This is a preprint from the author's website www.geraldartner.com
The fully edited original version is published as:
Gerald Artner OE1GAQ, Contesting with Error-Correcting Codes such as FT8 — Future Paths, NCJ, vol. 53, no. 5, pp. 3-5, 2025.

Contesting with Error-Correcting Codes such as FT8 – Future Paths

Gerald Artner, OE1GAQ

The first five years of contesting with error-correcting FT codes now lie behind us and it keeps evolving—A good time to make predictions on where we might be headed.

Onions

The frequency band now has layers like onions. On each continent, stations distribute themselves evenly across the whole band to avoid QRM. Other continents do the same, so the frequency band gets regional layers. Weaker DX signals are buried under the stronger layer from your own continent.

A rotatable antenna with high gain can provide spatial filtering. The main beam amplifies DX stations and the negative gain towards the sides attenuates signals from the own continent. If FT contests become more popular, then stations will need to spread out over a wider frequency range.

More Densely Packed Spectrum – Spreading Out Again?

Split operation was not common in the first year of the WW Digi contest, but now practically everyone uses the "Hold TX Freq" option. Run chose a QRG with an empty receive time-slot and an empty transmit slot. S&P answered on the exact Run frequency, just like in SSB, CW, RTTY and PSK contests. The problems came with pileups. If several S+P reply on Run QRG then software couldn't decode.

The next evolution was that S+P started on any frequency and jumped to Run QRG when answered. Software decodes the whole audio bandwidth, so S+P are not limited to Run QRG. For example, [1] recommended search-and-pounce (S+P) stations to transmit 0, 60 or 120 Hz above Run QRG. The expectation at the time, was that Run had selected a QRG where it could receive well. S+P couldn't know if their QRG had QRM, but it worked better than being on pileup QRG. There were still problems. Inexperienced S+P would forget to change QRG after the QSO and effectively blocked the Run receive slot, so Run had to find a new QRG. But Run required a new QRG where both time slots were empty. S+P also needed a new empty QRG every time they finished a QSO. Everybody was jumping their QRG around and it felt quite hectic.

S+P eventually figured they could stay at their QRG. If Run could receive them there, why would they jump to Run QRG? After the change to split operation started there were small penalties for sticking with the old ways: If Run answered someone, then WSJT-X would disable all other S+P on Run QRG. An S+P in a pileup on Run QRG would constantly have its transmission disabled while a split S+P could keep transmitting. Later, Run stations would no longer bother to look for a QRG with an empty receive time-slot. Transmitting on Run QRG as S+P became meaningless as Run QRG was as good (or as bad) as any other frequency. Split operation is an efficient use of the spectrum. Jumping to Run QRG requires double the bandwidth as Run must receive S+P on both frequencies. Today, stations can share their QRG with someone else in their receive slot. There is little distinction between CQ and S+P operation, and stations switch between the two roles [2]. The band is tightly packed, but feels more relaxed. The waterfall consists of long vertical lines although FT modes don't mandate frequency slots. This trend is visible on the waterfall in Figure 1. What if FT contests become even more popular?

We might see the return of a frequency slot system similar to the one we have in SSB and CW now. Only Run stations have a QRG and S+P response on Run QRG (like we had in the early FT days before split operation became the norm). Neither SSB nor CW have a technically forced frequency slot system, but the band is filled evenly with Run stations that spread out to avoid QRM and then hog their QRG. These Run are typically multi-operator big-guns and the crowd that answers them are smaller single-OP stations. A prerequisite is an abundance of multi-operator stations that we do not yet see in FT contests.

Or, we will have separate spectrum chunks, each about an audio bandwidth wide, where both Run and S+P stations use their own QRG with split operation. Such a system of spectrum chunks might seem counterintuitive to SSB and CW operators, but this system is already evolving. WW Digi contest uses dedicated contest areas on each band, but contest QSOs also happen in the bands for regular operation. For example, 40m WW Digi contest takes place on 7.0475 MHz (FT4 regular), 7.074 MHz (FT8 regular), 7.080 MHz (FT4 WW Digi) and 7.090 MHz (FT8 WW Digi), with split operation contained within each of these bands.

Fewer <CQ> <MYCALL> <EXCH> messages

Calling CQ is a tedious thing for Run. In theory, Run can work a QSO with a single transmission like S+P does, but in practice pileups are rare and short-lived and Run spend a lot time calling <CQ> <MYCALL> <EXCH>. WSJT-X now has an option to highlight also messages with 73 or RR73 and I expect that in the future more S+P will respond to 73 and not wait for Run to waste a time slot on CQ.

For contests that use grid locators as exchange, software should automatically extract <EXCH> from the complete contest logfile (ALL.txt) that stores all decoded messages and not just from this particular QSO.

Working Everyone at Once – Parallelized Contesting

WSJT-X Version 1.9 brought an innovation in 2018: Fox-Hound Mode [3]. Error correcting codes are the first where simultaneous contest operation is possible. QSOs could be worked simultaneously instead of successively. In SSB, multiple signals on band are a result of more manpower but in FT, multiple signals on band are a result of technical progress.

Logcheck evidence

WSJT-X ALL.txt provides logcheck evidence and should be submitted by high scoring stations. Screen recordings can become what audio files are for SSB/CW.

Programmers

Contests should create automated categories where no operator input is allowed after starting the station. Supervision might be needed technically and legally, but intervention means end of contest participation. To meet legal requirements, software could introduce a button that when pressed confirms the operators continued intention to transmit the suggested messages, but has no influence on the fully automated suggestions from the software. Operators can still press “Halt TX” in software or intervene physically on the rig.

What is the meaning of software winning an amateur radio contest? A callsign and its associated person or club will win, but the winning software will really be in the spotlight. It is in the interest of the amateur community that the automation procedures become public, it’ the only way progress can happen. It is also in the interest of the software developers to highlight their achievement, especially in the early years when manual operation might perform better. Of course, programmers don’t want to publish their automatons right away. Developing that software is hard work and then

everyone would use their work the following year! The premise is similar to inventions and patents. Similarly, it might be solved by a time delay. Organizers can't grant monopolies on automation software, but they can do the following: Contestants submit their automation solutions with their logfile at entry, but while the log is published immediately (or after log checking), the software is kept secret for a defined period. After the period, say five years, the software is published. Others can then learn from previous approaches; developers get bragging rights when their solution is revealed and the guard time ensures that the developers' continuous improvements are still theirs for the coming contest.

Power to the builder

Operating skills remain relevant in a field where the QSO is worked by the machine, but automation opens contesting to a new audience in our vast hobby. Builders and tinkers might have less interest in spending a summer weekend in the shack, but semi-automated contests provide a valuable stress test for station hardware. Hams will participate in contests in three roles: as operators, as automaters and as builders.

Single Operator – Multi Transmitter – All Bands (Single Unlimited)

The reduced operating effort of FT modes opens a new challenge. A single operator who works all bands simultaneously using multiple transmitters is now within reach. In CW and SSB only the most skilled OPs can listen to two audio streams simultaneously. Single-Unlimited wasn't possible with previous digimodes either; without error-correction operators need to proofread received messages. FT modes are the first to enable a Single Unlimited category.

What is the shortest QSO of the future?

A single transmission is now standard for Run and S+P, but it can be even shorter. It is actually possible to work a QSO as run station without investing a single transmit slot. Figure 2 shows a QSO between OE1XTU and EI8KW.

Learning and Teaching FT Contesting.

It's time for the early-adopters to pass on their findings to the next generation. Operating SSB is a stressful thing for newcomers, teaching FT is a lot easier. FT operating requires neither listening nor talking. The FT auto-sequencer relieves even more pressure. The strategic choices remain, can be taught from the beginning and discussed live. Which stations to prioritize? How much effort put into a difficult QSO? Which direction to rotate your antenna? When to switch bands? You can discuss that live during the contest!

Working the Contest Together

I've saved the strongest argument for the end. Working multi-operator categories together is way more fun with FT modes. The reason is simple: We can talk while operating. In SSB/CW we only met in the breaks. Try it, you'll be surprised what a huge difference it makes!

Literaturverzeichnis

[1] Joe Taylor, K1JT, „FT8 in the ARRL RTTY Roundup," *QST,* 2019.

[2] Joe Taylor, K1JT, Steve Franke, K9AN, and Bill Somerville, G4WJS, „The FT4 Protocol for Digital Contesting,“ 2019.

[3] Joe Taylor, K1JT, „FT8 DXpedition Mode User Guide,“ pp. 1-10, 2018.

Figure 1: Waterfall examples from different years. Viewed from a working station, so every second time-slot is visible. Top waterfall is from WW Digi 2022 and the bottom waterfall is from WW Digi 2024. In 2022, Run stations are long vertical lines on the waterfall. S+P jump to run QRG to finish QSOs and then find a new empty frequency. In contrast, the 2024 waterfall consists mainly of continuous vertical lines, because both run and S+P OPs hold their frequencies. Operating in 2024 feels more relaxing, because you stay on QRG for a longer time.

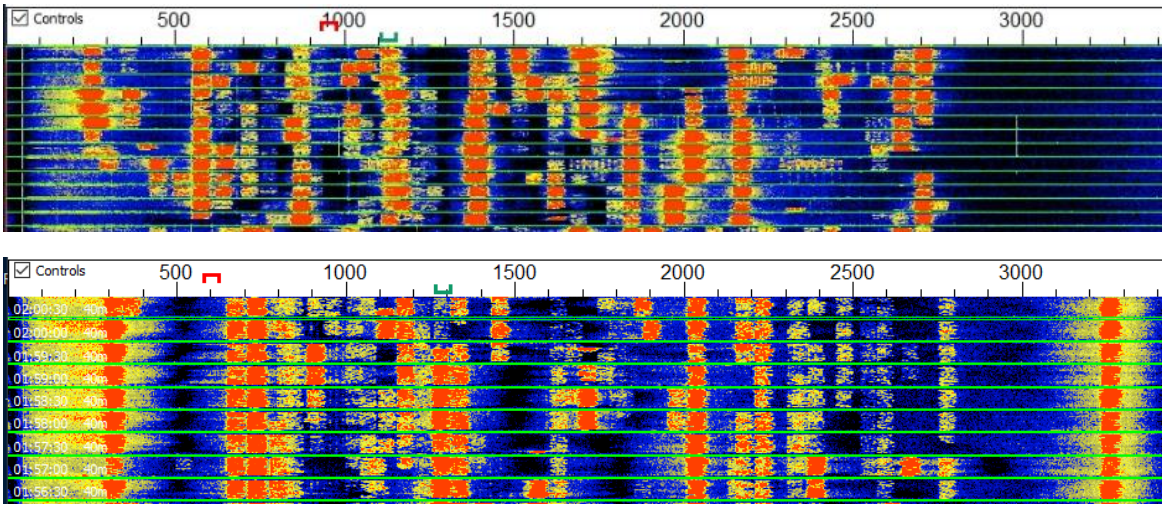

Figure 2: A QSO with EI8KW for which OE1XTU didn't need a single transmission.

203830	2	0.1	2877	+	OE1XTU K3ORC FM19	Regular QSO between OE1XTU and K3ORC
203837	Tx		1980	+	K3ORC OE1XTU R JN88	
203845	2	0.0	2878	+	OE1XTU K3ORC FM19	
203845	4	0.4	1978	+	OE1XTU EI8KW IO63	EI8KW answers OE1XTU
203852	Tx		1980	+	K3ORC OE1XTU R JN88	Maybe EI8KW didn't receive this time slot and assumed the OE1XTU answer got lost
203900	0	0.0	2877	+	OE1XTU K3ORC RR73	
203900	2	0.5	1979	+	OE1XTU EI8KW RR73	EI8KW send RR73, so OE1XTU logs
203907	Tx		1980	+	K3ORC OE1XTU 73	
203915	-12	0.1	2228	+	OE1XTU WA3LXD EL99	