TALES FROM THE SWAMP

February 2023

Editor: Kevan Nason, N4XL

Thank you to our group leadership:

President – Ed, K3DNE
Vice President - Dave, WN4AFP
Treasurer – Phil, NI7R
Secretary – Kevan, N4XL

Web Master – Frank, KG4IGC
SFCG Webpage: swampfoxcontestgroup.com

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President's Corner

What a fantastic first week for the W1AW/4 SC ARRL Volunteers On The Air Event! It went very smoothly and hopefully was enjoyed by all. For me, it was like coaching the USA basketball "dream team" in the Olympics - just sit back and watch the team do their thing!

Our W1AW/4 SC VOTA team was made up of a dozen SFCG members and an additional 28 we recruited from around SC. Members were made up of active DX'ers, contesters and those with special event experience (POTA, IOTA, SOTA, 13 Colonies, 2014 Centennial Challenge and State QSO Parties).

Collectively we made over 17.5K QSO's. Individually we had one team member who broke the 2K QSO barrier - congrats for leading the way, K9RX, with 2563 QSO's! Five of us (K4QQG, N4UFP, W4GE, AA4V and K3DNE) were in the 1K+ QSO club and AC4MC, K4CAE, KG9V, N4XL and NJ4Z all in the 500+ QSO club. All those big numbers sure are great but as members of the Swamp Fox Contest Group hear me drone on and on about, it's NOT all about the big scores - it IS about participation, and we had excellent participation which is what really added up the grand total to 17K+ QSO's! I'd like to thank each and every one of our participants for their contribution and support which helped make this a very successful event.

In addition to thanking all our participants, I'd like to send out a special “Thank You” to our ARRL Section Manager Marc N4UFP for asking SFCG to spearhead and coordinate the event and to the dozen from the Swamp Fox Contest Group (specifically; N4XL for N1MM and expert logging information and recruitment advice, WN4AFP for recruitment advice and website design and management and N4IQ and NJ4Z for recruitment assistance). They volunteered their time, energy, and talent to not only operate but to help plan, coordinate, advertise and implement the event. I said early on - "this will take a village" and everyone really came through. I'd like to especially recognize Scott KG9V. Scott was responsible for all the Google spreadsheets and forms used during the recruitment and planning process, the awesome schedule and summary page, member contact list, Facebook page, K2L recruitment information, advice gained and shared from his 13 Colonies Event experience and so much more that went on behind the scenes (and 721 QSO's of course). Thanks Scott!

We’ll be in touch in May or June to plan our July activation week which begins on July 19’th. More info about this year long operating event can be found here: http://www.arrl.org/files/file/VOTA%20-%20Volunteers%20On%20The%20Air/QST%20VOTA.pdf

Until then, see you in the pileups!

73,
Ed K3DNE

NN4SS – Welcome!

The SFCG has another Big Dog in the skulk. (A group of foxes is **a** skulk.) In his welcome email President Ed K3DNE wrote:

> Please welcome Larry Abelkop NN4SS to SFCG! Larry is a well known CW DX operator and contester. Larry was first licensed in 1963 as WN4LPV then WA4LPV. In '76 he obtained the Vanity call of W4ABE and in 2012 became NN4SS. He has a Mechanical Engineering Degree from Georgia Tech and worked as an Environmental Engineer in Atlanta. His shack equipment includes an Elecraft K3 xcvr, KPA 1500 and 500 amps as well as an Acom 2000A. His prized stainless steel Begali anniversary sculpture key is displayed on his QRZ.com page. His antenna farm includes a 3 element Steppir at 100 feet along with an open wire dipole that he's been using since he was 14 years of age with the help from his Elmer; W4NTO. Larry has been a loyal supporter of SCQP and has won the HP CW SO category the last 2 years. Larry states he is very active with his local club (Spartanburg ARC). Larry: Welcome to the Swamp Fox Contest Group!

From Larry’s QRZ.com page:

> My other interest include Cars, Motorcycles, Computers, Guns & Martial Arts. I retired from the martial art of AIKIDO in 2001 after 20 years of practice.
>
> My Elmer was Fritz Nitsch W4NTO, who helped me with everything and still helps other Hams at the ripe age of 99. He installed my 100 foot tower at the age of 76.

Welcome Larry. We've noticed in recent years how you have become a South Carolina contest force to be reckoned with. Glad to have you with us instead of against us!

KZ3P – Welcome!

From Ed K3DNE:

> Please welcome Bob Wright KZ3P to the Swamp Fox Contest Group! Bob was recruited by Dave WN4AFP after Dave noted his score in the PA QSO Party. Bob and I had a QSO in Sweepstakes phone and had a very short discussion on how he's from Westminster SC and I moved to SC from Westminster MD. Bob holds an Extra class license and enjoys both contesting and rag chews on SSB. He uses a Kenwood TS-570S, Acom 2100 amp (QRO HF2500dx as backup) feeding a Cushcraft A3S Tribander and a homebrew ZS6BKW 80m dipole. He states he has 70 feet of used Heights Tower ready for a spring project. Bob, you have picked a great time to join the club with the winter/spring contest season upon us!

Bob wrote he's looking forward to the soon to be held SCQP. We're looking forward to that great station of yours helping with the SC presence too. Welcome Bob!

The SCQP Wants You!

The 2023 SCQP is fast approaching. It starts at 1500z February 25th and ends 0159z February 26th. See scqso.com for rules. Dave WN4AFP is seeking operators to activate various counties. Mobiles are especially welcome as two key mobile operations are not able to participate this year. Contact Dave for further information. Expect to see more about this event on the reflector as the day approaches. Dave posted a listing of q's by county from last year to the SFCG reflector.

Dues are Due

It's that time of year. $10 isn't too much to ask for a year's worth of information, local comradery, and promoting contesting through plaque sponsorships. We've a new Treasurer, Scot KG9V, so don't send them to Phil this year. See our SFCG web page at swampfoxcontestgroup.com for further information. Please note that because of PayPal fees we ask if you use the button on that web page you send $11 instead of the normal $10. Payment by check or your personal PayPal account remains at $10.

Contest Tips:

From Operating Mechanics: The X Factor in Contesting Success, by Patrick Barkey N9RV

How to Run Faster Rate	• Be prepared for content • Recognize and respond to complete callsigns • Transmit only as necessary • Know when to dig
Prepare yourself to copy	• Focus attention at end of each CQ • Hands on the keyboard • RIT cleared • Filter wide

From the Florida Contest Group, Contesting Do's & Don'ts Rev. June 2021

Before the Contest
• Load logging software and test with your transceiver
• Choose your goals, such as breaking an existing record, making 1,000+ QSOs
• Prepare snacks, drinks, meals in advance
• Be active on the air at least a couple days before the contest...get a "feel" for the bands and propagation.
After the Contest
• http://www.hornucopia.com/3830score/
• Submit Cabrillo file to contest sponsor before the deadline
• Report to your family that you are alive and well!

EI8IC Contesting Tips

The feedline of choice these days is of course coaxial cable, or 'coax'. There are many different types available, but buying cheap coax is not a good idea due to the losses involved. A budget contester should not cut corners here, but stick to at least RG-8U of good quality. Hardline is even better - just check out the loss-tables in most amateur radio handbooks and find out where those DX signals are disappearing. There's no point losing those hard-earned dBs from amplifier or antenna down a cheap bit of RG-58. Here's something to ponder on - for the budget contester wishing to improve his station, the 'dBs per dollar' figure for good coax is a lot better value than a new linear amp or yagi. Be careful also about second-hand coax. It could be a good deal, but could also be a complete waste of time if worn, damaged or corroded. Check it out first, or you'll be wasting your money.

With the price of good quality coax being what it is, an option for those with antennas grouped together is a remote coax switch, which can be purchased or home-made. The control cable will be a lot cheaper than multiple coax runs, and as long as the switch is well constructed, will have a minimum insertion loss, especially at the lower frequencies used by HF contesters. Whilst on this subject, Dick, WC1M suggests a home-made remote switch box for your antenna rotators as well. Not only are you saving on cable, but you only need to purchase one controller. I use this idea, though switched at the shack, and the switching is easy enough to do, though I would recommend powering down the controller when switching between rotators.

(Originally from Dave WD5N via CQ Contest Reflector)
Step 3. Correct monitor height:

1. Screen should be 16" to 22" from your eyes.
2. Adjust so the top of the screen is at eye level. Bifocal users may need to lower it to a comfortable level.
3. Tilt or use a glare filter to reduce glare from overhead lighting.
4. Adjust brightness & contrast controls to ease eyestrain.
5. Green-yellow colors are easiest on the eye.
6. Clean your screen and glare filter regularly for dust build-up.
7. Take down decorations, notes, and other distractions around your screen; Your eye muscles are straining to focus on these as well. (hmm, what about schedule and band opening reminders and inspirational signs like "Think Loud!)

From VE9AA's Tip of the Week posts

If you find your 'contesting spirit' or hutspa is in a rut, don't be scared about trying a new mode, category or doing a single band entry (even if rules don't list a single band cat)

Every time I am feeling blah, I try a new entry cat and my spirit is renewed and I (usually) feel good about my entry.

Things I've tried that seem to really work to invigorate:
HP, LP or QRP
Single band
All band assisted
Single antenna (like a multiband G5RV or HF9V antenna)
Remote
Mobile
Portable
Unusual callsigns. (VC9T in WPX for example.. the jury is out on this one.)
(Editor's Comment: I laughed at that. Apparently entering any contest category reinvigorates Mike! But I agree with his point about doing something different if you find yourself falling into a rut.)

From the Reflector:

- Mike "ID" Burton KY4ID and Dave "Wallpaper Hound" WN4AFP are beginning to make a habit of breaking the 100 q's barrier in their hour long weekly CWT Mini-test sessions. It's a milestone many participants have yet to achieve. It seems not that long ago Bill N4IQ was the only one regularly posting CWT scores. It's picking up in popularity with George N4QI, John K4FT posting frequent scores. Al NE4EA is even joining in the fun.
- Some SFCG folk are having email issues. Things unexplainedly going to junk mail. This is affecting both reflector post mailings and personal emails. Late delivery. Failing to be delivered at all. If you are expecting a reply from someone it might be worthwhile to reach out in a couple different ways to ensure your information was delivered.
- Frank KG4IGC has been dealing with some medical issues. We're glad to hear you are home, Frank. You've a good support team in Sarah! Work on regaining your strength. Er… On second thought, don't work very hard at that. Make sure you get plenty of rest too.
- Dave, WN4AFP, has picked up Webmaster hosting from Frank KG4IGC. Among other things he added a VOTA section for information on our states W1AW/4 operation and added a link so people can access past newsletters from the main page. Pretty snazzy there, "Wallpaper Hound."
- Matt NU4E is looking to automate his antenna switching. Keep us informed of how it's going Matt.
- VHF and higher contesting meant a lot to Ed K3DNE before he retired here in the south and discovered the low activity level. Ed sold off some no longer used yagi's. The thought of a 112 element yagi is a bit mind boggling. Sorry to hear you've had to let a past love fade, Ed.

- *(Editor's Note; In case you missed it earlier a skulk is a group of foxes.)*
  The Skulk was out in force for the NAQP SSB contest. We did well and had a great time. Fun was had with Star Trek themed banter and team names. Dave WN4AFP presented Ed K3DNE with a Klingon communicator at our annual SFCG meeting.
- Dave "Wallpaper Hound" WN4AFP has a truly outstanding addition to his collection 1st Place W/VE Single Operator Unlimited, Mixed Mode, Low Power in the 2022 IARU HF World Championship. WAY TO GO DAVE!!!
- Foxes are doing what we in the Nuclear Navy call Theory-To-Practice experiments. The theory is the higher antennas are the better your score. Some have raised their antennas and discovered that practice in fact does result in higher scores.
- Ed K3DNE and Dave WN4AFP announced the 2022 State QSO Party Challenge.
- Several had fun in the CQ160 contest. Good to see that one picking up in popularity too.
- Dues are due. Please see info on the main page of our SFCG web site for information on payment. https://www.swampfoxcontestgroup.com/
- Gary AF7T graciously offered four free HV-3 20/40/80 verticals to members that he realized he will never be using. Three are spoken for. The remaining will need some TLC but would undoubtedly be useful for the aluminum even if it isn't used as intended. They are 31 ft tall, have a 5 ft top hat, and are self-supporting. I read online they share similar features to the HV-1 vertical for which the manufacturer claims an 85 mph wind survivability. That's some stout tubing.
- Tom WA2BCK was the first to report working 3Y0J. Great snag, Tom!
- Preparations for the SCQP are ramping up. Checkout scqso.com for rules and categories.
- Unfortunately, George N4QI pushed his indoor 10 meter antenna a bit too hard during the CQ WPX RTTY contest. He believes his 4:1 balun failed due to the higher duty cycle RTTY imposes. Hope it is fixed soon George.

A Qualitative Analysis of Amateur Radio CW Transmit Signals

Editor's Introduction: I found Wolf Heeren's, NN7CW, article in a Florida Contest Group's newsletter and was pleased he quickly provided permission to use it here. Wolf explains a problem many hams are not even aware of. Something not noticed by an operator during normal operation of their radio. You must visually observe the transmitted signal and possess the knowledge to understand what you see to recognize it. Specifically, many of us are unintentionally causing unnecessary interference to our fellow hams by legally operating our FCC approved radio as per the manufacturer's instructions. Wolf explains the mechanism. It is thought by some that unscrupulous contesters use this interference to their advantage rather than respecting their peers and seeking to improve their signal. Responsible operators however, now that they are informed, can use this information when considering what new rig to purchase. They can also check the rise time setting in their radio and ensure is not set too low. 6 msec is considered the lowest desired value most of us should use, but I have read that at least one radio comes from the factory set at 2msec. Hopefully, thanks to articles like this, knowledge will continue to spread throughout our community and manufacturers will continue to improve their equipment. With so many dirty transmitters being "in the wild" this problem will not disappear any time soon, but eventually, hopefully, as the offending equipment is retired it will become less and less of an issue. Look closely at

your band scope next time you are enjoying CW and you will likely see the same wide signals Wolf points out in his last image. Thank you, Mr. Heeren, for your article on this important topic.

A Qualitative Analysis of Amateur Radio CW Transmit Signals

Wolf Heeren, NN7CW
NN7CW@GMX.com

Abstract — Because of different transmit circuit designs, Amateur Radio transceivers produce individually shaped CW pulses in the time domain, which results in different signatures in the frequency (spectrum) domain. NC0B and others have repeatedly stated that the average transmit signal quality deteriorated when transmitter technology transitioned from tubes to solid state [1]. However, after several years of focusing on receiver performance optimization, the major commercial manufacturers have finally started improving their transmit circuit designs, which led to significant transmit signal quality improvements within the last ~10 years [2]. Unfortunately, factory transceiver configurations are often times not ideal and it appears that many Amateur Radio operators are not aware of resulting implications. Rise time settings are often shorter than they could be and result in unnecessarily wide, QRM-producing signals. Under normal circumstances, short rise times are not necessary.

This article investigates the effects of individually shaped CW pulses generated by different Amateur Radio transceivers and proves that Amateur Radio operators can actively impact their transmit signal cleanliness by choosing a well-designed transceiver and using it in the best-possible configuration. ARRL Transceiver Product Reviews were analyzed to create a rating to support fair, competitive CW contest operations. A rating of 23 contest-relevant transceivers is presented.

Given the transmit performance improvements all major transceiver manufacturers have established in recent years, the results suggest that poorly performing transceivers should be considered outdated for the use in competitive radio contest environments, because they over proportionally interfere with other stations.

1. Introduction

Amateur Radio contest activities are more popular than ever. Major contest sponsors have shown in their statistics reports that the number of participants has been growing continuously [3]. More participants result in more crowded band conditions, so more and more signals have to fit inside the limited frequency spectrum.

Ambitious contesters often times compete to the best of their abilities, limited by their location, station performance and personal constraints. While each of these factors is of individual nature, there is another factor that is not: the “Signal Cleanliness”, or transmit signal quality of other competitors [4].

The most important causes of objectionable transmit signal quality are

- poorly shaped CW pulses (keywords: rise time, fall/decay time, ALC overshoot), often associated with the term “key clicks”
- Intermodulation Distortion products (IMD)
- (Excessive) Transmit Phase Noise

- Recent, compared to tube amplifiers, less linear Solid State amplifiers
- Station defects/configuration errors (e.g. unreasonably short rise time settings, overdriven/incorrectly tuned amplifiers, amplifier hot switching, transceiver defects, etc.)

In the last decade, there have been numerous discussions, talks and presentations about excessive Amateur Radio Transmit Noise, which results in signals that occupy an unnecessarily wide bandwidth [5]. Product reviews, such as the ones that can be found in the ARRL QST magazine, have illustrated the transmit characteristics of tested shortwave transceivers for years. In some cases, companies have offered kits to improve the transmit quality of poorly designed commercial transmitter designs [6]. When compared to older designs, more recent transceivers exhibit improved transmit signal quality characteristics [7]. This can be explained by advancing technology, but also a greater focus on the openly discussed performance characteristics mentioned above.

1.1 A General Look at Interfering Signals in Contesting

In Amateur Radio contesting, participating stations can either look for stations they want to work (Search and Pounce, S&P), or they can utilize a fixed frequency to call for other stations to contact them (Run).

S&P stations are impacted by interfering signals when they can't work a station, due to the presence of a signal that interferes with them, or the run station they want to contact.

Run stations are impacted such that they can't work others, due to the presence of an interfering signal, or they can't hear the interference themselves, but they won't be called by stations that are impacted by an interfering signal.

In his 2014 talk "A Comparison of ARRL Lab Data For Selected Transceivers", K9YC has pointed out that

- Per FCC Rule 97.307 (a), the legality of excessively wide, dirty transmissions is questionable
- "… the station with the dirtier radio has a significant competitive advantage"

Interference issues are part of the contesting game. However, the impact of each competitor varies widely, based on his/her transmit signal quality. A poor interfering transmit signal costs other competitors more points than a clean signal would. In this article, a closer look is taken at the transmit signal quality of differently shaped CW pulses, which results in suggestions how all of us can make sure that our signals are as clean as possible to improve fairness in CW contesting.

2. Background

Linear systems theory can be used to describe the relations of signals in the time domain vs. the frequency domain. In theory, a continuous sinusoidal wave in the time domain results in a signal at one exact frequency ("zero-bandwidth" line) in the frequency domain. The almost opposite extreme is the Dirac Delta (Impulse) function, where the signal in the time domain is infinitely short while its level is infinitely large. This results in a pulse throughout all frequencies in the spectrum. Obviously, that kind of pulse doesn't exist in the real world, but nature comes relatively close when lightning occurs; that's why the electrostatic discharge of lightning strikes can be heard throughout the whole radio spectrum.

Figure 1 shows a measurement of a continuous, in amplitude, frequency and phase sufficiently stable sine wave at 14.02MHz. The result is limited by the capabilities and settings of the transmitter and the receiver (in this case a waveform generator and a spectrum analyzer), but it is sufficient to prove the

point: a continuous wave in the time domain results in a narrow response in the frequency domain. The direct Amateur Radio equivalent is a silent AM carrier.

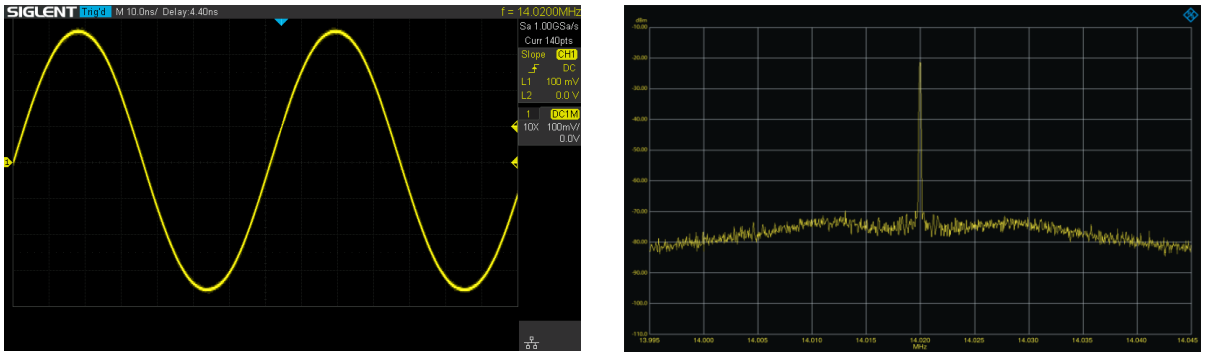


Figure 1: Sine wave (l/h) and its resulting signal in the frequency domain (r/h)

Once a signal is modulated (through noise, Morse code keying, etc.), the response in the frequency domain widens. Figure 2 shows an overlay of the previous sine wave and the same sine wave keyed by a rectangular signal at 5Hz. This means that the sine wave is abruptly switched on and off, without any pulse shaping applied. As a result, the previously narrow sine wave is now consuming a significantly increased amount of bandwidth.

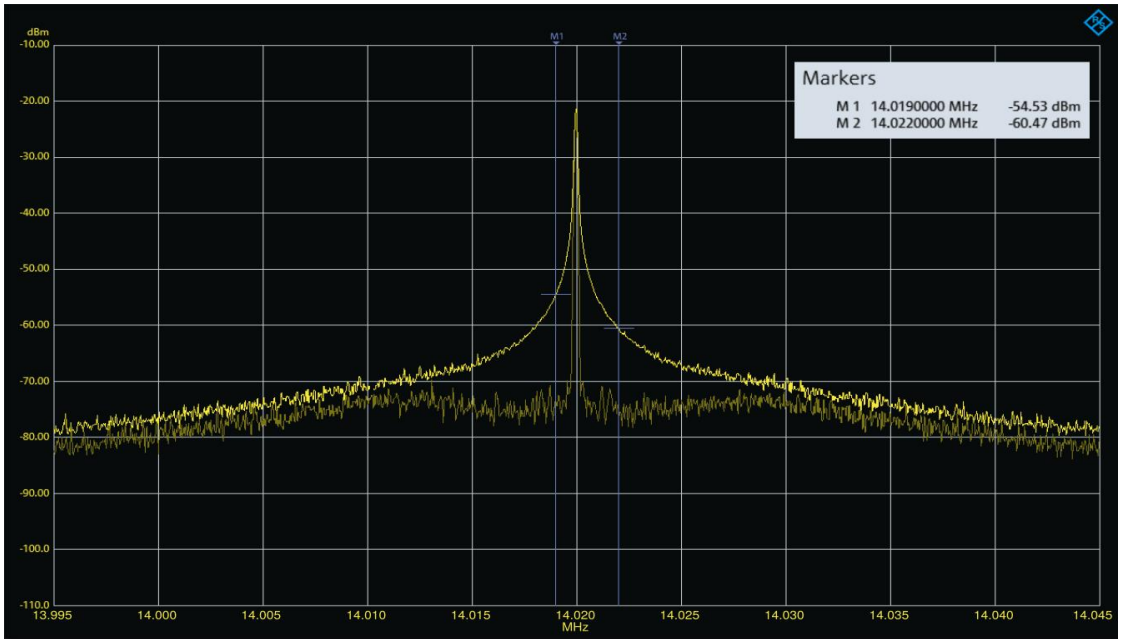


Figure 2: Continuous sine wave (faint) vs. intermittent sine wave (bold)

The markers show that, assuming the average signal level of the continuous wave is at ~-77dBm, the signal degraded by 17dB at 2kHz offset from the carrier, and 23dB at an offset of 1kHz. That means that, in Amateur radio terms, the abruptly keyed signal creates almost three s-units of noise at +/-2kHz and almost four s-units of noise at +/-1kHz carrier offset, compared to the continuous signal.

3. Measurements of Modern Amateur Radio Transmitters

To investigate how modern transceivers perform in this regard, four different transceivers are measured and compared. The following radios were tested:

- Elecraft K3 (late model), 2.8kHz 8-pole tx filter
- Elecraft K3S, 2.7kHz 5-pole tx filter
- Icom IC-7300
- Yaesu FT-991

Firmware versions were current at the time the measurements were taken (July 2021). The transceivers were run at 13.8V power supply voltage and set to 50W output power at 40WPM keying speed, transmitting into a 50Ω dummy load at 14.02 MHz. All pulses sent were “dots”. Higher keying speeds are explicitly mentioned. To create identical keying, an external keyer (W5UXH iCW Keyer) was utilized. The frequency span of the following spectrum plots is 5 kHz.

3.1 Keying Pulse Investigations

While Elecraft K3(S) transceivers don’t offer rise time adjustments, the IC-7300 and FT-991 do. Hence, keying impulses at different rise time settings are examined. Measurements were taken at 20WPM, 40WPM and 60WPM, but only relevant results are shown and discussed.

3.1.1 Elecraft K3

Figure 3 shows the keying output of the K3. The shape of the keying pulses remained consistent throughout different keying speeds. Elecraft describes the keying function as a sigmoidal waveform.

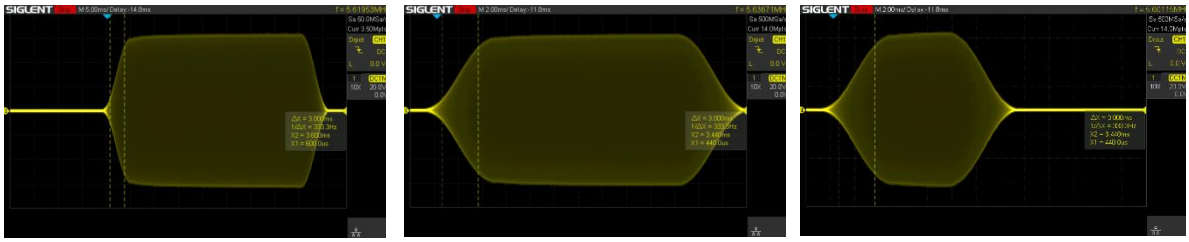


Figure 3: Keying of the K3 at 20WPM (l/h), 40WPM (center) and 60WPM (r/h)

Rise times and decay times appear consistent at ~3ms. The sigmoid function creates additional rounding at the edges, resulting in a narrow bandwidth in the frequency domain, shown in Figure 4.

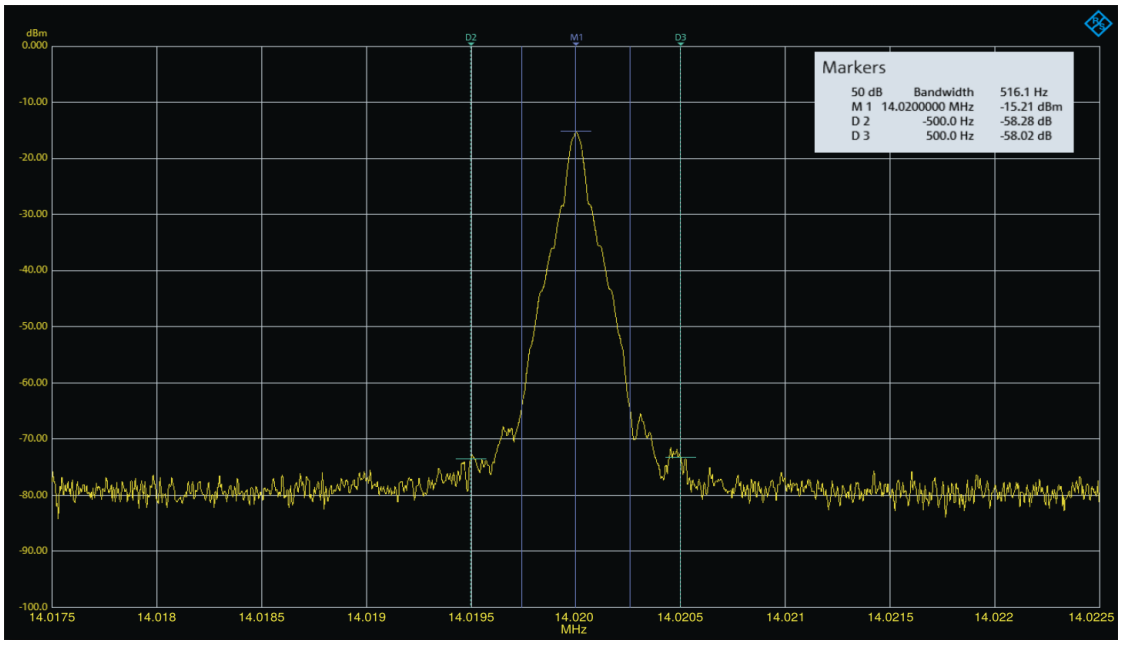


Figure 4: K3 response in the frequency domain

The 50dB bandwidth is about 516Hz and the delta markers show that the signal level is down -58dB at 500Hz distance from the center frequency.

The following image shows that the K3 exhibits pulse length variation. The keying speed is set to 60WPM in all three cases. This effect has been noticed and examined before [8] and is typical for all Elecraft K3(S). It does not have any negative practical effect for keying speeds below 60WPM.

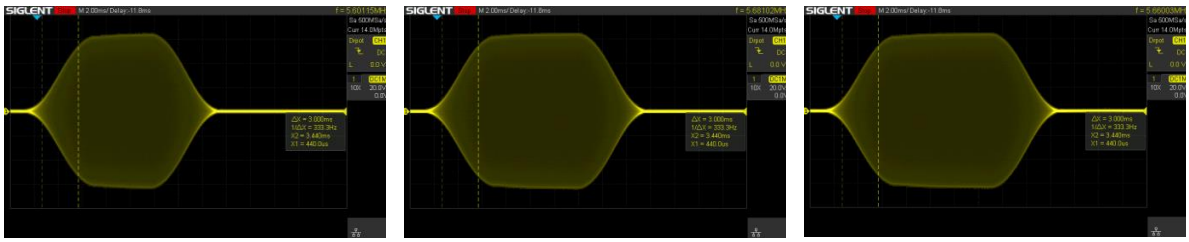


Figure 5: K3 pulse length variation

3.1.2 Elecraft K3S

Figure 6 shows the keying output of the K3S. Similar to the K3, the shape of the keying pulses remain consistent throughout different keying speeds and analog to the K3, the pulse lengths vary.

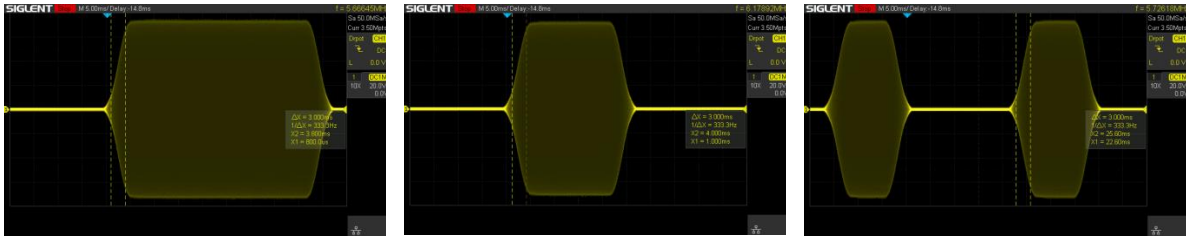


Figure 6: Keying of the K3S at 20WPM (l/h), 40WPM (center) and 60WPM (r/h)

The K3S uses ~6% more 50dB bandwidth than the K3. The 500Hz bandwidth is almost identical:

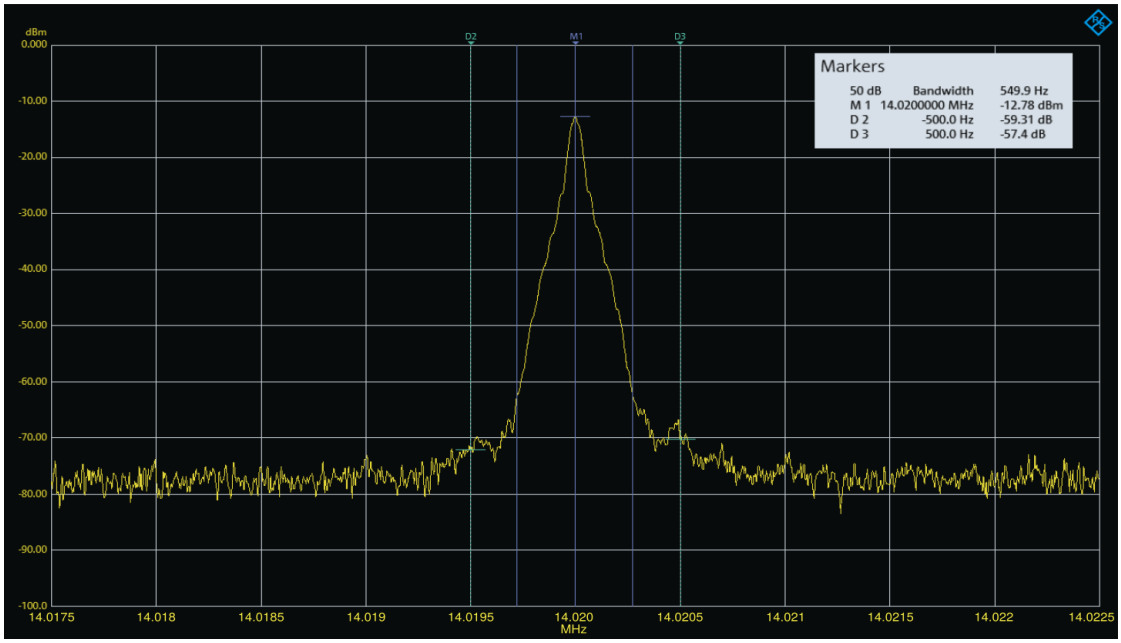


Figure 7: K3S response in the frequency domain

3.1.3 Icom IC-7300

The Icom IC-7300 allows rise time settings of 8ms, 6ms, 4ms and 2ms.

Figure 8 confirms that the rise time values are accurate. The decay time seems to be fixed at 2ms.

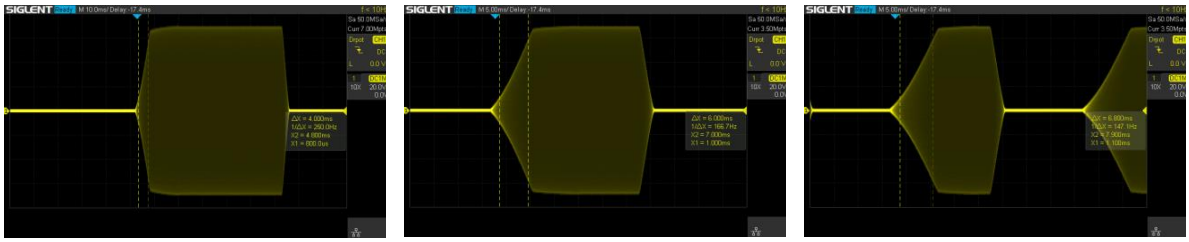


Figure 8: Keying of the IC-7300 (6ms rise time) at 20 WPM (l/h), 40 WPM (center) and 60 WPM (r/h)

To understand the implications different rise time settings have, the next two plots show the extreme cases possible at 40WPM (8ms vs. 2ms).

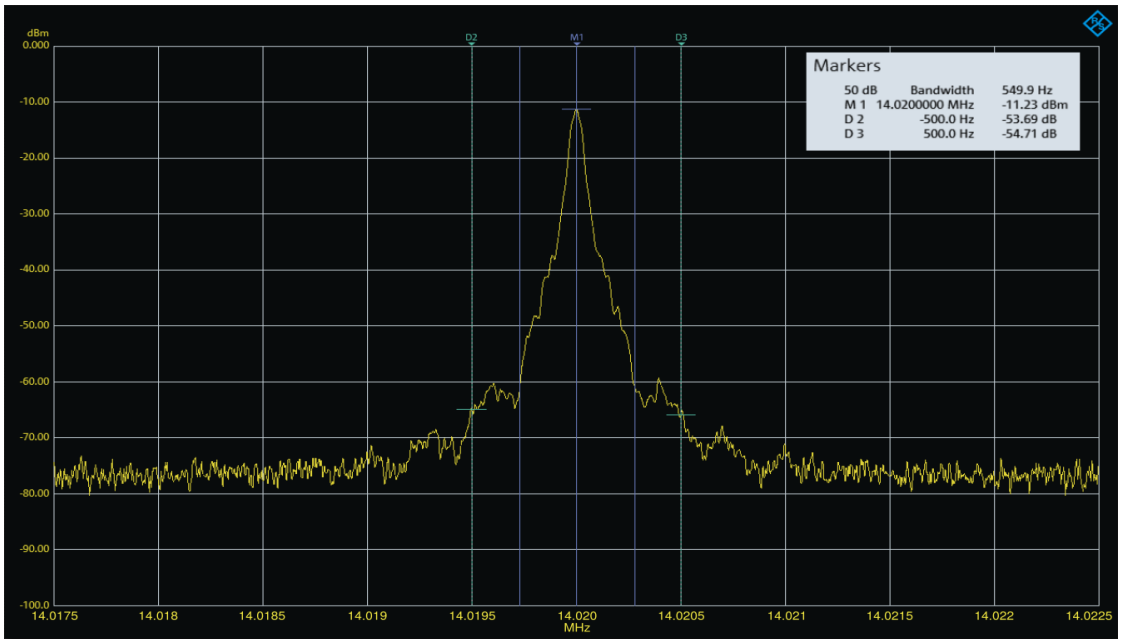


Figure 9: 40 WPM keying of the IC-7300 at 8 ms rise time

Figure 9 shows that, using 8 ms rise time, the 50dB bandwidth is about 550Hz and the delta markers show that the signal level is down ~ -54dB at 500Hz distance from the center frequency. The performance is comparable to the Elecraft K3(S). In contrast to that, Figure 10 shows a massive change: the 50dB bandwidth increased by almost 70%. The performance within +/-1 kHz suffers noticeably.

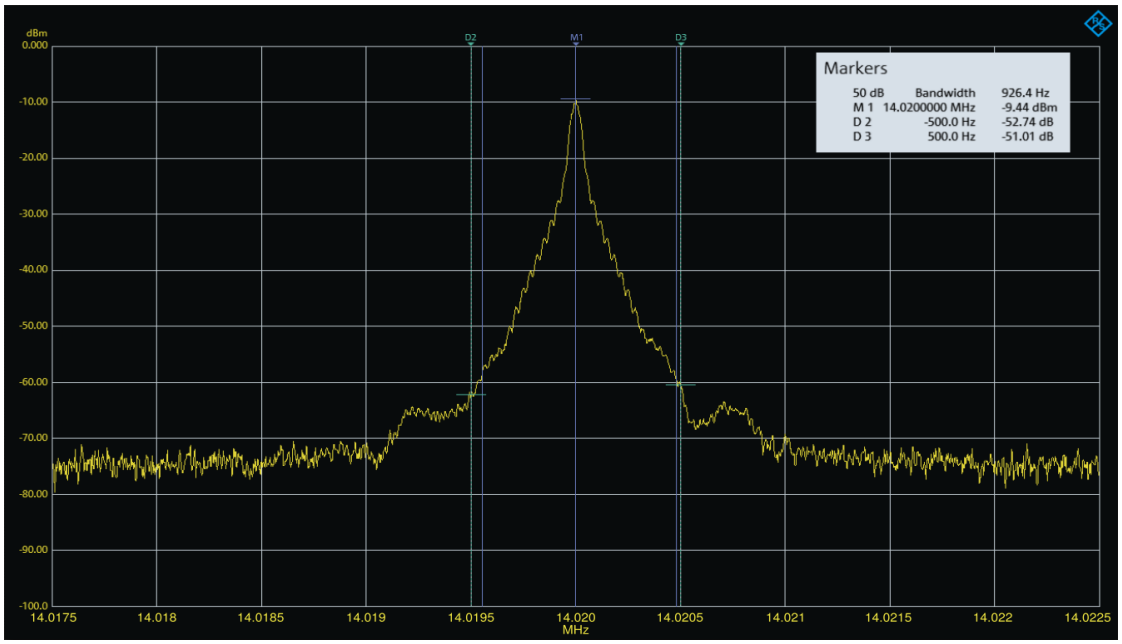


Figure 10: 40 WPM keying of the IC-7300 at 2 ms rise time

To evaluate if the readability of the CW signals generated are compromised at 8ms rise time, keying pulses were examined at 40WPM and 60WPM (Figure 11). At 40WPM, the pulse shapes are acceptable. At 60WPM, the pulses appear shortened; could the rise time be too short in this case?

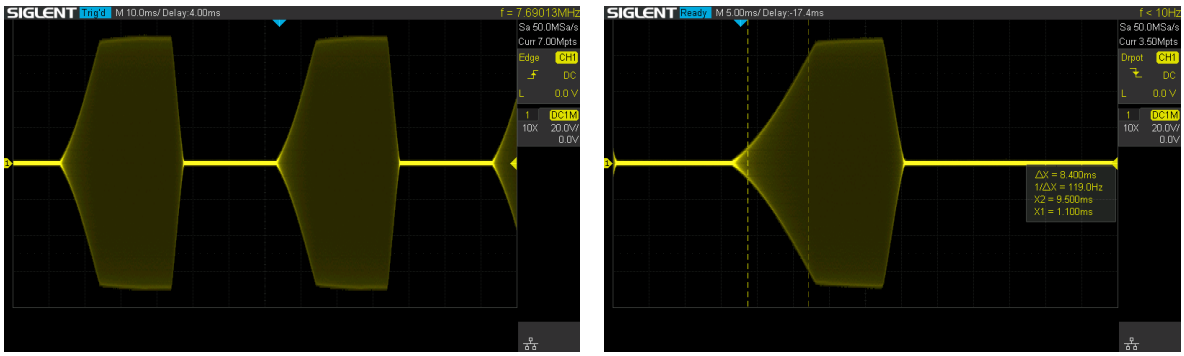


Figure 11: Keying of the IC-7300 at 40 WPM (l/h) and 60 WPM (r/h), using the 8 ms rise time setting (decay remains at 2 ms)

Rise Time is the time it takes for a signal to rise between 10% and 90% of its steady state, which is roughly displayed through the markers in Figure 11 r/h. As mentioned before, it appears that the rise time is over proportionally long, but it needs to be considered that a signal at a particular final strength (e.g. S5) already reaches S4 after 25% of its given rise time. It can be concluded that, even if external factors like the receiving station's (helping) AGC are ignored, at least half of the rise time cannot practically be differentiated from the final steady state signal level. Hence, the rise time can't really be heard. To further support this statement, an audio recording of the IC-7300 transmit signal is shown in Figure 12, using the Elecraft K3 receiver and Audacity 2.4.2. Acoustically, as well as visually, the readability of the signals (2ms rise time vs. 8ms rise time) are in practice identical. Therefore, in case of the IC-7300, at least up to 60WPM, using 8ms rise time does not come with any disadvantage, compared to faster rise rime settings.

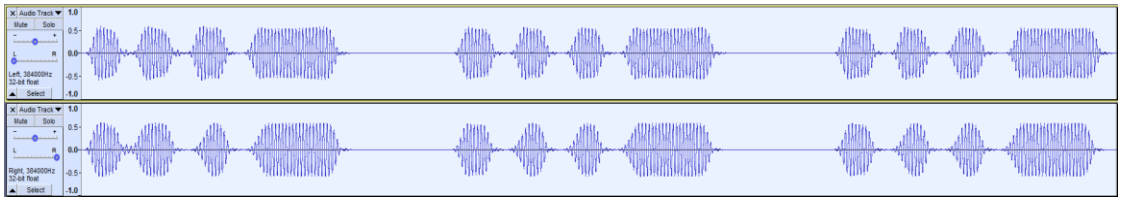


Figure 12: 60 WPM Rx Audio of the IC-7300 Tx signal: 2ms Rise time (top) and 8ms Rise Time (bottom)

3.1.4 Yaesu FT-991

The Yaesu FT-991 only offers rise time settings of 4ms and 2ms. Per Figure 13, measurements taken at 40WPM suggest that the real values are closer to 2ms and 1ms respectively.

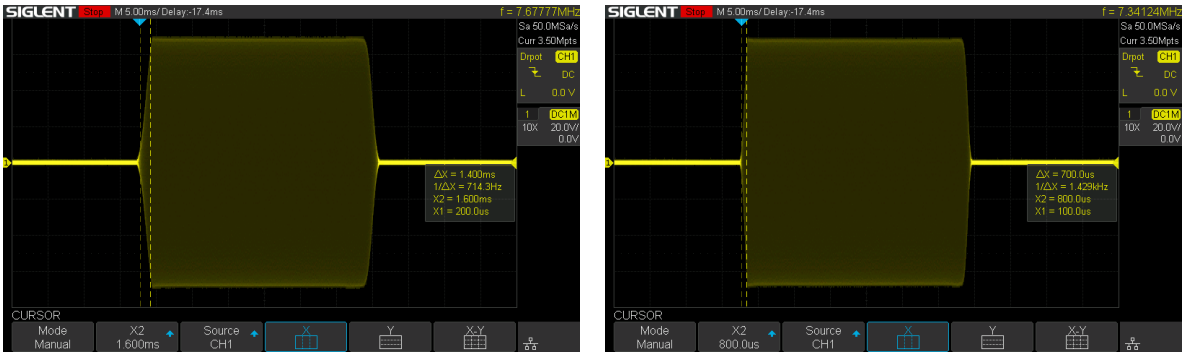


Figure 13: Keying of the FT-991 at 40 WPM. The rise time is set to 4 ms (l/h) and 2 ms (r/h)

The short rise time without any additional pulse shaping suggests that the Yaesu FT-991 occupies a wide bandwidth in both cases. The frequency response shown in Figure 14 confirms this assumption.

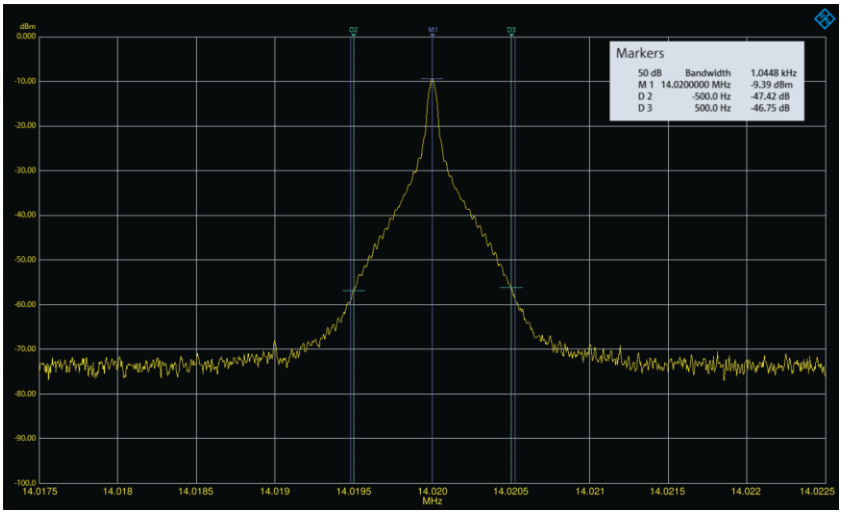


Figure 14: Yaesu FT-991 at 40 WPM keying speed, using the 4 ms rise time setting

In the best case configuration (displayed rise time value = 4ms), the 50dB bandwidth is about twice as wide as the values the other transceivers exhibited. Additionally, the +/- 500Hz bandwidth is poor. Even configured in the best-possible way, the FT-991 measured is a “dirty” CW transmitter. As shown in Figure 15, using the 2ms rise time setting, the 50dB bandwidth is almost 1.7kHz wide. The +/- 500Hz performance is unacceptable, considering modern transmitter design standards.

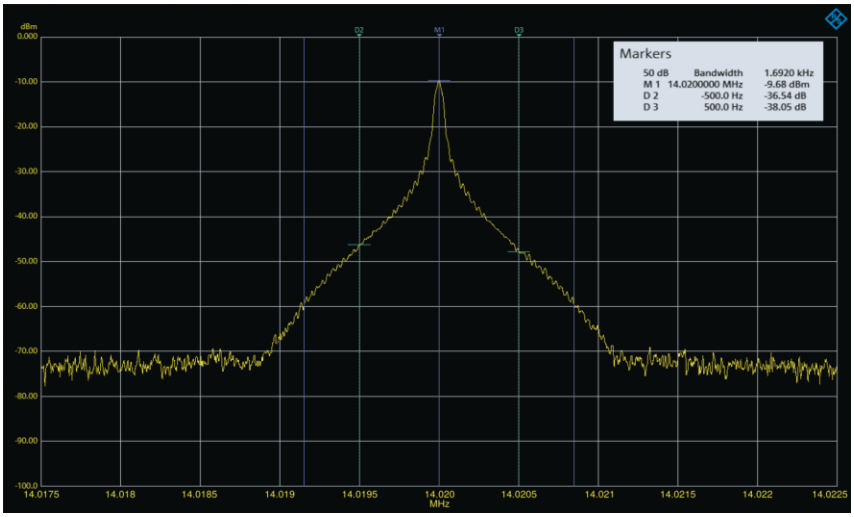


Figure 15: Yaesu FT-991 at 40 WPM keying speed, using the 2 ms rise time setting

3.1.5 Final Comparison

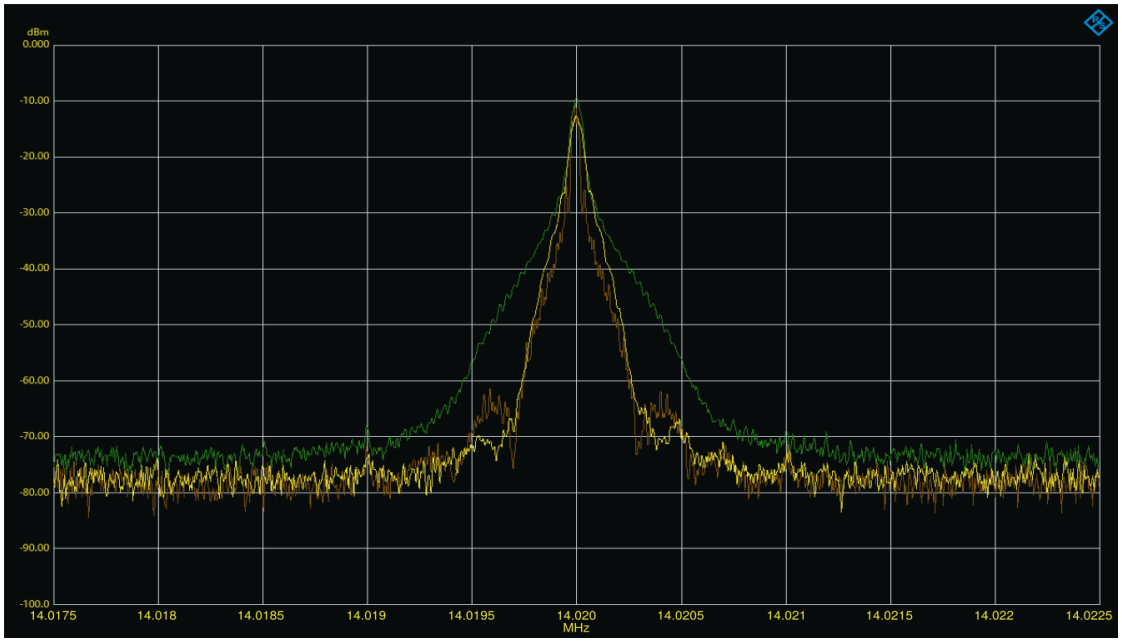
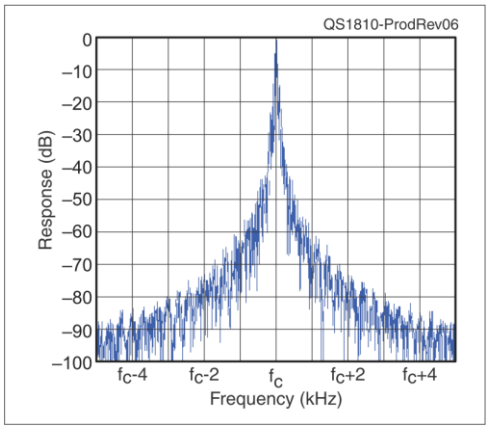


Figure 16: 40WPM CW pulses of Elecraft K3S (yellow), Icom IC-7300 (brown) and Yaesu FT-991 (green)

Figure 16 shows the signals of all three transceivers, using their best-possible rise time settings. It illustrates the difference between good, "neightbor-friendly" cw pulses and a poor signal which will cause unnecessary interference for other stations, especially in crowded band conditions.

4. ARRL Transceiver Product Test Data Review

For many years, for each radio test report, the ARRL has provided a spectral display plot during keying sideband testing, with the equivalent keying speed of 60 words per minute (WPM) using external keying and the default rise time setting. The transmitters are usually set to transmit at their full output power level at 14MHz. These plots can be used to make comparisons similar to the ones discussed above.



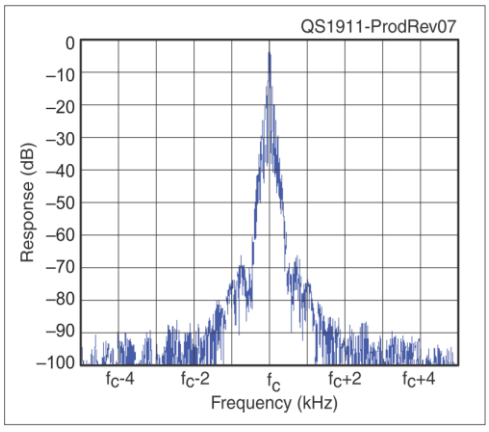


Figure 17: Example plots from QST Product Reviews 10/2018 (Icom IC-7610) and 11/2019 (Yaesu FTDX101D) [7]

For this article, product reviews of radios considered relatively current and potentially used by contesters were reviewed. 23 radios are chosen to determine the median of transmit signal levels at particular offsets above and below the carrier frequency to create a rating.

Disclaimer:

1. Table 2 contains visually determined values from ARRL QST test reports. While they were determined with great care, errors might be possible.
2. Some of the plots are hard to read. The plots in the QST magazines are small and some of the online versions seem incomplete, probably because of issues that occurred during digitizing. It is assumed that all plots start at Response = 0dB.
3. If at a neighboring value further away from fc spikes up, that value replaces the better reading of the value closer to the carrier. The reason for this is to avoid misleading results through very good minima closer to the carrier, while values further away are worse.
4. The product test reports are usually based on a test of a single device under test. Some production-related variation of the absolute numbers cannot be ruled out.
5. Modern radio performance can be altered by firmware changes. The table reflects the test results the league published in the QST reviews. Default settings (e.g. rise time) were not changed.

4.1 A Rating for Fair, Competitive CW Contest Operations

To make this rating easily applicable in Amateur Radio terms, 6 dB = 1 s-unit rating steps were chosen to differentiate between different rating grades. Measurement values at +/- 500 Hz (1 kHz span), +/- 1000 Hz (2 kHz span), +/ 2000 Hz (4 kHz span) and +/ 3000 Hz (6 kHz span) are determined for each radio and the median is calculated for each frequency offset. Every radio, which performs at or above the calculated median values, is considered an excellent performer. The next bracket (within 6 dB = 1 s-unit below the median) defines good radios, followed by acceptable ones and borderline performers. Everything below borderline is considered unacceptable by today's standards. For better visibility, the categories are color-coded.

Table 1: Median-based Performance Rating for Fair, Competitive CW Contest Operations

ΔfCenter [Hz]				
Rating	±500	±1000	±2000	±3000
Excellent	-58	-71	-82	-86
Good	-52	-65	-76	-80
Acceptable	-46	-59	-70	-74
Borderline	-40	-53	-64	-68
Unacceptable	> -40	>-53	>-64	>-68

Table 2: Relevant Amateur Radio Contest Transceiver Models

Brand	Model	ΔfCenter [Hz] ±500	±1000	±2000	±3000	ARRL Test
Yaesu	FTDX5000	-39	-51	-71	-76	Dec-10
Kenwood	TS-590S	-60	-71	-82	-85	May-11
Ten-Tec	599AT Eagle	-48	-59	-72	-83	Aug-11
Yaesu	FTDX3000	-43	-58	-70	-77	Apr-13
Yaesu	FTDX1200	-44	-59	-72	-80	Jan-14
Kenwood	TS990S	-60	-72	-81	-84	Feb-14
FlexRadio	6300	-46	-60	-70	-75	Apr-15
FlexRadio	6700	-54	-63	-76	-80	Apr-15
Kenwood	TS590SG	-50	-71	-81	-81	Jul-15
Apache Labs	ANAN-100D	-68	-80	-87	-84	Oct-15
Icom	IC-7851	-56	-77	-88	-88	Jul-16
Icom	IC-7300	-53	-66	-84	-88	Aug-16
Elecraft	K3S	-58	-76	-92	-95	Nov-16
FlexRadio	6500	-78	-92	-102	-109	Feb-17
Apache Labs	ANAN 8000DLE	-60	-79	-88	-92	Apr-18
Icom	IC-7610	-50	-61	-73	-78	Oct-18
FlexRadio	6400M	-60	-70	-82	-87	Feb-19
Kenwood	TS-890S	-61	-78	-87	-90	Jun-19
Yaesu	FTDX101D	-67	-73	-87	-89	Nov-19
FlexRadio	6600M	-58	-69	-81	-87	Feb-20
Yaesu	FTDX101MP	-53	-74	-83	-87	Dec-20
Apache Labs	ANAN-7000DLE MKII	-65	-80	-88	-86	Mar-21
Yaesu	FTDX10	-69	-80	-92	-92	Jun-21
Median		-58	-71	-82	-86	

5. Conclusion

In the beginning of this article, the root causes and the impact of interfering signals in Amateur Radio are discussed. “Dirty” transmitters interfere over proportionally with others and provide an unfair advantage over clean transmitters. The focus of the content lies on poorly shaped CW pulses. The other initially introduced causes of objectionable transmit signal quality (IMD, Transmit Phase Noise, linearity issues and defects/configuration issues) expand beyond CW (as an Amateur Radio modulation scheme) and requite additional articles, or white papers to be discussed in appropriate detail.

Four transceivers are measured in the time domain, as well as in the frequency (spectrum) domain. The impact of different pulse shapes on the signal in the frequency domain is illustrated. The two tested Elecraft transceivers produce clean signals, while the signal quality of the Icom IC-7300 depends on the rise time setting. The IC-7300 can be set up to be comparably clean as the Elecraft K3(S) in its unchangeable default configuration. The tested Yaesu FT-991 does not produce clean CW pulses in any of its rise time configurations.

Finally, a ranking system is presented for 23 potentially contest-relevant transceivers. It uses test data from ARRL product reviews and is focused on CW transmit performance for fair, competitive CW contest operations. Not only can the ranking table be used to personally choose a clean CW transmitter, but it also shows that, except for one older, but still available model [9], currently marketed transceivers have significantly improved CW signal quality, compared to older designs. Reasons for that likely are advancing technology, but also an increased focus on CW signal quality, encouraged by numerous discussions, talks and presentations about excessive Amateur Radio Transmit Noise.

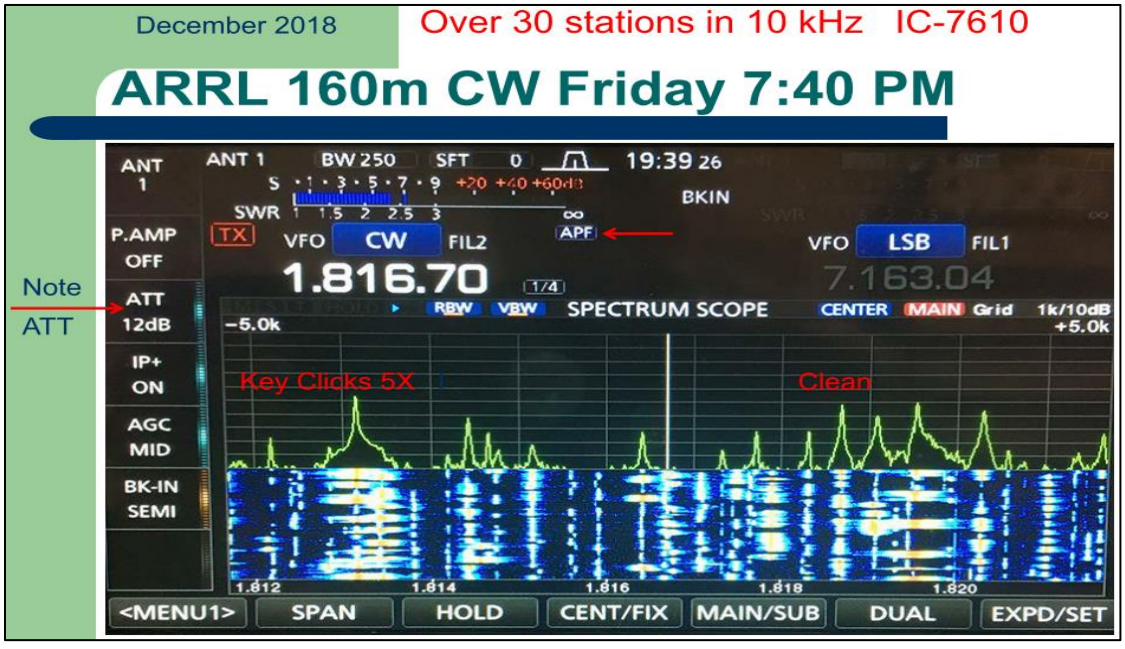


Figure 18: Screenshot ARRL 160m Contest by NC0B [1]

Figure 18 is a good example for the fact that, due to the rising spread of transceivers with integrated frequency spectrum displays, dirty signals will no longer be hidden by obscurity. Dirty signals lead to unfair advantages over clean signals, because they cause more interference for others than they are interfered with. Clean competitors do not only suffer from more interference, but they are also forced

to keep a greater distance and QSY away from the interference, so the interfering station has advantages when it comes to receiving weak signals, and holding a frequency.

For the sake of Ham Spirit and personal integrity, most contesters hopefully have a personal interest in supporting fair competition. Therefore, they should make sure that their signal quality is up to date. For all others, it is worth mentioning that many contest sponsors have added rules for dirty signal characteristics [10]. They explicitly state that signals that occupy excessive bandwidth through splatter or key clicks, or strong harmonics on other bands can now be penalized.

References

[1] NC0B, 2021: Contest University 2021 Presentation "Transceiver Performance for the HF Contest & DX Operator"

[2] ARRL QST Product Reviews

[3] For example: https://cqww.com/stats.htm

[4] K9YC, 2014: "A A Comparison of ARRL Lab Data For Selected Transceivers", section: "How Much Does This Matter?"

[5] For example: K6XX and K9YC, 2013: "Signal Cleanliness is Godliness"

[6] For example: INRAD FT-1000MP Key Click Mod Kit

[7] Online publications ARRL QST Product Reviews

[8] Demonstrated in 2018 by AA0HW in his Youtube video "QRQ CW ELEMENT timing jitter test on the Elecraft K3S when keyed in full QSK CW, qrq+ mode engaged"

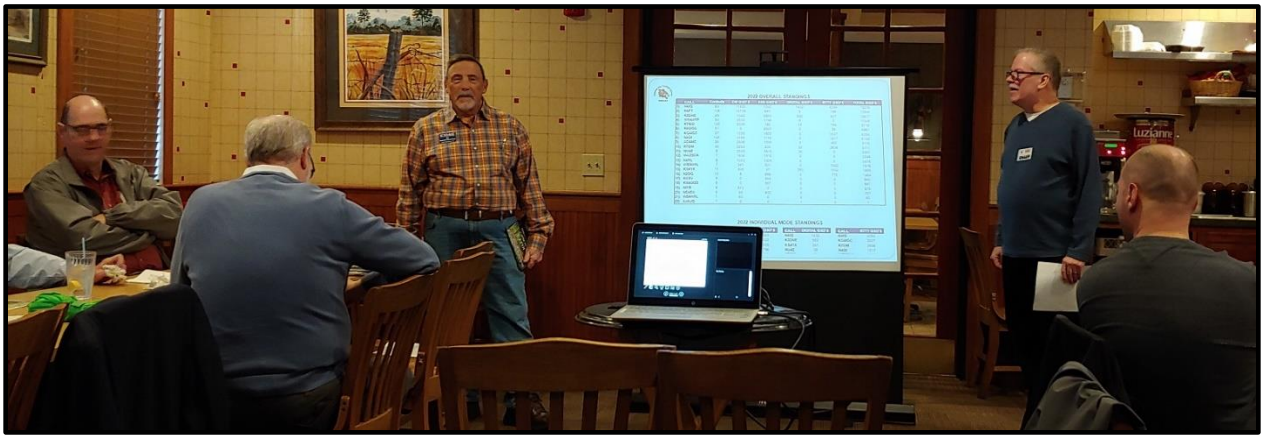
[9] Since 2014, a firmware update has been available to decrease the poor CW transmit signal characteristics of Yaesu FTDX5000 transceivers. It can be downloaded from the Yaesu homepage. The latest firmware is version 0131, released in July 2019. To see the current firmware version installed, push and hold GEN, 50 and ENT while turning on the transceiver. The clarifier display shows the version of the installed MAIN firmware.

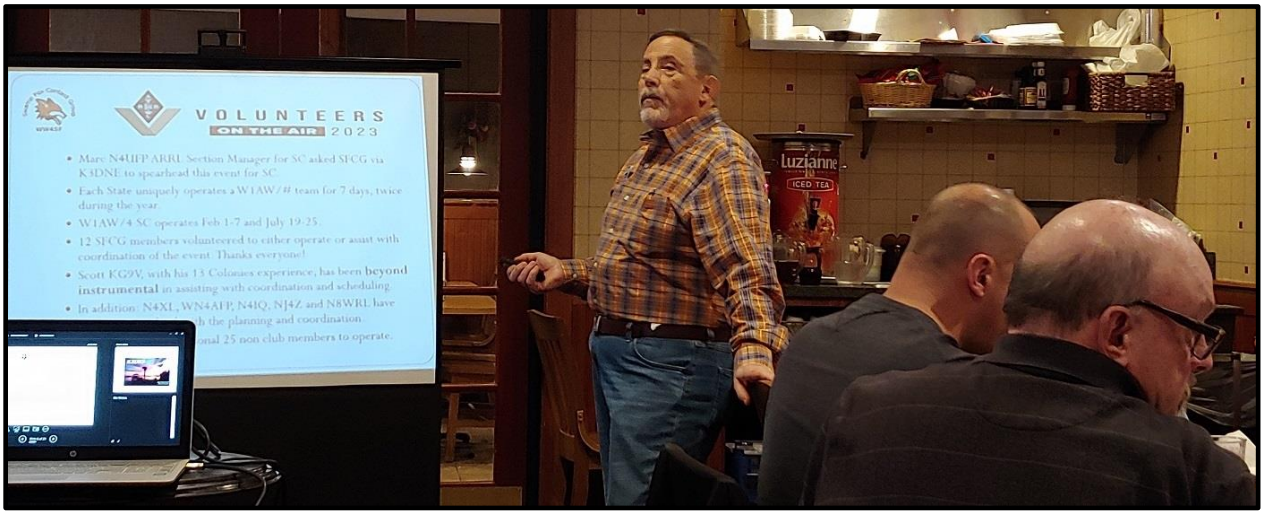
Without the update, even using the longest-possible rise time of 6ms, the FTDX5000 exhibits a very poor CW transmit signal. AC0C shows on his homepage (https://ac0c.com, tab "FT5K, CW Occupied Bandwidth) pre- and post-update measurements, as well as a comparison to a K3. Per the shown plots, the transceiver won't reach state-of-the-art performance, but the update results in a noticeable improvement (~10dB) and smoothing of the strong side bands and is therefore worth performing.

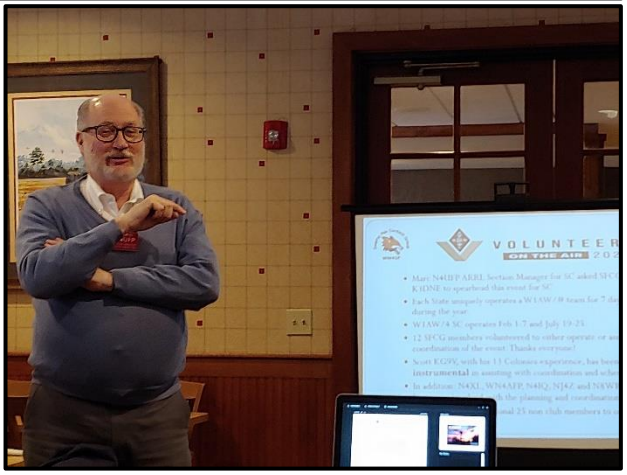
[10] For example: https://cqww.com/rules or https://contests.arrl.org/ContestRules/DX-Rules.pdf

SFCG Annual Meeting

The meeting was well attended. Discussion active. Business was conducted. Fun was had. Presentations made. You missed out if you weren't there. See you next year! Meeting minutes are, or shortly will be, posted on the SFCG website.







Observations by the Editor:

- Whether you operate Assisted or not, the Reverse Beacon Network (RBN) affects you in CW, RTTY, and FT8 contests. I'm only familiar with the CW aspects of that. *(Editor's Hint: All you other mode ops might start feeding me tips and info for the newsletter about your favorite modes.)* Most want to be spotted and there are tips to help the algorithm read your call. RBN guru Pete N4ZR wrote this on cwops.group.io "…we do NOT recommend speed changes when sending your call. From the

standpoint of being copied correctly by RBN nodes, that does not appear to help. Consistent spaces between characters are far more important, particularly between TEST and your call during a CQ" That was in response to Hans KØHB saying he uses "KØ~>H<~B" in N1MM when sending his call. The ~ uses a half space instead of a full space. The > slows CW down a bit and < returns it to normal speed. He does that to put a slight gap in his call and slow the H down to highlight the H. Too many people copy the H as an S. The point of my observation is to be aware of unintended consequences when you start enhancing your call sign with fancy gadgets.

- Regarding the RBN… Before the RBN spotting people was a kind act to help your fellow hams. Strong, confident, contesters would make it a point to spot everyone – even their competition. That is called good sportsmanship. The more stations an op can find the more fun they have. The more fun contesting is the more ops participate in the contest. The more ops in a contest the more fun everyone has – including the spotter. Setting aside the idea of abandoning being nice to people by refusing to spot anyone and hording multipliers to yourself, these days many ops do not feel the need to manually spot people because the RBN automatically does it. People don't spot because it seems redundant. It turns out that is not the "whole truth". First, the cluster owner has to decide if they want to route cluster spots through their feed. RBN feeds use significant amounts of bandwidth, and some do not include RBN spots in their feed. People using those nodes can only see manual spots. So even though the RBN is doing a great job we should still be manually spotting now and then. Second, many clusters require you to manually enable spots from the RBN. Some people logging onto those sites do not know they must manually enable them and only see manual spots. Third some ops, either intentionally or not, use a method of soliciting calls that the RBN does not easily pick up. Many times when spinning the VFO to find stations (instead of click and work using spots) I have come across someone working a big pileup by simply sending their call sign once. Those stations do not appear on RBN feeds. Take a half-second to click N1MM's "Spot" button – or whatever your favorite logger calls it. There's a hidden hint in there for you Assisted ops… Don't forget to spin the big knob on the front of your rig every now and then. Or you can use N1MM's Spectrum Window features to jump to strong unidentified signals if you prefer. You're cheating yourself of easy mults if you don't. I personally use all three methods during contests-- spots, VFO, and SHIFT+UP/DN (Spectrum Window jumps to strong signals)
- The Astron RS-60-M power supply for the local hospital's SCHEARTS repeater died and I am gathering info to try and resurrect it. Figure it's probably the LM723 Voltage Regulator IC which is a common failure point. Found this on the Repeater Builders website. I like Astron's, but always kind of suspected this to be true because many people, including yours truly, have had them fail if you push them hard.

  The above model tag shows that an RS-20 is rated by Astron at 16 amps continuous duty. Don't believe it!!! My personal opinion, which a number of my repeater-building friends share, is that you never load an Astron at over one-half its advertised rating and anything over 25% requires a fan on the heat sink. In other words, an RS-50 is only good for about 20 to 25 amps in continuous service, and one knowlegeable person suggests that an RS-50 is only good for about 12 amps continuous duty!.

  Astron's use of the term "ICS" on the label DOES NOT stand for "Intermittent Commercial Service" (a description that has an industry standard meaning), instead they say it stands for "Intermittent Communications Service" (Astron's own invention). Astron marketing explains that

by saying that in normal operation the user listens (i.e. low current) a lot more than he / she talks (high current). They say this gives time for the heat sink (and pass transistors), transformer, etc. to cool down.

In other words, Astron is marketing peak intermittent current capacity and counting on a low duty cycle for their product to survive everyday use. Due to the fact that Astron products have repeatedly failed, a number of system owners have abandoned Astron as the primary supplier of their repeater power supplies - most have switched to Duracom or Samlex SEC-series supplies (SEC-40, SEC-60, SEC-80 or SEC-100). This includes your page maintainer... at the 9 sites he helps maintain there are no Astrons in commerical service... all Samlex or Duracom.

Update: I dug into the hospital's supply after writing the things above in my draft newsletter and found it working fine. I had taken the word of the man who talked with me about it being bad and didn't check things out before we pulled it out if the rack. The problem turned out to be the repeater's power amplifier. Something in that failed and caused the RS-60's crowbar circuit to clamp and protect the power supply.

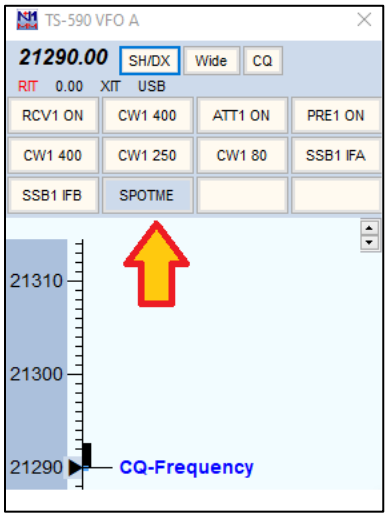
- Rediscovered a truism. Early in my Ham career, when I was copying about 13 WPM, many people who did 25+ WPM told me they had trouble copying slow CW. That didn't make sense to me at the time, but it's true. The brain gets used to how letters and words sound. That's why you give no thought to understanding people when they talk. You don't listen to someone talking and think about what individual letters make up the words you hear. CW is basically another language. Just as you do with spoken language you should strive to recognize how CW words sound. When CW comes in slow it doesn't sound the same and I end up being confused. I sometimes need to replay in my head what I had just heard. Sometimes I mentally counted the dots and dashes to figure out what people were saying. Obviously, that isn't how one should copy CW. I paid attention during this week's W1AW/4 activation and found I'm better at CW in roughly the 16 to 35 WPM range. Slower than that sometimes makes my brain stutter. In fact, it sometimes stuttered at 20 WPM, especially if that slower speed comes after a bought of 30+ WPM code.

N1MM+ Tips:

- We've some new members so I will sometimes bring back tips covered in prior newsletters from years ago. They will be intermixed with new items.
- John K3CT says: When a Windows Update informs you that a restart is required to finish, you should exit all running programs. This definitely includes our software. If Windows abruptly kills our software to restart, at a minimum the database cache files will not close and the user settings will not be saved.
- You may sometime want to quickly find when you last worked a station amongst the hundreds (or thousands) of q's in a big log. Ensure your Log window is open and enter their call in the Entry Window. Use the key combination Ctrl+F. The Log will display the contact at the top of the window. Repeat to locate even earlier contacts.
- Some useful keyboard shortcut keys

- Ctrl+U, if you have a serial number in the exchange field of the Entry Window then each time used this will increment the number by 1. Useful for us Little Pistol stations trying to bust a big pileup.sv2h
- Ctrl+Q and CTRL+A Quick edit previous (Q) or next (A) call
- Ctrl+Up/Dn Grab next qso from bandmap
- Ctrl+Alt+Up/Dn Grab next mult from bandmap
- Ctrl+Alt+Enter Log a not accepted qso (invalid exchange, usually)
- Space The spacebar will jump from field to field filling in defaults like the callsign and information from previous contacts with this station. *SPACE IS THE PREFERRED TAB CHARACTER*

- The {SPOTME} macro was included in User Defined Contests (UDC) for N1MM+. At first you needed to manually add a line to a UDC and use an experimental version of N1MM+, but that has been made a permanent addition in recent N1MM+ updates. Initial implementation instructions said {SPOTME} needed to be put into a Function Key. Not wanting to give up a Function Key macro slot I tried putting it into one of the programmable buttons at the top of the Bandmap. It works fine there too. I'm going to keep it there and just click on it whenever wanted in any contest be it a UDC or built in contest log.



- As many have found out viewing a waterfall display using programs other than N1MM is often more visually pleasing, but displaying band signals that way (rather than using N1MM's Spectrum Window) results in losing many features built into N1MM that help your rate. This is true even when you operate unassisted. I'll soon bring back an article from a previous newsletter to explain that, but this time around wanted to say if you are connecting an external SDR device like an SDRPlay (RSPxx) or an Airspy it is best NOT to use the previously recommended I/Q method of transferring information from the SDR to N1MM. Instead use N1MMSDRServer.exe to access SDR info from your device and feed it to N1MM. This reduces CPU loading and improves N1MM's performance. Information on how to do this for some popular devices is found in the N1MM+ user manual under the section titled "The Spectrum Display Window".

Upcoming Contests:

See the WA7BNM webpages https://www.contestcalendar.com/contestcal.html

SFOTA Current Leaderboard:

Feb-12-2023

Current Leaderboard

2023 OVERALL STANDINGS

	CALL	Contests	CW QSO'S	SSB QSO'S	DIGITAL QSO'S	RTTY QSO'S	TOTAL QSO'S
1)	K4FT	23	2292	122	0	50	2464
2)	N4IQ	5	1087	0	0	1272	2359
3)	KY4ID	13	1703	0	0	0	1703
4)	WN4AFP	15	1116	408	0	0	1524
5)	K7OM	4	352	0	0	440	792
6)	K3DNE	1	0	791	0	0	791
7)	N4QI	13	440	119	0	177	736
8)	NU4E	2	500	200	0	0	700
9)	K4QQG	5	0	357	0	104	461
10)	AC4MC	3	126	267	0	0	393
11)	KS4YX	1	0	0	0	252	252
12)	KG4IGC	1	215	0	0	0	215
13)	NE4EA	2	66	0	0	0	66
14)	N2OG	1	12	0	0	0	12

2023 INDIVIDUAL MODE STANDINGS

CALL	CW QSO'S
K4FT	2292
KY4ID	1703
WN4AFP	1116
N4IQ	1087
NU4E	500
N4QI	440
K7OM	352
KG4IGC	215
AC4MC	126
NE4EA	66
N2OG	12

CALL	SSB QSO'S
K3DNE	791
WN4AFP	408
K4QQG	357
AC4MC	267
NU4E	200
K4FT	122
N4QI	119

CALL	DIGITAL QSO'S

CALL	RTTY QSO'S
N4IQ	1272
K7OM	440
KS4YX	252
N4QI	177
K4QQG	104
K4FT	50

3830 Activity:

Date	Call	Class	Power	Score
BC QSO				
2/6/2023	K4FT	Single OpCW	LP	748
2/6/2023	K4QQG	Single OpSSB	HP	162
2/6/2023	N4QI	Single OpMixed	LP	768
2/6/2023	WN4AFP	Single OpMixed	LP	1,694
CQ160 CW				
1/29/2023	K4FT	Single Op	LP	47,196
1/30/2023	K7OM	Single Op	HP	19,530
1/30/2023	KB1QU	Single Op	HP	89,475

Date	Call	Class	Power	Score
2/1/2023	KD4S	Single Op Assisted	HP	9,724
1/29/2023	KY4ID	Single Op	LP	6,592
1/29/2023	NN4SS	Single Op	HP	48,906
1/29/2023	NU4E	Single Op Assisted	HP	196,736
EU-DX				
2/6/2023	N4QI	SOABCW	LP	5,760
HA DX				
1/22/2023	K4FT	SOABCW	LP	5,136
MnQP				
2/6/2023	K4FT	Single OpCW	LP	640
2/6/2023	K4QQG	Single OpSSB	HP	1,748
2/5/2023	N4QI	Single OpMixed	LP	896
2/5/2023	WN4AFP	Single OpMixed	LP	26,600
NA Sprint CW				
2/5/2023	KY4ID	Single Op	LP	6,478
NAQP CW				
1/15/2023	K4FT	Single Op Assisted	LP	176,870
1/15/2023	K7OM	Single Op	LP	13,920
1/15/2023	KG4IGC	Single Op Assisted	LP	28,810
1/15/2023	KY4ID	Single Op Assisted	LP	187,750
1/15/2023	N4IQ	Single Op Assisted	LP	220,174
1/15/2023	N4QI	Single Op	LP	20,615
1/15/2023	NE4EA	Single Op	LP	2,223
1/15/2023	WN4AFP	Single Op	LP	85,260
NAQP SSB				
1/22/2023	AC4MC	Single Op Assisted	LP	34,977
1/22/2023	K3DNE	Single Op Assisted	LP	166,110
1/22/2023	K4FT	Single Op	LP	9,516
1/22/2023	K4QQG	Single Op Assisted	LP	39,824
1/22/2023	N4QI	Single Op	LP	5,626
1/22/2023	N4XL	Single Op	LP	145,996
1/22/2023	NU4E	Single Op	LP	18,600
1/24/2023	WN4AFP	Single Op	LP	45,832
1/22/2023	WW4SF(@KG4IGC)	Single Op Assisted	LP	75,600

Date	Call	Class	Power	Score
NCCC Sprnt Lad				
2/3/2023	KY4ID	Single Op	LP	374
2/10/2023	KY4ID	Single Op	LP	342
VtQP				
2/6/2023	K4FT	Single Op	LP	72
2/6/2023	K4QQG	Single Op	HP	18
2/6/2023	N4QI	Single Op	LP	324
2/6/2023	WN4AFP	Single Op	LP	1,835
WFD				
1/29/2023	KS4YX	1H	LP	1,428
XE RTTY				
2/6/2023	K7OM	Single Op	HP	58,432
2/6/2023	N4QI	Single Op	LP	4,448

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