Contest Gazette

Florida Contest Group

www.floridacontestgroup.com

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January 2022

From the President's Corner

Chris Plumblee, W4WF, FCG President

The FCG leadership team is looking forward to welcoming many of you to the Orlando HamCation and to the Orlando Contest Dinner next month. K5KG and his prize elves are working to get raffle prizes secured from many of the HamCation vendors, and I am continuing to make plans for the dinner itself.

Further to the dinner, thanks to the able assistance of W4LT and a number of others, we have made arrangements for N4OC to speak remotely. Ed is reluctant, given his previous health issues, to attend the dinner in person. I certainly understand his reluctance to attend given the recent rates of COVID infection and his individual health concerns. However, it is to Ed's credit that he insisted on going forward with a virtual address to honor his commitment.

If you are weighing whether to attend the dinner in person, let me reassure you that we (the club leadership) will certainly understand if you decide that attending the dinner is a risk you do not want to take. Your choice of whether to attend should be informed by your own risk tolerance and comfort with an event that is primarily indoors as well as your health at the time of the event. We will take every step that we reasonably can to make the event as safe as possible. The venue for 2022 has several sets of French doors on both the east and west walls of the building. If the weather on the night of the dinner permits, I will have those doors opened for the entirety of the dinner. Weather permitting, the buffet tables and the ticket table will be set up outside as well. Please be considerate of your fellow guests and wear a mask when not actively eating and drinking, and if you feel ill, please stay home.

Contest University will make its debut in Orlando on Thursday, February 10. If you are able, I hope you'll consider attending CTU as a part of the celebration of the ARRL's National Convention. CTU will take place at the Doubletree Hotel near SeaWorld. Pre-registration is required and, according to the email I received from the ARRL, costs $90 and includes a seat at the National Convention Luncheon at the hotel as well. Speakers including FCG members K9VV/NP2X, K5KG, NX4N, W4LT, and KJ4EUT as well as friend of the club I4VEQ will be the faculty for CTU in Orlando. This is the first year that CTU has been presented at Orlando, but I hope that it won't be the last.

Finally, several people have asked about the club's traditional Golden Corral luncheon on Saturday. Unfortunately, as best I can determine, that Golden Corral on West Colonial Drive where we'd had our lunch for the past ~20 years has closed due to the pan-

Continued on next page….

Inside this issue:

The Contest Gazette is the newsletter of the Florida Contest Group (FCG). The Gazette is published quarterly and notifications for input and publication will be on the FCG reflector. Please send input to Marty Brown, N4GL, n4gl.marty@gmail.com. MS Word documents are preferred, or type your article into the body of an email. Pictures are encouraged. Please include names, call signs, and location/ event when possible.

demic and not reopened. Many but not all Golden Corral restaurants around Orlando suffered the same fate. In the absence of a good restaurant to hold our meeting, I've decided to forego that portion of the weekend programming for 2022. I will speak with the OARC leadership about finding a place at the HamCation to hold a club meeting on Saturday in place of the lunch in 2023. However, for 2022 the club leadership and I decided to prioritize CTU and spend our limited time and energy in an effort to make that event a great success. We will revisit the Saturday FCG luncheon in 2023 and either find an alternate restaurant to host us or find a place at the fairgrounds where we can hold an abbreviated meeting.

In addition to the excitement about Orlando activities, there are contests to discuss! The ARRL 10m contest was something of a disappointment. After outstanding openings to EU in CQWW SSB and more limited openings in CQWW CW, the 10m Contest saw only a short spotlight opening to EU and decidedly mediocre conditions to North America for most. Despite the less-than-ideal conditions, many FCGers put together big scores in various categories. All of the following are based on claimed scores. Congratulations to (in order) N4TB, K1TO, WB4TDH, and WC4E (as N4AO) for their 1-2-3-4 finish in the CW LP category, and to NN7CW for his convincing win in CW HP Assisted. K1KNQ won USA SO Phone Only LP. AD4ES appears to have won the USA in M/S HP, N4OX in the panhandle finished a strong 2nd place in Mixed HP, and K2PS put his temporary station through its paces to win Mixed LP convincingly. Mixed Unlimited HP was another murder's row of FCG juggernauts, as WO4O, N4UU, and K5KG finished 1-2-3. Not to be outdone, K9OM and W4EE finished 1-2 in Mixed Unlimited LP.

ARRL 10m Contest Raw Scores:

https://contests.arrl.org/rawscores.php?cn=10m

I was seduced by how good 10m sounded during CQWW SSB and booked a ticket to Cleveland, OH to guest op with old friends K8AZ and K8NZ at K8AZ's station in the Cleveland suburbs. Unfortunately, W8 was not the place to be for the 2021 10m Contest, but we made the best of it with outstanding conversation and company. Tom has a very formidable station on 10m when the sunspots are high, so I've already made provisional plans to go back to Ohio for a future 10m Contest, time and circumstances permitting.

Coming up on the air is the NAQP CW (set to begin tomorrow afternoon as I write these words), the NA Sprint in early February, then the ARRL DX CW and DX SSB contests in February and March. AA8R has organized teams for NAQP in memory of K4LQ and his XYL, and I'm sure we will represent Fred proudly on the air. I hope that you're making plans to operate some or all of those events as they inspire your interest.

Finally, check your email for a recap of 2021 in the FCG's FCP standings. Congratulations to everyone for their participation, and thanks to K4SBZ for selflessly taking on the administration of a difficult program. I had the occasion to discuss with a member of another large contest club the impact of our FCP on our contest scores. He was seeking ideas for how to incentivize members of his club to operate more in particular contests, and I explained to him that FCP was not aimed primarily at individual contests or even types of contests. We did not measure the success of the FCP by our club score in a particular contest. We measured it by the increase in BIC times by our members in contests throughout the year. By that measure, FCP has been an outstanding success.

73/OJ,
Chris W4WF

FCG Hamcation Events

FCG at CTU

Chris Blake, NX4N

Several FCG members will be presenting at the ARRL National Convention & Orlando HamCation Contest University (CTU) on Thursday February 10. To my best knowledge these are the Presentations:

- **Contesting to Save Lives** with Fred NP2X/K9VV
- **Mobile QSO Party Contesting** with George K5KG and Chris NX4N
- **SSB Contest Audio Characteristic**s with Lu W4LT
- **Youth Contesting** - Max KJ4EUT (FCG's youngest member!)

In addition, Claudio I4VEQ will also make a presentation regarding WRTC 2022/2023.

This is the first time that CTU is coming to the Orlando HamCation; Tim, K3LR will be hosting the event. Please note that the Dayton Hamvention will also hold CTU with different topics and presenters.

Orlando Contest Dinner

Announcing the 2022 Orlando Contest Dinner on February 11, 2022

New location is at **St Michael's Episcopal Church, 2499 Westmoreland Dr.** (at the corner of Westmoreland & Bryn Mawr St.) Parking on the church campus, behind Quigley Hall, and along both sides of Bryn Mawr as needed. Doors will open at 5:00pm; dinner will be served at approximately 6:15pm.

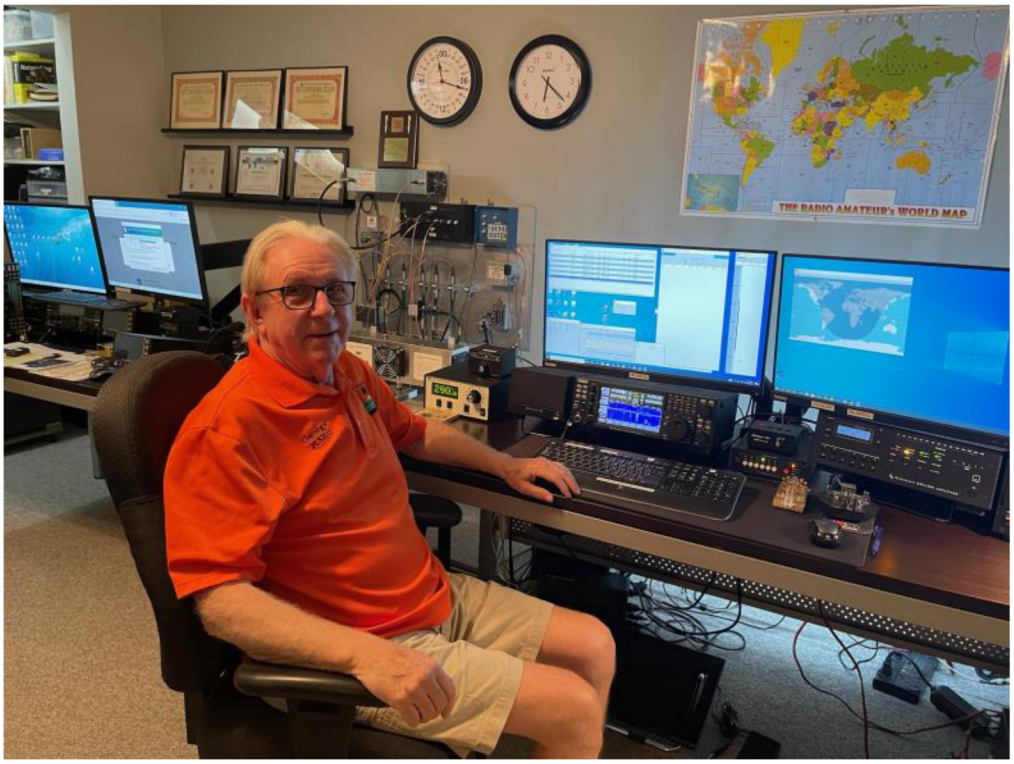
To order tickets: 2022 Orlando Contest Dinner

2022 Contest Resolution

My 2022 resolution is pretty simple! I plan to get out of this condo and buy a house, with no HOA, so that I can put up some antennas and contest again!

Very 73
Randy N4QV

George K5KG with new toy - Elecraft K4D



FQP Update

Dan Street, K1TO

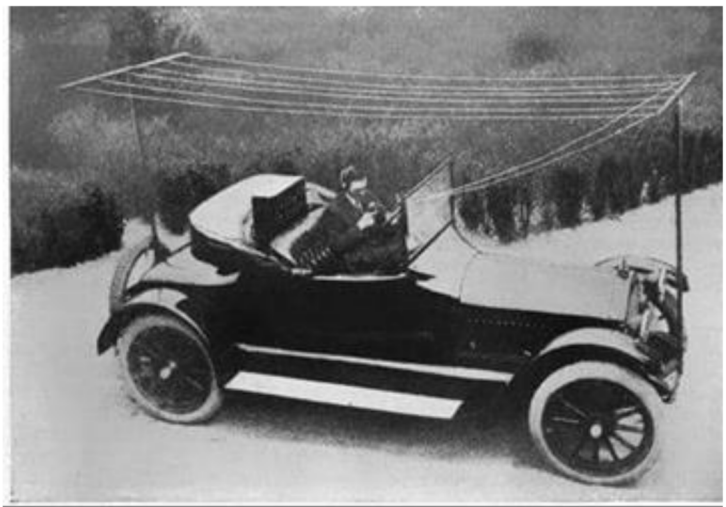
FQP Website

Completed - FQP 2021
All charts, 1x1 winners, plaque winners, FQP records. Sent VE results to VE3TW for inclusion in The Canadian Amateur

In Progress - FQP 2021
Results article/posting, plaques (production, distribution), certificates (FQP, 1x1)

To Be Done - FQP 2022 (#25!) preparations will be on the website as they happen - 1x1s, rules, publicity/ press releases, plaques

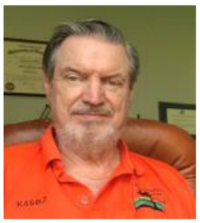
vy 73, Dan



Historic Photographs
An amateur radio set installed in a car in 1919

FCG Frequent Contester Awards Program (FCAP)
Members' Achievements, 2021 Final

Stan Zawrotny, K4SBZ
FCG Frequent Contester Program Administrator



This report represents the final report for 2021. The following scores are final.

Members participated in 149 contests last year compared with 132 during 2020.

The number of the club's members who submitted entries to 3830Scores stayed steady at 159. However, because our membership total increased, the percentage of participating members dropped from 48.8% to 44.3%. Please note that the membership increase occurred mostly at the end of the contest year.

54% of the entries were in Major contests. 29% were submitted for state QSO parties. The DX contests accounted for 17% of the total.

The average participant competed in 14 contests again this year with over 105 hours operating. They averaged over 1009 hours of BIC and 7.7 hours of BIC per contest.

Almost 90% of the operation was Single Op. The choice of operating power is split with HP at 55.9% and LP with 42.7%. Members operated QRP 31 times.

The **Florida QSO Party** took over first place as the most popular contest for 2021 with 84 participants. The **CQ Worldwide CW Contest** was a close second with 82 ops reporting entries. When measured by the most Op Hours, the **ARRL DX CW Contest** edged out the **CQ Worldwide CW Contest** with 1,172 Op Hours vs. 1,140. When BIC per contest for contests with 10 or more ops is measured, the **WPX CW** Contest comes out on top with 16.3 hours per contest. 13 contests had more than 10 average BIC for each contestant.

The top 10 in each category are listed below.

Contest	Entries	Rank	Contest	Op Hours	Rank	Contest	Op Hours	BIC
FlQP	84	1	ARRLDX CW	1,172	1	WPX CW	977	16.3
CQWW CW	82	2	CQWW CW	1,140	2	ARRLDX CW	1,172	15.2
ARRLDX CW	77	3	WPX CW	977	3	RTTY WPX	462	14.0
ARRL 10	68	4	CQWW SSB	780	4	CQWW CW	1,140	13.9
CQWW SSB	61	5	FlQP	748	5	CQ WW RTTY	360	13.8
WPX CW	60	6	ARRL 10	687	6	WAE CW	245	12.9
CWOpen	59	7	SS CW	656	7	CQWW SSB	780	12.8
SS CW	56	8	ARRLDX SSB	506	8	RTTY Roundup	439	12.5
ARRLDX SSB	52	9	WPX SSB	474	9	SS CW	656	11.7
IARU	50	10	IARU	463	10	WPX SSB	474	11.3

Click here to see where you stand....

A Qualitative Analysis of Amateur Radio CW Transmit Signals

Wolf Heeren, NN7CW
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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.

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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.

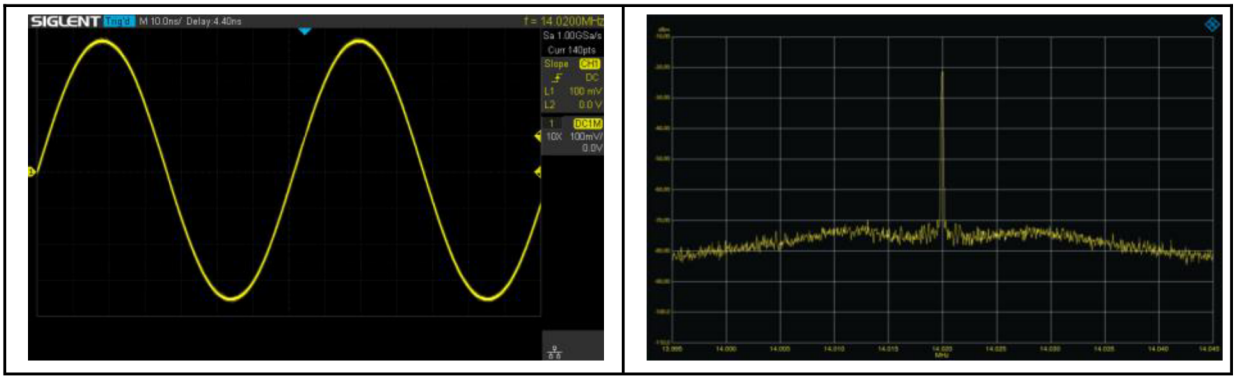

Figure 1: Sine wave (l/h) and its resulting signal in the frequency domain (r/h)

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.

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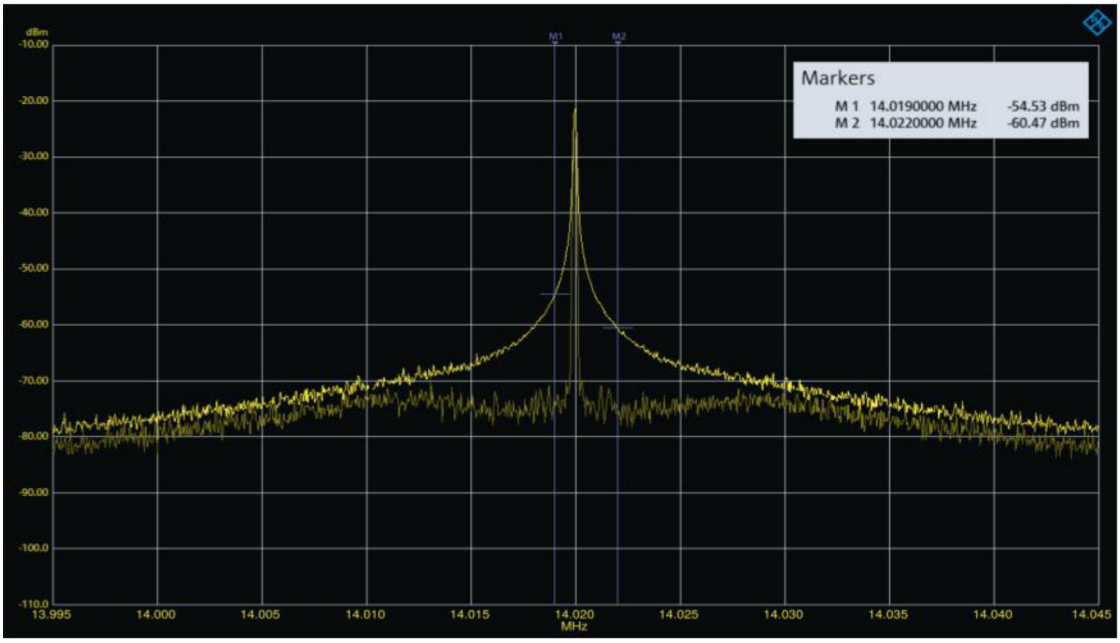

Figure 2: Continuous sine wave (faint) vs. intermittent sine wave (bold)

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.

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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 wave form.

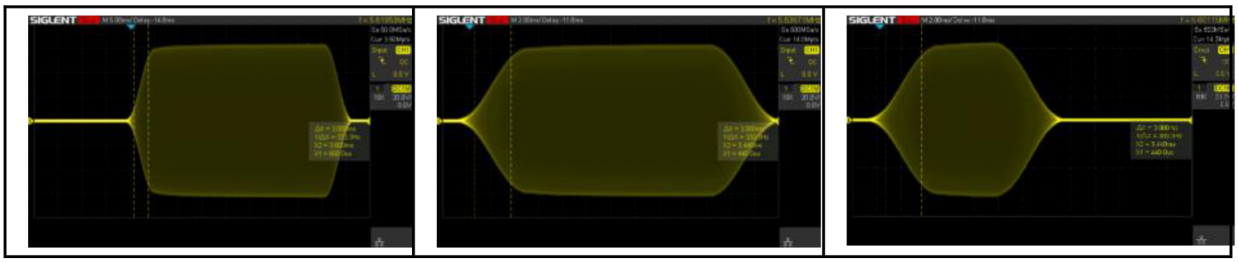

Figure 3: Keying of the K3 at 20WPM (l/h), 40WPM (center) and 60WPM (r/h)

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.

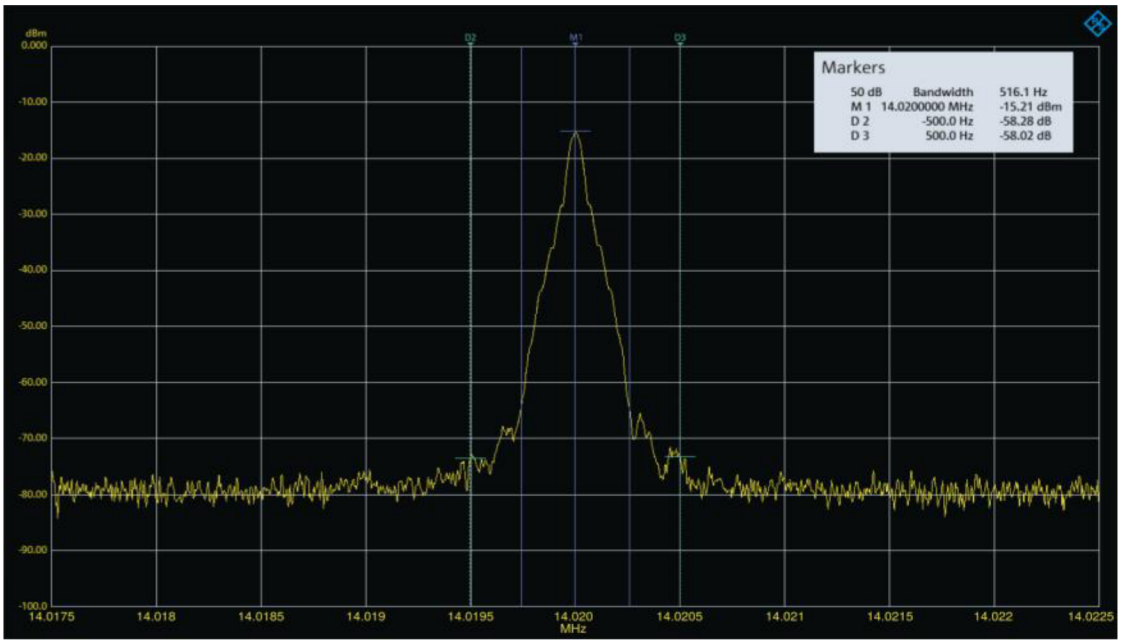

Figure 4: K3 response in the frequency domain

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.

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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.

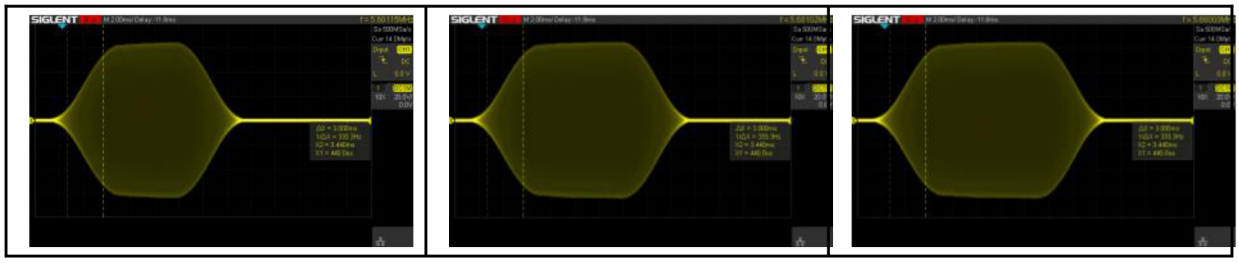

Figure 5: K3 pulse length variation

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.

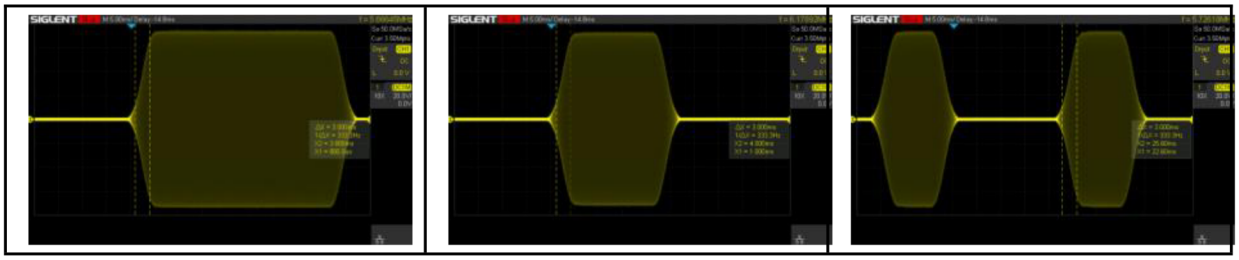

Figure 6: Keying of the K3S at 20WPM (l/h), 40WPM (center) and 60WPM (r/h)

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

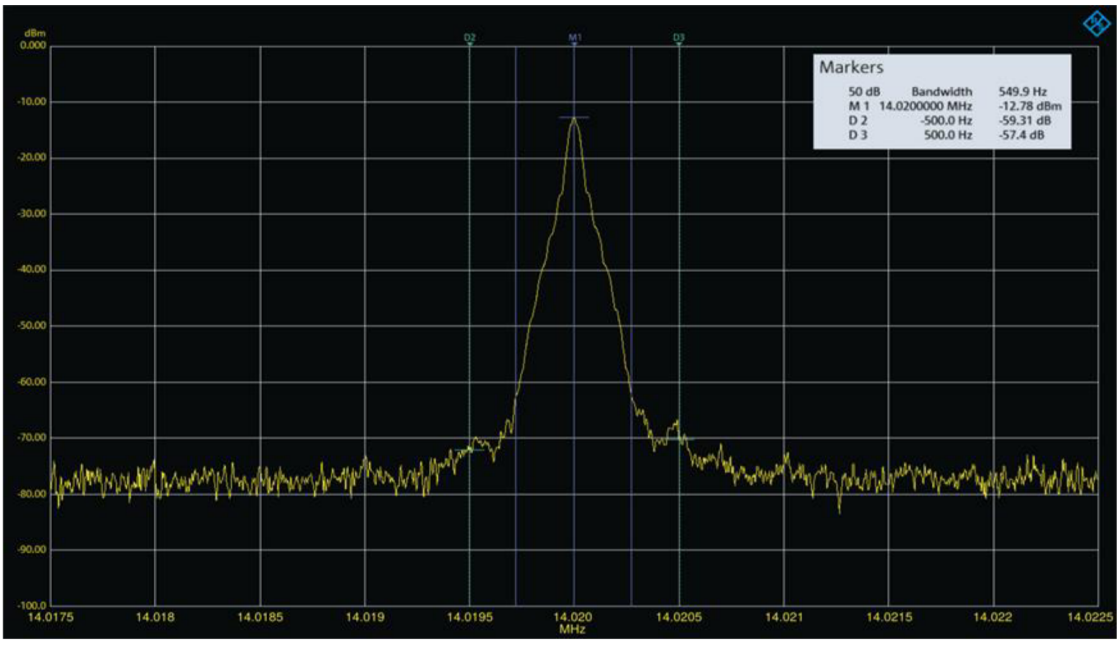

Figure 7: K3S response in the frequency domain

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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.

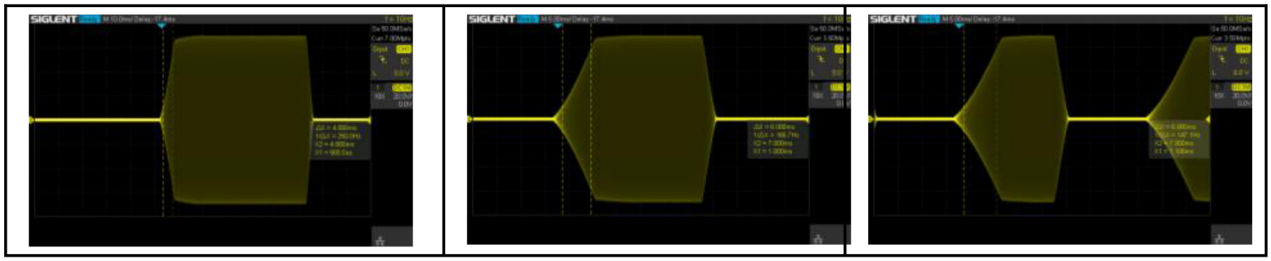

Figure 8: Keying of the IC-7300 (6ms rise time) at 20 WPM (l/h), 40 WPM (center) and 60 WPM (r/h)

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

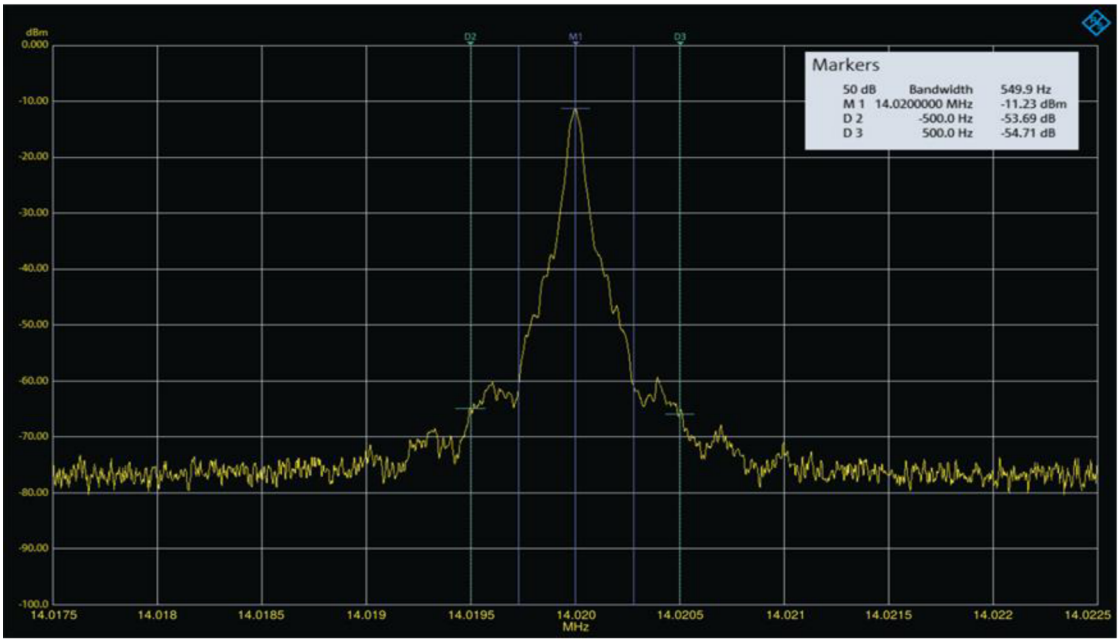

Figure 9: 40 WPM keying of the IC-7300 at 8 ms rise time

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.

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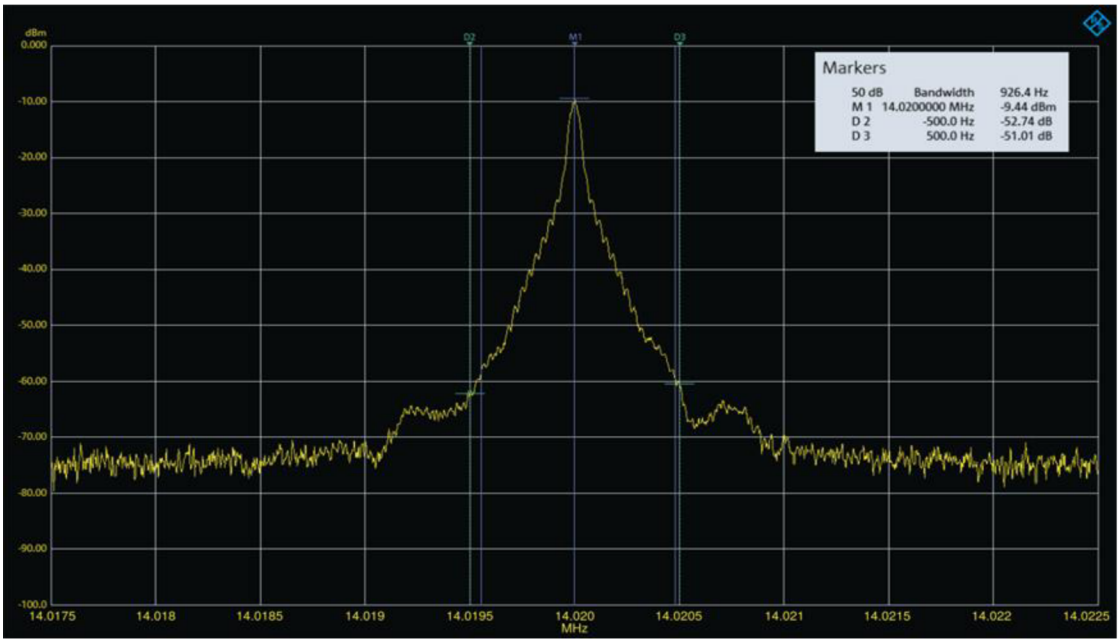

Figure 10: 40 WPM keying of the IC-7300 at 2 ms rise time

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?

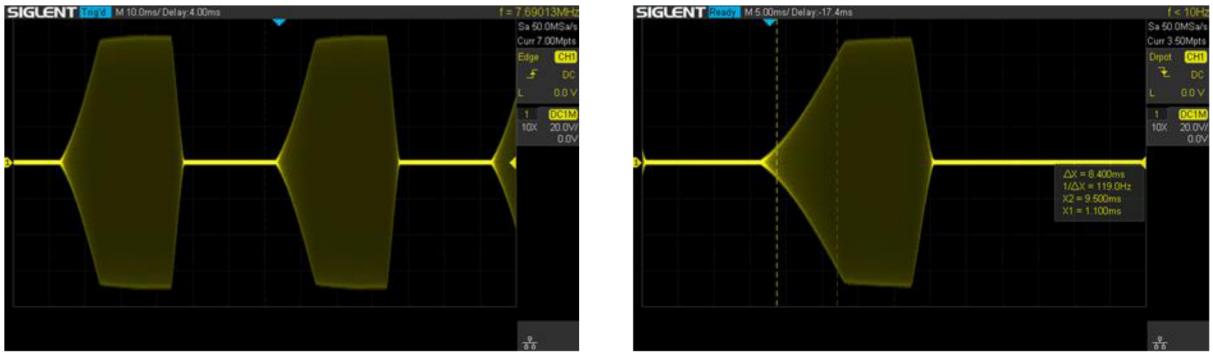

Figure 11: Keying of the IC-7300 at 40 WPM (l/h) and 60 WPM (r/h), using the 8 ms rise time setting (decay remains at 2 ms)

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.

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

3.2.4 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.

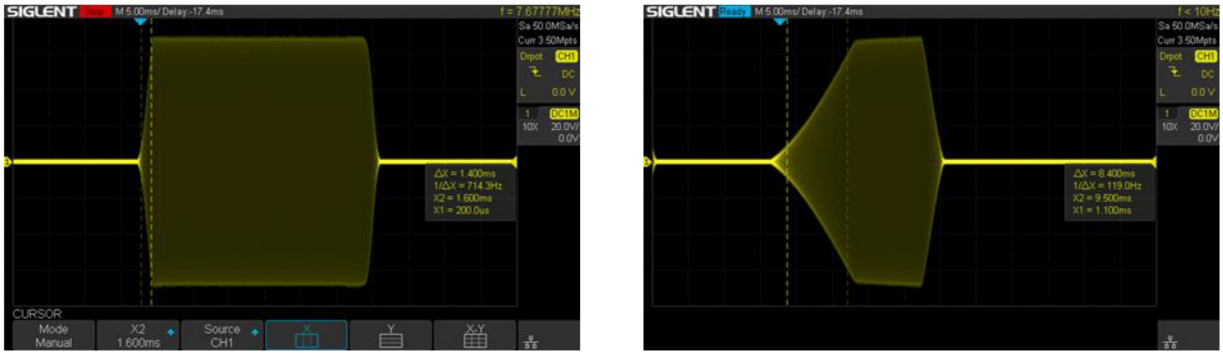

Figure 13: Keying of the FT-991 at 40 WPM. The rise time is set to 4 ms (l/h) and 2 ms (r/h)

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.

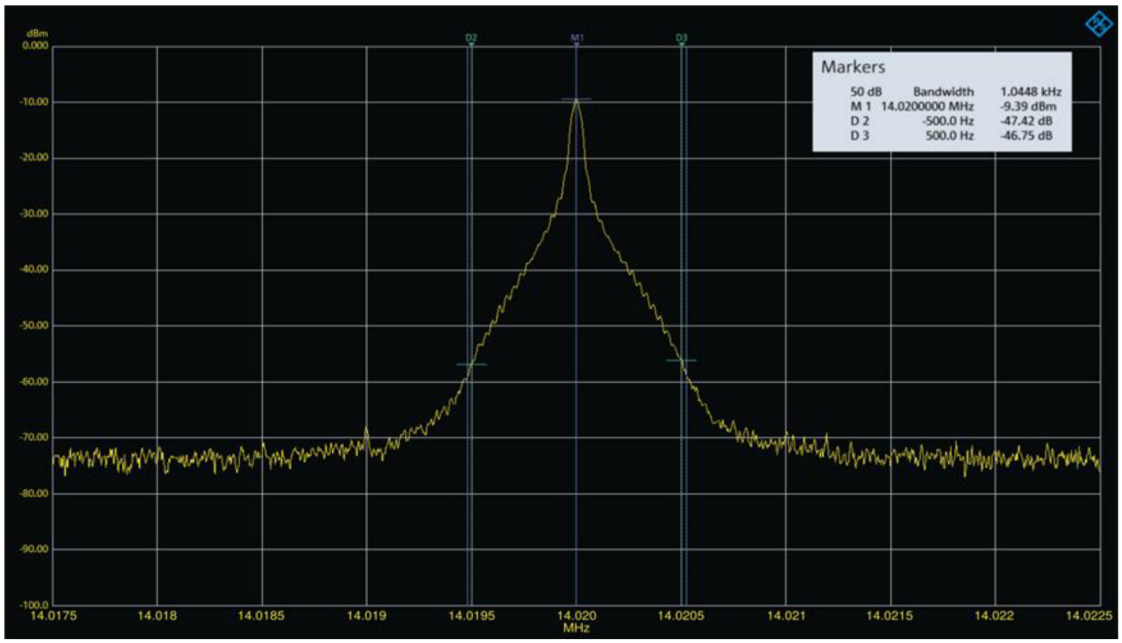

Figure 14: Yaesu FT-991 at 40 WPM keying speed, using the 4 ms rise time setting

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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.

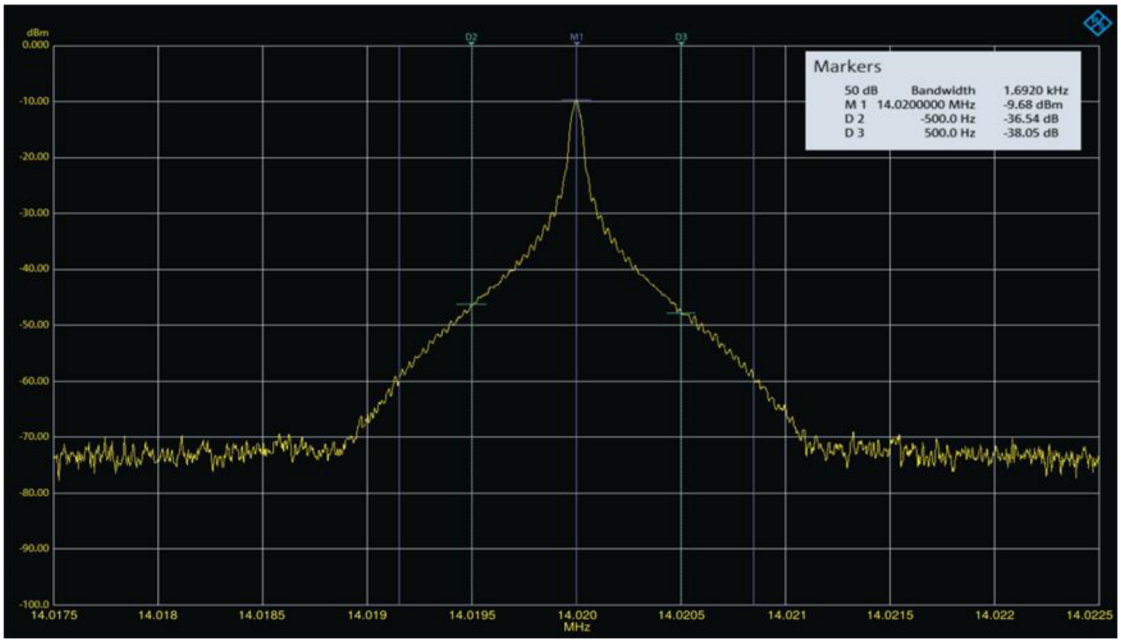


Figure 15: Yaesu FT-991 at 40 WPM keying speed, using the 2 ms rise time setting

3.1.5 Final Comparison

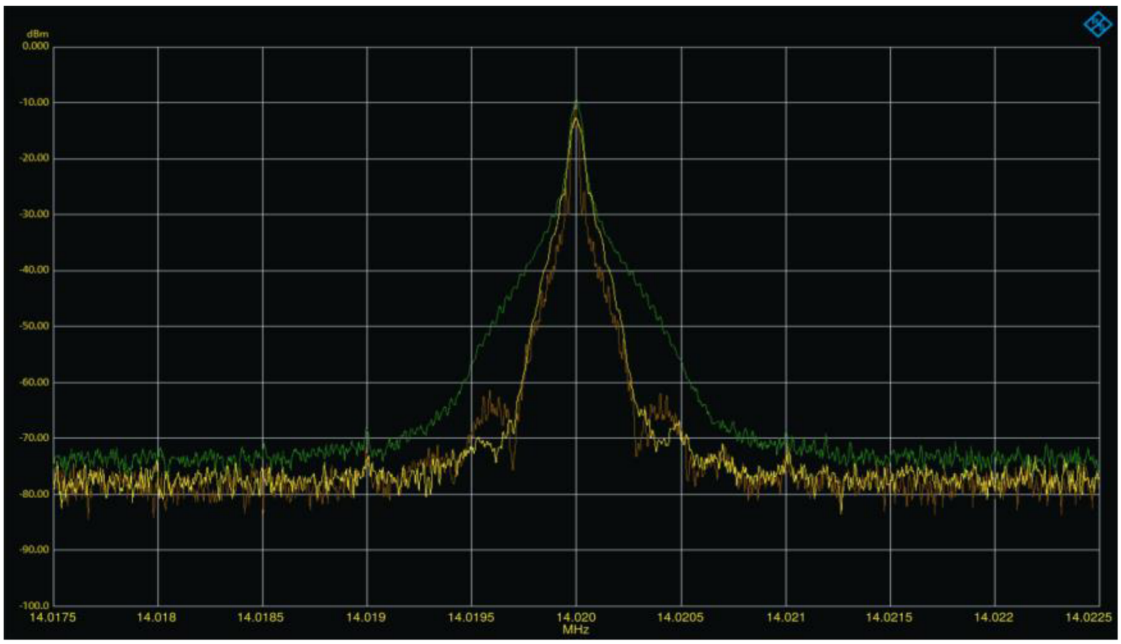


Figure 16: 40WPM CW pulses of Elecraft K3S (yellow), Icom IC-7300 (brown) and Yaesu FT-991 (green)

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.

Continued on next page….

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.

Icom-7610 Yaesu FTDX101D

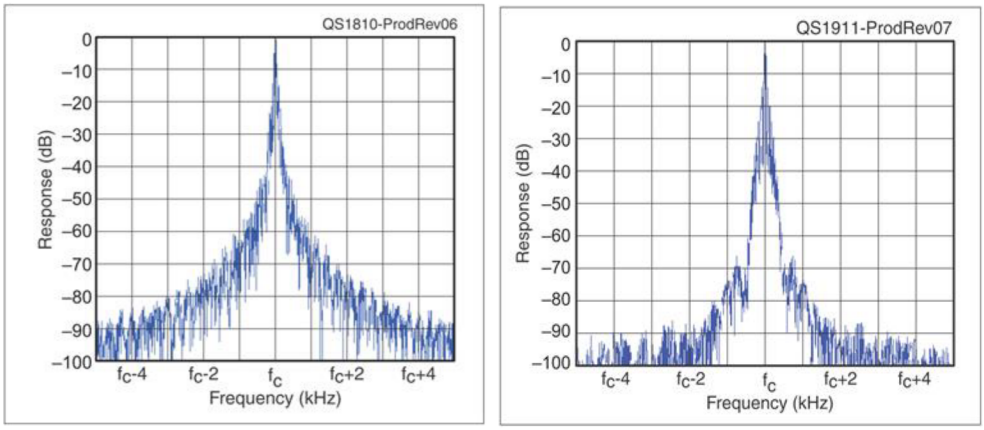


Figure 17: Example plots from QST Product Reviews 10/2018 (Icom IC-7610) and 11/2019 (Yaesu FTDX101D) [7]

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.

Disclaimer:

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 border-line is considered unacceptable by today's standards. For better visibility, the categories are color-coded.

Continued on next page….

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	

Continued on next page….

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.

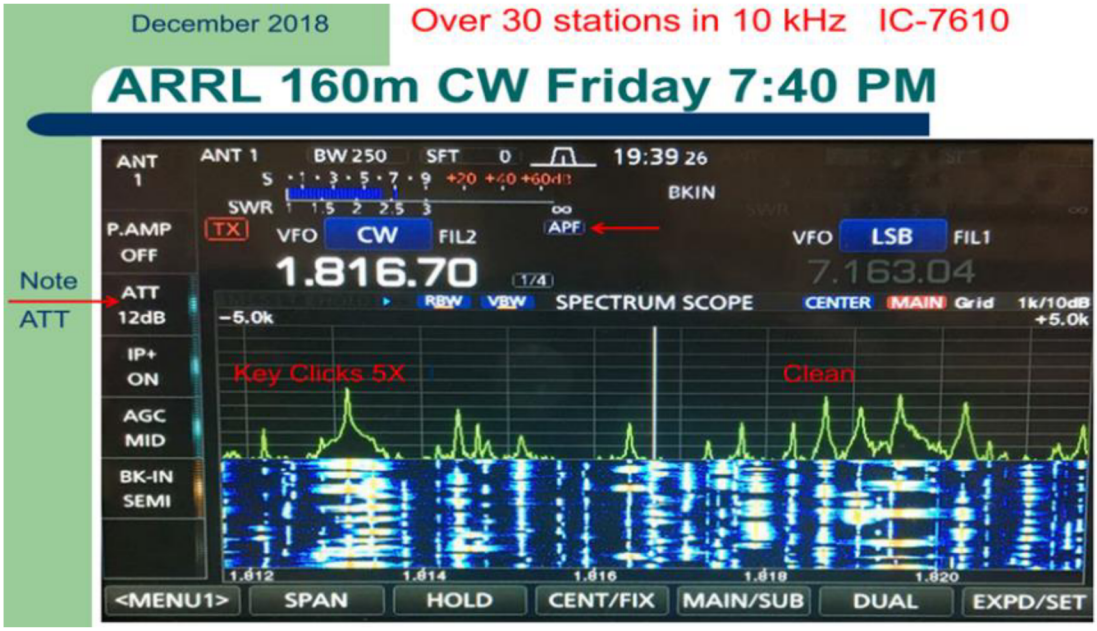


Figure 18: Screenshot ARRL 160m Contest by NC0B [1]

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.

Continued on next page….

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 FT DX 5000 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 FT DX 5000 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

FCG Shirts

George Wagner, K5KG
FCG VP Ops

If you are new to the FCG and have not attended an FCG Contest Dinner, you may not be aware that many FCG members will be a "sea of orange" wearing their Orange FCG Shirts at the dinner.

If you would like to purchase an FCG shirt, you may contact Joyce Ann at Stitchin' Waves in Sarasota. Joyce Ann has both Orange and White FCG shirts and FCG hats if you are interested. She embroiders the FCG Shirts with the FCG Logo and First Names and Call Signs. Hats are embroidered with the Call Sign.

Stitchin' Waves
Joyce Ann Wright
ja@stitchinwaves.com
941-929-1155

If you wish to order, send an email to Joyce Ann, and provide the following information:

- Identify yourself as an FCG member
- First and Last Name
- Call Sign
- Mailing Address (not a PO Box)
- Size of shirt
- Color: Orange or White

Please let me know if you have any questions.
OJ, George K5KG

stitchin' waves

ARRL Contesting Circle

Fred Kleber, K9VV / NP2X, Secretary

One of my tasks as Secretary is to keep track of which club members are inside of the ARRL's 175 mile circle for eligibility to submit scores for FCG aggerate club scores. (FCG submits as a medium sized club). This is what the circle looks like.

ARRL Club Competition Contest Score Submission Rules

Wayne Brown, N4FP

Fred, K9VV/NP2X submitted the details for submission of contest logs by members of a club that wants to compete as a club in an ARRL sponsored contest. Specific rules are provided for each category of entry: Unlimited, Medium, and Local. The winning club in each category is awarded a gavel. Entries for FCG members will usually fall in the Medium category, which includes more than 10 but less than 51 entries.

Here is a summary of the rules as they generally apply to FCG members submitting ARRL contest logs as club members of FCG:

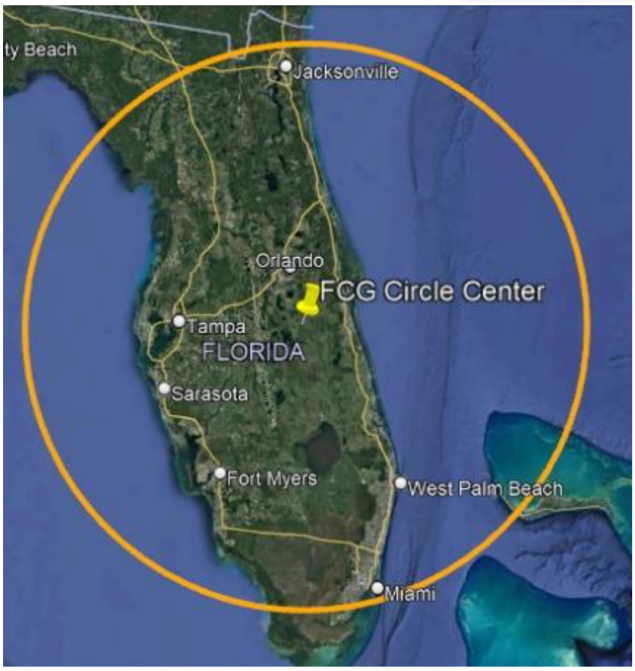
Members must reside and operate within the 175 mile diameter ARRL designated center, as shown on the map. This covers the area from north of Jacksonville to south of Miami. FCG has a "Panhandle" division for contesters who live outside the ARRL defined circle.

All members must be "members in good standing" according to the FCG rules and requirements.

One station can submit two entries, one on CW and one on Phone, in the November Sweepstakes and the ARRL DX contest.

Eligible members that operate stations outside the club territory may not compete in the club competition, except if operating in a DXpedition (outside the United States and Canada) in the ARRL International DX Contest, provided all other requirements are met.

A Guest Operator score for FCG at a single operator station must be an eligible FCG member and the station



must be located within the defined FCG territory. The owner of the station does not need to be a member of FCG. Additionally, for a Multioperator entry, at least 50% of the operators must be eligible FCG members and live within the defined FCG territory. An FCG Multioperator entry can be only for FCG.

As an option, a Multioperator entry may include non FCG member operators licensed one year or less and not include them in the 50% calculation, to encourage recruiting contest operators.

Additional detail is included in the linked data that outlines actions not to take to meet eligibility.

Details may be found at: http://www.arrl.org/general-rules-for-all-arrl-contests.

Thank you, Fred.

(Note the CQ WW 250 mile contest circle on the next page.)

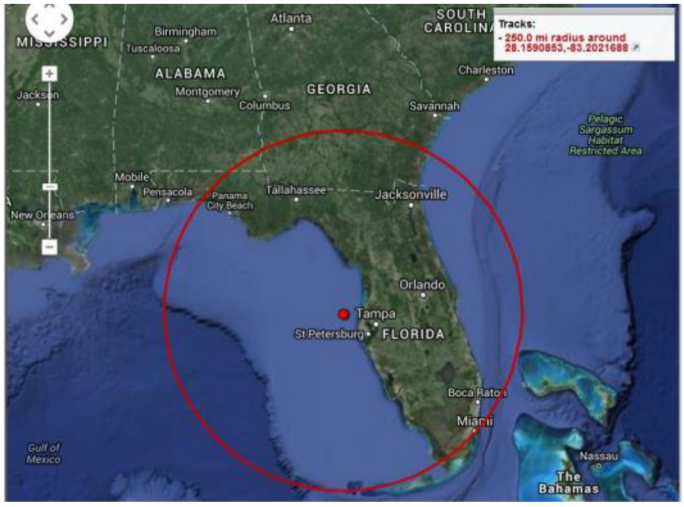
CQ WW Contest Club Circle

Dan Street, K1TO

CW WW designates a 250 mile radius, which includes more of the Panhandle. For CQWW rules go to:

CQ WW Club Competition Rules

Look for, VII, Club Competition Rules



FCAP Approved Contests, thru April 15, 2022

Stan Zawrotny, K4SBZ
FCG Frequent Contester
Program Administrator
FCG.Contesting@gmail.com

Contest	Type	Pts	Contest Schedule Start Date	Start Time	Finish Date	Finish Time	Modes CW	SSB	RTY	DIG	Bands	Val'd?
North American QSO Party, SSB Jan	Maj	10	22-Jan	1800Z	23-Jan	0600Z		S			160-10	Y
UBA DX Contest, SSB	DX	5	29-Jan	1300Z	29-Jan	1300Z		S			160-10	Y
Vermont QSO Party	QSO	7	5-Feb	0000Z	5-Feb	2359z	C	S	R	D	All	Y
Minnesota QSO Party	QSO	7	5-Feb	1400Z	5-Feb	2359Z	C	S	R		160-10	Y
British Columbia QSO Party	QSO	7	5-Feb	1600Z	6-Feb	2359Z	C	S	R	D	160-10	Y
European Union DX Contest	DX	5	5-Feb	1800Z	6-Feb	1800Z	C	S			160-10	Y
Dutch PACC Contest	DX	5	12-Feb	1200Z	13-Feb	1200Z	C	S			160-10	Y
CQ 160-Meter Contest, SSB	Maj	10	25-Feb	2200Z	25-Feb	2200Z		S			160	Y
REF Contest, SSB	DX	5	26-Feb	0600Z	27-Feb	1800Z		S			80-10	Y
South Carolina QSO Party	QSO	7	26-Feb	1500Z	26-Feb	1500Z	C	S	R	D	160-6	Y
North Carolina QSO Party	QSO	7	27-Feb	1500Z	28-Feb	0100Z	C	S	R	D	80-2	Y
ARRL Inter. DX Contest, SSB	Maj	10	5-Mar	0000Z	6-Mar	2400Z		S			160-10	Y
Oklahoma QSO Party	QSO	7	12-Mar	1500Z	13-Mar	2100Z	C	S	R	D	80-6	Y
Idaho QSO Party	QSO	7	12-Mar	1900Z	13-Mar	1900Z	C	S	R	D	160-10	Y
Wisconsin QSO Party	QSO	7	13-Mar	1800Z	14-Mar	0100Z	C	S	R	D	All	Y
Russian DX Contest	DX	5	19-Mar	1200Z	20-Mar	1200Z	C	S			160-10	Y
Virginia QSO Party	QSO	7	19-Mar	1400Z	20-Mar	2400Z	C	S	R	D	All	Y
CQ WW WPX Contest, SSB	Maj	10	26-Mar	0000Z	27-Mar	2400Z		S			160-10	Y
Louisiana QSO Party	QSO	7	2-Apr	1400Z	3-Apr	0200Z	C	S	R	D	160-2	Y
Mississippi QSO Party	QSO	7	2-Apr	1400Z	3-Apr	0200Z	C	S	R	D	160-2	N
Missouri QSO Party	QSO	7	2-Apr	1400Z	3-Apr	2000Z	C	S	R	D	All	N
SP DX Contest	DX	5	2-Apr	1500Z	3-Apr	1500Z	C	S			160-10	Y
North American SSB Sprint Contest Apr	Maj	10	3-Apr	0000Z	3-Apr	0400Z		S			80-20	N
OK/OM DX Contest, SSB	DX	5	9-Apr	1200Z	10-Apr	1159Z		S			160-10	Y
Nebraska QSO Party	QSO	7	9-Apr	1300Z	10-Apr	2200Z	C	S		D	All	N
New Mexico QSO Party	QSO	7	9-Apr	1400Z	10-Apr	0200Z	C	S	R	D	160-2	N
Georgia QSO Party	QSO	7	9-Apr	1800Z	10-Apr	2359Z	C	S			160-6	Y
North Dakota QSO Party	QSO	7	10-Apr	1800Z	11-Apr	1800Z	C	S	R	D	160-2	N
Holyland DX Contest	DX	5	15-Apr	2100Z	16-Apr	2100Z	C	S	R	D	160-10	Y

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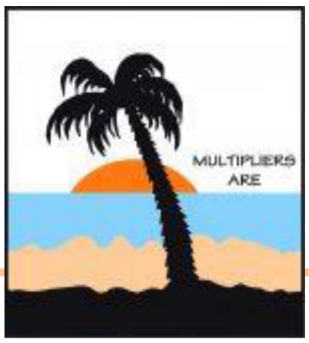
The Florida Contest Group



"I love contesting. There is something about the camaraderie, discipline and knowledge contesting demands that fits me; it doesn't fit everyone . . . but it sure fits me." – Jim White, K4OJ (SK)

The Florida Contest Group (FCG), an ARRL affiliated club, is Florida's amateur radio contest club. It's members share a common interest in the sport of amateur radio contesting. FCG members have a wide range of contesting experience, from beginners to World Champions. They willingly share their knowledge and skills to promote ham radio contesting in Florida. Members, who number in excess of 300, range from Jacksonville to South Florida. FCG has a "Panhandle" division for those contesters living in the Florida Panhandle who are outside the ARRL's 175 mile "club circle".

The Florida Contest Group supports and encourages all types of contesting, from HF to light, all modes, power classes and skill levels.