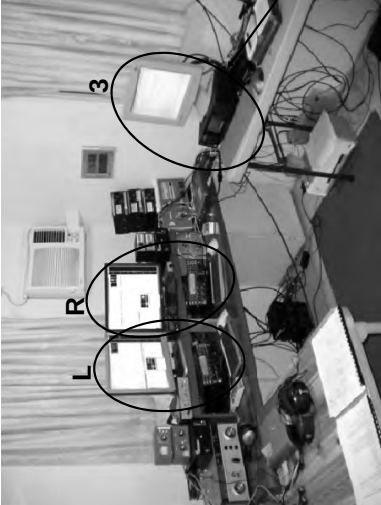
> 2 radios

- Simplify antenna/filter band-decoding:
 - Dedicate a band/antenna to the 3rd (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 provides radio 1, radio 2 or both



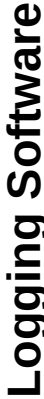
SONR

Multi-Multi configuration



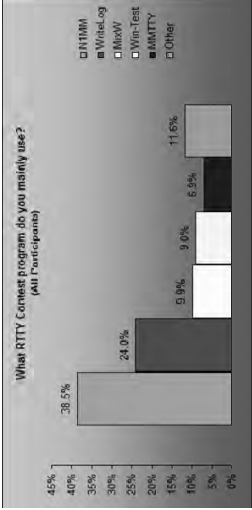
dedicated to 10 meters



Logging Software

2010 survey



Program	Percentage
N1MM	38.5%
WinLog	24.3%
MixW	9.8%
Win-Test	9.0%
MMTTY	6.8%
Other	11.6%

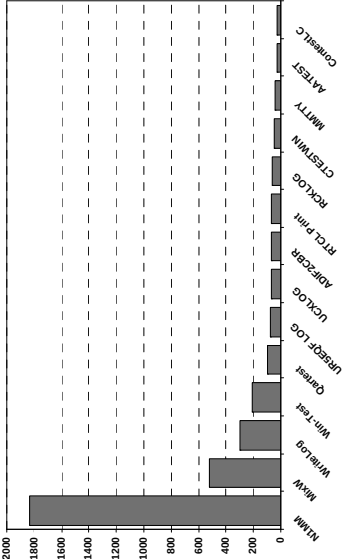
- MixW still ahead of Win-Test
- MMTTY used stand-alone






2012 CQ WPX RTTY

3550 submitted logs



Software	Count
N1MM	1800
WinLog	400
Win-Test	200
MMTTY	100
CTESTWIN	50
POKLOG	50
RTCL mini	50
ADIF-320	50
LOG-LOG	50
UNSCOR-LOG	50
Queset	50
CometLog	50
ATTEST	50






Logging Software

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

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




Logging Software

basics

	N1MM	WriteLog	Win-Test
MMTTY	☺	☺	☺
- other decoders	some	☺	none
Call sign acquisition	☺	☺	☺
Contests supported	☺	☺	fewer
Advanced RTTY	-	-	none

- All three are entirely adequate for basic RTTY contesting
- Use the logger you are already familiar with for CW & SSB

Logging Software

N1MM Logger, WriteLog, Win-Test

- 13 features compared
- Simplifying assumption: features equally weighted
- Rated 0 to 5
- All three score '5' on:
 - MMTTY integration
 - Stateful Enter key (ESM: Enter Sends Message)
 - Accelerator keys
 - QRV message parameter
- Another 9 advanced RTTY features distinguish these loggers

Logging Software

MMTTY integration

- Install free MMTTY software
- Logger integrates MMTTY
 - WriteLog requires additional MMTTY plug-in SW

- All three loggers
- Integrated excellent encoder/decoder

Logging Software

stateful Enter key

- Stateful Enter key (ESM=Enter Sends Message)
 - Cursor in call sign field:
 1. Sends CQ if Call Sign Window empty, else
 2. Sends call sign & exchange
 - Cursor in exchange field:
 3. Sends TU/CQ
- N1MM Logger highlights active key(s)
- All three loggers
- Efficient keyboarding



Logging Software

accelerator keys

- Insert grabs call sign & sends exchange
- + logs QSO & sends TU/CQ



65/90



- All three loggers
- Saves keystrokes



Logging Software

automatic QRV

- QRV 28079.3
- Message parameter for other radio's VFO



66/90



- All three loggers
- Efficient QSY, mult move or "self-spotting"



Logging Software

N1MM Logger, WriteLog, Win-Test

N1	WL	WT
4	5	4
4	5	0
4	5	0
5	0	0
5	5	0
3	5	3
3	5	5
5	5	3
5	2	5
38	37	20



67/90



Logger

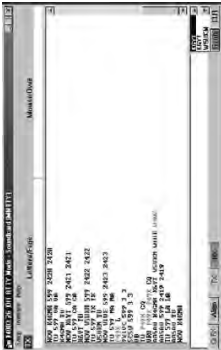
- RTTY window readability
- Multiple decoders
 - multiple MMTTY decoders
- ESM mouse control
- SQ2V
- M2 SQ2R configuration
- Key re-mapping
- Call sign stacking
- Sprint modes

Overall



Logging Software

RTTY Window Readability



N1MM Logger



WriteLog



68/90



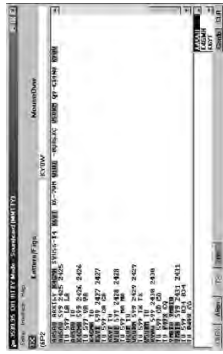
Colored highlighting has outstanding readability. The text all remains black for maximum contrast and the highlighting does not detract. Rather the large highlight area around the text make it extremely easy to zero in on the call sign of interest, especially when quickly moving one's eyes between multiple windows.

Colored text is difficult to read, especially the dark blue (unworked call) which has negligible contrast to black text or black background. The dark blue cannot be changed by the user. **HOWEVER ...**

Logging Software

RTTY Window Readability

N1MM Logger



Colored text is difficult to read, especially the dark blue (unworked call) which has negligible contrast to black text or black background. The dark blue cannot be changed by the user. **HOWEVER, there is now an option for highlighting like Writelog and WinTest.**

Writelog



Colored highlighting has outstanding readability. The text all remains black for maximum contrast and the highlighting does not detract. Rather the large highlight area around the text make it extremely easy to zero in on the call sign of interest, especially when quickly moving one's eyes between multiple windows.

Writelog is unique in having a NON-SCROLLING RTTY window, so you don't have to chase text up the screen!



69090



Logging Software

multiple decoders

- N1MM Logger limited to four total, but has best DXP38 support
- WriteLog has unlimited additional decoders and the most hardware MODEMs
- WriteLog & N1MM Logger only
- Multiple parallel decoders for marginal copy



70990



Logging Software

ESM mouse control

- Left-click enters call sign or exchange
- Right-click (ESM) sends exchange or TU/CQ
- QSOs can be worked entirely with mouse action, except for the rare instance where a call or exchange must be typed in
- Particularly suited to unique non-prefillable exchanges such as serial numbers
- N1MM Logger only
- Eliminates keyboard for efficiency



71590



SO2V

- Basic capability with two VFOs
- Advanced capability with two receivers
 - Requires second receiver in radio
 - Independent RTTY window for second receiver
 - radio/logger SPLIT mode
- N1MM Logger & WriteLog
- Interleave S&P QSOs on Run band



72990



SO2R

M2 configuration

- PC & UI per radio; networked
- Single signal interlock
- Extendible to SOnR
- Only WriteLog
- Another user preference alternative; SOnR



7390



Logging Software

key re-mapping

- Soft re-definition of keyboard keys
- Examples:
 - Insert → ‘
 - = → PopCallToStack
- WriteLog provides a rich built-in function set for key shortcuts
- WriteLog & Win-Test
- N1MM Logger remaps Fn keys & Accel. keys
- Relocates keys for efficiency



7400



Logging Software

re-mapped keys



7590



Logging Software

callsign stacking

- N1MM Logger can automatically fill stack
- WriteLog has convenient stack management
- Win-Test script can use partner stack
- All three loggers
- Doubles rate by skipping CQ & pile-up



7690



Logging Software

callsign stacking

- N1MM Logger automatically pushes calls into the Grab window.
- It can also explicitly push calls onto the Call Stack (like Writelog and Win-Test)
- There is a rich list of stack functions and ESM integration
- WriteLog explicitly right-clicks calls onto the call stack
- Win-Test requires a LUA script to push calls onto the Partner Stack

Automatic vs. explicit pushing is personal pref.

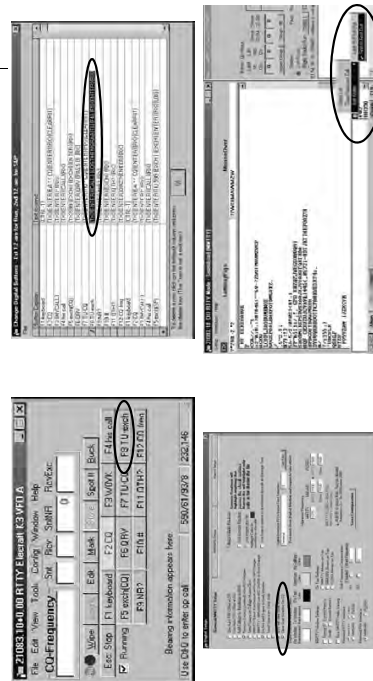
Logger Software

callsign stacking: N1MM Logger

- Setup:
 - Create a F8 message (macro):
 - {TX)! {LOGTHENGAB}TU NOW {F4}{F5}{RX}
 - ! or F4: his call; F5: CQ-exchange ... your choice of Fn
 - Configure the Grab window:
 - Choose "Clear Grab window with CQ" (on DI tab of Configuration window)
 - Choose "First In, First Out" (right-click Grab window)
- Operate:
 - Each highlighted call in DI window automatically goes into Grab window
 - Send this macro in place of TU/CQ macro when you want to work the next call in stack
 - Sending the CQ message clears the Grab window
 - Delete calls from stack by right-clicking and choosing "Delete"

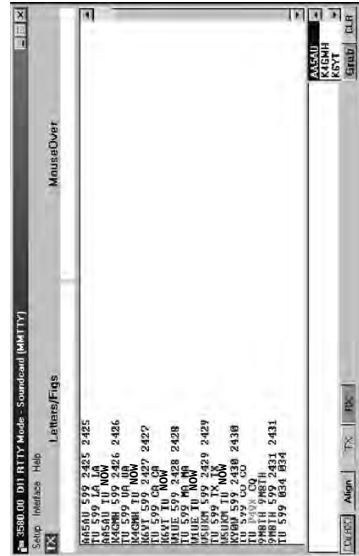
Logging Software

callsign stacking: N1MM Logger - 2



Logging Software

callsign stacking: N1MM Logger - 3



Logger Software

callsign stacking: N1MM Logger - 4

Alternatively, the Call Stack may be used:

- Setup:
 - Create a F8 message (macro):
 - {TX}! {LOGTHENPOP}TU NOW {F4}{F5}{RX}
 - ! or F4: his call; F5: CQ-exchange ... your choice of Fn
- Operate:
 - Alt-click a callsign to push it onto the Call Stack
 - Send this macro in place of TU/CQ macro when you want to work the next call in stack
 - Sending the CQ message clears the Call Stack
 - Delete calls from the Call Stack by right-clicking and choosing "Delete"



83/90



Logging Software

callsign stacking: WriteLog

- Setup:
 - Configure right-click for Push-only in writelog.ini:
 - [RttyContextMenuEntries]
 - 1=PUSHCALL
 - Define Push and Pop keys, using the Keyboard Shortcuts feature:
 - Push Call on the Graves (-) key
 - Pop Call on the Equals (=) key
 - Create <TU NOW msg>
 - %R%C TU NOW%
 - Operate:
 - Push calls onto stack
 - Push calls right-click for single menu item
 - right-click call in Rttyrite window
 - At the end of the current QSO, press <TU NOW msg> followed by the Insert key or Enter key (the normal CQ-exchange msg)
 - Press TU/CQ msg (rather than + or Enter) when you don't want to pop the stack for your next contact
 - Pop/Push to rotate the desired call into Entry window without losing others (replace Push with Alt-W to delete a call, or do another Pop)



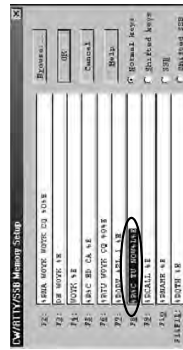
82/90



Logging Software

callsign stacking: WriteLog - 2

- Create Fn macro
 - %R%C TU NOW%L%E
- Push calls onto stack
 - Right-click call in Rttyrite window



83/90



Logging Software

callsign stacking: WriteLog - 3



84/90



• **CTU •**
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- 85/90



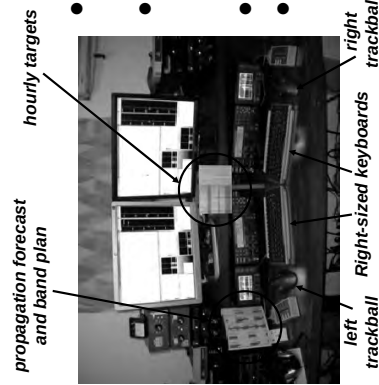
N1	WL	WT
4	5	4
4	5	0
4	5	0
5	0	0
5	5	0
3	5	3
3	5	5
5	5	3
5	2	5
38	37	20

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- 87/90



En key labels



Full-size QWERTY keyboard; no number pad; integrated cursor keys



06/88



Ergonomics

keyboard or mouse?

- Keyboard – minimal typing in RTTY
 - Either:
 - F1, Insert and + ... or,
 - Enter, Insert and Enter (ESM – Enter Sends Message)
 - Plus Fn keys or re-mapped Fn keys
 - Mouse click received exchange, if not pre-filled
- Mouse/trackball
 - 100% (N1MM Logger)
 - 80% (WriteLog and Win-Test)



Resources

- www.rttycontesting.com
 - Tutorials and resources (beginner to expert)
- WriteLog/MMTTY
- rtty@contesting.com
 - Email reflector
 - RTTY contester networking
 - Q&A
- Software web sites
 - minhamsoft.amateur-radio.ca/ (MMTTY)
 - n1mm.hamdocs.com/tiki-index.php (N1MM Logger)
 - www.write-log.com (WriteLog)
 - www.win-test.com (Win-Test)
- Software Reflectors
 - mmmtv@vahogroups.com (MMTTY)
 - N1MMLcenter@vahogroups.com (N1MM Logger general)
 - N1MMLcenter-Digital@vahogroups.com (N1MM Logger RTTY & PSK)
 - write-log@contesting.com (WriteLog)
 - support@win-test.com (Win-Test)

CTU Presents

Enriching Your Contesting
Experience

Tim Duffy K3LR



Contest University Update

- 6th year for Dayton CTU
- 4 years each for Italy and England
- 3rd year for Germany
- July 2012 – CTU Finland
- Over 1000 students will attend CTUs in 2012
- CTU on the Internet – at Dayton 2012
- Look for more exciting CTU developments



Montichiari, Italy



Stefano, IK2QEI



300 attended CTU Italy 2012



CTU England



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Mark, M0DXR

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Friedrichshafen – CTU Germany



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Improving your Contesting

- Ask lots of questions this weekend – keep notes
- Listen to others during contests – keep notes
- Know the bands – use clusters and RBN the week before – keep notes
- Fix your “noise” – rfl@contesting.com – before the contest
- Read 3830 and online logs know your competition
- Timely post to 3830 – share – be POSITIVE

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More Contest Hints

- Set your Packet/UBN filters before the contest. No out of band temptations
- Never be afraid to call CQ
- Latest logging software loaded and tested
- Calling “zero-beat” makes CW Pileups hard
- SCP and CTY files updated B4 contest
- Reset your radio FW
- Check “tight” - all connectors

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More Contesting Hints

- Get a good night's rest before the contest and eat breakfast
- Total station pre check 24 hours before the start
- Be ready to operate at least 1 hour before the start
- Peppermint and peanuts are your friends
- Sit straight – 5 hour energy
- Be confident, even if you don't feel like it
- Don't quit! EVERY QSO matters



Giving Back to the Hobby

- Share your passion with others
- Be loyal to your contesting efforts
- Have an open heart to operators just starting – send congratulations emails
- Be active in your local club – not just Field Day
- Love what you are doing – let it show
- When you are on a team – be a team player
- Support those who donate time to help with Contests
- Prepare and give a program on Contesting to any club or group

Or write an article for an online service – or the NCJ
Give a presentation or write an article and save \$\$\$ on
CTU 2013



CTU Presents

The Fitful Rise of Solar Cycle 24
What it Means in the Coming Year

Frank Donovan
W3LPL

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Introduction

- This presentation focuses on:
 - The four major fall and winter DX contests:
 - CQ WW SSB and CW
 - ARRL DX SSB and CW
 - Propagation mostly from the eastern half of the U.S.
 - The years of highest solar activity: 2012-2015
- Its conclusions will need to be updated regularly as Cycle 24 progresses

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The Long, Deep Solar Minimum

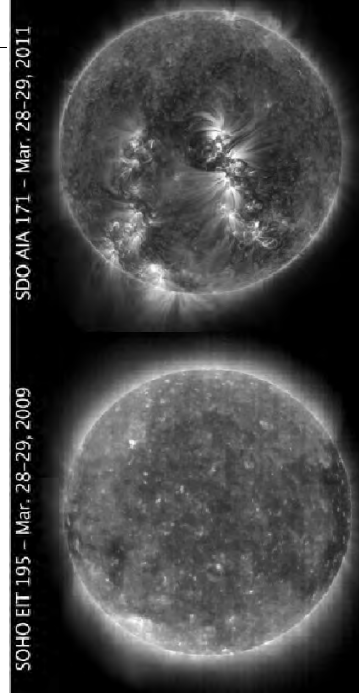
- The first spotless sun of Cycle 23 occurred in 2004
 - solar minimum was then predicted for January 2007
- Three years of exceptionally deep solar minimum
 - no sunspots during 44% of the days of 2007
 - no sunspots during 73% of the days of 2008
 - the "blankest year" since 1913
 - no sunspots during 71% of the days of 2009
- The official solar minimum occurred in December 2008
 - We are now more than three years into Solar Cycle 24
- Sunspot activity began to increase slowly in 2010

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The Quietest Sun in the
History of HF Radio

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March 2009 vs. March 2011



Many East Coast to VU4PB QSOs
were made on March 28-29, 2011

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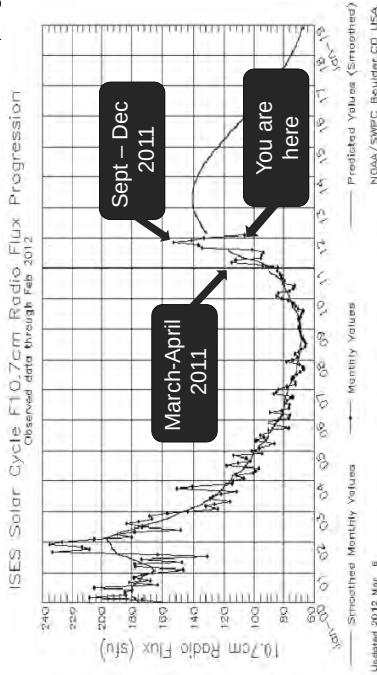
The Fitful Rise of Cycle 24

- Cycle 24 sunspots were first seen in January 2008
- Cycle 24 is rising much more slowly than any solar cycle in 100 years
- Solar flux suddenly increased in February and September 2011
 - But the solar flux declined significantly in May 2011 and January 2012
- Solar maximum is forecast in just 12 months
 - May 2013
- Solar flux is forecast to decline to current levels in just two years
 - Mid - 2014

- **The most important take away from this presentation:**

Improve the performance of your
10 and 15 meter antennas now

Solar Flux Suddenly Increased from Mar - Apr and then Sept - Dec 2011



Dramatically Improving but Fitful DX Propagation

- 15 meters started to dramatically improve during 2010
 - Strong openings nearly every day
 - except for a few disturbed days each month
- 10 meters improved dramatically from Sept through Dec 2011
 - The strongest and most persistent DX openings in at least 10 years
 - Daily short path propagation to Europe and the Mid East
 - Trans-polar and long path propagation to the Far East and Southeast Asia
 - Short path propagation to the far western Pacific until well after sunset
- Many CQ WW and ARRL DX contests will be incredible
 - for at least the next three years

More Frequently Degraded HF DX Propagation

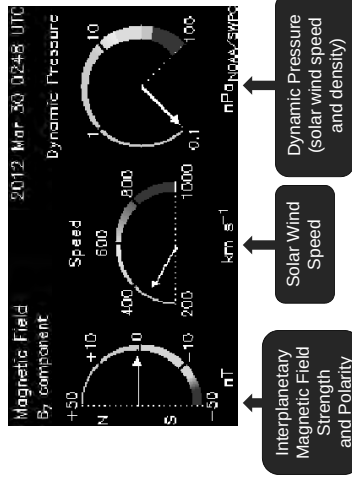
- The historically quiet, predictable geomagnetic conditions of 2007-2009 are over for at least four years
- Geomagnetic conditions (measured by the K-index) often degrade suddenly and without warning
- Forecasting of disturbed geomagnetic conditions is less reliable
 - Always prepare for the possibility of degraded propagation on Sunday of every DX contest, regardless of forecasts
- Always expect the unexpected during DX contests
 - DX contests will sometimes experience periods of moderate to severe geomagnetic activity and storms
 - Often with little or no warning

The K Index vs. the A Index

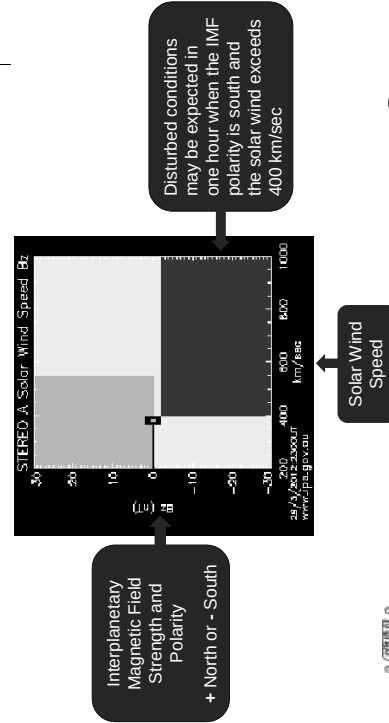
- K Index – a rapid indicator of changing auroral absorption
 - A logarithmic index (0 - 9) covering the last 3 hours
- A Index – an average of yesterday's auroral absorption
 - A linear index (0 - 400) covering the 24 hours before 2100Z
- The indexes and propagation to Europe and Asia

• Low	K = 0-2	A = 0-10	Excellent propagation
• Moderate	K = 3-4	A = 10-50	Normal propagation
• High	K = 5-6	A = 50-100	Poor propagation
• Severe	K = 7-9	A = 100-400	Very poor propagation

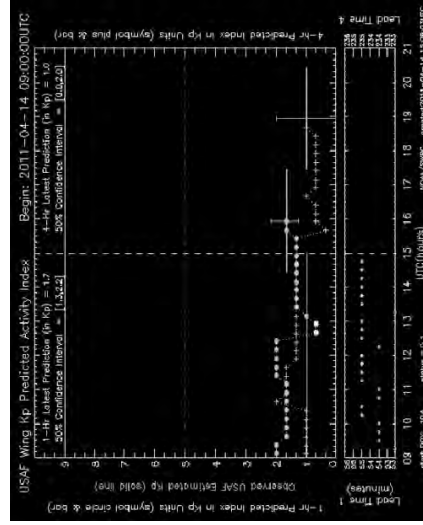
Space Based Solar Wind Data One Hour Ahead of Real Time



Analyzing IMF Polarity and Solar Wind Speed



Wing K Index Prediction Model



Much More Active Auroral Oval

- The auroral oval is always present
- normally a narrow band of mild absorption affecting only high latitude propagation to Europe and Asia
 - from the northern U.S. to northern Europe
 - from the northeast U.S. to Japan and the Far East
- The oval always tilts towards the night side of the Earth
- the solar wind always pushes it away from the sunlit side
- During geomagnetic disturbances
 - the oval moves towards the equator, especially at night
 - the oval widens greatly especially when the K index is > 5
 - absorption on paths to Europe and Asia increases greatly



The Mid-Latitude Trough

- A 5 degree wide region of greatly lowered MUF
- Located on the equatorward edge of the auroral oval
- Moves towards the equator with the auroral oval when $K > 3$
- Present on most but not all nights in late fall and winter only
- The MUF drops rapidly after most sunsets in the ionosphere
- The MUF instantly returns to normal at sunrise in the ionosphere
- Shuts down 20, 15 and 10 meter propagation to Europe during most -- but not all -- winter afternoons in the northeast U.S.
- Shuts down 20, 15 and 10 meter propagation to Japan a few hours after most -- but not all -- winter sunsets in northeast U.S.
- Shuts down 40 meter short path propagation to JA from the northeast US during most winter nights. Short path often opens just before sunrise



Learn to recognize days
when the trough is not active

Mid-Summer Propagation

- Cycle 24 improves propagation much less during July and August than during the rest of the year
- 10 meters – little changed from low sunspot years
 - unpredictable sporadic-E remains the dominant summer propagation
- 15 meters
 - longer and more frequent openings, especially to VK/ZL
- 20 meters
 - somewhat better during the evening and night, especially to VK/ZL
- 40 meters - little changed except for weaker early evening openings
- 80 and 160 meters - significantly shorter and weaker openings



Mid-summer propagation is
much less improved by Cycle 24

Fall, Winter, Spring Propagation

- Major propagation improvements except during relatively frequent geomagnetic activity and storms
- 10 meters - a major worldwide DX band since October 2011
 - Fiftful world wide propagation from October through March
- 15 meters - strongest daytime DX band from September to May
- 20 meters - a 24 hour worldwide DX band
 - The European sunrise opening to the U.S. returns during many nights
 - Strong night time propagation to VK/ZL and Africa
- 40 meters - weaker mid-afternoon DX propagation
- 80 meters - significantly shorter openings and weaker propagation
- 160 meters - less frequent and much weaker DX propagation



Cycle 24 significantly improves
propagation from September - May

10 Meters

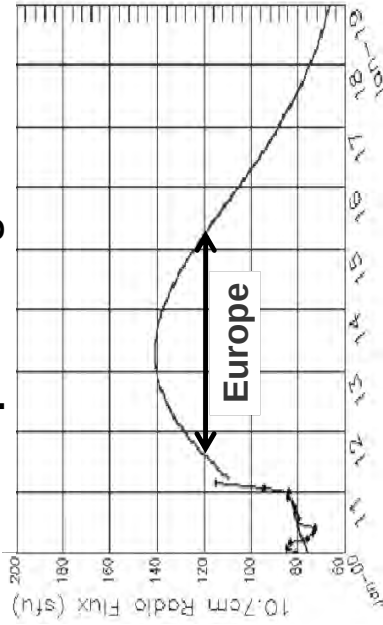
- World wide propagation from October through March
 - many days, but much less reliable when the K index is 4 or higher
- European openings during most mornings
 - starting after sunrise until mid-afternoon
- Multiplier rich Asia long path openings from 1200 -1400Z
- Almost daily strong propagation from the east coast U.S. to the Far East returned from October to November 2011
 - But short path JA openings have been very infrequent in 2012
- VK/ZL propagation until several hours after sunset

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Fitful worldwide daytime DX
from October to March

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Fitful 10M Propagation to Europe through 2015

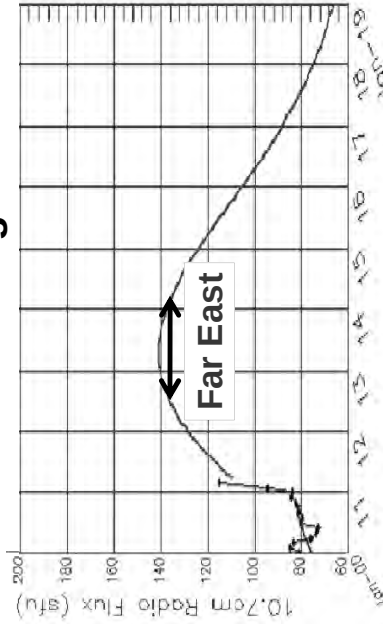


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October 2011 – March 2015

ICOM

Fitful 10M Propagation to the Far East through 2014



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October 2011 – March 2014

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15 Meters

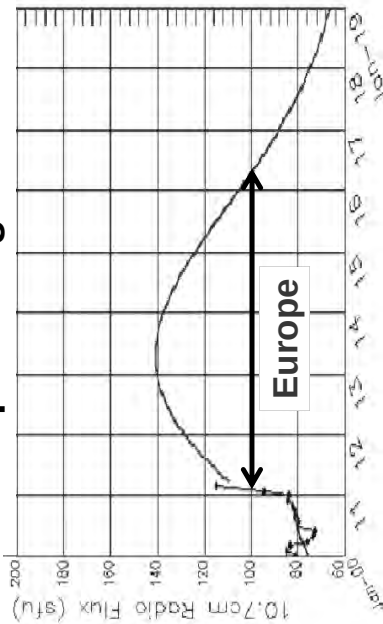
- World wide propagation from before sunrise until late evening almost every day
- European openings almost every day
 - from before sunrise until late afternoon
- Frequent, strong propagation from the east coast U.S. to the Far East
 - multiplier rich Asia long path openings from 1200-1400Z
- VK/ZL propagation almost every day
 - will last three to four hours after sunset during many evenings

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The strongest daytime DX band
from September through May

ICOM

Regular 15M Propagation to Europe through 2016

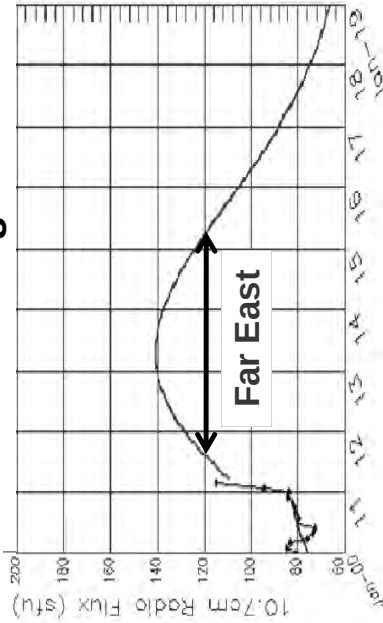


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February 2011 – March 2016

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Regular 15M Propagation to the Far East through 2015



CONTEST UNIVERSITY

October 2011 – March 2015

ICOM

20 Meters

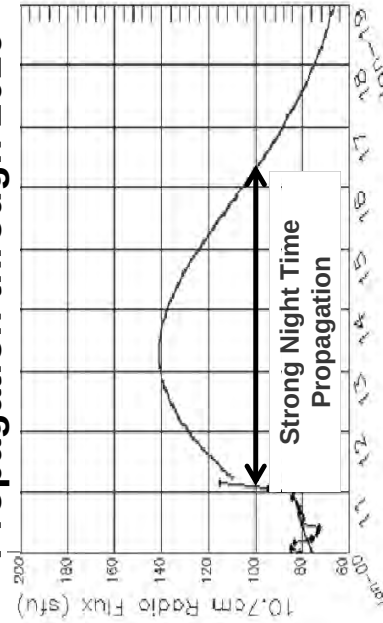
- World wide propagation for nearly 24 hours on most days
- Strong European openings every day and many nights
 - European sunrise opening becomes a major factor – 0800Z
- Strong propagation from the U.S. east coast to the Far East
 - 1200 -1400Z most mornings and for several hours after sunset
- Strong long-path propagation to the Far East and VK/ZL
 - 1200 -1400Z (southwest) propagation to South Asia
 - 2000 - 2300Z (east) propagation to VK/ZL
- Strong VK/ZL short path propagation from 0400-1400Z

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The most reliable year round worldwide day/night DX band

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Strong 20M Night Time Propagation through 2016



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February 2011 – March 2016

ICOM

40 Meters

- Mid-afternoon DX propagation weakens significantly
- Strong worldwide openings begin about an hour before sunset
- Strong European signals will produce huge QSO rates
- Short path openings to Japan will become less frequent
- Caused by the reduced MUFs in the Mid-Latitude Trough
- The sunrise skew path (southwest) opening becomes more important for Asian multipliers

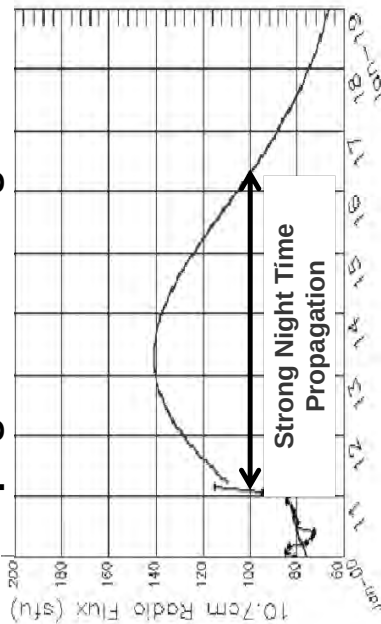
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A strong night time
worldwide DX band

ICOM



Strong 40M Night Time Propagation through 2016



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February 2011 – March 2016

ICOM

80 Meters

- Much shorter and less reliable European openings
 - but Europeans will continue to be very important to overall QSO and multiplier totals
- Knowledge of worldwide 80 meter DX propagation is critical to competitive QSO and multiplier totals
- Competitors must remain serious about this important band
 - even as night time propagation returns to the higher bands

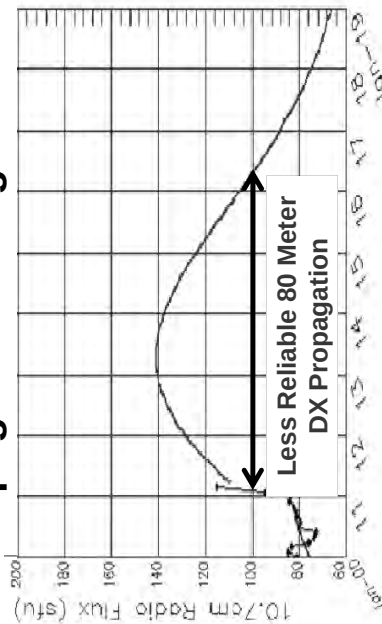
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Weaker and less frequent
openings through 2016

ICOM



Less Reliable 80 Meter DX Propagation through 2016



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February 2011 – March 2016

ICOM

160 Meters

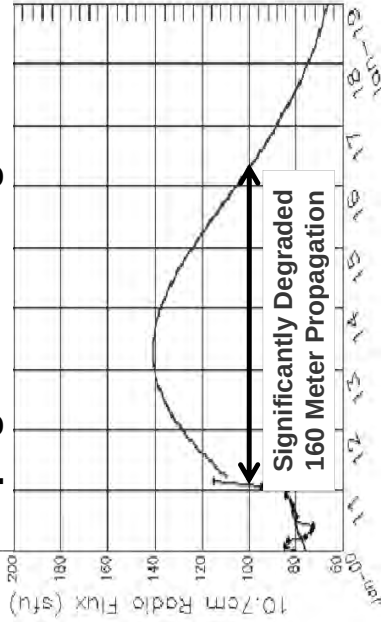
- Strong knowledge of 160 meter DX propagation is critical to a competitive multiplier total
- Openings to Europe and the mid East will occur unpredictably and unreliably between sunset and 0800Z
 - especially just before sunrise on the eastern end of the path
- Good openings to the Pacific sometimes occur just before sunrise



Much weaker and less frequent openings through 2016



Significantly Degraded 160M Propagation through 2016



February 2011 – March 2016



0000Z - Starting the Contest

- High rate bands: 40M (Eu), 20M (Eu, JA) and 15M (JA)
- All six bands will probably be open
 - 10M: Pacific and South/Central America
 - 15M: JA, Asia, Pacific, South/Central America
 - 20M: Worldwide propagation
 - 40M: Europe, Mideast, Africa, Caribbean
 - 80M: Europe, Africa, Caribbean
 - 160M: Caribbean and a few Europeans and Africans
- 10 meters will start to close after 0100Z



Favor 15M or 20M at 0000Z Friday



0200 – 0400Z

- High rate bands: 80M (Europe) and 40M (Europe)
- 160 through 15 meters will probably be open
 - 15M: Pacific, South/Central America
 - 20M: Asia, Pacific, South/Central America
 - 40M: Europe, Mideast, Africa, South/Central America
 - 80M: Europe, Caribbean, South/Central America
 - 160M: Europe, Africa, Caribbean, South America
- 15 meters will start to close by 0200-0300Z



Focus on 40M from 0200-0400Z



0400 – 0600Z

- High rate bands: 80M (Europe) and 40M (Europe)
- 160 through 20 meters will probably be open
 - 20M: Asia, Pacific, South/Central America, Africa
 - 40M: Europe, Africa, Caribbean, South/Central America
 - 80M: Europe, Caribbean, South/Central America
 - 160M: Europe, Africa, Caribbean, South/Central America

 **Good time for 80 and 160 meters** 

0600 – 0800Z

- High rate bands: 80 (Europe) 40 (Europe)
- 160 through 20 meters will probably be open
 - 20M: Pacific, South/Central America, Africa.
 - 40M: Europe, Africa, Caribbean, Pacific
 - 80M: Europe, Caribbean, South/Central America
 - 160M: Europe, Africa, Caribbean
- 80 meters will close to Europe by 0700-0800Z

 **Good time for low band multiplier hunting** 

0800 – 1000Z

- High rate bands: 40 (Europe) and 20 (Europe)
- 160 through 20 meters are likely to be open
 - 20M: Pacific, South/Central America, Africa.
 - Watch for a strong European sunrise opening at 0800Z
 - 40M: Europe, Africa, South/Central America, Japan, Pacific
 - 80M: Caribbean, Central/South America, Pacific
 - 160M: Caribbean, Central/South America, Pacific
- 40 meters might open to Japan if the k-index is 2 or less

 **Watch for 20M openings hours before sunrise** 

1000 – 1200Z

- High rate bands: 20M (Europe) and 15M (Europe)
- 160 through 15 meters are likely to be open
 - 15M: Europe, Mideast, Africa, Caribbean
 - Watch for pre-sunrise openings to Europe and Africa
 - 20M: Europe, Mideast, Africa, Caribbean, South America
 - 40M: South/Central America, Japan, Pacific
 - 80M: Central/South America, Japan, Pacific
 - 160M: Central/South America, Pacific
- 40 meters may open strongly to Japan at sunrise
 - if the k-index is 2 or lower

 **Watch for pre-sunrise 15M openings** 

1200 – 1400Z

- High rate bands: 20M (Eu, JA), 15M (Eu) and 10M (Eu)
- 40 through 10 meters are likely to be open
 - 10M: Europe, Mideast, Africa, Caribbean, South America
 - watch for an early opening to Europe just after sunrise
 - 15M: Europe, Mideast, Asia, Africa, Caribbean, South America
 - watch for a long path Asia opening
 - 20M: Europe, Mideast, Asia, Africa, Caribbean, South America,
 - 40M: Japan, Pacific
- 40 meters may strongly open to Japan at sunrise
 - if the k-index is 2 or lower

 **Watch for 10M openings just after sunrise** 

1400 – 1600Z

- High rate bands: 20M (Eu), 15M (Eu) and 10M (Eu)
- 20 through 10 meters are likely to be open
 - 10M: Europe, Mideast, Africa, Caribbean, South America
 - 15M: Europe, Mideast, Asia, Africa, Caribbean, South America
 - 20M: Europe, Mideast, Asia, Africa, Caribbean, South America
- 10 and 15 meters might close by late morning
 - especially if the K Index is 3 or higher

 **Focus on the highest open band** 

1600 – 1800Z

- High rate bands: 20M (Europe) and 15M (Europe)
- 40 through 10 meters are likely to be open
 - 10M: Europe, Mideast, Africa, Caribbean, South/Central America
 - 15M: Europe, Mideast, Africa, Caribbean, South/Central America
 - 20M: Europe, Mideast, Africa, Caribbean, South/Central America
- 10 meters may remain open to Europe until mid-afternoon
 - especially if the K Index is 3 or lower

 **Excellent time for 20 meters to Europe** 

1800 – 2000Z

- High rate bands: 20M (Europe) and 15M (Europe)
- 20 through 10 meters are likely to be open
 - 10M: Caribbean, South/Central America, Pacific
 - 15M: Europe, Africa, Caribbean, South/Central America, Pacific
 - 20M: Europe, Mideast, Africa, Caribbean, South/Central America, Australia (long path)
- 15 meters might close to Europe in early afternoon
 - especially if the k-index is 3 or higher

 **Good time for worldwide multipliers** 

2000 – 2200Z

- High rate bands: 40M (Eu), 20M (Eu) and 15M (Eu, JA)
- 40 through 10 meters are likely to be open
 - 10M: Caribbean, South/Central America, Pacific
 - 15M: Europe, Africa, Caribbean, South/Central America, Pacific, Japan
 - 20M: Europe, Africa, Caribbean, South/Central America, Australia (long path), Japan
 - 40M: Europe, Africa, Australia (long path), Caribbean
- 15 meters may remain open to Europe until late afternoon
 - if the k-index is 2 or lower

 **Look for JA openings from 2100Z** 

2200 – 0000Z

- High rate bands: 40M (Eu), 20M (Eu, JA) and 15M (JA)
- All six bands will probably be open
 - 10M: Caribbean, South/Central America, Pacific
 - 15M: Caribbean, South/Central America, Pacific, Japan
 - 20M: Europe, Africa, Caribbean, South/Central America, Japan
 - 40M: Europe, Africa, Australia (long path), Caribbean
 - 80M: Europe, Africa, Caribbean
 - 160M: Caribbean, a few European big guns

 **Prime time for Japan and Far East** 

Cycle 24 – Yes Its Finally Here!

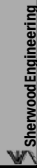
- Refurbish your 10 and 15 meter antennas this summer
 - build them bigger and better !
 - they're smaller and more affordable than lower band antennas
- 10 and 15 meter antennas and transmission lines are more susceptible to moisture and ultraviolet damage than lower band antennas
 - Proper installation, regular inspections and preventative maintenance are more important than ever
- Develop your high sunspot contest skills and strategies
 - you will need new skills and strategies for the next four years

 **Prepare now for CQ WW** 

Transceiver Performance 10 Years of Change

Rob Sherwood
NCØB

Great Strides + Many Problems Ignored



- **What is important in a contest or DX pile-up environment?**
- Good Dynamic Range to hear weak signals in the presence of near-by strong signals.
- You need a better receiver for CW than for SSB.
- Lots of choices today in the top performers.
- **Many secondary issues still not addressed.**

What Parameter is Most Important for a CW Contester?

- Close-in Dynamic Range (DR3)
- (We have to know the noise floor to calculate Dynamic Range)

What is Noise Floor?

Sensitivity is a familiar number, normally applies to SSB.

Sensitivity = 10 dB Signal + Noise / Noise (10 dB S+N/N) 🗣️ 🗣️

Noise Floor = 3 dB Signal + Noise / Noise (3 dB S+N/N)

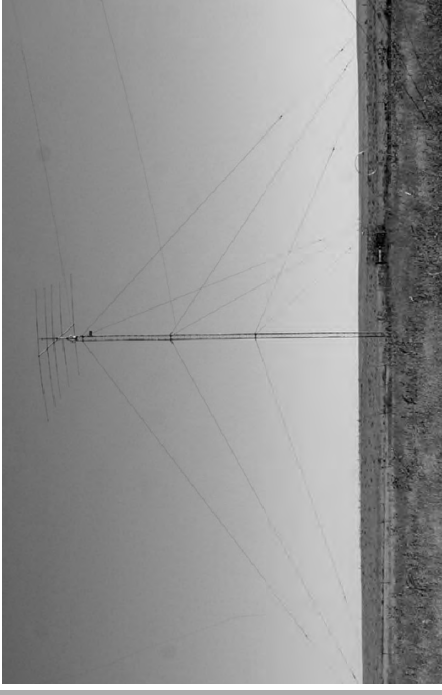
Noise floor can be measured at any filter bandwidth, CW or SSB, for example, and is bandwidth dependent.

League normally only publishes noise floor for a CW bandwidth, typically 500 Hz CW filter.

Noise Floor – Rarely an Issue on HF

- On 20 meters and below, atmospheric, galactic and man-made noise predominates.
- On 15 meters, in a quiet rural location, the receiver is still rarely the limit. Example:
- NC0B, 5 element yagi at 70 feet, 270 feet of 7/8th inch hardline, antenna pointed in the quietest direction (30 degrees) at 4 PM on 2/28/2010.
- Receiver sensitivity, no preamp, 2.4 kHz = 0.35 μ V
- Receiver sensitivity, w/ preamp, 2.4 kHz = 0.14 μ V
- Receiver noise floor, no preamp, 500 Hz = -132 dBm
- Receiver noise floor, w/ preamp, 500 Hz = -140 dBm

LJ-155CA yagi in the previous example



A simple test with only an analog meter

- Most hams don't own a calibrated signal generator.
- How do you evaluate your receiver?
- Measure the noise gain when you connect your antenna.
- All you need is an analog meter with a dB scale, hooked up to your speaker.

Measure the noise gain

- Disconnect your antenna and set the volume so your dB meter reads -10 dB.
- (Put a dummy load on the rig, but it will likely make no difference.)
- Connect the antenna and see how many dB the noise goes up when tuned to a dead spot on the band.
- Do this with Preamp OFF and ON
- Also rotate your yagi 360 degrees
- Noise can easily change 10 dB !

15 & 10 meters noise gain

Rig = Icom IC-756 Pro III

10 meter antenna = Hy-gain 105CA @ 65 feet

15 meter antenna = Hy-gain 155CA @ 70 feet

Preamp	15 M	10 M
None	4 dB	3 dB
Preamp 1	11.5 dB	9.5 dB
Preamp 2	13.0 dB	11.0 dB

More Variables – Plan ahead if you can

- At my QTH there are two towers near the house and four 200 to 350 feet away. My noise level on 20 – 10 meters is worse for the close-in towers, unless I turn off electronic devices.
- TVs (CRT or plasma), UPS & family-room computer, broadband router (makes birdies), wireless Internet dish, wall warts with switching power supplies, hand touch lamp !

Tower Distance vs. local RFI (noise)



Numbers with Preamp-1 ON

Noise Floor Quite Consistent in Top 10

• FTdx-5000D	-135 dBm
• Elecraft K3	-138 dBm
• Perseus	-125 dBm (No preamp)
• Flex 5000	-135 dBm
• Orion II	-133 dBm
• Orion I	-135 dBm
• T-T Eagle	-132 dBm
• Flex 3000	-139 dBm
• TS-590S	-137 dBm
• Icom R9500	-130 dBm
• Drake R-4C	-138 dBm (For comparison)

What is Dynamic Range?

The range in dB of very strong signals to very weak signals that the receiver can handle At The Same Time

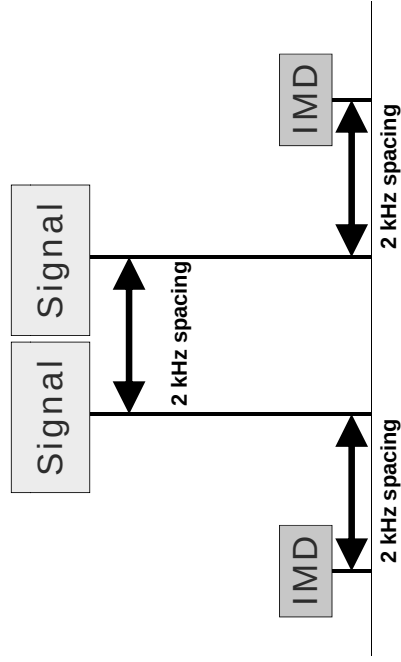
What is Close-in Dynamic Range vs

Wide-Spaced Dynamic Range?

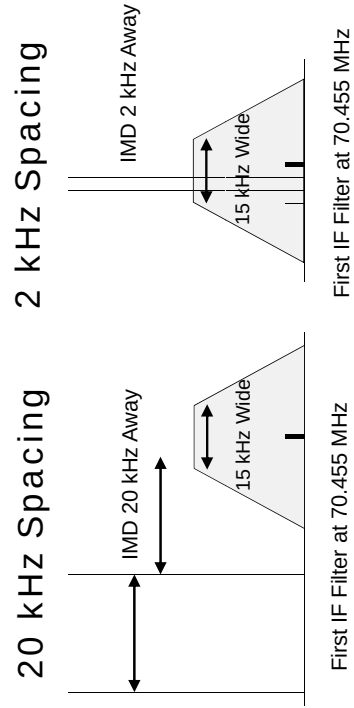
Why is Close-in Dynamic so important for CW ops?

Why is it less important for SSB operators?

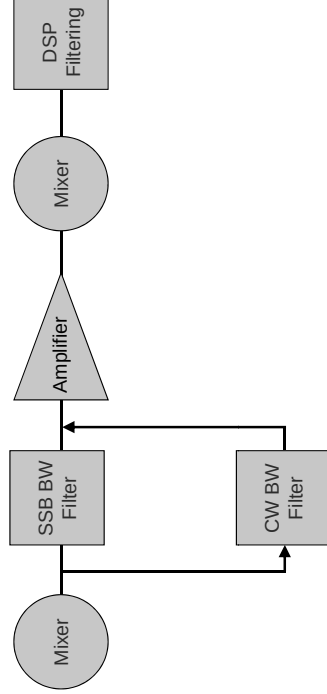
Third Order IMD to Measure Dynamic Range



Wide & Close Dynamic Range



Highest performance with a bandwidth appropriate filter right up front after the first mixer.



This keeps the undesired strong signals from progressing down stream to the next stages.

What has changed in the last 9 years?

- Ten-Tec started the change in 2003 with the Orion, going back to "down-conversion" (a first IF between 5 and 11 MHz, not VHF).
- Elecraft, Yaesu and Kenwood followed suit
- TS-590S has been a big seller at a great price point.
- The T-T Eagle receiver can be added as the Orion sub receiver
- Many choices from \$1650 to \$5000+

When are 2 Out of Pass Band Signals a Problem?

- If you know the close-in dynamic range of a radio, at what signal level will IMD start to be a problem?
- S Meter standard is $S9 = 50 \mu V$, which is -73 dBm
- Assume a typical radio:

• 500 Hz CW filter • Noise Floor of -128 dBm • Preamplifier OFF

Dynamic Range	Signal Level Causing IMD = Noise Floor
55 dB	S9
60 dB	FT-757 (56 dB)
65 dB	S9 + 5 dB
70 dB	FT-2000 (61 dB)
75 dB	S9 + 10 dB
80 dB	IC-7000 (63 dB)
85 dB	S9 + 15 dB
90 dB	1000 MP / Mk V Field (68 / 69 dB)
95 dB	S9 + 20 dB
100 dB	756 Pro II / III (75 dB)
	S9 + 25 dB
	Omni-VII / IC-7800 (80 dB)
	S9 + 30 dB
	TS-590S (88 dB)
	S9 + 35 dB
	Eagle & Flex 3K (90 dB)
	S9 + 40 dB
	Orion II & Flex 5000A (95 dB)
	S9 + 45 dB
	FTdx-5000, K3 (200 Hz roofing)

Dynamic Range of Top 8 Transceivers

Close-in 2-kHz Test @ 500 Hz BW

- | | |
|---------------|--|
| • FTdx-5000D | 101 dB |
| • Flex 5000 | 96 dB (Flex users raise hand) |
| • Elecraft K3 | 95 dB (with 500 Hz filter) |
| • Orion II | 95 dB |
| • Orion I | 93 dB |
| • TT Eagle | 90 dB |
| • Flex 3000 | 90 dB |
| • TS-590S | 88 dB (Low Freq 1 st IF mode) |
| • TS-590S | 76 dB (30, 17, 12, 10 & 6 M) |

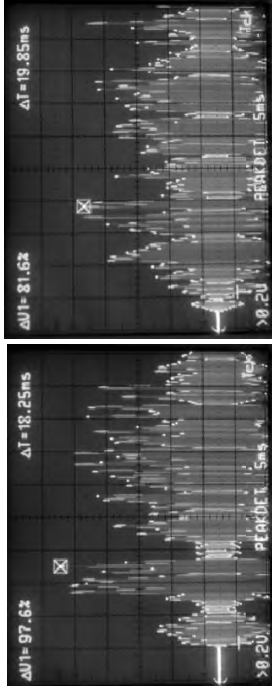
Let's now look at the transmitters

- ALC overshoot is a common problem
- How clean is our signal?
- I am now testing transmitters with white noise feeding the microphone, in addition to a two-tone test.
- The effect of IMD products (splatter) are more obvious with noise.
- Think of it as a 1000 tone test, more approximating real voice.

ALC Transmit Overshoot Problems

- ALC time constants often too fast or too slow.
- Too fast = increases distortion / IMD
- Too slow = Overshoot could damage linears that only need 40 to 60 watts of drive.
- Unfortunately many rigs today exhibit ALC issues.
- ALC overshoot often worse at reduced power

TS-590S with firmware 1.06



- Rig set to 50 watts
- 100% = 100 watts
- Peaks at 97.6% voltage
- Peak = 95 watts

- Rig set to 25 watts
- 100% = 100 watts
- Peaks at 81.6% voltage
- Peak = 67 watts

IC-7410 data from PA3EKE



Set for 20 watt carrier



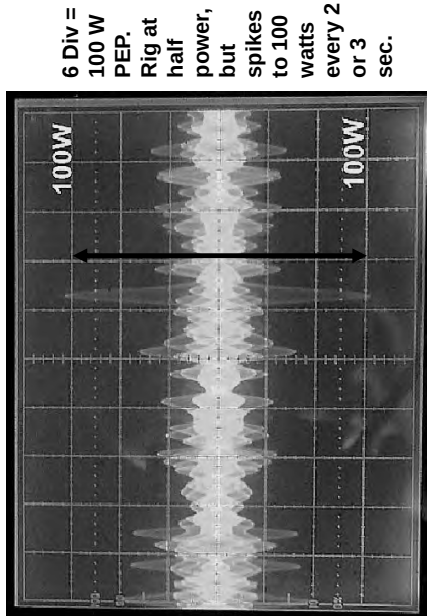
Overshoot 80+ watts on voice peaks

For comparison: IC-7410

- Look at what happens to ALC spikes with the IC-7410 and IC-9100 with white noise and 50% ALC reading on the meter.

Courtesy Adam Farson – VA7OJ

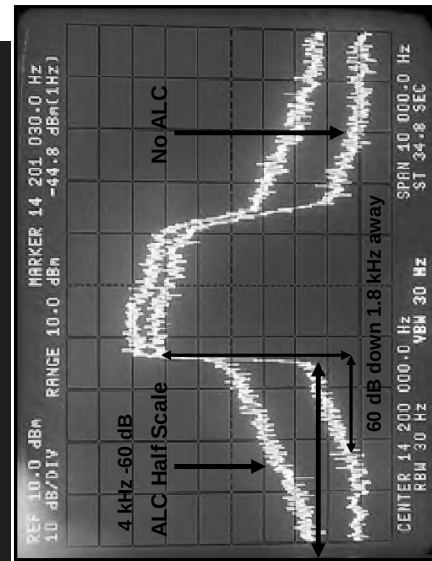
Set to 50 Watts Key Down - White Noise



Different ALC philosophy at Yaesu

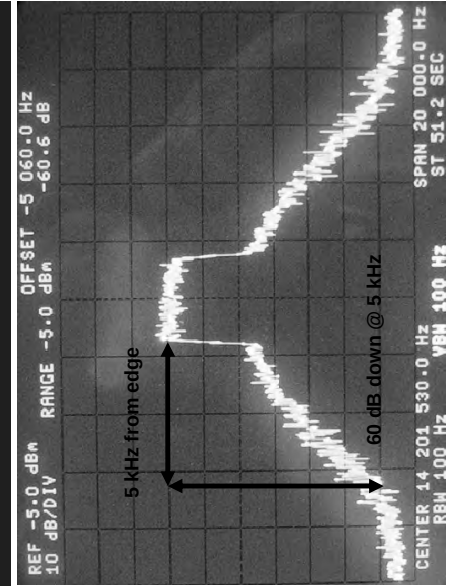
- Decades ago Collins stated that an ALC circuit should have a SLOW decay time constant. ALC should just be a slow leveling circuit. Speech processing should be done way before the PA and the ALC.
- Yaesu: "If the ALC responds to a short pulse, the overall power level will be too low, and become a major concern of users."
- Unfortunately this design negates much of the advantage of their very clean rigs that offer class A operation.

FTdx-5000D Class A – Two Levels ALC



Noise source = GR 1381, 5-kHz -3 dB BW

Icom IC-7410 Class AB, White Noise



CW Signals – How wide are they?

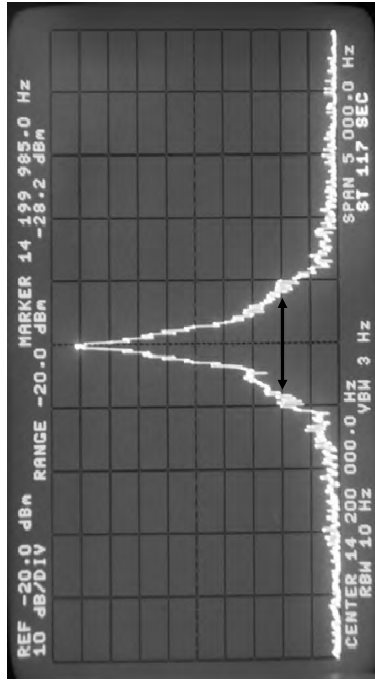
We have seen how width of an SSB signal & its IMD products affects how close you can operate to another station.

How does CW compare?

How close can we work to a strong adjacent CW signal?

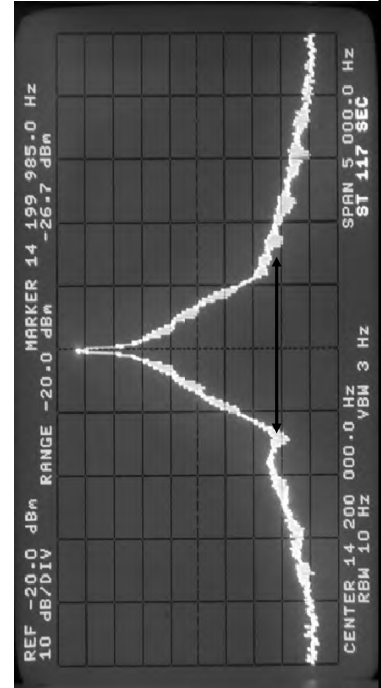
Spectrum of CW Signal on HP 3585A Analyzer

Rise Time 10 msec, “dits” at 30 WPM,
Bandwidth -70 dB = ± 450 Hz = 900 Hz



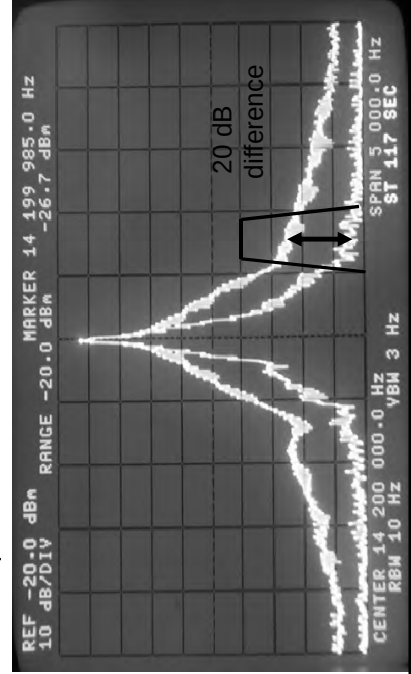
Spectrum of CW Signal on HP 3585A Analyzer

Rise Time 3 msec, “dits” at 30 WPM,
Bandwidth -70 dB = ± 750 Hz = 1500 Hz

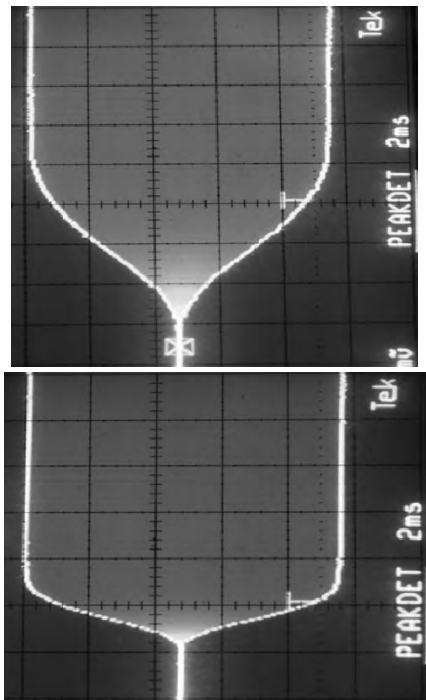


Spectrum of CW Signal on HP 3585A Analyzer

Comparison of 3 msec vs 10 msec rise time



Leading edge of "dit" 3 & 10 msec



Just the Facts

On SSB you want DR3 = 70 dB, or more.

On CW you want DR3 = 80 dB, or more.

This is most economically accomplished with low IF (5 to 9 MHz) selectable crystal roofing filters.

It is much more difficult to deliver 80 dB or higher DR3 with the more common Up-Conversion design.

Transmitted bandwidth of the interfering signal is often the limit, not the receiver.

What dynamic range is possible and needed for CW?

80 dB or better @ 2 kHz with a 500 Hz bandwidth.

2001 Ten-Tec Omni-VI+:	80 dB
2003 Icom IC-7800:	80 dB
2003 Ten-Tec Orion I:	93 dB
2005 Ten-Tec Orion II:	95 dB
2007 Flex 5000A:	96 dB
2007 Ten-Tec Omni-VII:	80 dB
2008 Elecraft K3:	95 dB
2010 Kenwood TS-590S:	88 dB
2010 Ten-Tec Eagle:	90 dB
2010 FTdx-5000:	101 dB

Other radios for comparison, 2 kHz dynamic range data

Elecraft K2:	80 dB
Collins R-390A:	79 dB
Kenwood TS-850S:	77 dB
Icom Pro II / Pro III	75 dB
Collins 75S-3B/C:	72 dB
Kenwood TS-870S:	69 dB
Yaesu FT-2000:	63 dB
Icom IC-7000:	63 dB
Yaesu FT-One:	63 dB
Yaesu FT-101E:	59 dB
Drake R-4C Stock:	58 dB
Yaesu FT-757:	56 dB
Yaesu VR-5000:	49 dB

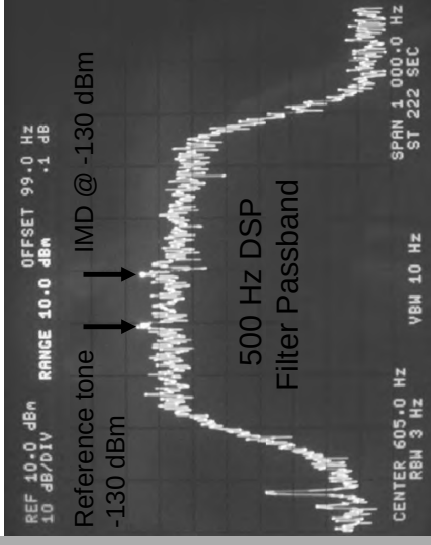
This is shockingly bad

Worst radio I have ever tested !

ARRL Dynamic Range Numbers

- Many modern transceivers are phase noise limited, particularly close-in at 2 kHz. The League wanted to be able subtract out the phase noise when measuring IMD, and came up with a new method in 2007 using a spectrum analyzer with a 3-Hz filter. It can also be done with a 10-Hz filter and averaging of the signal over time.
- One may also use an FFT analyzer with long-term averaging to suppress the noise, and make the measurement more quickly.

IC-7600 with 3-Hz Spectrum Analyzer



Phase noise limited dynamic range is 78 dB at 2 kHz. Measured with a 3-Hz filter on the analyzer, the dynamic range is 87 dB at 2 kHz!

ARRL 2007 – 2011 DR3 Method

- 2006 and earlier, IMD or noise increased 3 dB. This was published as the dynamic range, either IMD or noise limited.
- With the 2007 - 2011 method, phase noise buried the IMD product.
- 3-Hz filter used for the third-order dynamic range measurement, and the published values were greater than in 2006 and before.
- Non synthesized rigs (S-Line / C-Line) would not have any reciprocal-mixing issues.

IC-7410 Dynamic Range Data

Example	Value
• Spacing	107 dB some noise
• 100 kHz	102 dB noise limited
• 20 kHz	90 dB noise limited
• 5 kHz	78 dB noise limited
• 2 kHz	89 dB noise ignored
• 2 kHz ARRL*	
• * (Using spectrum analyzer and narrow BW)	

The ARRL / Sherwood Compromise

- In September 2011 the League agreed to add emphasis to their reciprocal-mixing data. The first Product review with the testing change was April 2012.
- The League's reciprocal-mixing (RM) values should equal their pre-2007 noise-limited data, and my published noise-limited or IMD limited data.
- IC-7410 RM limited dynamic range = 78 dB
- Sherwood noise-limited DR3 = 78 dB
- The IC-9100 review uses the new reporting, and has a nice sidebar on page 55 explaining the changes.

Phase Noise Revisited in IC-9100 review

- The League's third-order dynamic range is measured in such a way to eliminate phase noise from the equation. Their new 2-kHz reciprocal-mixing dynamic range can be equated to 2006 and older "phase noise limited" dynamic range data.
- Icom IC-9100 data, April QST 2012
- 2-kHz 3rd order DR3 = 87 dB (with 3-Hz filter)
- 2-kHz reciprocal mixing dynamic range 77 dB

2012 ARRL method is a great improvement

- Is the 3-Hz data useful? IC-9100 data
- 20 kHz 3-Hz blocking = 141 dB
- 20 kHz reciprocal mixing = 101 dB
- 40 dB bigger number !
- 2 kHz 3-Hz blocking = 111 dB
- 2 kHz reciprocal mixing = 77 dB
- 34 dB bigger number !

AGC Impulse Noise Anomaly

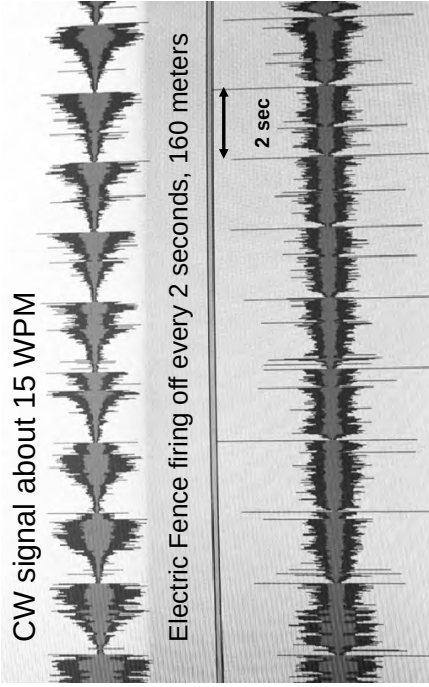
Most new radios since 2003 exaggerate impulse noise.

The exceptions: Elecraft K3, Flex 5000 & TS-590S

Programmed DSP to ignore a tick, click or pop.

Elecraft calls it the Sherwood Test.

Omni-7 on Top - Pro III on Bottom



Listen to 30 second audio clip

- Audio Icom 756 Pro III
- 160 meters, 4 PM, Dec 13, 2008
- Electric fence & CW signals
- KV4FZ calling DX station
- Note volume level relatively constant

Audio clip with DSP AGC problem

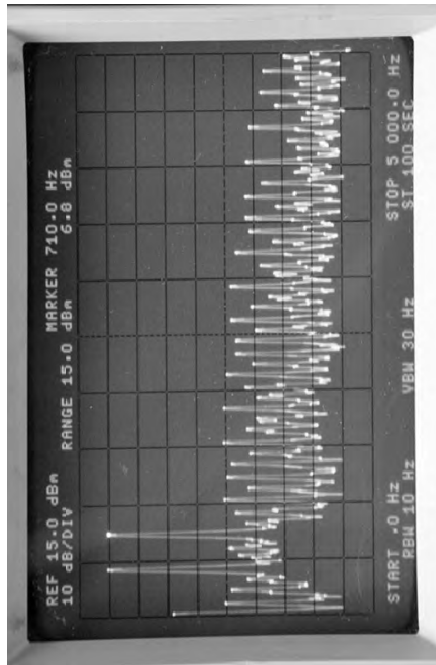
- Audio Ten-Tec Omni-VII
- 160 meters, 4 PM, Dec 13, 2008
- Electric Fence & CW signals
- Exact same signals as with Pro III
- Note AGC being hammered by impulses
- Other rigs with the same AGC problem:
- IC-7800, IC-7700, IC-7600 & IC-7000
- FTdx-9000, FT-2000, FT-2000D
- Orion I & II

Contest Fatigue from audio artifacts

- In the "good old days", a pair of 6V6s in push pull were common. Audio was smooth and pleasant.
- Often today receive audio is an after thought.
- The rig manufacturers need to be concerned about the noise and distortion beyond the 300 to 3000 Hz bandwidth. Our ears hear much more than 2700 Hz of bandwidth.

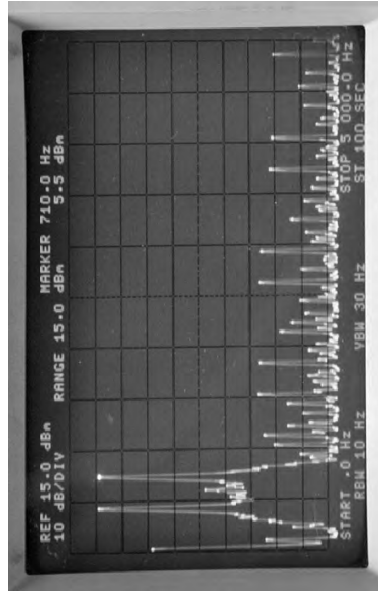
Factory Confirms K3 Audio Problem

Screen shot from Elecraft Lab Fall 2008



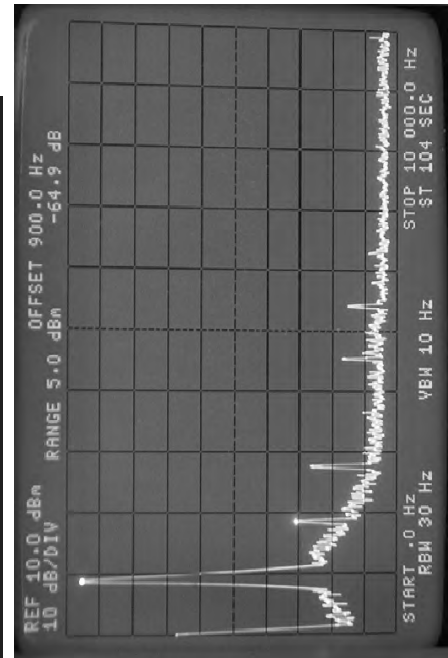
Factory Addresses K3 Audio Problem

K3 After New Choke Installed



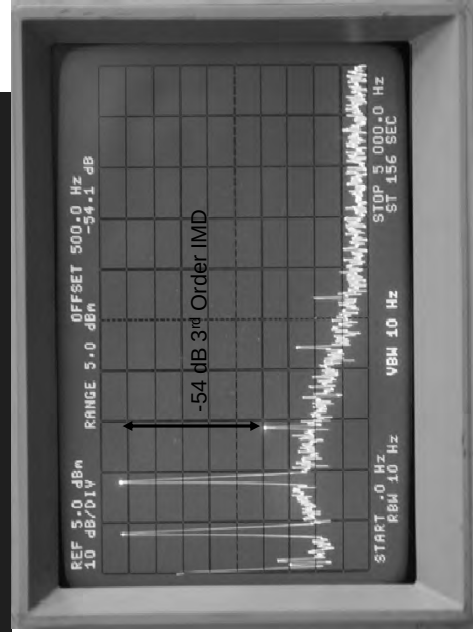
0.1 % distortion

Icom 756 Pro III Harmonic Distortion



< 0.3 % distortion

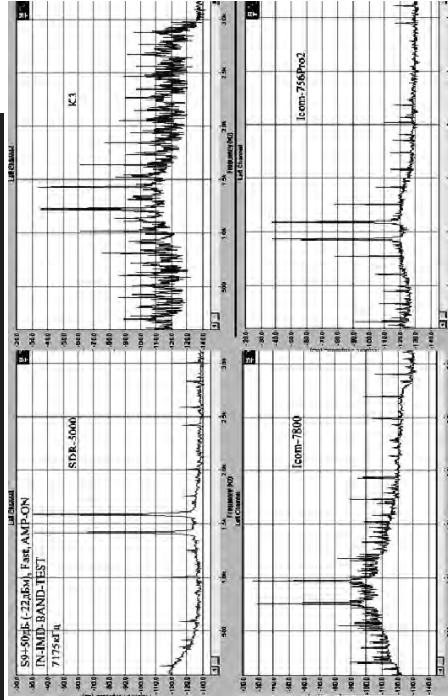
Icom 756 Pro III in-band IMD Distortion



FlexRadio Ad in March 2012 CQ Mag

- In-band distortion, particularly IMD, is rarely mentioned in reviews. The League does now test for total harmonic distortion (THD) at 1 V. RMS, though a two-tone test would be much more revealing.
- The Flex ad does not identify the “other” radio, which has been improved since the UR5LAM data was published.

Data from UR5LAM on 4 Transceivers



Question: How good is good enough?

High Dynamic Range Receiver (DR3).

Minimum 70 dB for SSB & 80 dB for CW

If the “real” DR3 > 90 dB, your receiver is fine.

Differences of a few dB are NOT significant.

Areas needing improvement:

Transmit ALC & Receive AGC

In general, how a transceiver performs dynamically with real signals, not just in the lab with a signal generator.



Sherwood Engineering

<http://www.sherwood-engineering.com>

<http://www.NC0B.com>



Introducing the Inrad HF Triplexer



The Inrad HF Triplexer is the perfect solution for adding more fun and points at Field Day:

- Perfect for Field Day!
- Three stations may share one 10M/15M/20M tribander simultaneously using a single feedline. (Note: additional bandpass filters may be necessary to protect receivers.)
- Maximize your station's flexibility!
- Input Power Level (per radio port): 200W ICAS (into < 1.5 VSWR antenna)
- Insertion Loss: 0.25–0.35 dB (typical)
- Isolation (typical):

	20M Xcvr A	15M Xcvr B	10M Xcvr C
20M	—	25 dB	30 dB
15M	30 dB	—	20 dB
10M	>40 dB	20 dB	—

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July 8 - 14, 2014

Contesting's Best are Coming to New England!

In July 2014 the world's top radio contesters will converge on the Northeast United States for the 7th World Radiosport Team Championship. This will be the first WRTC held in the United States since 1996.



Removing the variables of geography, power, and antennas, 59 two-operator all-star teams will battle for personal and national pride on a world stage.

More than just a competition, WRTC is an opportunity for competitors, referees, and visitors from around the world to make and renew friendships.



WRTC 2014 needs your help.

Funding for construction of the 59 identical stations comes from the generosity of the contesting community. Donations via PayPal to donations@wrtc2014.org. WRTC2014, Inc. is an IRS approved 501(c)(3) public charity.

What is WRTC?

Contesting is a unique sporting challenge. Everyone is trying to make the best score they can, but inequities such as location, power, antennas, and more make it difficult to compare one score with another. Held every four years, the World Radiosport Team Championship brings some of the world's best operators together to compete on a level playing field. The result is an intense all-star competition and showcase of amateur radio capabilities.

Qualifying to be a competitor in WRTC 2014 is based on 12 contest scores accumulated over a 3 year period. Operators who earn a coveted entry are truly some of the best in their region of the world.

Want to be involved?

In addition to the 118 competitors and 59 referees, there are hundreds of people who help make the competition possible. We need help with station setup, drivers, hosts, and logistics support. Be a part of WRTC 2014 and take advantage of this rare opportunity to meet and learn from these top operators.

If you can't make it to New England, you can still participate by working the WRTC stations and submitting your log to help with the log checking.

The first test of the WRTC stations will occur during the IARU Radiosport Contest July 14-15, 2012. Join us in person or look for us on the bands.

Participate in person or on the air...Plan to be a part of WRTC 2014!

Feel the excitement – Watch the video at www.wrtc2014.org



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Owned and Operated since 1996 by
fellow contester Scott Neader KA9FOX

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