PVRC Newsletter
March

Newsletter Editor: John K3TN jpescatore@aol.com
Website: http://www.pvrc.org
Meeting Info: http://www.pvrc.org/chapters.htm
Facebook: https://www.facebook.com/groups/PotomacValleyRadioClub/

President's Letter – Mike N4GU

"The only constant in life is change." – Heraclitus

Few of us like change. It is usually full of unknowns. We have been living with a world-wide pandemic that required a lot of changes in our lives, but hopefully, we are much closer to end of that than the beginning. Now, the world is facing a war in Ukraine that will hopefully be contained, but there will likely be ripple effects to the world economy at a minimum. Our fellow hams in Ukraine have been ordered off the air for 30 days, for now. We look forward to the day they can return.

Recently, the ARRL dropped a load of changes to their contest rules. These were primarily the work of the Contest Advisory Committee (CAC), who, in recent years, have been given a great deal more latitude in choosing the topics they wish to address, and their suggestions seem to face little pushback from their nominal bosses at the Program and Service Committee, who appear to be ready to rubber stamp their suggestions.

Some of these changes have been generally accepted by the contest community such as changing the power limit for low power entries from 150W to 100W. Likewise, limiting all stations to 100W in Field Day has been mostly universally accepted as a positive thing. The new single operator, single band categories of the ARRL DX Contests seem long overdue. The splitting of Multioperator DXpedition scores by club is another overdue change.

Other changes have been a mixed bag. The new ARRL International Digital Contest has been welcomed since it has allowed the ARRL RTTY Roundup to return to what its name suggests, a RTTY (only) contest. Critics of all things FTx are no doubt disappointed to see another Digital contest on the calendar. The WW Digi DX Contest has already been added to the PVRC 5M program in large part because of its club competition. No doubt the new ARRL Digital Contest will also have a club competition, so it will likely be added next contest season. So digital contests continue to creep into our list of focused contests.

The most controversial change the ARRL has made is to eliminate the prohibition on self-spotting by multi-ops and assisted single op stations. This has ruffled feathers in the contest community. This undermines a fundamental ethos of contesting against self-spotting. It is certainly one codified in all the CQWW contest rules. Smaller contests are often silent on the subject, but for decades it has always been seen as at the very least unethical if not outright prohibited. Now that's changed, at least for ARRL contests. For some the sky is falling, others see it as 'keeping up with the technology'. I suspect the reality will land somewhere between the two. This will change the game, we're just not sure how yet.

Perhaps most upsetting to many is that they feel that this, and other changes were dumped on the contest community by surprise. While the CAC did not ride around waving big banners about these changes, they did report their consideration and recommendations on the topics of self-spotting and social media in their July 2021 Semi-Annual Report to the ARRL Board.

As an organization, PVRC rarely is unanimous in its position on topics within the contesting community. This is the case of the new ARRL rules changes. As such, the officers do not feel it is appropriate to take a stand purporting to represent all members of PVRC. However, we do feel it is appropriate, and even more desirable, for individual members to register their opinions on these and other related issues with the appropriate persons at ARRL.

Who would that be? At a minimum, your division representative on the Contest Advisory Committee and division director. If you feel so inclined, an email or letter to the ARRL CEO and/or President or the CAC Board Liaison may also help. Fifty letters of support for a position will carry more weight than a single letter purporting to represent a single club, even one as large as ours.

The topic of self-spotting is significant enough, I doubt we have heard the last of it. The latest information indicates that this new rule will not be in effect until 2023. But I suspect we get a chance to see what changes it will bring before it is possibly changed again.

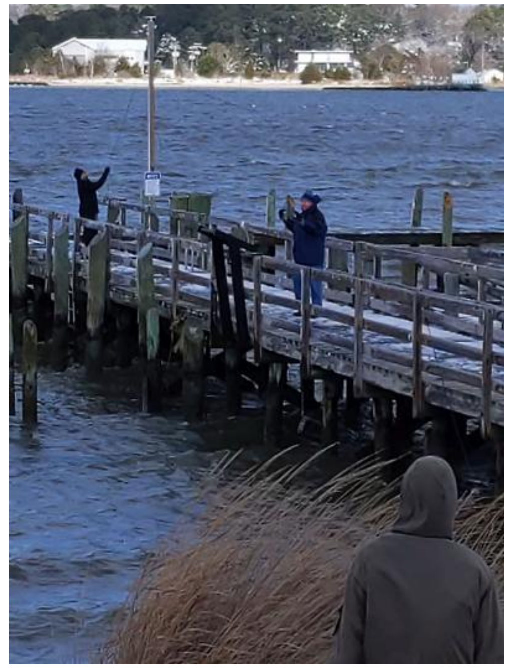
Colonial Capital Chapter: 6th Highest RTTY Sprint Team Score -Jerome K8LF

The Colonial Capitol PVRC chapter has been active getting chapter members setup on RTTY. Our efforts paid off in the RTTY Sprint with a 6th place showing.

Team Scores

1. SWACC #1		2. NCCC #1		3. SWACC #2		4. SMC Greta Garbo	
K6LL	4,292	N6WM	3,625	K5AM	2,900	N9LQ	2,444
N3QE	3,510	W6SX	3,451	WQ5L	2,808	KKØU	1,610
K9OM	3,451	AJ6V	2,730	**Total**	**5,708**	WD9CIR	1,562
NØXR	3,132	WØYK	2,712			**Total**	**5,616**
N4ZZ	2,716	**Total**	**12,518**				
Total	**17,101**						

5. NCCC #2K6GHA, NN7SS, WK6I, K6LRN 5,116
6. PVRC Colonial Capita K8LF, AI4WU, W4YSN.......................... 1,380
7. SM Rockets AA9L 589



Of course, our team was out a total of 7 teams but hey we were not last! Let's see how we can do in the March RTTY Sprint…

On the right, WB7URZ, K1NUH and KO4PQL rig the antenna for a Winter FD effort.

PVRCers at Orlando Hamcation

L-R, standing:
Rob K6RB, John N3AM, Ralph, W1DAR, Ted WA3AER, Henry WA2ROA

L-R seated:
Art WA8VSJ, Jim N3JT, Burt W3GG

Photo by WA2ROA

Remote Contesting at K3AJ Update – Tom K3AJ


During last February's "Virtual Galactic Event" I gave a talk about how K3AJ is set up for remote multiop contesting. We do this using an all-software approach as developed by Mike W4RN. Mike has been doing this a long time with some very competitive results.

The basic concept is that the N1MM logger is running on the shack computer, which the remote operator accesses using remote desktop software (such as Real VNC, Google Remote Desktop, AnyDesk, etc.). N1MM can handle much of the rig control needed for contesting and is used to send CW and RTTY messages with essentially zero latency (the computer and the rig are sitting next to each other, and the remote desktop connection is very fast). Station accessories such as rotators, RX antenna switching, and amplifier control are also handled via the remote desktop.

We simultaneously run the RemoteHams RCForb client/server software between the shack and the remote operators. RCForb provides a reliable audio channel with reasonable latency (the audio stream has adjustable buffering), a very well-integrated remote footswitch capability for SSB and provides a full remote radio front panel. Although as time has passed, some of what I reported last year has been superseded, the talk can be found here.

Since that time, we have made several improvements (mostly simplifications) to the set up:

- We came up with a reliable remote footswitch USB adaptor that works well with RCForb for SSB contesting. Remote SSB contesting is still a little more difficult because of the extra latency involved in sending the audio stream in two directions rather than just the one required for CW. But we have done some SSB contests with good results.
- We switched from driving the N1MM Spectrum Window from the radio IF output, through an SDR to N1MM with some intermediate software (Waterfall Bandmap). That arrangement worked well but required fudging in offsets that varied by mode. We now

use an SDR Play SDR connected to the antenna in use (TX antenna or RX antenna) and feed the N1MM Spectrum Window directly from the SDR.

- The external soundcard was eliminated, and we just use the one in the shack computer.
- Some buttons were added to the Bandmap Window in N1MM to make a few frequently needed adjustments easier (RX bandwidth and XIT).
- We created a set of instructional videos to help operators get familiar with the details of the set up.
- Although we haven't done this at K3AJ, W4RN has had operators use a remote K3, KX3 or K3 mini to act as a remote front panel for the station radio. RCForb provides that capability when using a K3 as the station radio. (*I remotely opped Tom's station a few times and use my K3/Mini with RCForb – K3TN)*

Remote operating takes some getting used to. Yes, there is some latency in the audio stream, not really significant on CW or RTTY, but it is there. Occasionally some radio adjustment gets tangled up inadvertently, the amp trips, or some window gets temporarily lost. The problem can usually be fixed by the remote op, but it is not as obvious what is going on when you aren't sitting in the shack. Results vary depending on how good the internet connection is at both ends. Occasional audio drop outs and even losing the whole shebang on rare occasions is just part of the game. Some of the ops have only one screen to work with and that makes things a bit more difficult. Over time, the team has developed the skills and patience to work through those kinds of issues. Even the station owner has had to eat his own cooking a few times when all of us operated remotely.

We did pretty well in 2021. We submitted multiop scores in 24 contests using all modes – CW, RTTY, SSB and Digi. We made 26,890 QSO's. And boy, did we have fun. We do a lot of kibbitzing in real time via text message while we are having at it so there is even some electronic camaraderie. More than one person at a time can be connected, so we can watch and listen to each other operate. Our main operators were: WT3K, ND3D, K3WA, WR3R, KB3IKC (son of ND3D) and K3AJ.

Why do this? The station gets a lot more use than it otherwise would. Some of our ops have very limited station capabilities at home, so this provides them with a nice way to get their fill of contesting. We share the operating schedule and usually can accommodate other personal needs on contest weekends. Nobody has to leave their home.

W4RN has said it many times: there must be a lot of stations in PVRC that aren't used as much as they could be. I know of quite a few members that don't have the ability to install much in the way of a station at home. There is a lot of opportunity here to have more PVRC stations set up for remote multiop contesting. Contact either W4RN or K3AJ to talk about how you can do this too. If you would like to take a "test drive" contact me - a CWT session is a good way to do that.

A Qualitative Analysis of Amateur Radio CW Signals – Wolf NN7CW

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 must fit inside the limited frequency spectrum.

Ambitious contesters often 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.

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.

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.

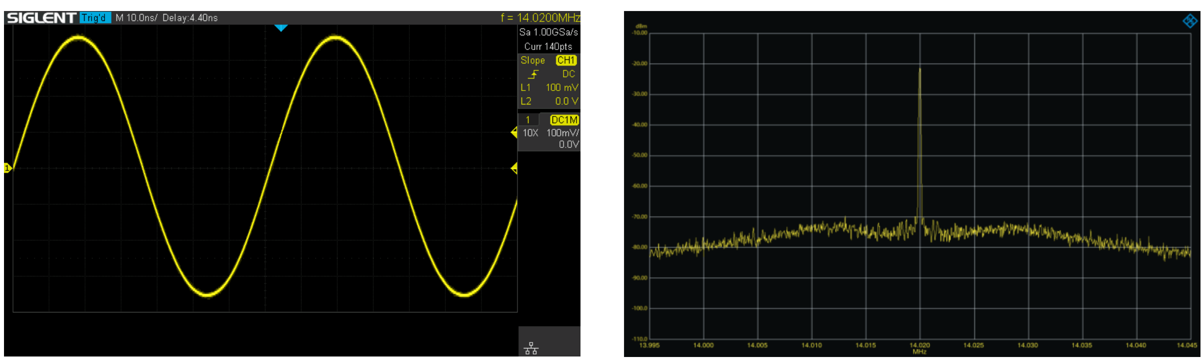


Figure 1: Sine wave (l/h) and its resulting signal in the frequency domain (r/h)

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.

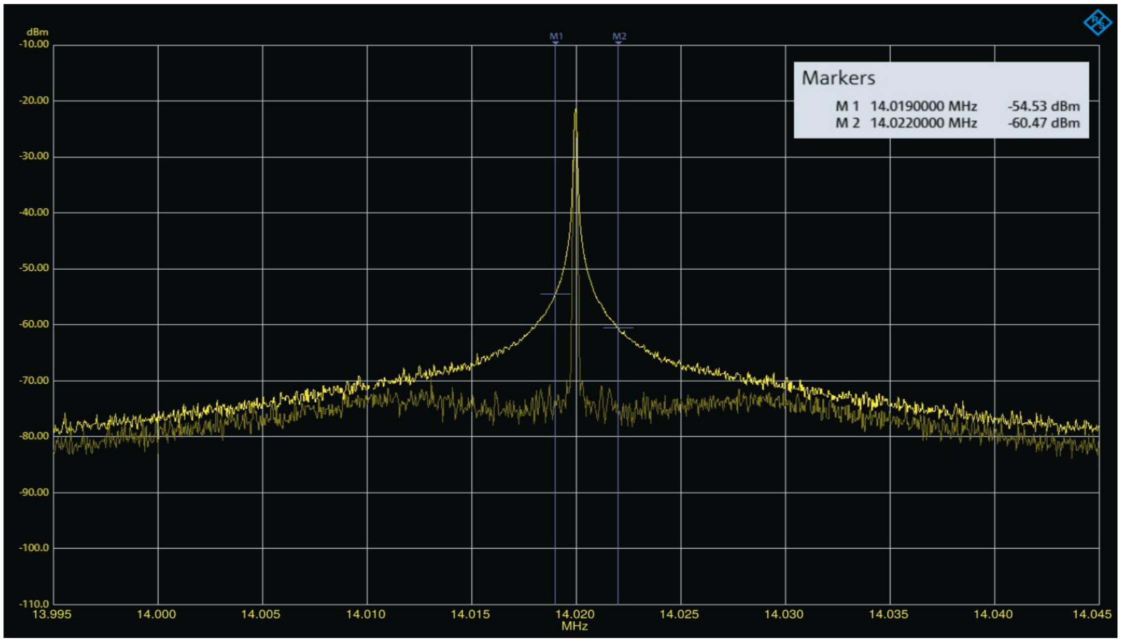


Figure 2: Continuous sine wave (faint) vs. intermittent sine wave (bold)

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.

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.

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.

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.

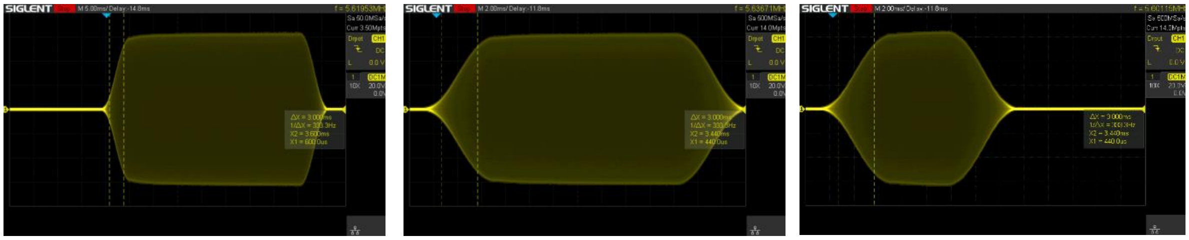


Figure 3: Keying of the K3 at 20WPM (l/h), 40WPM (center) and 60WPM (r/h)

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.

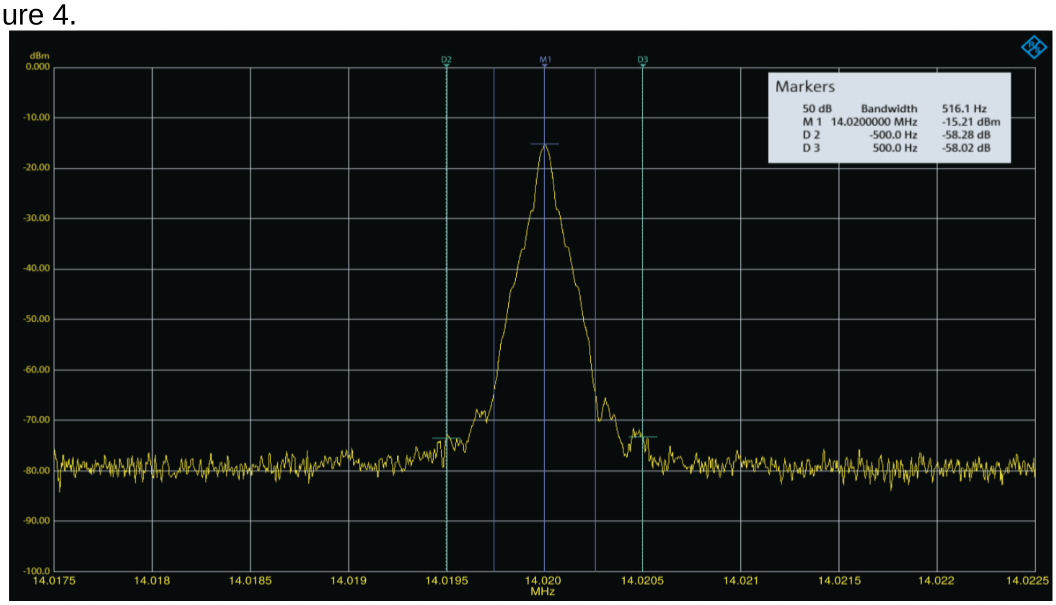


Figure 4: K3 response in the frequency domain

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.

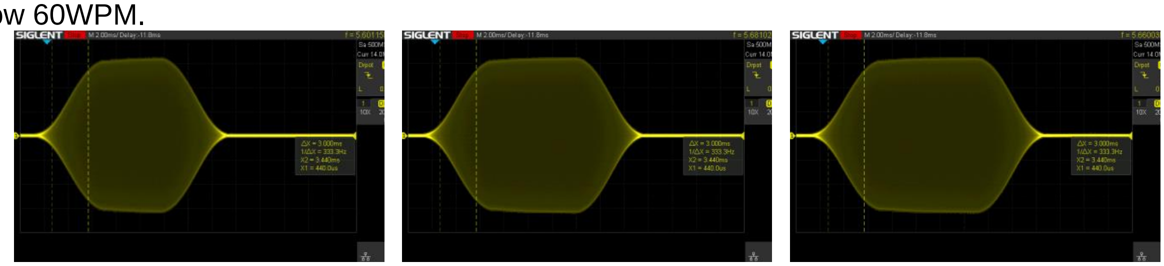


Figure 5: K3 pulse length variation

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.

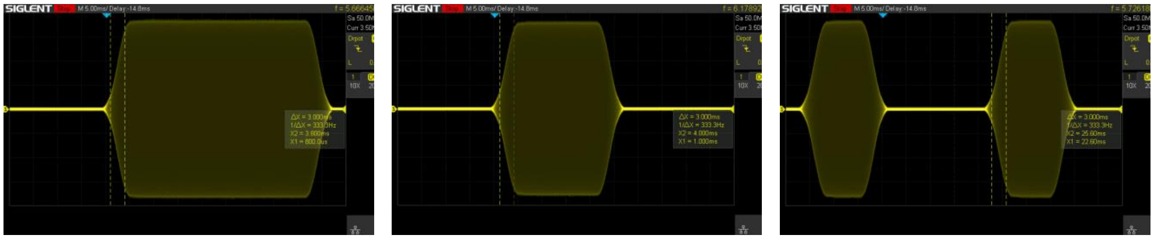


Figure 6: Keying of the K3S at 20WPM (l/h), 40WPM (center) and 60WPM (r/h)

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

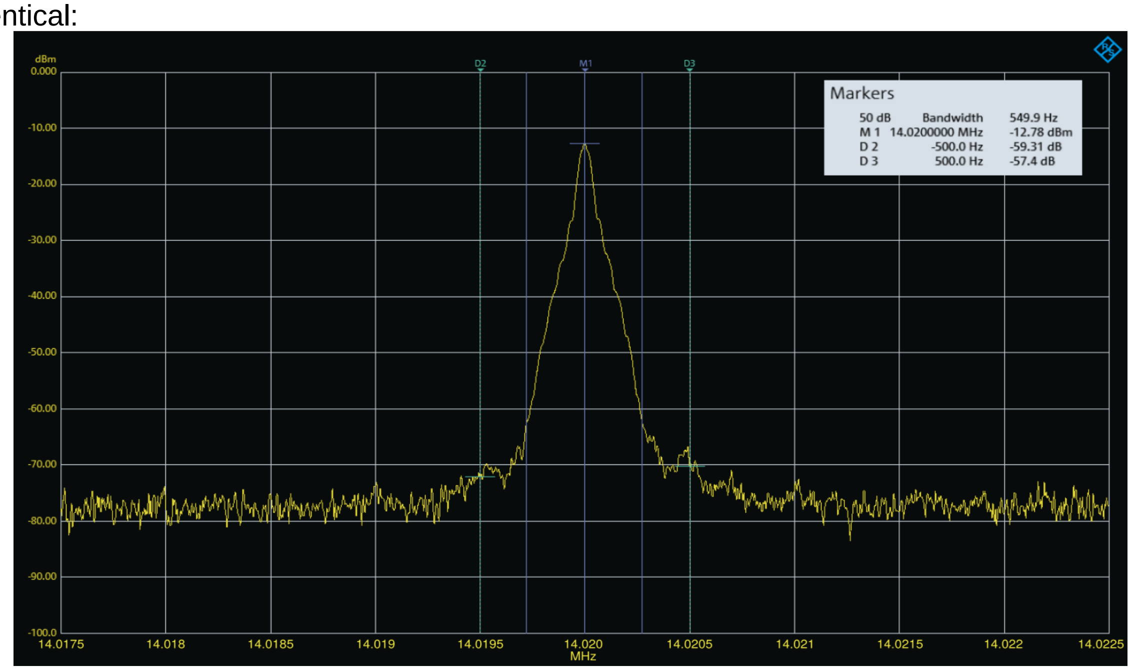


Figure 7: K3S response in the frequency domain

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.

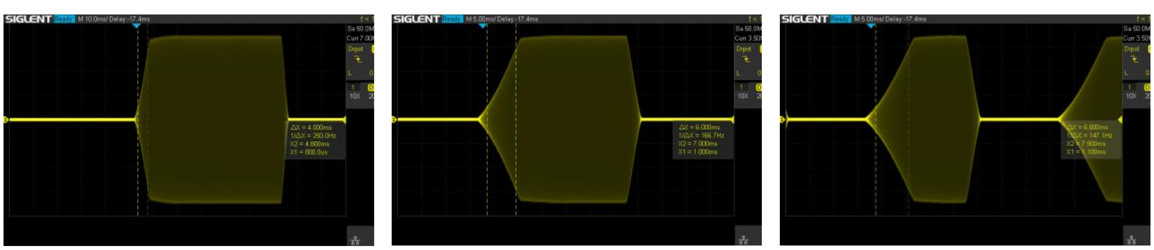


Figure 8: Keying of the IC-7300 (6ms rise time) at 20 WPM (l/h), 40 WPM (center) and 60 WPM (r/h)

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

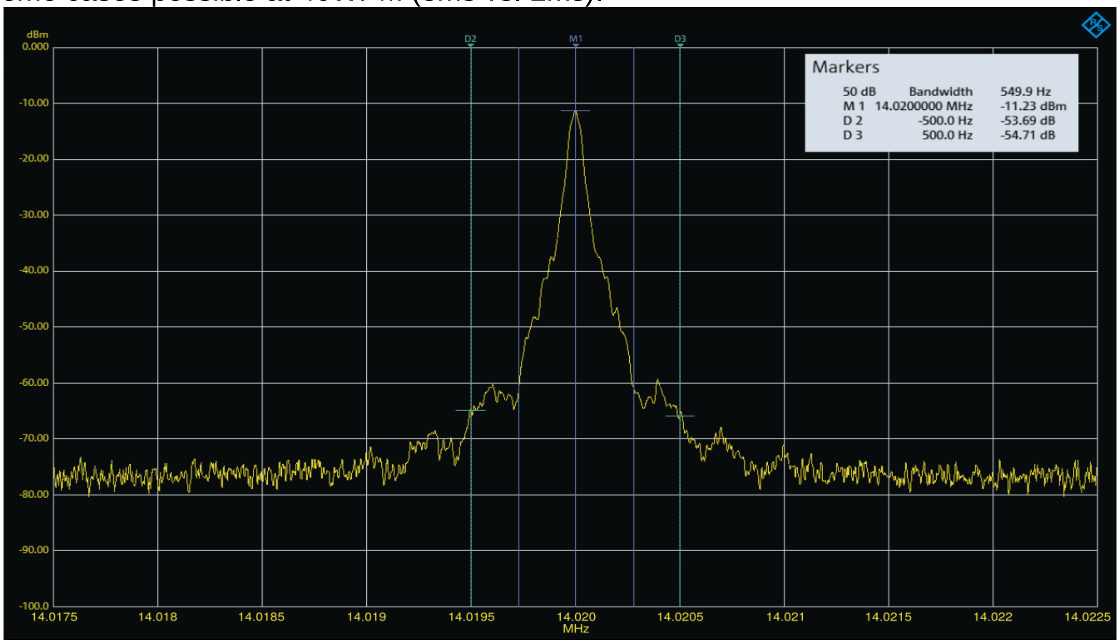


Figure 9: 40 WPM keying of the IC-7300 at 8 ms rise time

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.

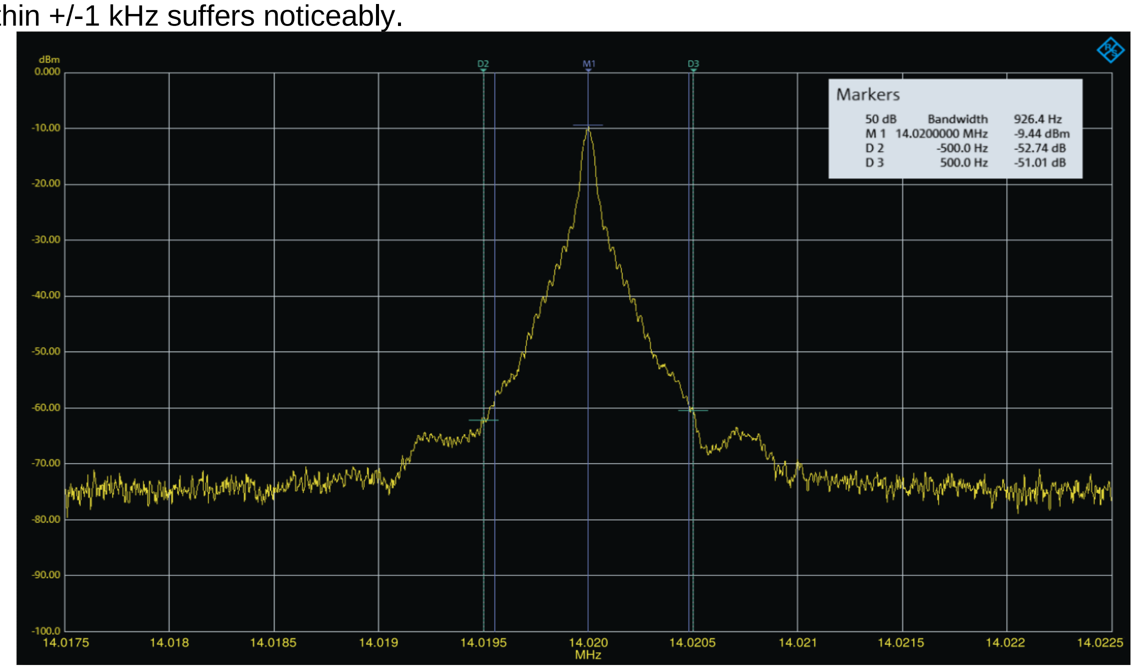


Figure 10: 40 WPM keying of the IC-7300 at 2 ms rise time

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?

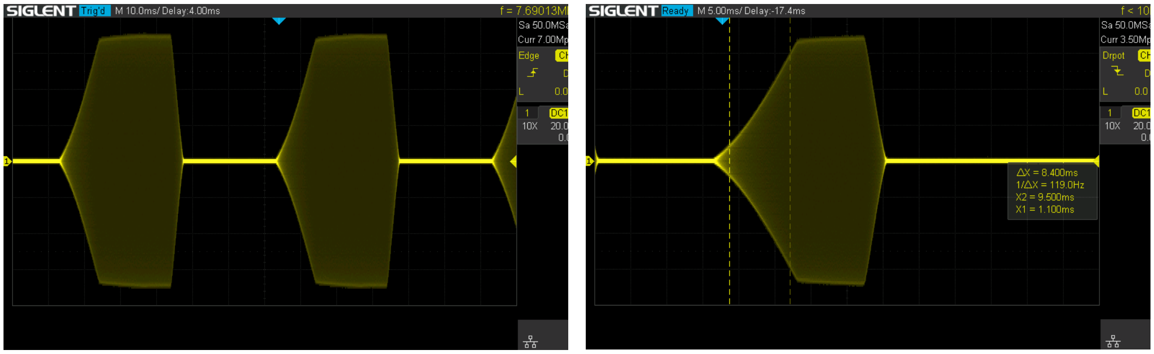


Figure 11: Keying of the IC-7300 at 40 WPM (l/h) and 60 WPM (r/h), using the 8 ms rise time setting (decay remains at 2 ms)

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.

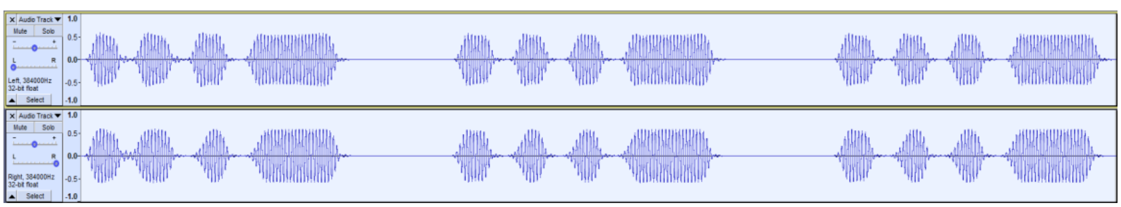


Figure 12: 60 WPM Rx Audio of the IC-7300 Tx signal: 2ms Rise time (top) and 8ms Rise Time (bottom)

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.

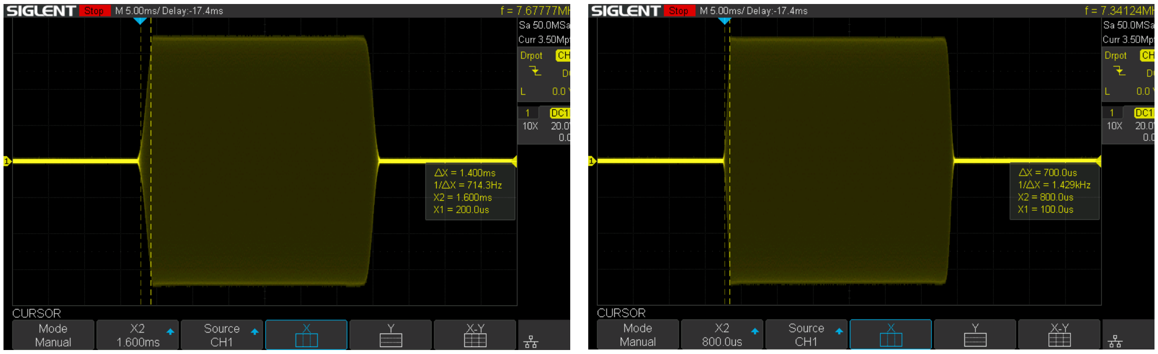


Figure 13: Keying of the FT-991 at 40 WPM. The rise time is set to 4 ms (l/h) and 2 ms (r/h)

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.

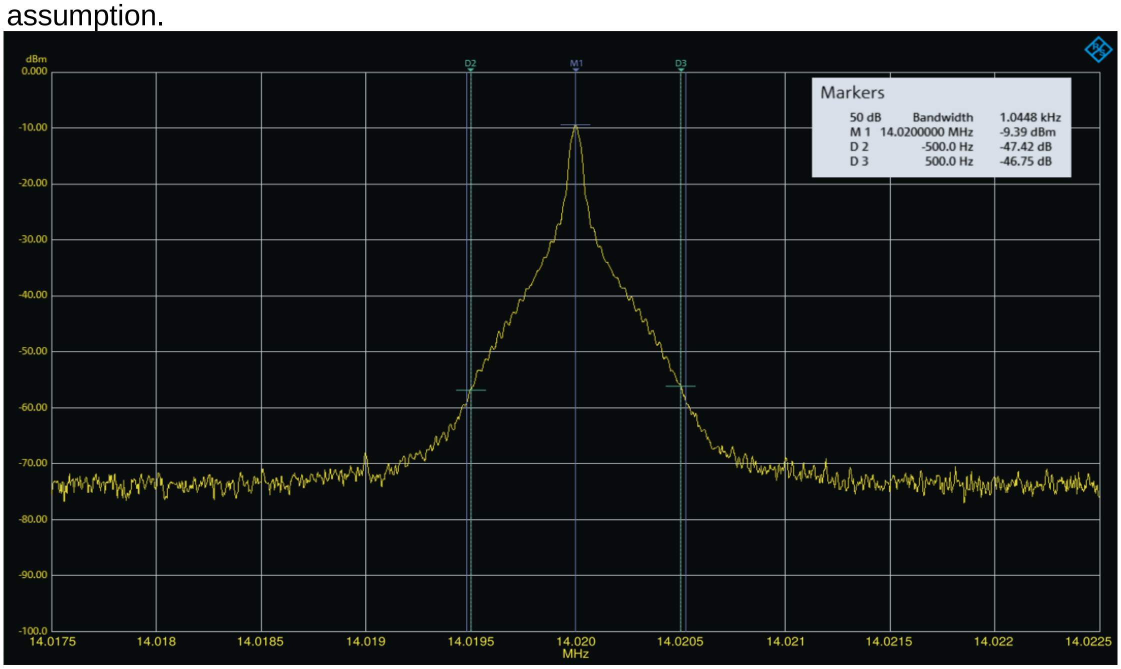


Figure 14: Yaesu FT-991 at 40 WPM keying speed, using the 4 ms rise time setting

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.

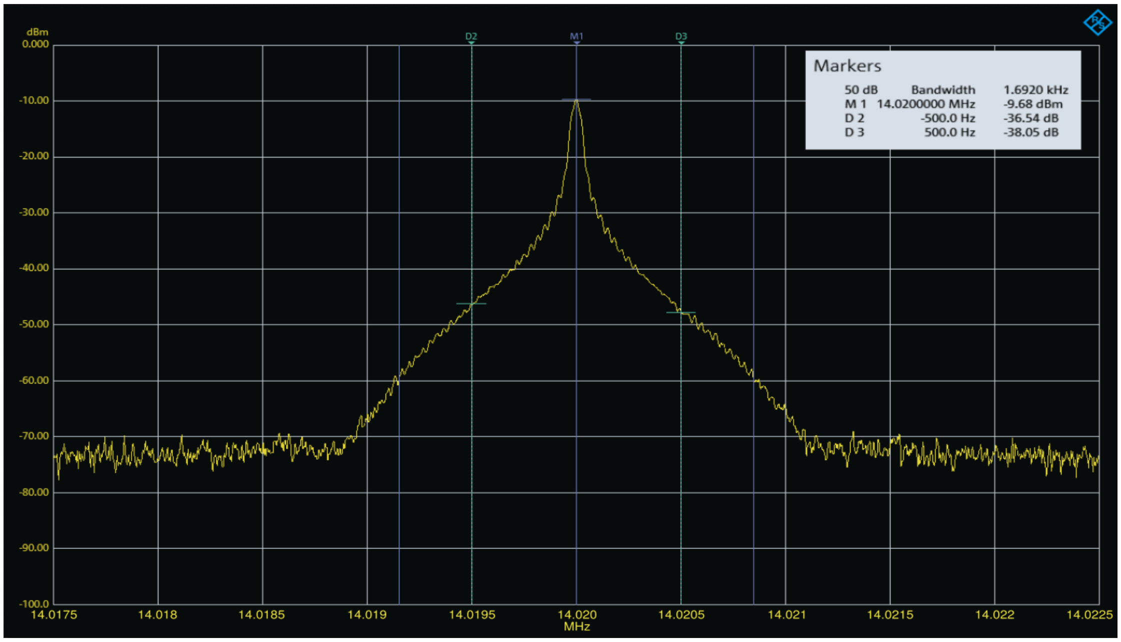


Figure 15: Yaesu FT-991 at 40 WPM keying speed, using the 2 ms rise time setting

Final Comparison

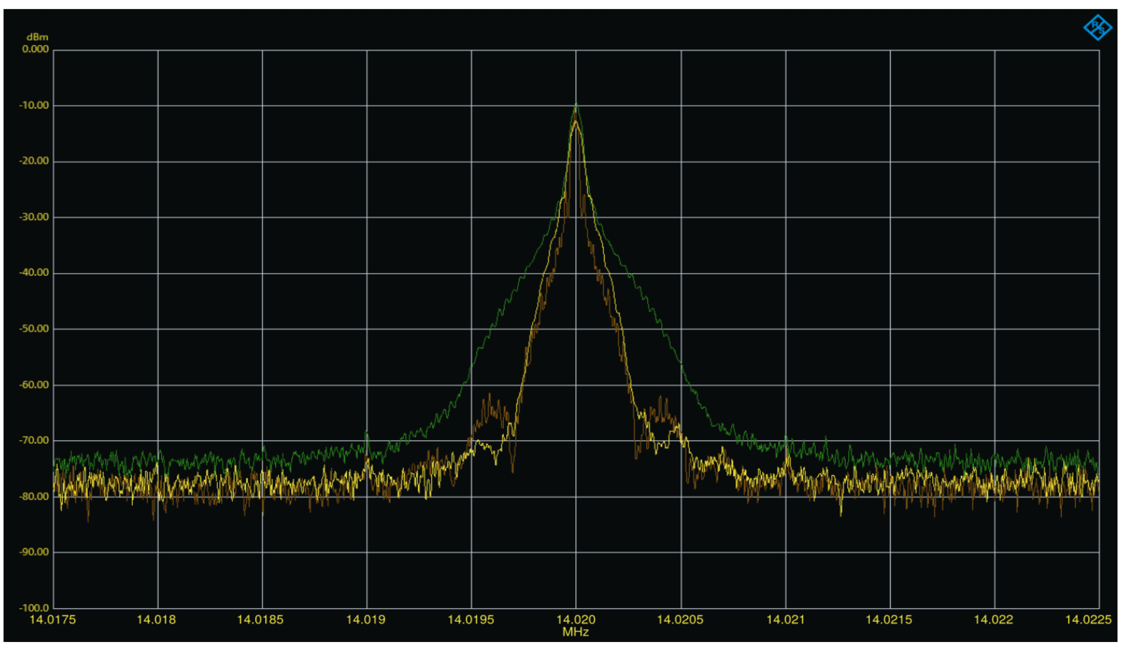
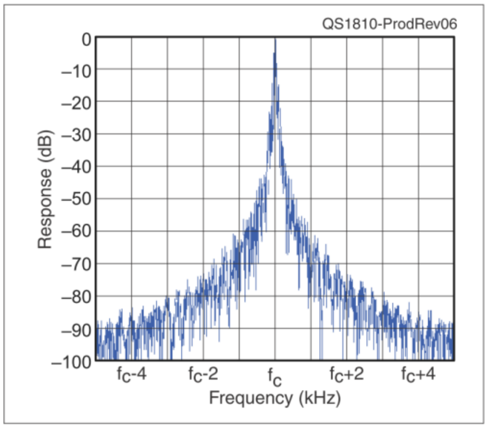


Figure 16: 40WPM CW pulses of Elecraft K3S (yellow), Icom IC-7300 (brown) and Yaesu FT-991 (green)

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

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.



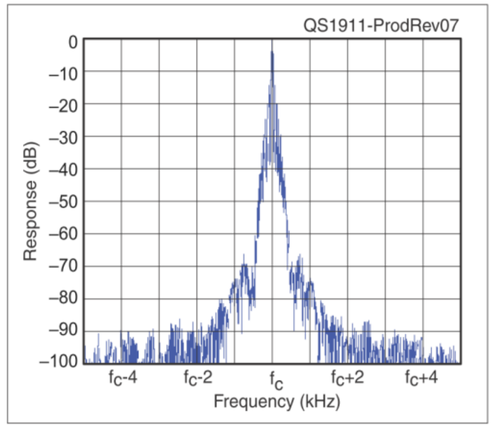


Figure 17: Example plots from QST Product Reviews 10/2018 (Icom IC-7610) and 11/2019 (Yaesu FTDX101D) [7]

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.

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.

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

		ΔfCenter [Hz]				
Brand	Model	±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	

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.

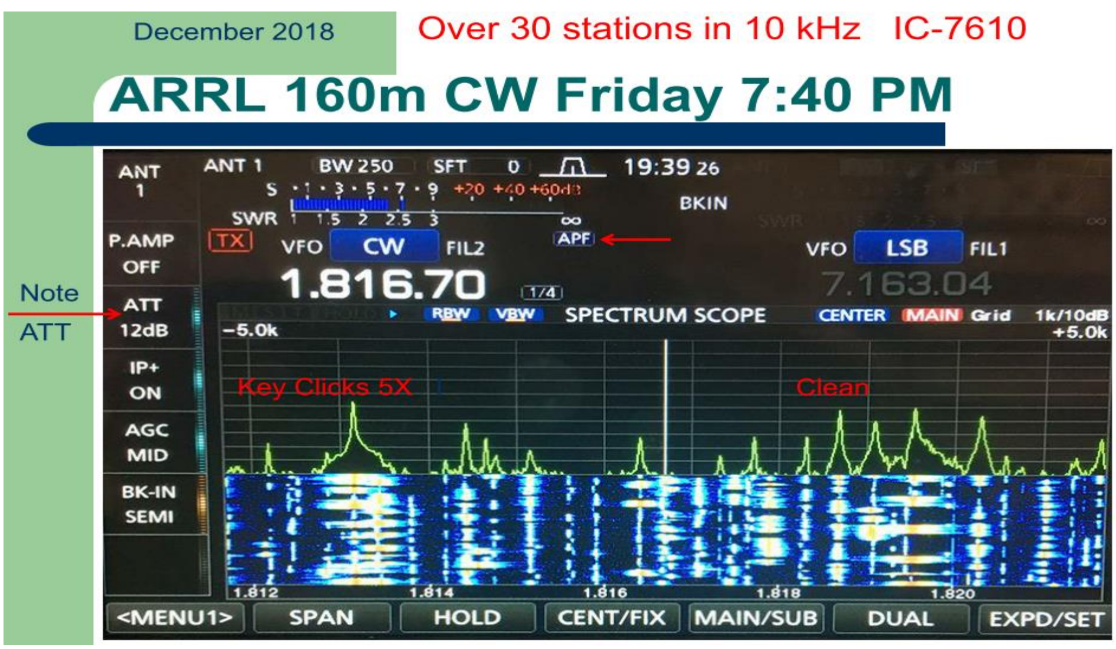


Figure 18: Screenshot ARRL 160m Contest by NC0B [1]

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

[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

(This article was reprinted with permission from the Florida Contest Group Contest Gazette. PVRCer Tom K2GO/HP1XT spotted and forwarded it – K3TN)

PVRC 160 Meter DXCC Standings – Frank W3LPL

Below are the 160M DXCC totals for PVRC members, transcribed from the ARRL DXCC data as of the 20th of each month or so. Thanks to Frank for the data each month to make this a regular feature. Please report any omissions or errors to Frank.

CALL	DXCC	CALL	DXCC	CALL	DXCC	CALL	DXCC
W8LRL	344	N1LN	219	N3RC	146	K5RJ	114
W4ZV	338	AB3CV	218	K3TN	145	N4DJ	113
W4DR	336	W0VTT	217	N4GG	145	K1KO	112
W3UR	321	W4NL	214	W3IP	144	N4TL	112
W3LPL	316	W3YY	213	N3KK	144	W3MR	112
K4CIA	306	N4MM	212	WA2BCK	143	W3UL	112
K4ZW	302	K3WA	210	W3BW	141	W4NF	111
N2QT	287	W3GG	200	W4VIC	139	NA1DX	110
W4PK	287	K5RT	197	W2YE	138	N3HBX	110
K3SX	285	K3JT	193	W4YV	138	KA4RRU	110
K4SO	277	N4DB	192	N4PY	135	K1BZ	108
KG4W	271	K4FJ	192	AA4NC	132	W4ZYT	108
K6ND	263	K1GG	186	N3KS	129	W3KB	107
K5VRX	256	K2PLF	174	N3RR	129	W2GPS	106
W3DF	254	K3AJ	172	K5VIP	129	K3WC	106
N3NT	253	W4FQT	172	K3XA	128	W3NRJ	105
WB3AVN	245	N4XX	169	W0YVA	127	N4NW	105
KG7H	242	K4XD	167	N3MK	125	W3TMZ	104
WX4G	240	K3KY	166	KM3V	123	W3XY	103
K1HTV	238	N3OC	164	W2GG	121	W3EKT	102
K3SWZ	234	N4QQ	163	K2BA	120	W4JVN	102
W3KX	233	NR4M	155	W4PRO	120	KE4S	101
K4XL	232	N8II	153	W4HZ	119	N3AF	100
K1AR	228	W2RS	152	N3UA	118	K3TZV	100
K5EK	226	N5JB	151	N3ND	117	KC4D	100
W3LL	222	N3QE	150	N3MN	114	KN4KL	100
WS6X	221	K4RG	147	K3OSX	114		

Membership News – Tim N3QE

Chapter leaders please remember to complete the Meeting Attendance Report. Members can check and update their roster details via the Roster Lookup.

Upcoming Contests – from WA7BNM

March 2022	
+ ARRL Inter. DX Contest, SSB	0000Z, Mar 5 to 2400Z, Mar 6
+ Stew Perry Topband Challenge	1500Z, Mar 12 to 1500Z, Mar 13
+ North American Sprint, RTTY	2300Z, Mar 12 to 0300Z, Mar 13
+ BARTG HF RTTY Contest	0200Z, Mar 19 to 0159Z, Mar 21
+ Russian DX Contest	1200Z, Mar 19 to 1200Z, Mar 20
+ CQ WW WPX Contest, SSB	0000Z, Mar 26 to 2359Z, Mar 27

Editor's Last Word – John K3TN

Thanks to Jerome K8LF, Jim N3JT, Tom K3AJ, Tom K2GO and Frank W3LPL for contributions to this issue of the PVRC newsletter.

We talk a lot about the aging of the ham population – this past weekend I had vivid evidence of aging's impact on an individual ham:

- I now have a 14-month-old grandson. My daughter and wife wanted to go out, and my son-in-law was out golfing, so I spent about 3 hours taking care of young Smith. Afterwards, I was more tired than 30 years ago after an overnight session operating 40M CW at W3LPL or than when I did a 100-mile bike ride last summer.
- Back in 2014 or so, I put my K3 transceiver at K4VV for remote operation and ended up buying a second K3 for home operating. After Jack K4VV's passing, that original K3 moved to W4RN for a few years but back in 2019 it returned and has been sitting in the basement since. But when I decided to sell it as part of downsizing a bit, I could not find it or the Astron RM35 power supply that was with it! I searched everywhere, nothing. I even called Mike W4RN and said, "Is my K3 still at your place??" – nope. Yesterday, I did one more search and the box with the K3 and Astron supply had magically reappeared.

What happened to getting older **and** wiser??

The quality and usefulness of the PVRC newsletter depends on contributions from members. If you have photos from club meetings, screen shots of new contest software, or brief writeups on station improvements or contest war stories, send them in any format to jpescatore at aol dot com.

From the PVRC Treasurer – Ted WA3AER

PVRC has chosen not to implement an annual dues requirement. We depend on the generosity of all our club members to finance our annual budget. In addition, active PVRC members are expected to participate and submit logs for at least two PVRC Club Competition contests per year.

When contemplating your donation to PVRC, each member should consider the benefit you are receiving from PVRC and its many opportunities for your personal growth in our wonderful hobby, then donate accordingly.

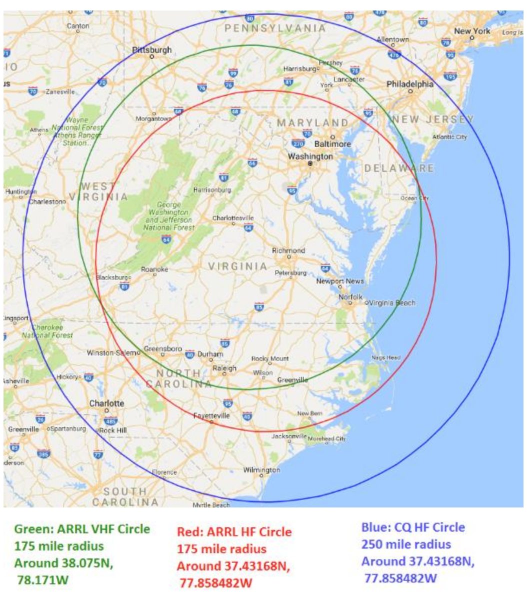
Direct donations to PVRC via Credit Card or PayPal may be made by clicking this "Donate" button and clicking the next Donate button that appears on your screen:

Donate

Donations to PVRC are not tax deductible

Eyeball QSO Directions

The latest info on local club meetings and get togethers will always be sent out on the PVRC reflector and posted on the PVRC web site.



Now a Word From Our Sponsors

PVRC doesn't ask for dues, but the Club does have expenses. You can also support the Club by buying from the firms listed who advertise in the newsletter!

Your source for DX News!

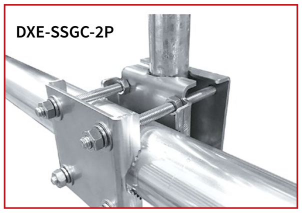
Get a free two week trial of The Daily DX and The Weekly DX by sending a request to **bernie@dailydx.com**.

The Daily DX
3025 Hobbs Road
Glenwood, Maryland 21738
Phone: 410-489-651

PVRC QSL Cards
by
LZ1JZ QSL Print

Plan Your Tower/Antenna Project with DX Engineering!

DX ENGINEERING



Tower Accessories

Upgrade your towers with DX Engineering designed and manufactured accessories. These include Advanced Design Thrust Bearings (for 2" and 3" O.D. masts); Tower Accessory Shelves; the Mastlock, which locks your tower mast in position for worry-free antenna maintenance; and stainless steel Genius Clamps for mounting round tubing and pipe members perpendicular or parallel to each other. We also carry guy and antenna support rope, tail kits, mast kits, hardware and more. **Enter "Tower Accessories" at DXEngineering.com.**

OPTIBEAM

OptiBeam Antennas

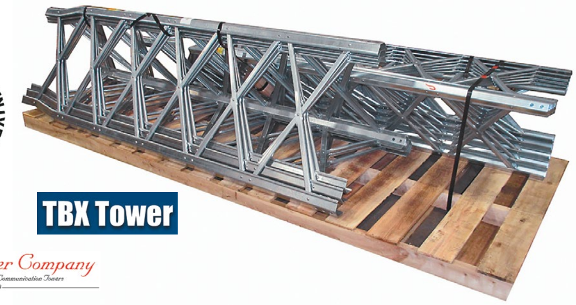
Proven in stations around the globe, OptiBeam's German-engineered, handcrafted directional monoband and multiband Yagi and log cell Yagi antennas deliver the highest possible gain, cleanest radiation patterns, optimum band coverage, and power handling without compromise. Many popular models are in stock and ready for fast shipment. **Enter "OptiBeam" at DXEngineering.com.**

InnovAntennas.com

InnovAntennas

DX Engineering is pleased to be the exclusive North American dealer for finely crafted Yagis, rotatable dipoles, and HF log periodic dipole arrays from InnovAntennas, each one the result of extensive testing and modeling to ensure stellar performance. Antennas are built with top-grade materials, including aircraft aluminum booms and elements, UV-resistant insulators, and stainless steel hardware. InnovAntennas' DXR antennas feature low maintenance; sturdy construction in a manageable size; no hairpins, traps, or matching links; and only one feedline for all bands. **Enter "InnovAntennas" at DXEngineering.com.**

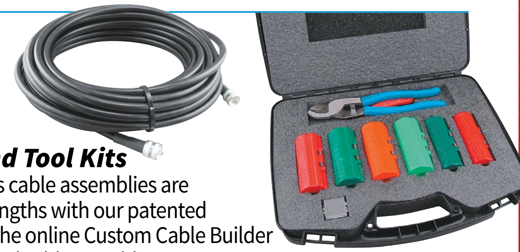
UNIVERSAL TOWERS · ROHN Products LLC · TBX Tower · American Tower Company



Towers

Make DX Engineering your go-to source for proven antenna towers. Choose from Rohn/American Towers, including Rohn G-Series guyed towers and Amerite 25 Series bracket towers; lightweight freestanding aluminum towers from Universal; and packaged tower kits from TBX, which come with rotor plate, top plate, hardware pack and top section steps. **Enter "Tower" at DXEngineering.com.**

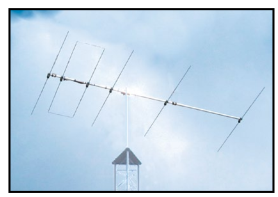
DX ENGINEERING



Coaxial Cable and Tool Kits

DX Engineering low-loss cable assemblies are available in standard lengths with our patented PL-259 connector. Use the online Custom Cable Builder at DXEngineering.com to build assemblies to your exact specs or purchase by the foot or in bulk spools. Plus, get everything you need to prep and install soldered, crimp-on or Universal Compression F-connectors on your coax. Complete kits include cable strippers, grippers, replacement blades, braid trimmer, cable shear and carrying case. Individual tools also sold separately. **Enter "Tool Kit" at DXEngineering.com.**

WiMO · EAntenna



EAntenna and WiMo Products

EAntenna is well known for its lineup of rugged HF and VHF antennas, including Yagi, log periodic, rotatable dipole, and vertical models. These antennas combine cutting-edge computer modeling optimization with robust mechanical and electrical designs to deliver high performance at a budget-friendly price. EAntenna products are now manufactured by WiMo, Germany's largest Amateur Radio supplier. Also check out WiMo's APRS modules, QRM Eliminator, and other gear. **Enter "EAntenna" or "WiMo" at DXEngineering.com.**

YAESU · ICOM · KENWOOD · ALINCO · GREEN HERON ENGINEERING · LOOS & CO. INC. CABLEWARE® DIVISION · JET-LUBE · ERICO

Check Out DX Engineering's Facebook Page and YouTube Channel!

DX ENGINEERING®

Ordering (via phone) Country Code: +1
9 am to midnight ET, Monday-Friday
9 am to 5 pm ET, Weekends

Phone or e-mail Tech Support: 330-572-3200
9 am to 7 pm ET, Monday-Friday
9 am to 5 pm ET, Saturday

Ohio Curbside Pickup:
9 am to 8 pm ET, Monday-Saturday
9 am to 7 pm ET, Sunday

Nevada Curbside Pickup:
9 am to 7 pm PT, Monday-Sunday

800-777-0703 | DXEngineering.com

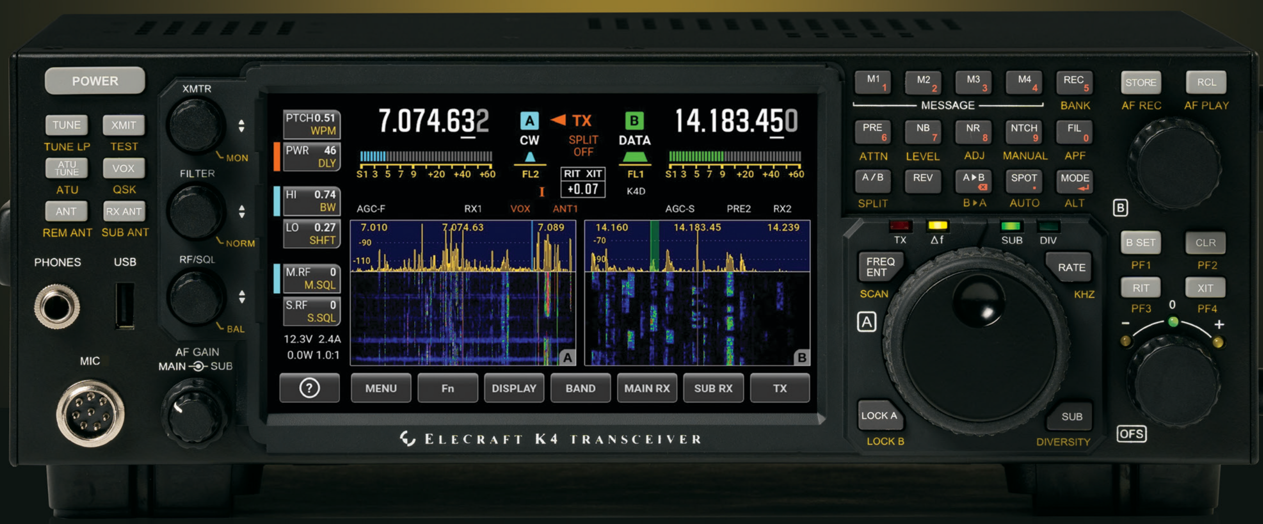
ON ALL BANDS — AN AMATEUR RADIO BLOG POWERED BY DX ENGINEERING

YouTube

We're All Elmers Here! Ask us at: Elmer@DXEngineering.com
Email Support 24/7/365 at DXEngineering@DXEngineering.com

ELECRAFT K4

High-Performance Direct-Sampling SDR



A direct-sampling SDR you'll love to use

Our new K4 transceiver harnesses advanced signal processing while retaining the best aspects of the K3S and P3. It features a 7" touch display, plus a rich set of dedicated controls. Per-VFO transmit metering makes split mode foolproof. Band-stacking registers and per-receiver settings are versatile and intuitive. Control usage information is just one tap away thanks to a built-in help system.

Modular, hybrid architecture adapts to your needs

The basic K4 covers 160-6 m, with dual receive on the same or different bands. The K4D adds diversity receive, with a full set of band-pass filters for the second receiver. (Thanks to direct RF sampling, there's no need for crystal filters in either the K4 or K4D.) The K4HD adds a dual superhet module for extreme-signal environments. Any K4 model can be upgraded to the next level, and future enhancements–such as a planned internal VHF/UHF module–can be added as needed.

Single or dual panadapter, plus a high-resolution tuning aid

The main panadapter can be set up as single or dual. Separate from the main panadapter is our per-receiver *mini-pan* tuning aid, with a resampled bandwidth as narrow as +/- 1 kHz. You can turn it on by tapping either receiver's S-meter or by tapping on a signal of interest, then easily auto-spot or fine tune to the signal.

Comprehensive I/O, plus full remote control

The K4's rear panel includes all the analog and digital I/O you'll ever need. All K-line accessories are supported, including amps, ATUs, and our K-Pod controller. The USB display output supports its own user-specified format. Via Ethernet, the K4 can be 100% remote controlled from a PC, notebook, tablet, or even another K4, with panadapter data included in all remote displays. Work the world from anywhere–in style!

K4 KEY FEATURES

- Optimized for ease of use
- Modular, upgradeable design
- 7" color screen with touch and mouse control
- ATU with 10:1+ range, 3 antenna jacks
- Up to 5 receive antenna sources
- Full remote control via Ethernet

The K4 interfaces seamlessly with the KPA500 and KPA1500 amplifiers

'The performance of their products is only eclipsed by their service and support. Truly amazing!' **Joe - W1GO**

ELECRAFT®

For complete features and specifications visit elecraft.com • 831-763-4211