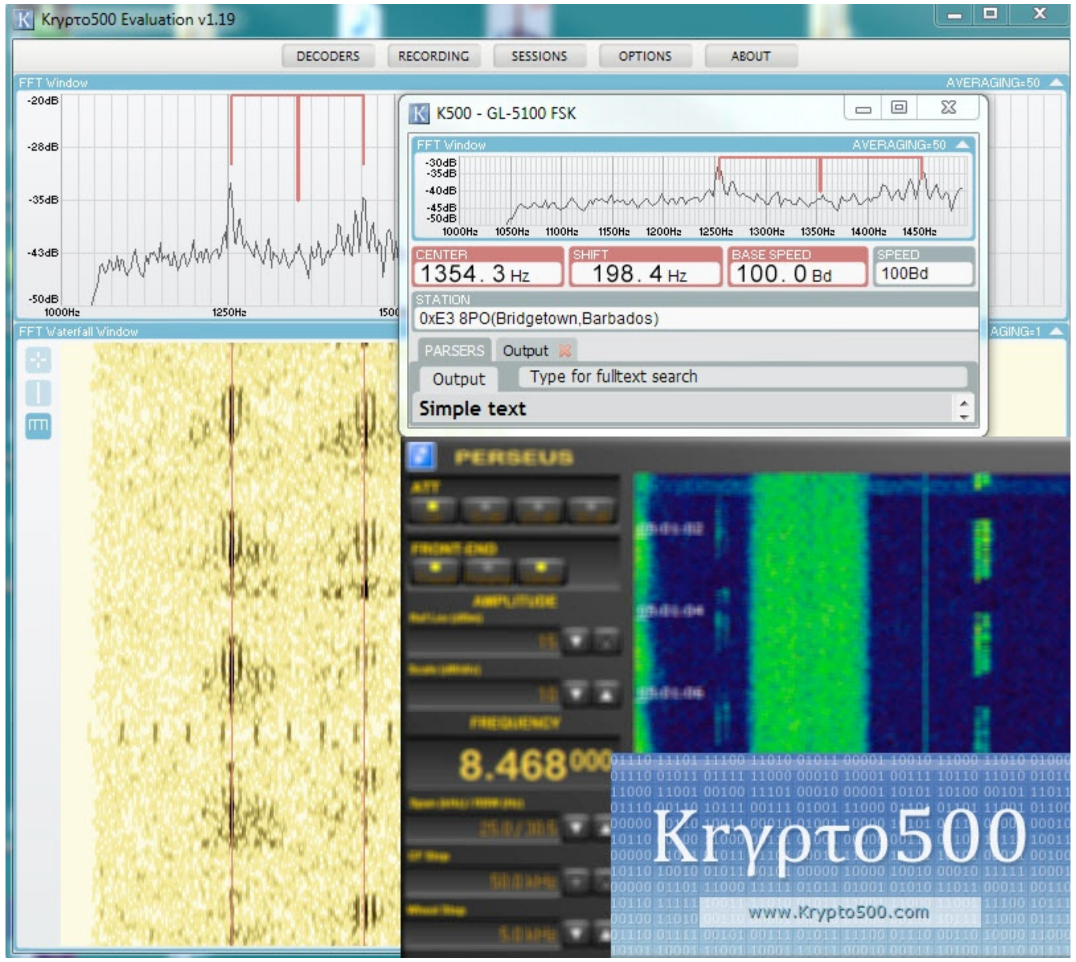
Utility DXing: Krypto500

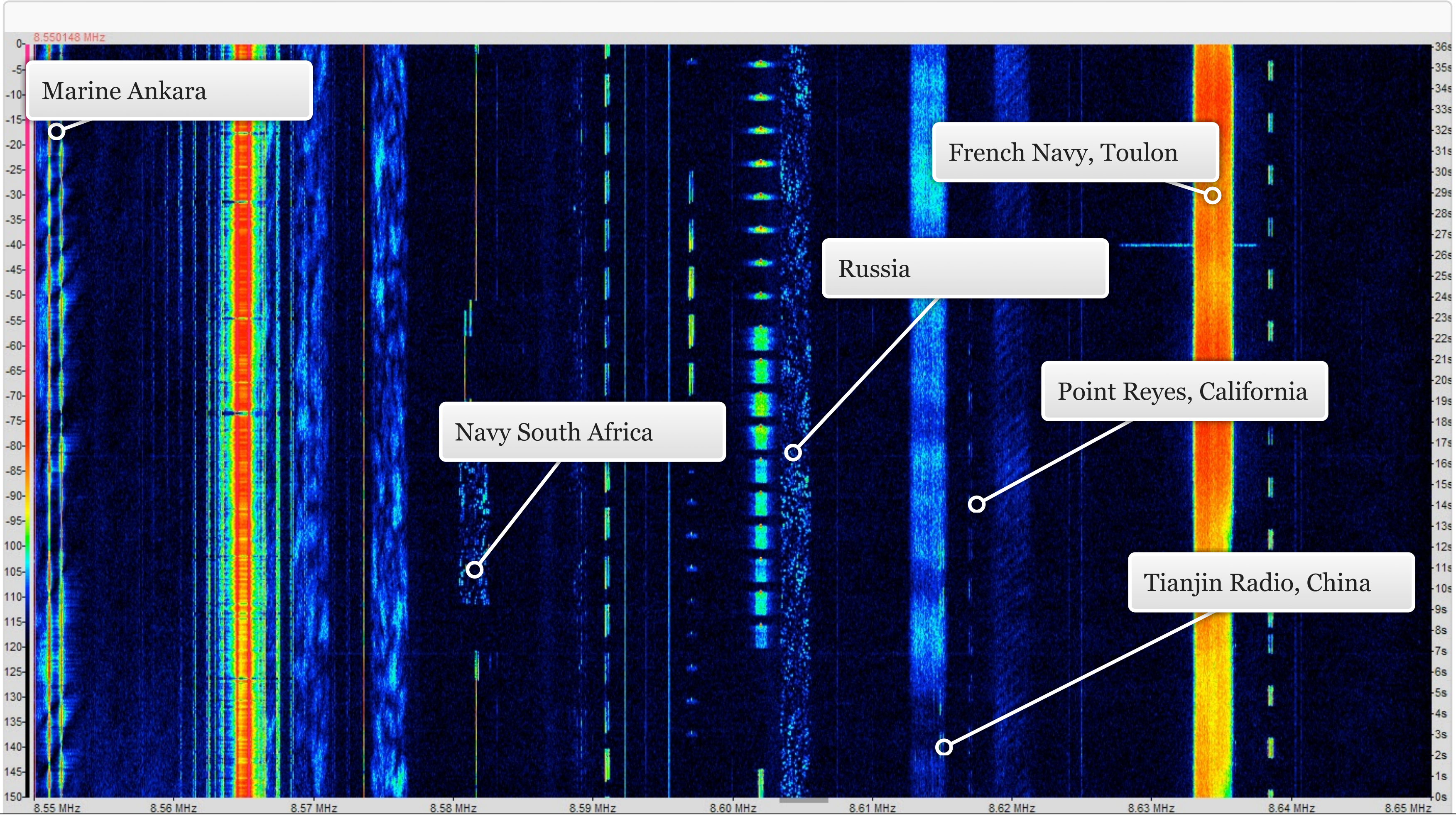


NILS SCHIFFHAUER, DK8OK

HF: Still full of Signals

Still shortwave is full of signals, mostly digital. Many of them can be demodulated and even decoded with some sophisticated software decoders. This iBook focuses on the new Krypto500 decoder, mainly using this new piece of software for a very short introduction into utility DXing. You will also find some hands-on comparisons with other high-tech decoders like GX430 by Rohde & Schwarz, Code3-32P by Hoka and W-Code by Wavecom.

Below: Some signals around 8600 kHz show many different modes and stations from all over the world.

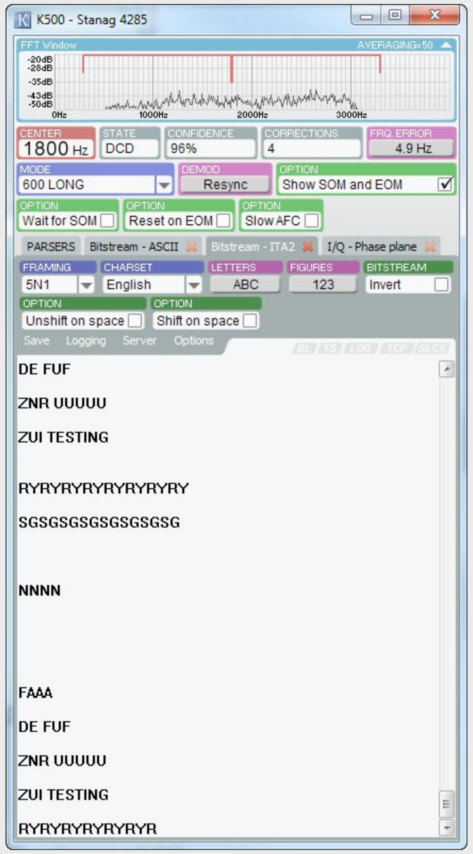


Utility DXing today

Despite the declining of international shortwave broadcast, the band is full of signals from professional stations like aviation, maritime, military, and NGOs, to name just a few of them. Increasingly, they shift from SSB to data communications.

Thanks to advances in both signal theory and digital encoders/decoders, usage of shortwave still is rising. This part of the solar cycle does reveal many new of them. Shortwave provides a worldwide channel free of charge and secure communications with a modest setup. ONEMI of Chile, for instance, runs a nationwide network covering also their Pacific entities like Easter Island and Robinson Crusoe Island with mere amateur radio transceivers delivering nor more than 110 watts to a small antenna. Automatic Link Establishment, or ALE, does the trick of automatically choosing the optimum channel out of a pool of assigned frequencies. Their ALE signals can be heard and decoded worldwide.

Same goes for the ARINC aviation network, relying on short bursts between air and ground. Or take those maritime networks like Global Wireless and SEAMAIL with also worldwide coverage. Still some old buddies are making waves: FAX transmitters with weather charts and news in Japanese, a few RTTY stations, NAVTEX maritime reports or the Global Maritime Distress Safety System GMDSS, both in SITOR-B and even some morse code (CW).



French Navy Martinique, FUF, 8478,5 kHz in STANAG4285

Encryption and legal issues

Plenty of communications is “open”, i.e. not encrypted. And even with usually encrypted signals, sometimes there is some open operators chatter. Many channels do run in an idle mode or just transmitting tests over and over again. Take the net of French Navy with stations from Tahiti to Djibouti, which all can be clearly read in a code called STANAG4285.

Are you allowed to tune in? It depends. In a law suit of German Authorities against me it was judged that the *source* of communications takes control of what is "public" and what is "secret". At this stage of technical development it can be stated that all communications which can be read with freely available hardware and software is considered to be "open". Hundreds of stations do even verify reception reports. However, there are some stations and some countries disliking this view.

QSL cards and letters from all over the world: Most utility stations do verify reception reports of shortwave listener if they report on some general „open“ contents like weather reports or CQ/RY calls. Among them: EMBRATEL, Global Wireless, ONEMI Juan Fernandez Island, Rogaland Radio and U.S. Coast Guard Puerto Rico.

Decoders: Focusing on Krypto500

Key to this world is a software decoder. The most recent one is named Krypto500. It has been developed in the Czech Republic, and is distributed by their website. At a price tag of US-$ 7400 or nearly 6000 Euros, it plays in the same league as e.g. Wavecom's W-PC or Hoka's Code300-32P. In this realm of decoders, GX430 of Rohde & Schwarz reigns king. Thanks to generous loans, I had the chance of testing all of them. This publication focuses on the Krypto500.

Professional Monitoring vs. SWLing

Professional monitoring differs significantly from what the shortwave listener (SWL) is doing. Where the SWL wants to receive some rare stations and identify them by a clear callsign, professionals are more interested in just *patterns* of modes and activities. Most transmission is encrypted anyway. Done professionally, it can be cracked only within a time, after which no tactical use can be made of its contents. On the other hand, frequency hopping is increasing. There, the communications is split up into short portions in the millisecond range or below and transmitted on many channels at to a distinctive pattern. Thus, you have to know this pattern as well as the code to actually read the contents. With sophisticated methods of direction finding, however, you can pinpoint the geographical location of the transmission and doing a finger printing on each transmitter. You can also log their activity.

Sounds disappointing in the ears of an ordinary SWL? Mustn't! There literally are thousands of stations which can be received, and many of their transmissions are decoded by a professional decoder like Krypto500. But this is only one part of the fun. You also need a good receiver, most preferably a software-defined radio, or SDR. Mainly for two reasons: they provide exceptionally linear filters of flexible bandwidths, and a large spectrum of HF can be recorded; like up to 4 MHz with Winradio's ExcaliburPRO. Most Utility DXing should be made on recorded files where you can repeat playing and changing e.g. bandwidths, AGC or passband tuning.

Three steps to monitoring

SDRs do also provide a sonagram, or "waterfall". This is a panorama of frequency and time. It considerably helps in revealing short-time activity and often assists in classifying the mode due to some distinctive patterns.

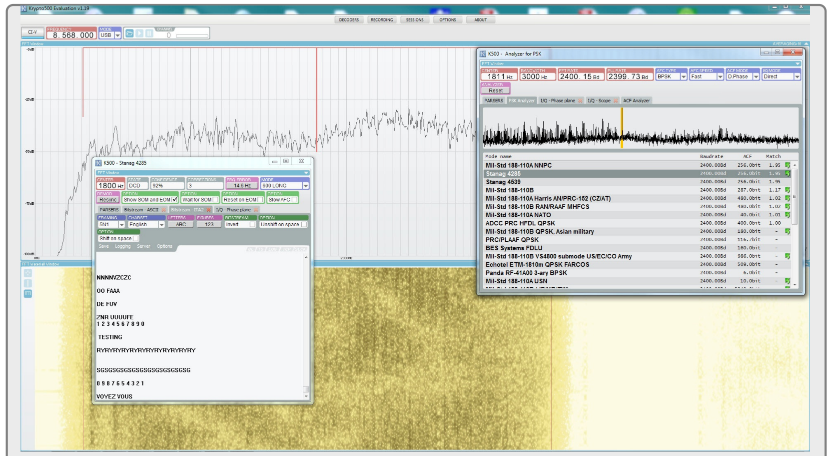
Monitoring will proceed in three steps:

- unearthing a signal
- classifying the mode
- decoding

To find a signal, a sonagram (page 1) is a must. In classifying the mode, function of "analyzers" or even "classifiers" as part of professional decoders will do the bigger part of this work. For "decoding", the decoder must have a great selection of up-to-date codes which nowadays are filling the air.

Helping hands

If you are a mere newbie to utility DXing, you surely will get lost between all the signals. But not only in this case, I would like to recommend two valuable reference books, namely Michael Marten's "Spezial-Frequenzliste" with about 30 000 detailed entries and Joerg Klingenfuß' "Guide to Utility Radio Stations", covering around 8 300 frequencies. To dive deeper into monitoring, Roland Proesch's excellent "Technical Handbook for Radio Monitoring HF" is a reliable guide through most of the modes you encounter on shortwave.



In action: Krypto500 has analyzed STANAG4285 (right) and decodes French Navy, Djibouti (left).

There are several Yahoo Newsgroups dealing with utility DXing, most notabliy that of UDXF. Among those many websites providing audio bites of several modes, that of Leif Dehio is a first to stop.

On the next pages, I will proceed the „Three steps of Monitoring“.

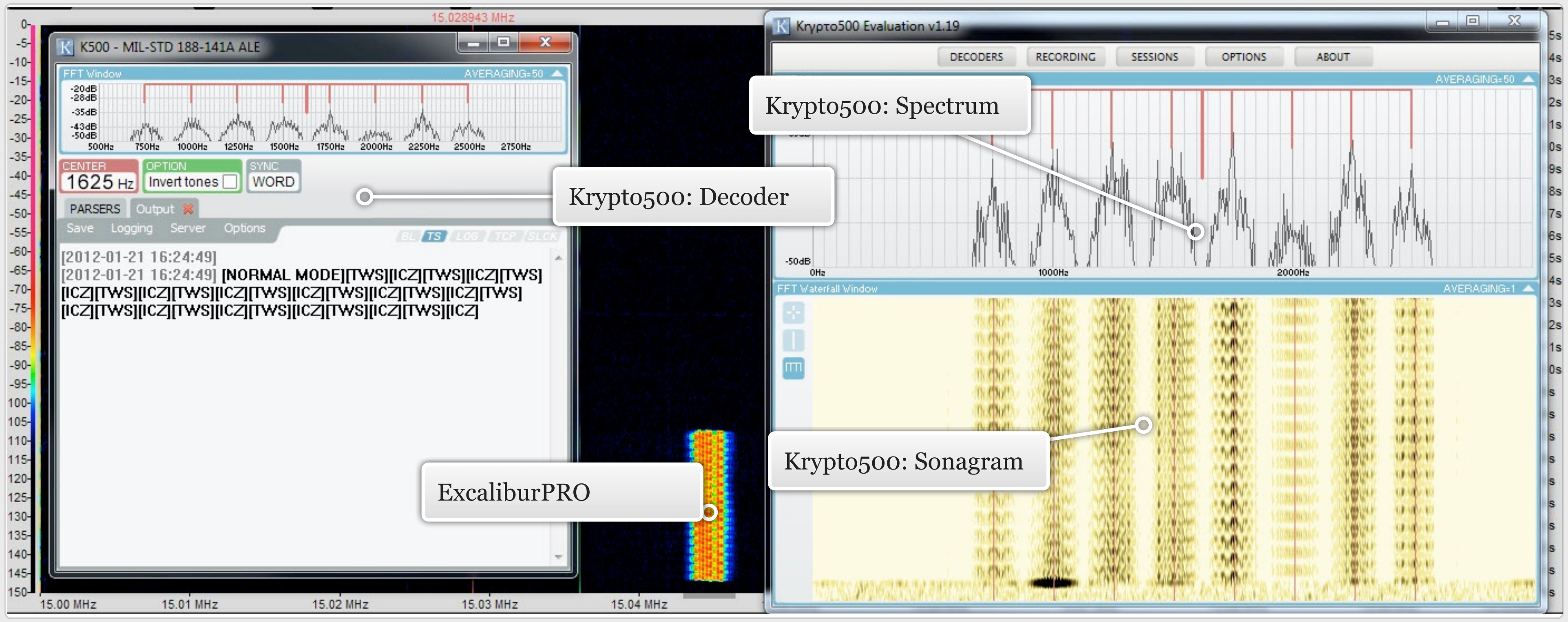
USB dongles are the key to professional decoders: Krypto500, Code3-32), W-Code and GX430 - from above.

Connecting Krypto500

The signal from the receiver must reach the input of the decoder. Krypto500 does accept audio and I/Q signals. Receiver and decoder are usually connected by a so-called virtual soundcard (VSC) or virtual audio cable (VAC).

Krypto500 presents the audio in two windows: spectrum and sonagram. Both can be tailored regarding e.g. colors, resolution, dynamic range, span and some more features. Use *that* combination which fits best to your signal. An „overlap“ function will dramatically increase time resolution, thereby often revealing some characteristics of a signal or mode.

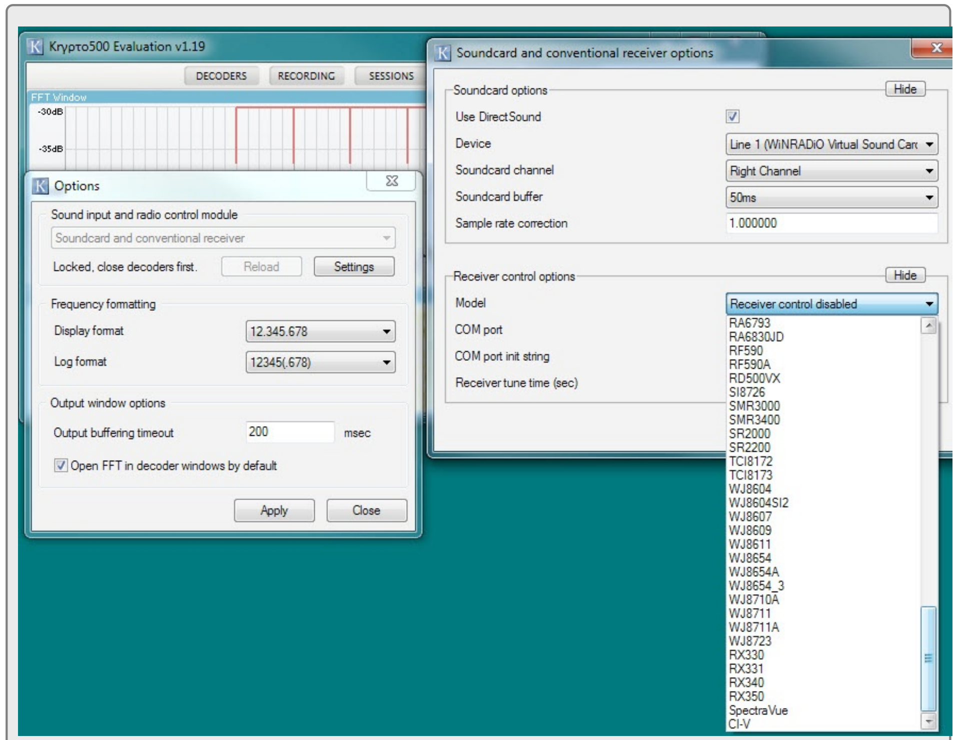
Reception of U.S. Navy Napoli/Italy „ICZ“ on 15043 kHz in ALE, MIL-SD 188-141A: tuning and decoding



Receiver Control

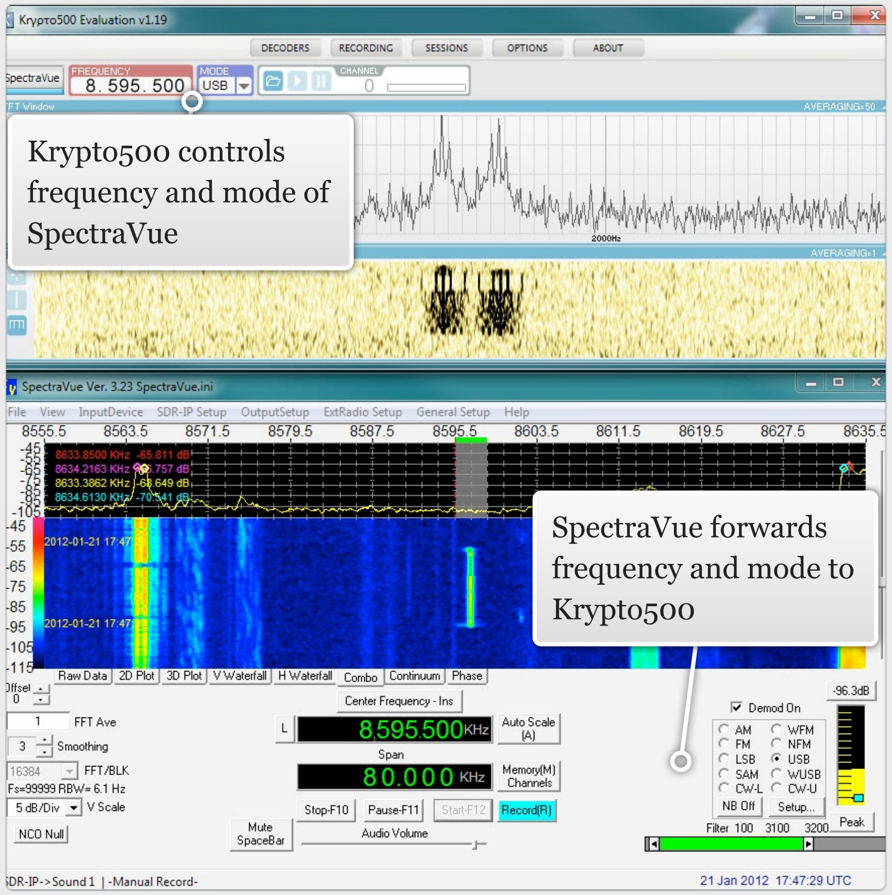
Krypto500 still recommends to use the graphical user interface (GUI) of the receiver. Nevertheless, the software provides connection for controlling at least some features of a vast selection of professional receivers, among SDRs also Perseus and some of RFSpace., and Icom's CI-V. With this feature, you can e.g. scan all ALE channels of a network.

See on the right, how a combination of SDR-IP, SpectraVue and Krypto 500 works: can control the receiver either by SpectraVue or some features (e.g. frequency) by Krypto500.



Krypto500 offers a really back selection of receivers, also Spectra Vue for all SDRs by RFSpace, CI-V and Perseus.

SpectraVue can be controlled by Krypto500 and vice versa.



You can e.g. tune the receiver by the freqeuncy control of SpectruVue or Krypto500 and the other frequency display will change accordingly. Some goes for the mode. You can also just click onto a signal in SpectraVue sonagram, and as SDR-IP changes to this frequency, also the audio stream will deliver this signal towards Krypto500. Alas, in the version tested, in this case the frequency display of Krypto500 would not change.

Part of receiver control is a scanner and a recording feature.

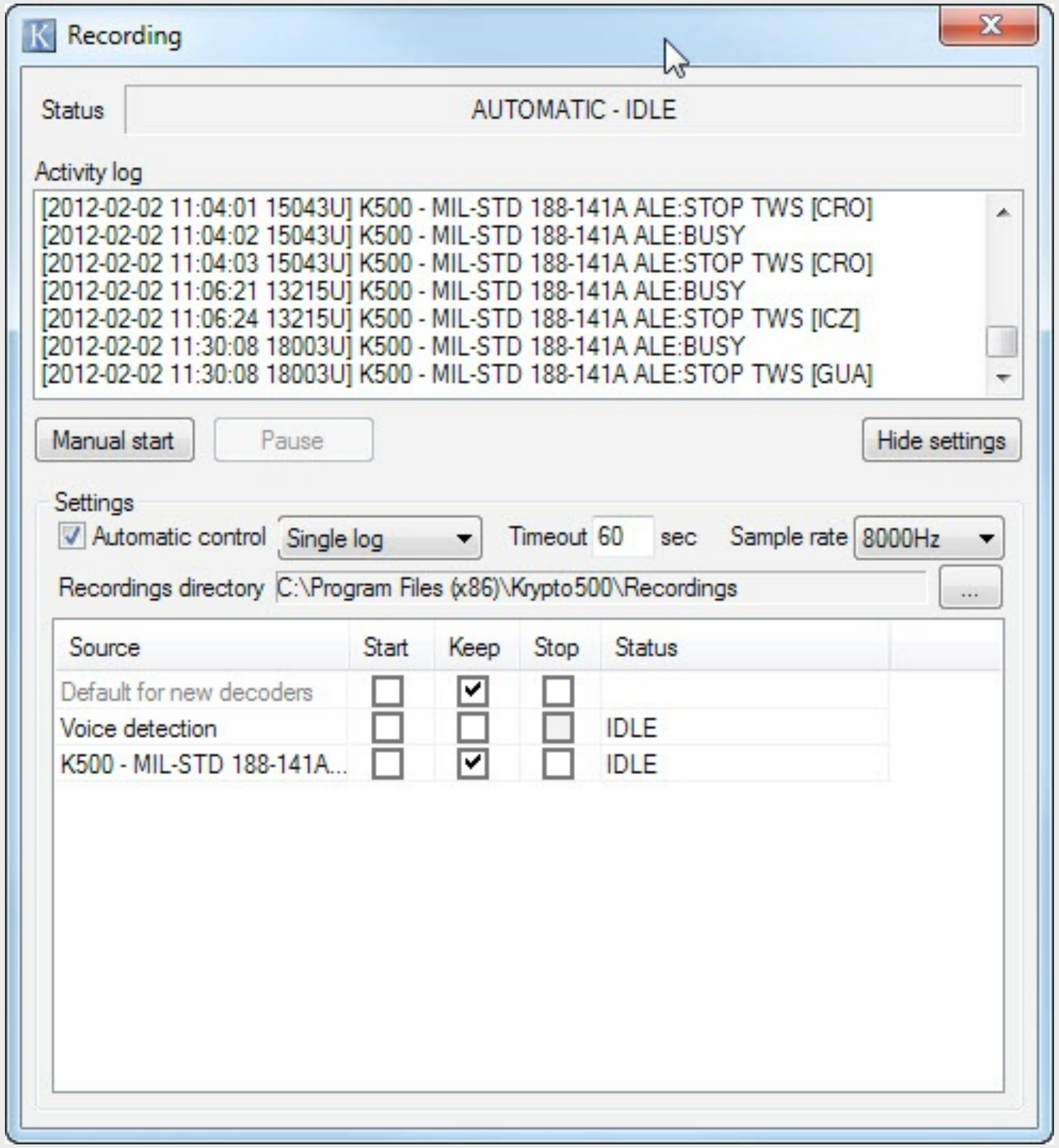
The scanner can be programmes with a set of frequencies, modes and bandwidths. The dwell time can be set also. After being started, it will look up channel by channel, stopping on each for the defined dwell time. If it notes some activity, it may stop and record and demodulate.

A typical example is a net of stations using automatic link establishment to choose the best channel for a following communications which may be in SSB oder ARQ or any other mode.

Krypto500 detects those ALE calls, decodes them, and documents them with timestamp plus frequency.

Additionally, a recorder might be automatically activated, writing a log and recording the communications.

Typically log of some scanned ALE channels, namely 15043 kHz, 13215 kHz and 18003 kHz in USB (U). It caught stations from Chroughton/U.K (CRO), Naples/Italy (ICZ) and Guam (GUA).

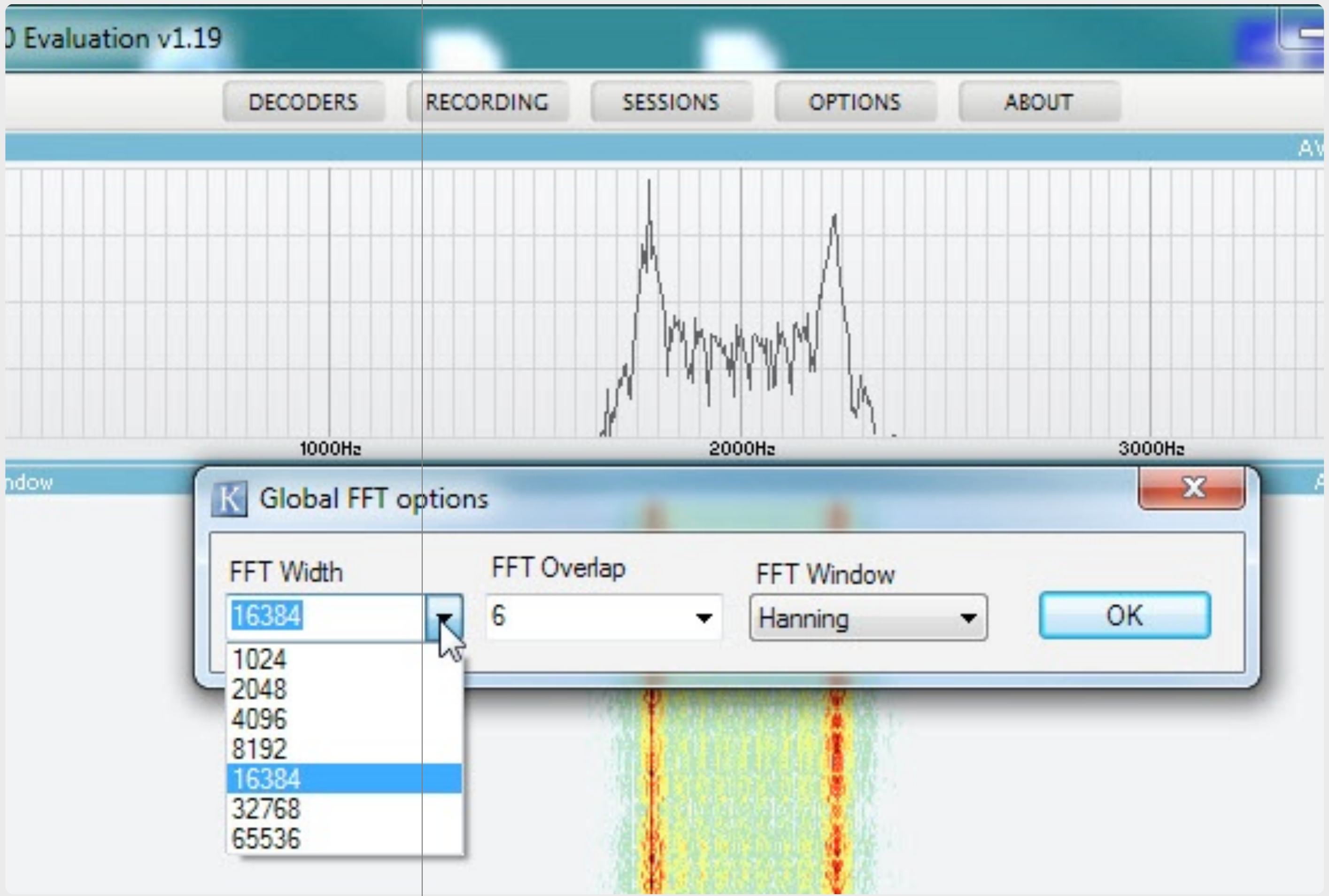


Spectrum and Sonagram

Both spectrum and sonagram do show the signal. With Krypto500 you have the choice between several FFT width and an overlap function. Adjusting both, you can accent time or frequency resolution.

The pictures in the gallery will give some examples at a RTTY station at 50 Baud.

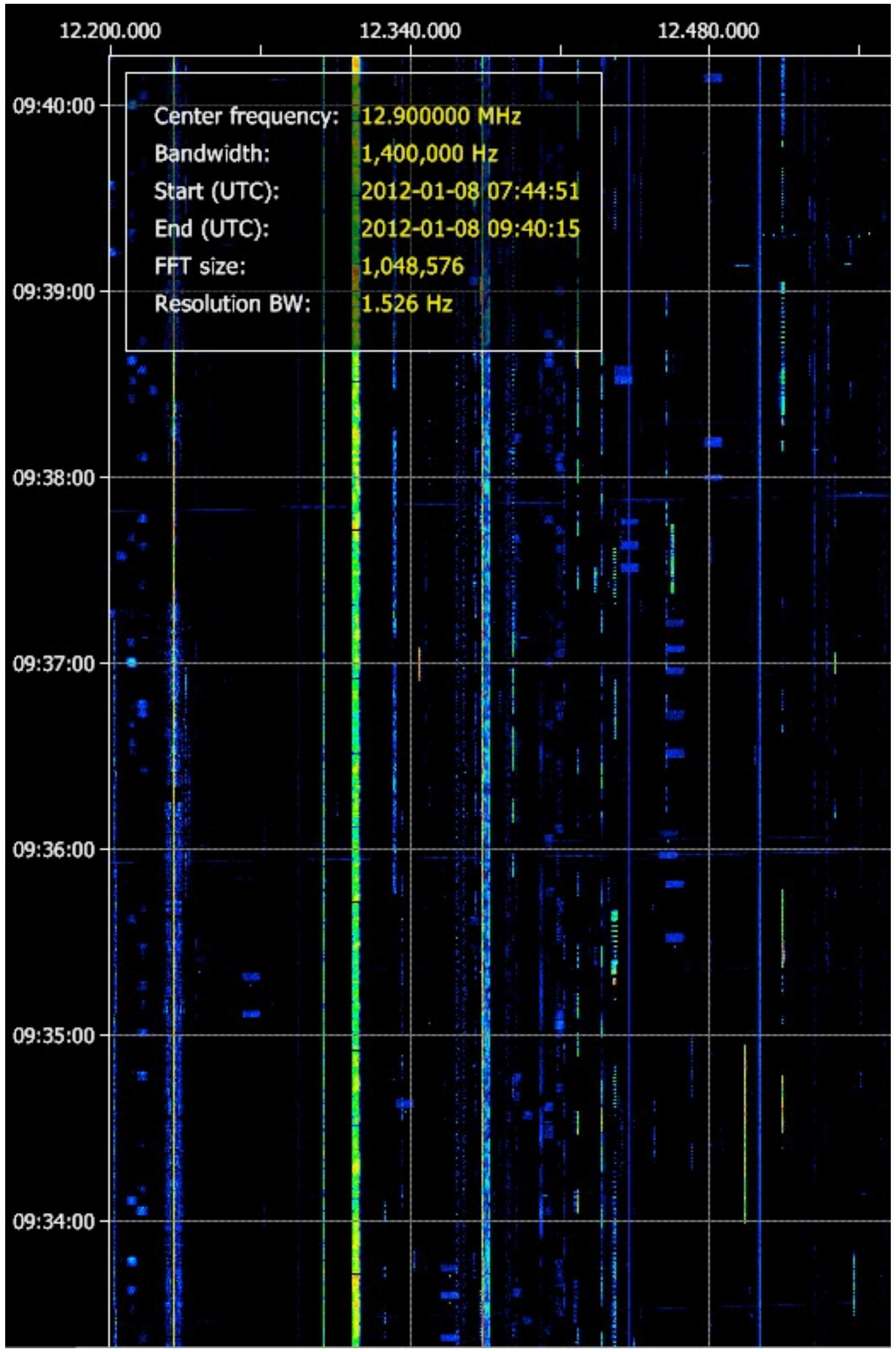
How FFT width and overlapping will stress different views onto a signal



Above you have the spectrum, below the sonagram. You can change the representation of the signals by choosing different values for „FFT Width“ and „FFT Overlap“.

Unearthing Signals

The best way to catch signals is to *record* a part of the shortwave band and to make a *sonagram* (right) of it.
Then you can tune into the wanted channels at the right time, where they are active, and propagation allows for a steady, strong and clear signal. See the figure on the right side for an example from some 150 kHz around 12340 kHz, recorded with SDR-IP from RFSpace and software SDR-Radio. You see many short activities which are worthwile to be scrutinized.



STEP-BY-STEP

Exploring an ALE Net

A sonagram is the tool of choice to get an overlook on activities in the utility bands. I use software SDR-Radio of Simon Brown, together with RFSpace's SDR-IP for its excellent HF performance, and because it can be locked onto GPS for ultra stable and precise frequencies.

These are some general steps to follow:

Choose the band you like to monitor, and the time. Make a recording, analyze it by SDR's function "IQ Data File Analysis".

Write down time and frequency of the signal. Take *that* part of the recording, where the signal performs best. Replay exactly this part of the recording. The "loop" function will help you with the next steps of analyzing the signal.

Have a look at the *gallery* on the next page, showing this step-by-step:

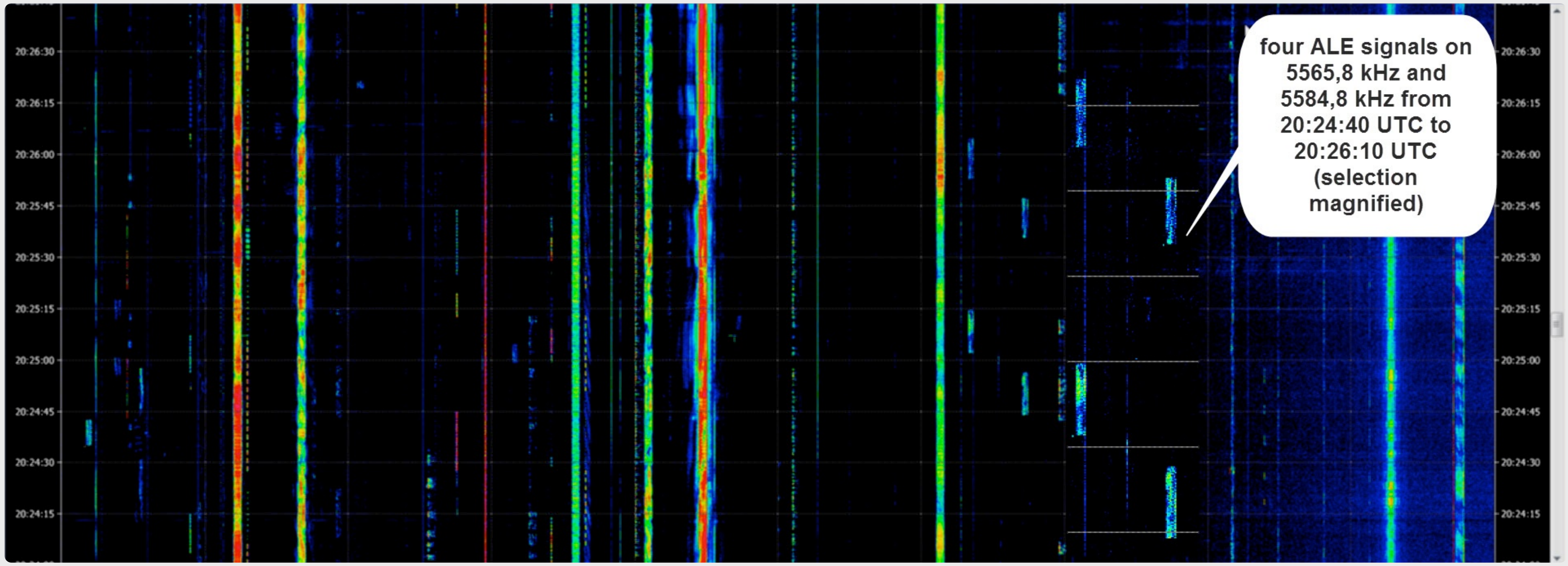
- Firstly, we have a look at a sonagram, 500 kHz wide, and showing two hours of activity on 15000 lines. As our brain has a good pattern recognition (some optical illusions also relying on this fact), we soon discover some distinctive ALE selcalls. They last for just twelve seconds and will be easily missed on a conventional radio.
- Secondly, I noted time and frequency of this activity and set up a loop of this recording from 20:24:40 UTC to 20:26:10 UTC [hh:mm:ss].
- Thirdly, decoding. Tune into the wanted frequency and match it to the decoder which is quickly done by the loop.

The results were as follows:

- At 20:24:44 UTC "DB5" calls "DBE" on 5584,8 kHz and changes at 20:25:02 UTC to 5565,8 kHz with the same call.
- At 20:25:36 UTC "DB3" calls "DBE" on 5565,8 kHz and changes at 20:25:54 UTC to 5584,8 kHz with the same call.

DBE stands for Iraqi Border Enforcement. DB3 is "III Border Police Region, Special Troops Batallion, Kut Central Iranian Border", whereas "DB5" stands for "V Border Police Region, Special Troops Batallion, Najaf Saudi Arabien Border". DBE is the headquarter. [Thanks to Tom at UDXF for these infos!]

Three steps from discover the signal to decoding, just leaf through the screenshots.

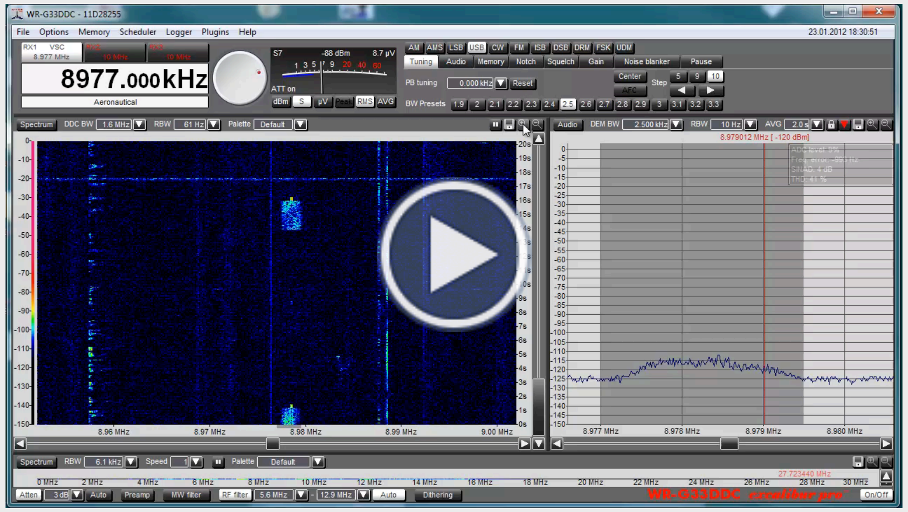


Step 1: Identify some interesting signals within the complete sonagram. Here, four ALE signals have been magnified.

What mode?

Krypto500 is among those few decoders which assists you in analyzing the signal to specify the mode – or a choice of modes. To speed up, you have to do a kind of pre-selection: is the signal frequency-shift keyed (FSK), or is it phase-shift keyed (PSK)?
A frequency-shifted signal usually consists of two (FSK) or more (MFSK) single tones, keyed in the rhythm of the information. See some modes for example in the video on the right.

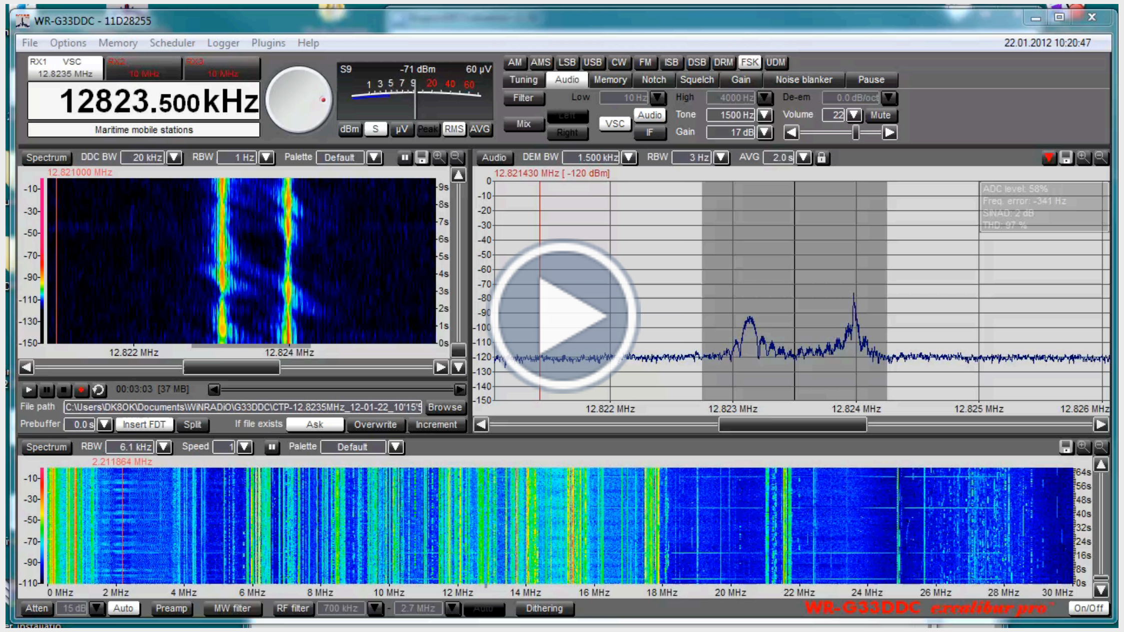
Some six modes - how they look, how they sound



Experienced listeners often recognize a code just in a sonagram or by its audio. This video shows six typical examples: ARINC 635, SELCALL ICAO, FAX (FM), Morse, Saab Grintek MHF-50 and GW-FSK.

Automatic Classification

How classification works.live and on the air.



Automatic classification and decoding of an RTTY signal can place some challenge. This live example compares GX430, W-Code, Krypto500 and Code3-32P. For all decoders, there has been used the same snippet of an HF recording of the strong signals of NATO Lisbon, 12823,5 kHz.

Only GX430 and W-PC (with options) do offer a general and automatic classification. GX430 does the best job ever seen in this respect, identifying even FAX transmission correctly. W-Code is most convincing with continuous signals, but burst signals are another animal. Code3-32P also has a classifier, working remarkably well in many cases.

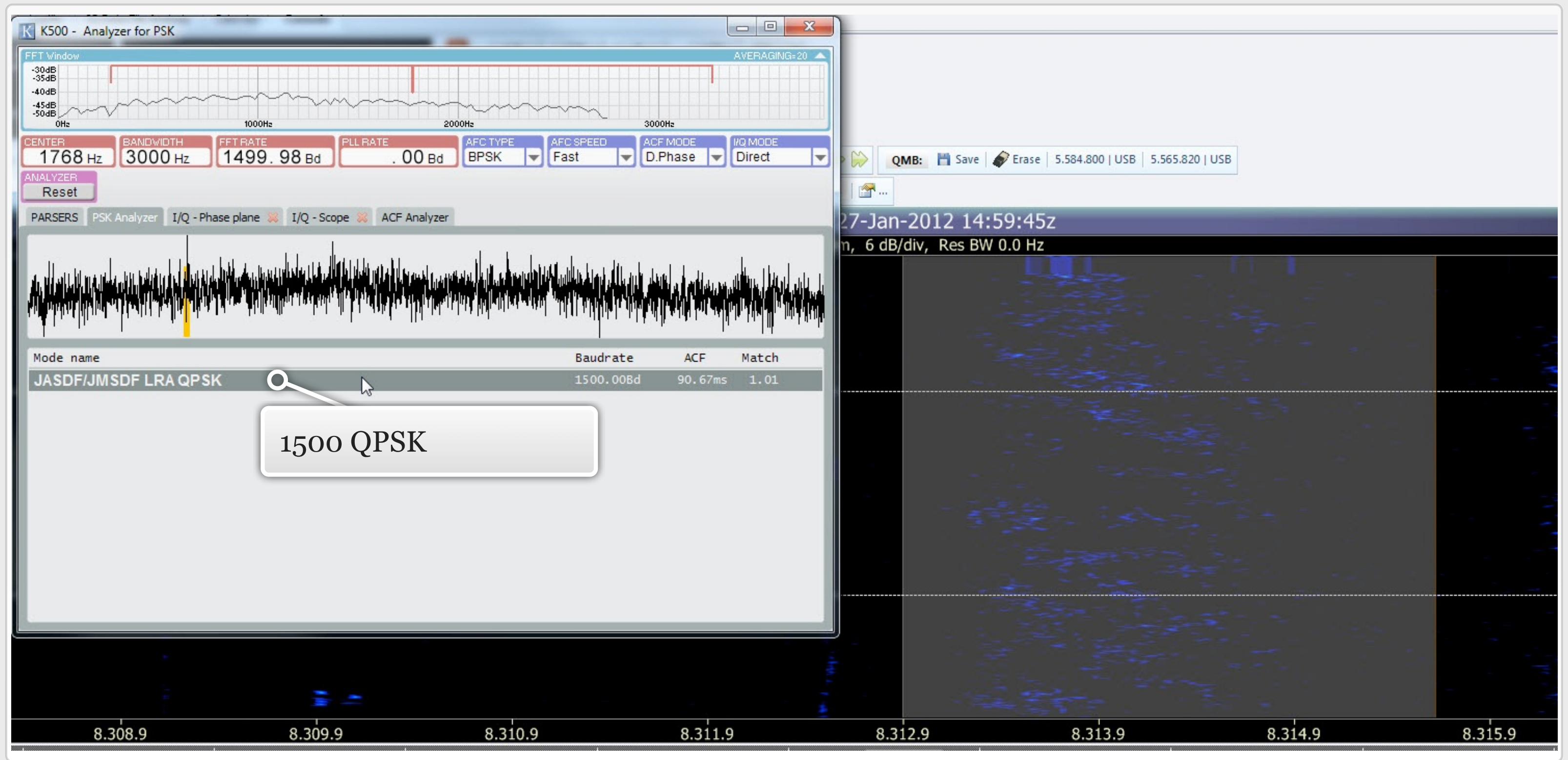
All classifiers try to determine specific parameters of the signal – like bandwidth, baudrate, number of tones of phase constellations. They check these specifications against a look-up table, giving their vote, often with a figure of probability. As there is a big number of combinations to check, classification can take some time. Noisy, weak and distorted signals will do the job even more difficult as ambiguity – (nearly) the same pattern for different modes – will add up to the challenge.

The video compares several decoders in classifying a 75 Baud FSK signal of NATO Lisbon. To sum it up: automatic classification with all decoders without GX430 is giving you nothing more than a bit of assistance.

To get a knowledge of how different codes look like in a sonagram or how they sound, and to choose the right code manually, will be often faster and more successful. The video on the page before shows some typical examples.

Krypto 500 is quite generous. The software even identifies many of those signals which in at least this version it cannot decode. Take for example the 1500 QPSK of the Japanese Navy. Yes, mostly those channels carry an 8-tone ASK (amplitude shift keying) signal called „Slot Machine“, but this is sometimes replaced by a QPSK signal, Krypto500 correctly determines - see the screenshot.

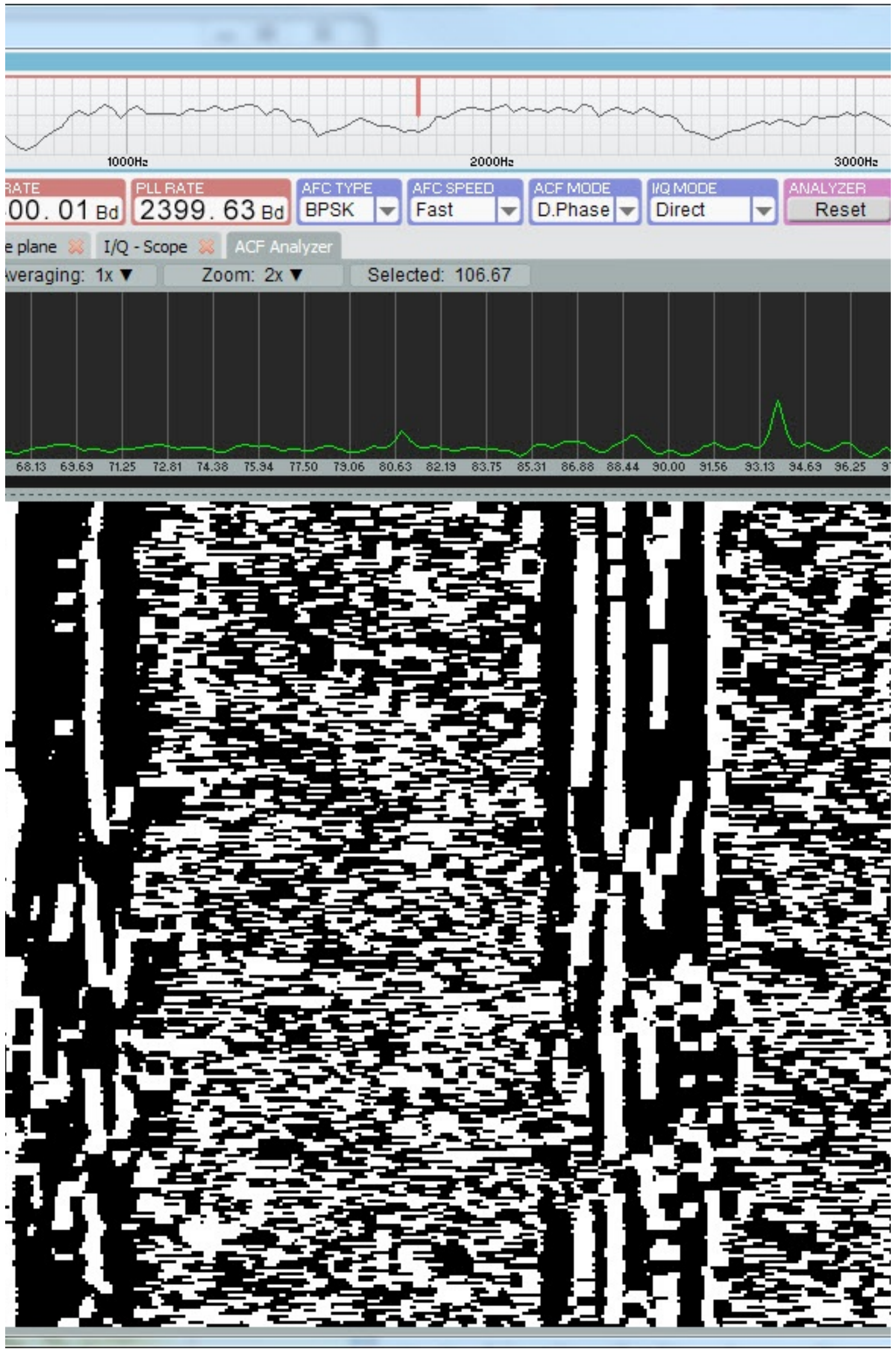
JJF on 8313 kHz with a 1500 baud QPSK signal, correctly analyzed as originating from the Japanese Navy. Alas, there is no green arrow behind the mode. Thus, this version of Krypto500 will not decode this signal.



The next chapter will deal with identifying also exotic signals manually by analyzing their specific characteristics.

How high the ACF?

Some decoders do have sophisticated modules to take measurements of e.g. frequencies, channel spacing and phase constellation - some not. At a first look, Krypto500 seems a bit sparse on this field. But many things are done automatically under the hood. Those functions will considerably help in identifying a mode, and can here be just scratched on the surface.



OF PHASES AND CORRELATION

FSK and PSK, X-rayed

As the manual of Krypto500 provides an instructive step-by-step introduction in analyzing a signal, I here just want to give a few examples.

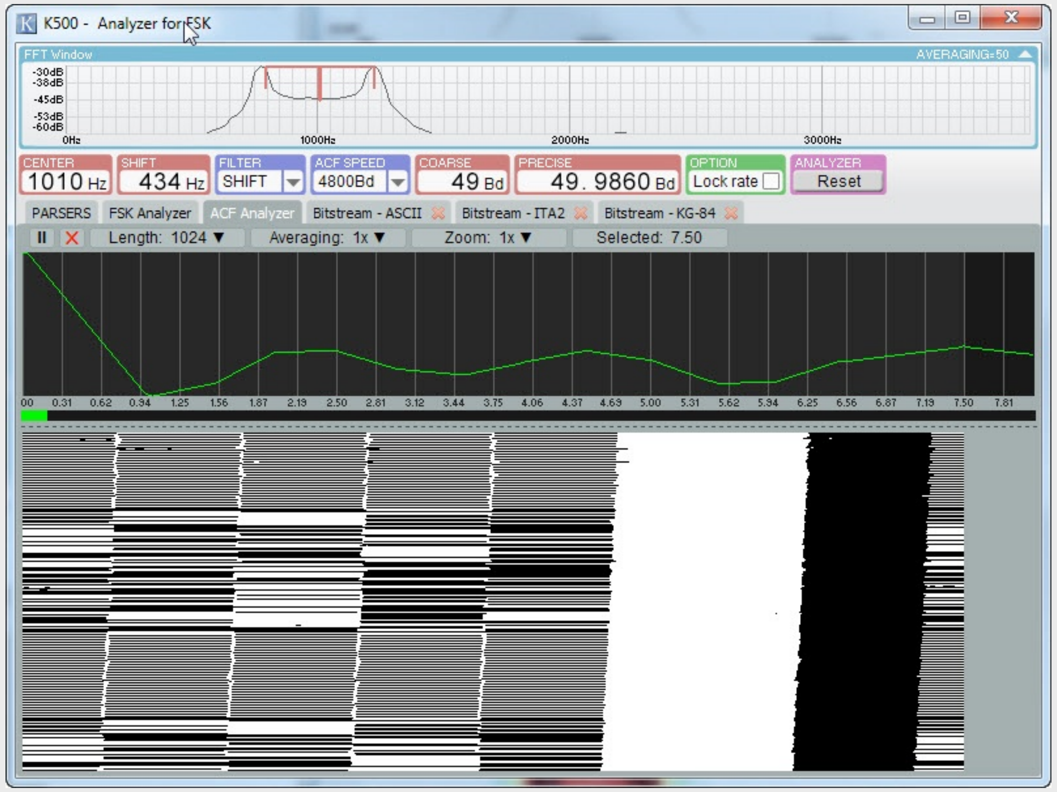
The software provides two analyzers: for FSK or frequency-shifted signals and for PSK or phase-shifted signals. Both analyzers do have the goal to get a smuch information on the signals to get a clue of their specific mode - even if Krypto500 may not have a decoder aboard, as for e.g. the 1500 Baud QPSK Mode of the Japanese Navy.

Let‘s start with FSK, then switch to PSK. We will do this with real-world examples, and not with modes from a generator. As some signal maybe weak, noisy and distorted, also some results may give no perfect pictures. Don‘t blame Krypto500 for that - it‘s just live.

FSK

FSK in its most easy form consists of two frequencies, switched alternatively according to the information. The shift between those two signals is as important as the Baud rate, and the pattern of those bits. ACF, or auto correlation function, will show this bit pattern. Krypto500 also most automatically will find both signals, and will determine the shift between them by „FSK Autotune“.

A RTTY station with 7,5 Bit (ACF) will show this window. Above you see both tones, followed by some measured values, starting with „Center Frequency“, followed by „spectrum“ of ACF, and its graphical representation below.

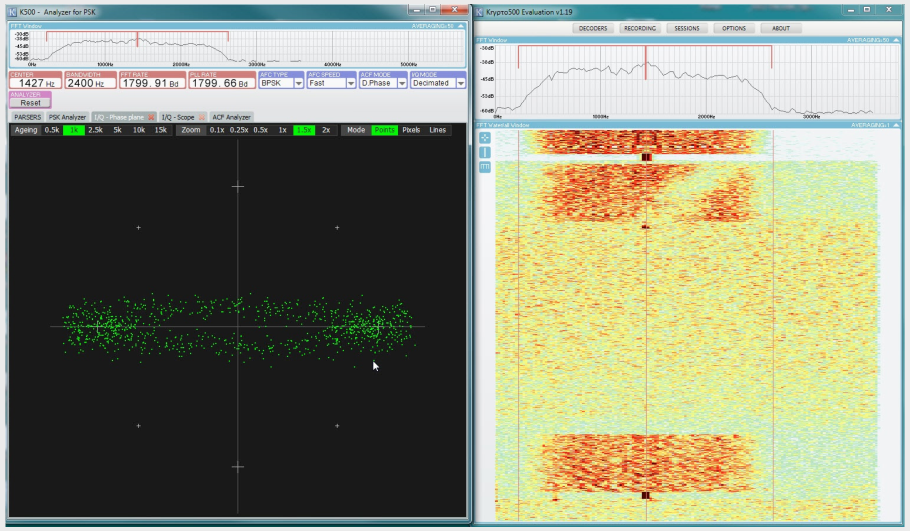


PSK

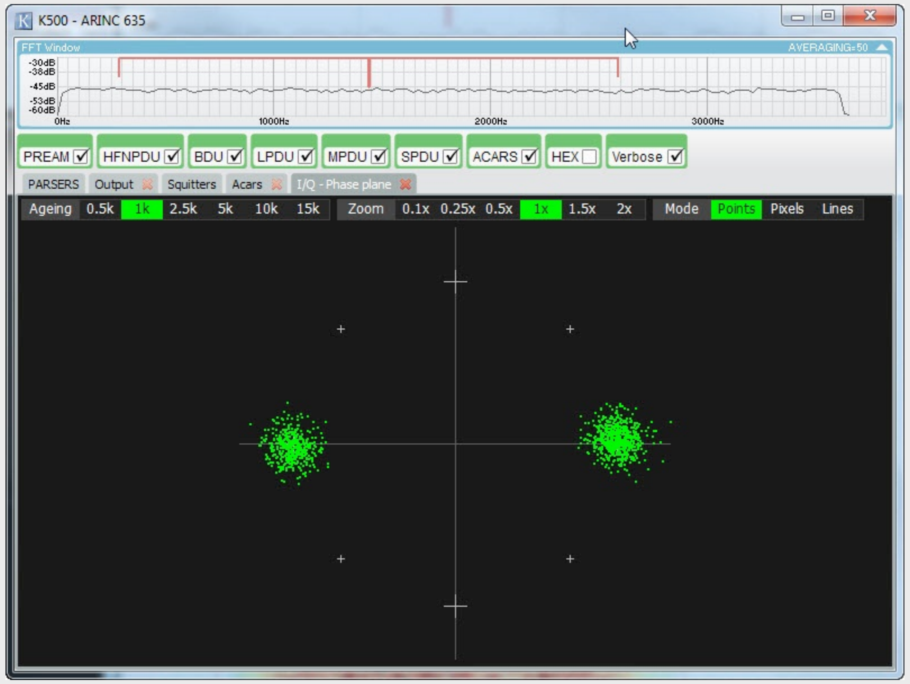
In PSK, phase shifting carries the information. With data communications within a bandwidth of 3000 Hz, two to 16 phases are common. They are represented by the phase plane.

Krypto500 will determine Baud rate as well as center frequeny automatically in most cases.

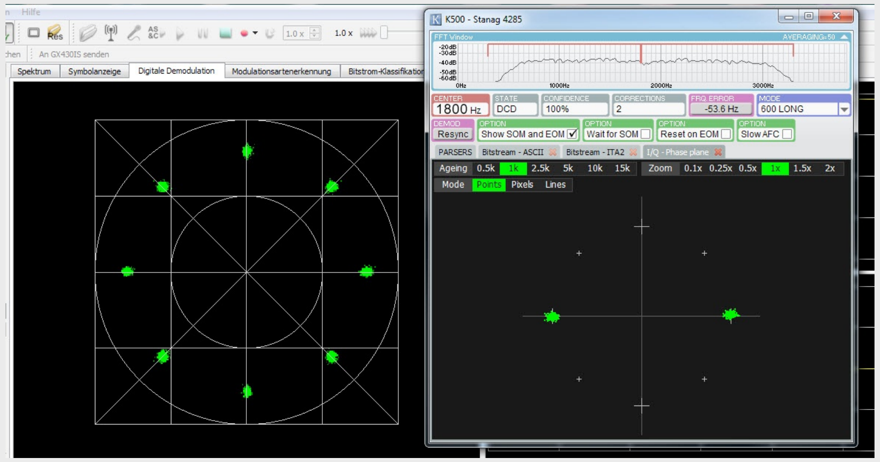
ARINC-635, 2-PSK transmission with 1800 Baud. On the left, you see the phase plane, on the right the usual sonagram.



Switched to decoding ARINC-635, the phase gets sharper.



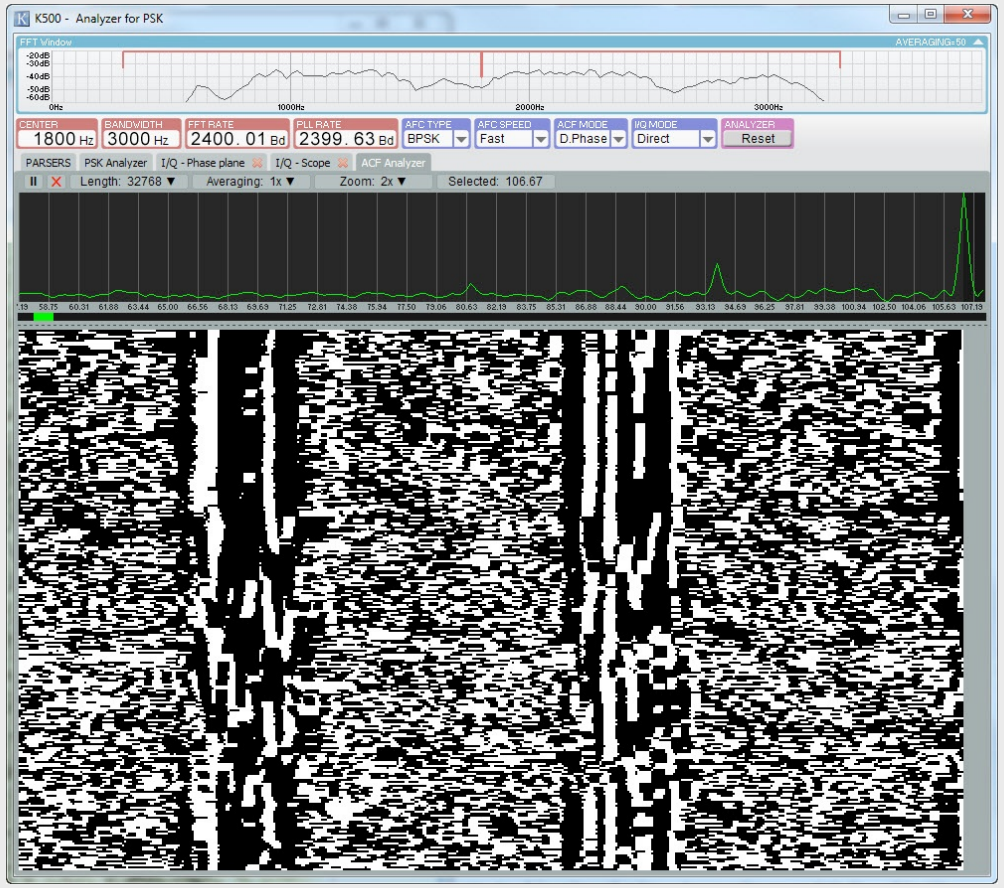
Phase plane of STANAG4285 in 8-PSK, left of GX430. Right the same signal, showing the 2-PSK *descrambled* symbols at Krypto500.



iBooks Author

ACF can also be detected and shown in PSK signals. Here a STANG4285 signal, exhibiting an ACF of 106,67 millseconds.

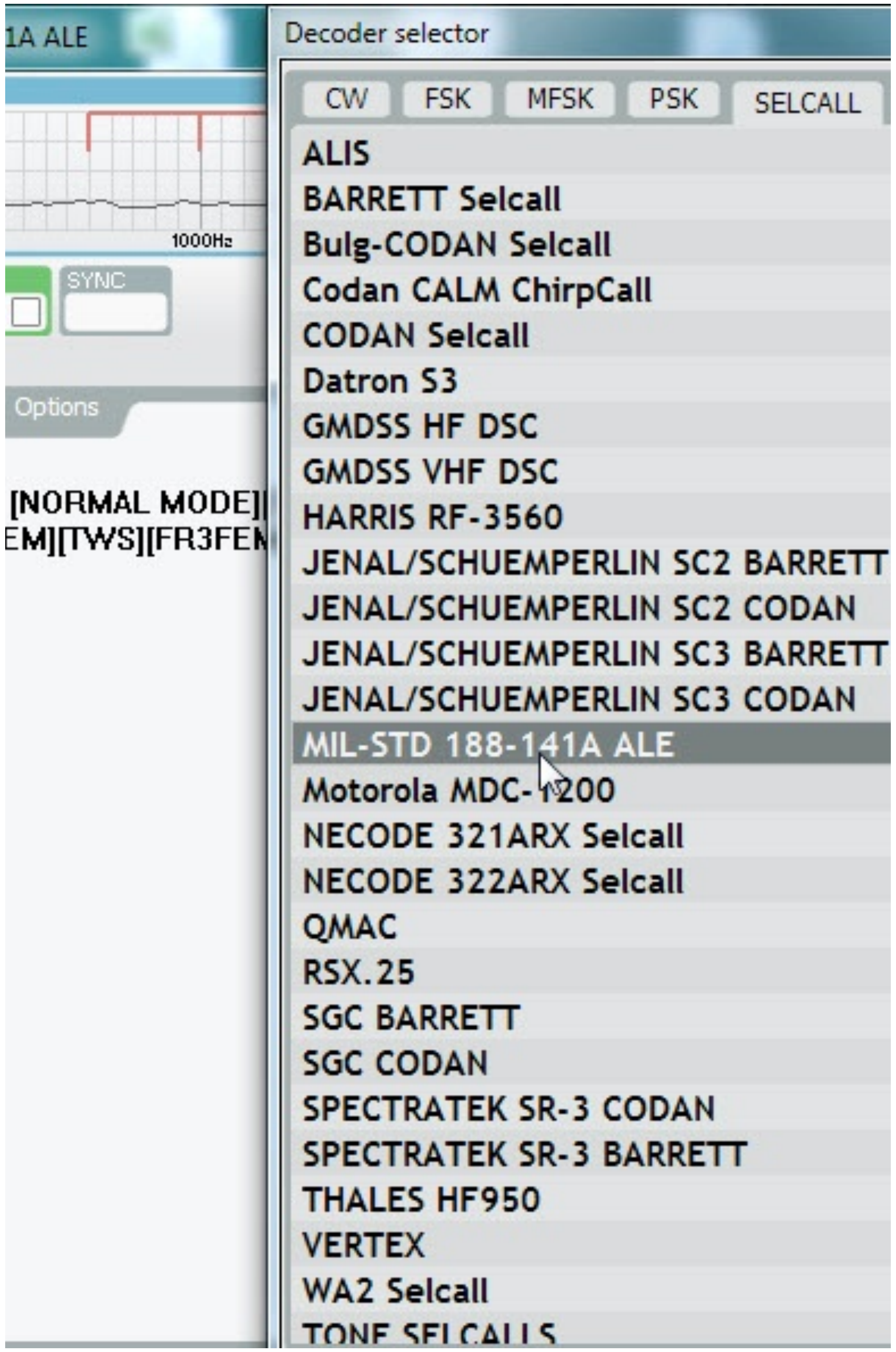
Autocorrelation function ACF of a STANAG4285 signal, 106,67 milliseconds.



Some Modes

The following pages will show some annotated examples on how Krypto500 decodes live signals.

See an example on the right:
SELCALL menue has been choosen, „MIL-STD 188-141A ALE“ clicked, and FEMA Region 3 with their Headquarters in Philadelphia PA/USA received on 12216 kHz and decoded („FR3FEM“).

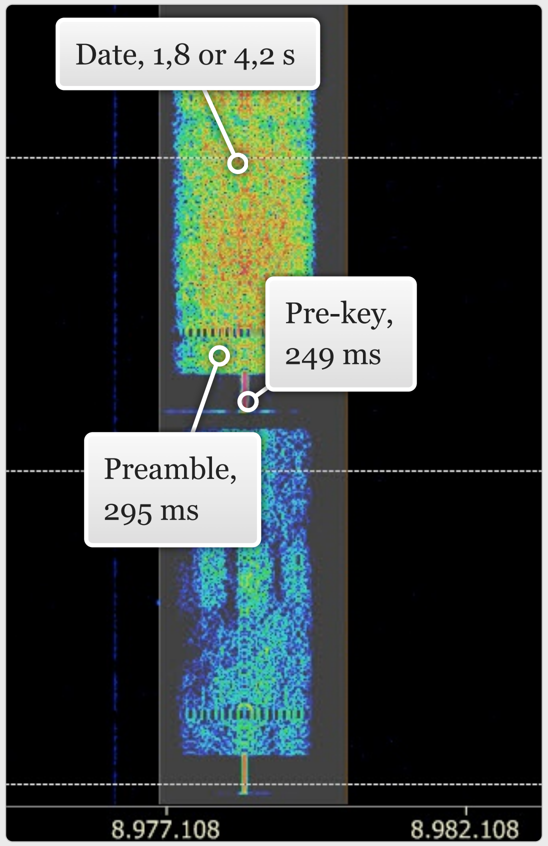


ARINC 635

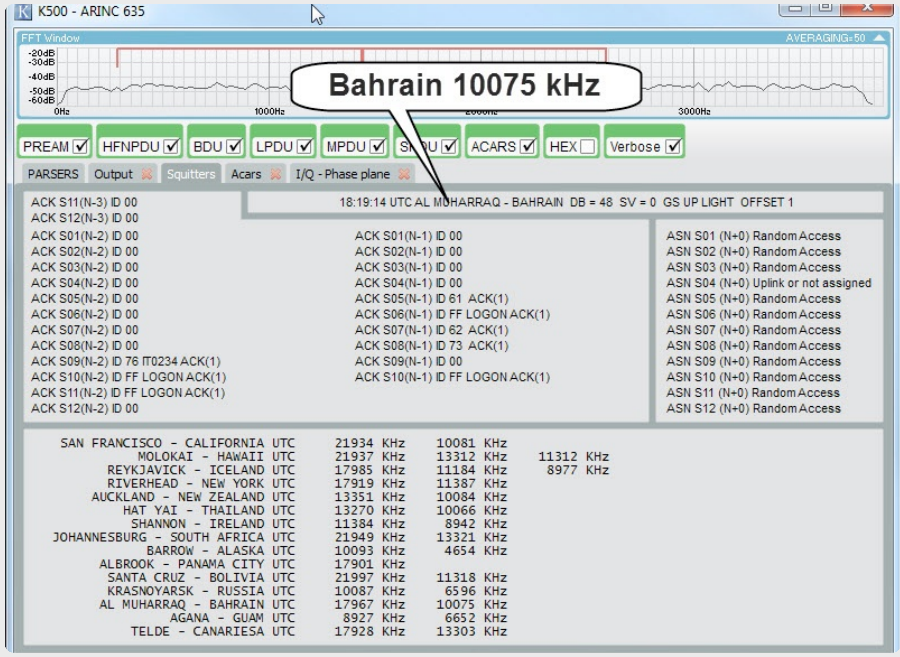
This is a system of worldwide ground stations, built by „**A**eronautical **R**adio Corporation **Inc**.“ of Annapolis MD/USA. You can receive and decode telegrams of ground stations as well as airborne stations which are sent in a GPS-controlled time pattern on numerous frequencies. The so-called „Squitters“ from the ground stations do carry the identification plus those stations and frequencies on this net which this specific station is able to receive. Thus, you can tune into exactly their frequencies to check whether the ionospheric path is open.

Exactly that has been done for the gallery on the right side, starting with Bahrain von 10075 kHz, switching to Guam 6552 kHz and eventually Johannesburg on 13321 kHz.

ARINC 635, structure of the signal



Three ground stations

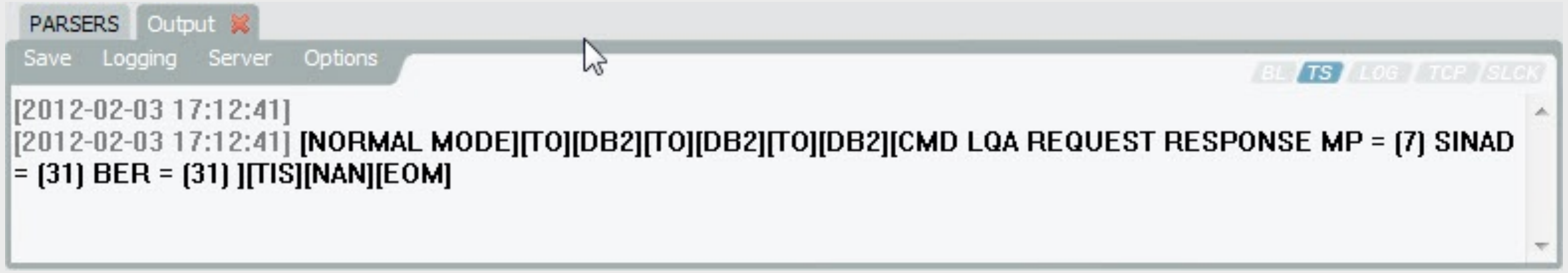


Tuned to 10075 kHz, I received Bahrain transmitting a list of ARINC station they hear.

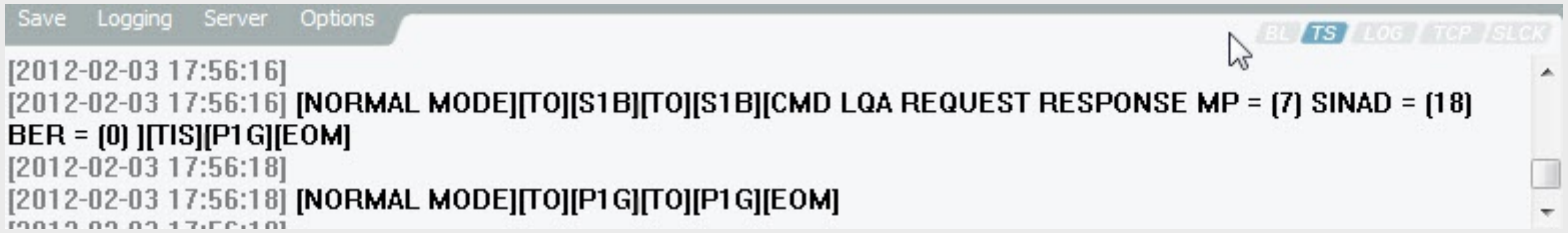
ALE

This „automatic link establishment“ is somewhat ubiquitous on the bands as in this publication.Just some quickly picked up examples below.

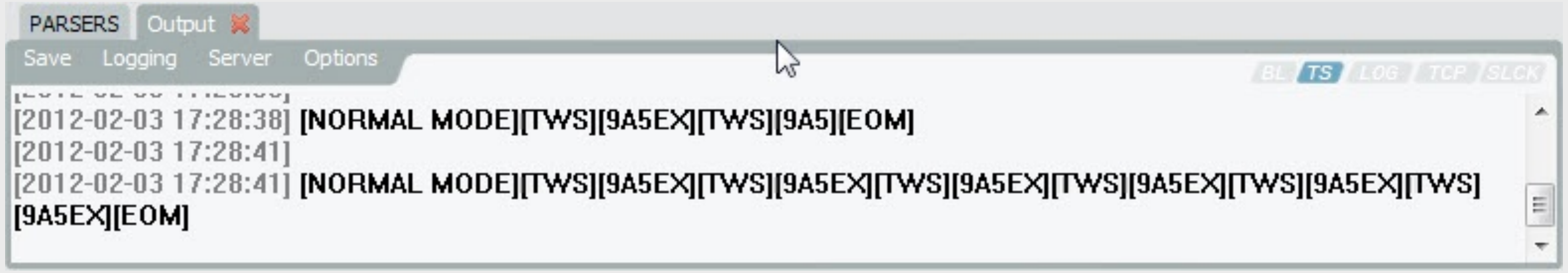
Iraqi Army, 7th Brigade Special Troop Bataillon, Ninawa („NAN“) calling Iraqi Border Police Tikrit („DB2“), 5493 kHz, 17:15 UTC



Navy Lithuania („P1G“), calling another station („S1B“), 8166 kHz, 17:45 UTC



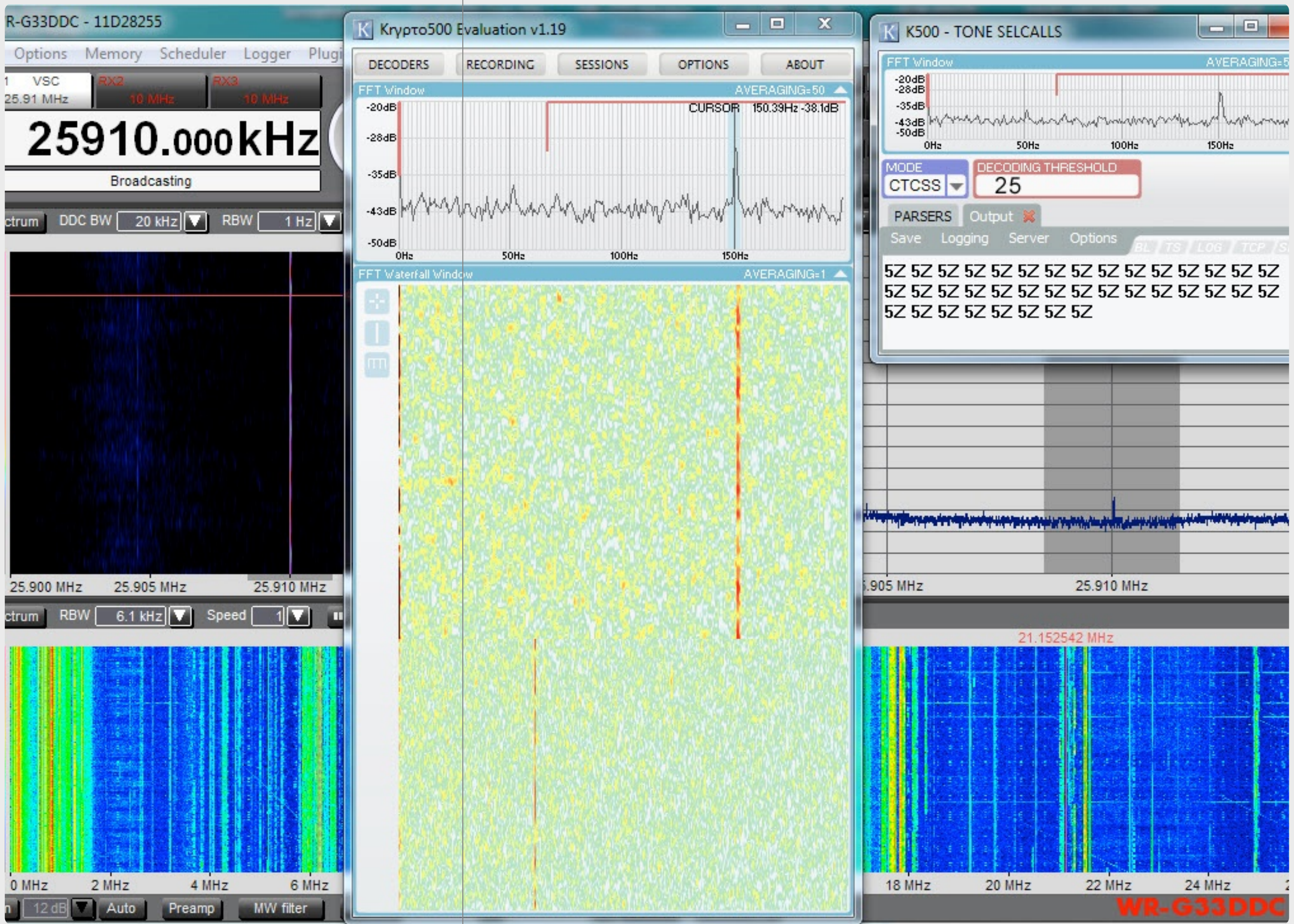
Croation Amateur Radio Emergency Operation Network (HRSVKS), near Samabor/south-east of Zagreb („9A5EX“), 5403,5 kHz, 17:20 UTC



CTCSS

In FM, some transmitters add a special tone in the lower audio range to open up e.g. the receiver of a relay. This „continous tone-coded squelch system“ is used by hams in the 10 m band, as well in CB radio, and also among radio stations with some feeder transmitters from studio to the main transmitter. The CTCSS tones range from 67.0 Hz to 250.3 Hz, and are filtered out („notched“) at the cooperating receiver. Krypto500 decodes those tones and shows their PL (private line) code, introduced by Motorola. Two examples are given in the picture gallery, both with feeder transmissions from the U.S.

Open, sesame!

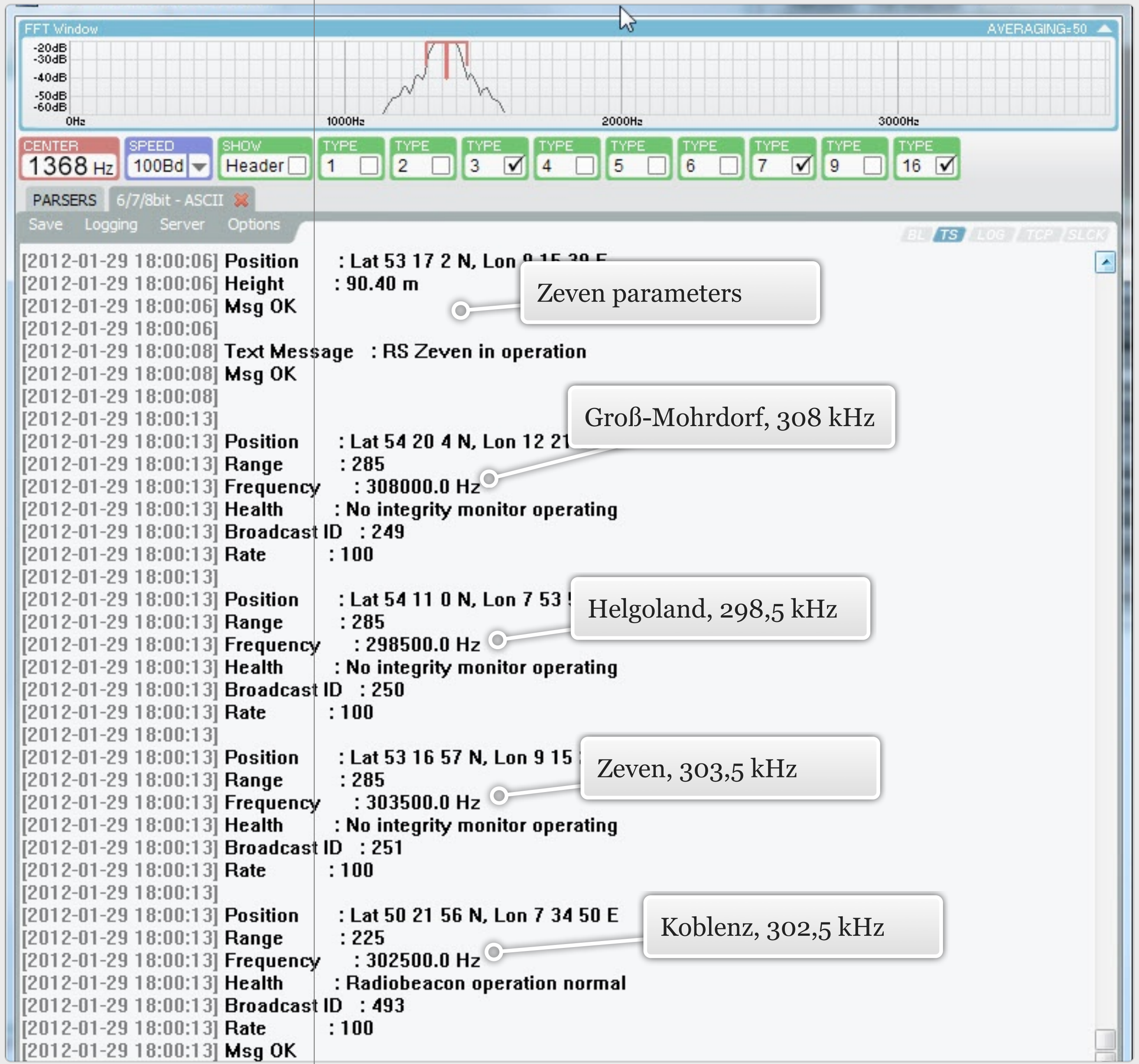


WBAP from Dallas/Texas provides their transmitters on 820 kHz AM and 96,7 FM by an FM feeder on 25910 kHz from their studios at 3090 Olive Street, Dallas. They secure the input of their transmitters - „relay“, technically speaking - by a CTCSS tone of 151.4 Hz. This corresponds to a PL designation of „5Z“. See also the peak at this frequency in the spectrum of Krypto500.

[M823] Differential GPS

A service on longwave, providing GPS receivers with information for correcting their values for most demanding resolution of the 3D geographical position. Also called „DGPS“ for short.

DGPS transmitter Zeven with its parameters and the Radio Beacon Almanac of this station plus some in its vicinity (chain 3D4x). Received on 303,5 kHz.



STANAG4285

You will find this mode nearly everywhere on shortwave, but only few signal can be decoded by the ordinary listener. Most of those do belong to the French and include such rare spots like Noumea, Point-a-Pitre, Papeete and Djibouti. You may already have seen some of them in this iBook, and more are to come.

On the left, you see a short video of KRYPTO500 decoding the weak to fair signal of French Navy Djibouti, just fading in on a January morning on 22447 kHz. Please also note some interference by PLC, power line communications.

FUV Djibouti - French Navy „East of Suez“

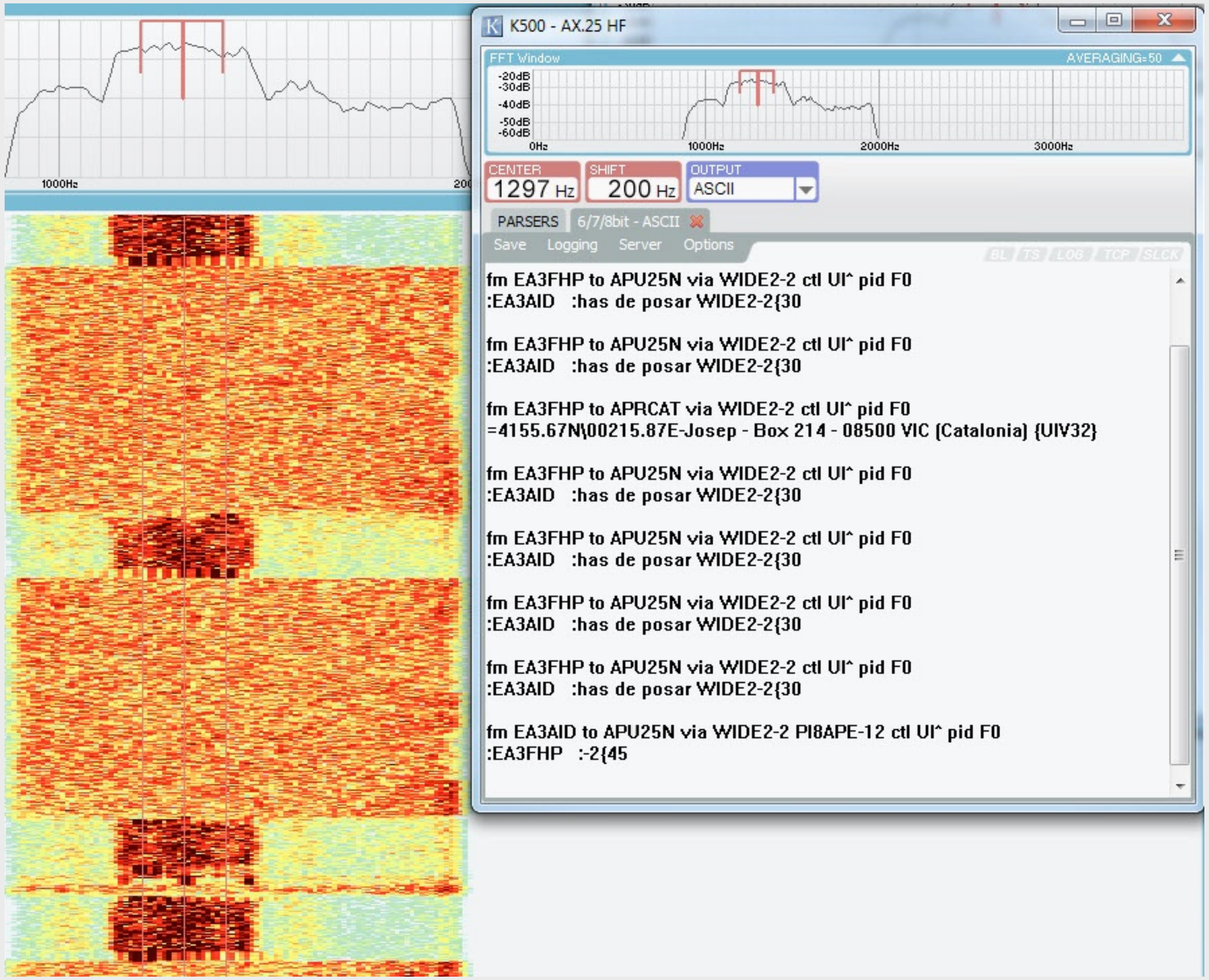
Signal fading from weak to fair, plus some interference of PLC. Nevertheless, Krypto500 provides a near-perfect copy.

AX25 - Packet Radio

Since years, Packet Radio has been widely used by hams, on shortwave as well as on the higher bands.

Mainly, you find mailboxes using this on shortwave a bit outdated mode. See picture on the right.

Amateur Radio mailbox on 14113 kHz.

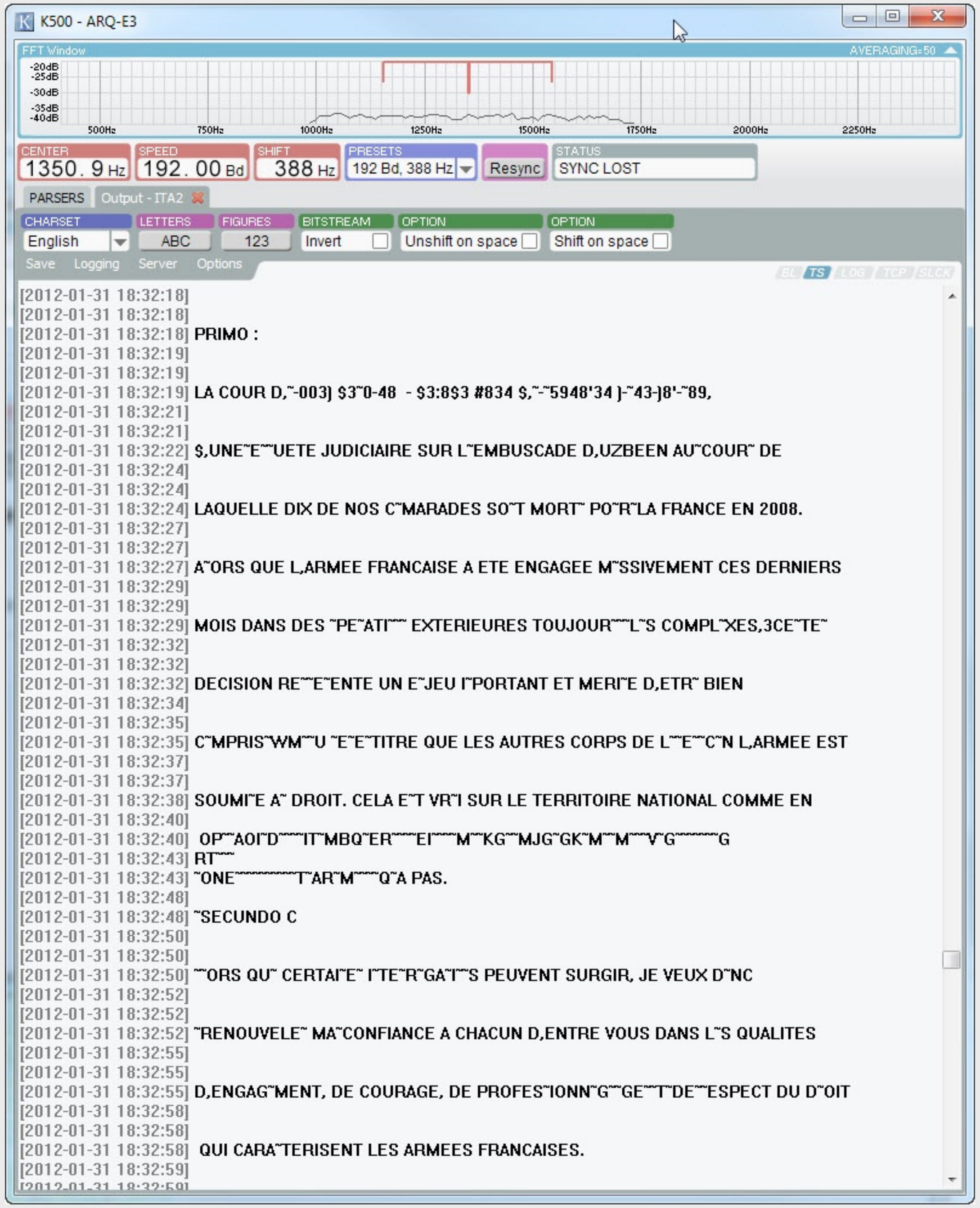


ARQ-E3

A mode, which nowadays is a rare one on shortwave. One of the very few stations still can be found on 11421,7 kHz. This is listed as DTRE Base Alfred-Faure Crozet Island, far south in the Indian Ocean. Most of the time idling, the few five-letter-groups and texts in French are regularly received here under just marginal conditions. Krypto500 is among the few decoders reading at least parts of these transmissions, and is doing this first class - see screenshot on the right.

In autumn 2011, there has be a discussion on the location of this transmitter. Professional direction finding points more to Djibouti than to exotic Crozet. Also Mayotte has been rumoured.

ARQ-E3 signal, 192 Baud, 388 Hz, 11421,6 kHz: Crozet, Mayotte, Djibouti?

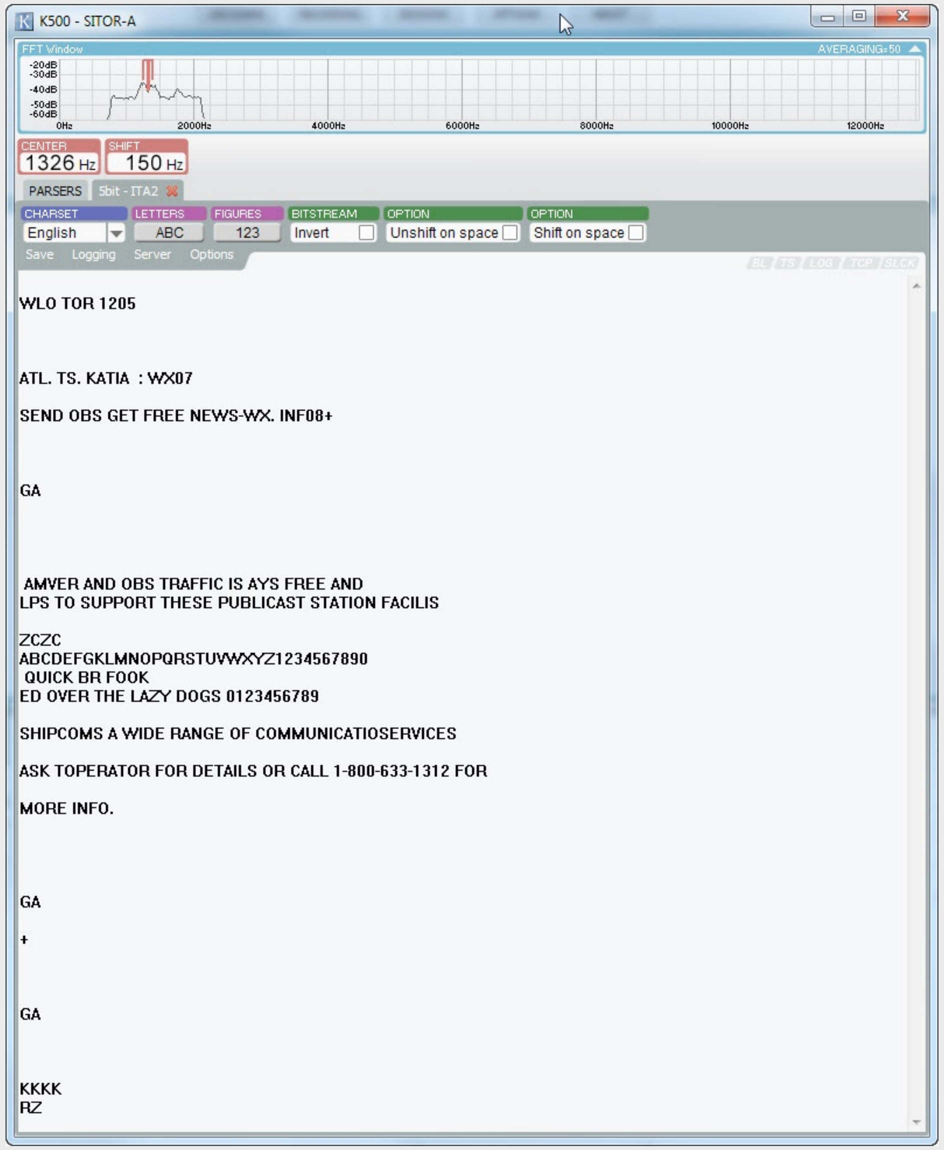


iBooks Author

SITOR-A, ARQ

A mode with automatic request, or ARQ. The transmitter sends out the message in small packets. The receiver has to check each packet wit a special algorithm and to acknowledge that this packet almost certainly has been received correctly or not. In the latter case, this packet is repeated by the transmitter. If you only listen, you may miss some packets, because you cannot acknowledge, neither aks for a second try. Still used for communications between ship and shore in the maritime bands.

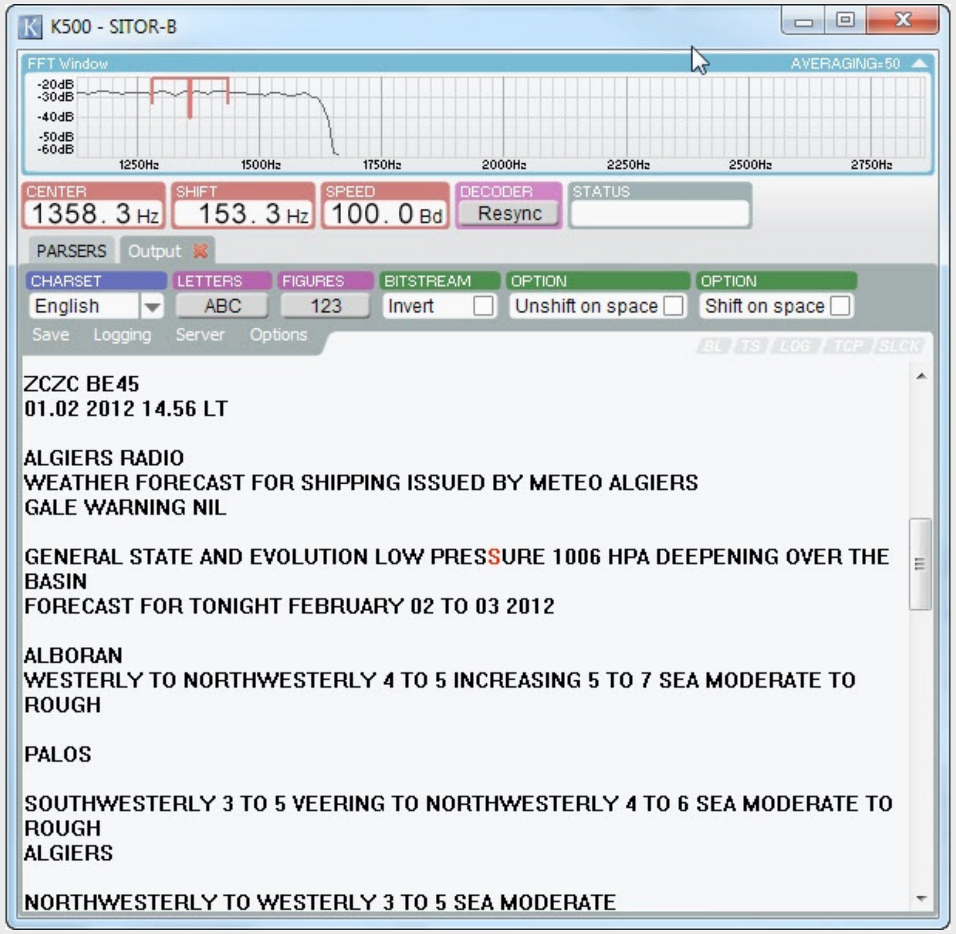
WLO, Mobile Radio AL/USA on 1258,5 kHz with a TOR massage (teletype on radio). The QBF („quick brown fox“) text has been receivednot completly



SITOR-B, FEC

A mode with so-called „forward-error correction/FEC“, which in fact is redundancy. Still used e.g. for weather broadcasts in the maritime bands.

Algiers Radio on 518 kHz with a weather report.

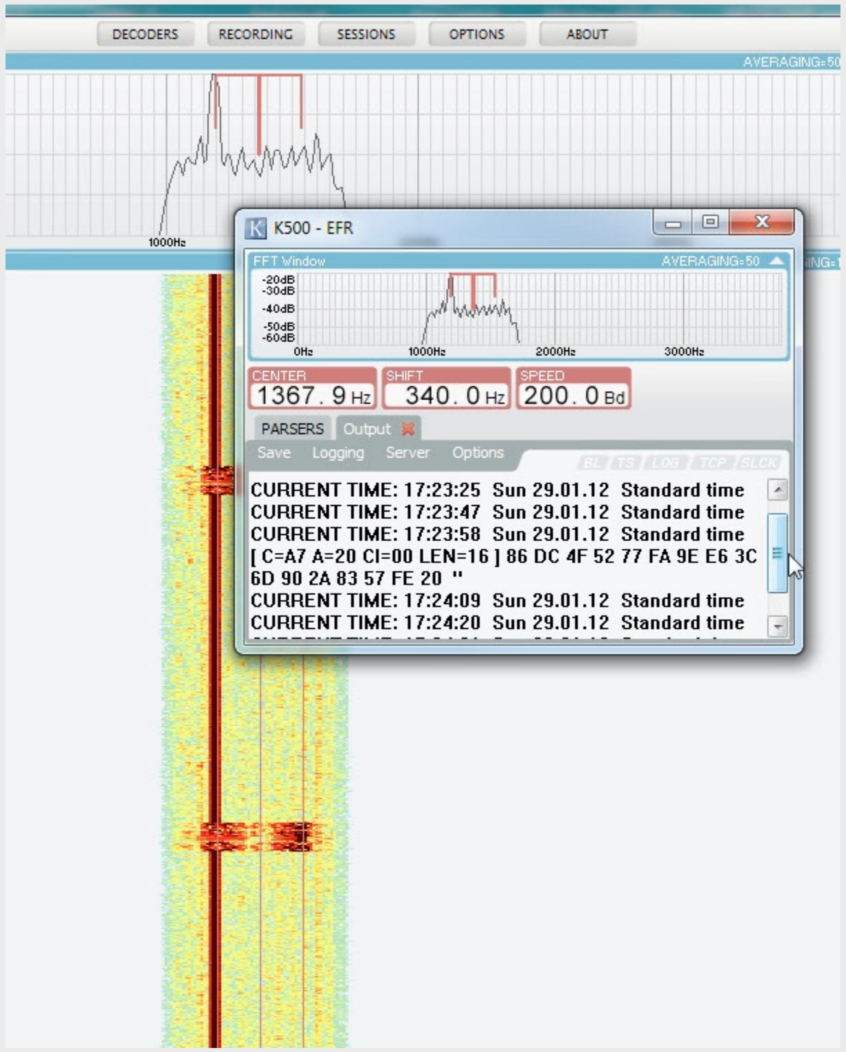


iBooks Author

EFR - Europäische Funk-Rundsteuerung

Kind of a remote control service, operated by three longwave stations; one of them in Germany, the other one in Hungary.

135,6 kHz, transmitter Lakihegy/Hungary. Transmitting time information between the control signals.

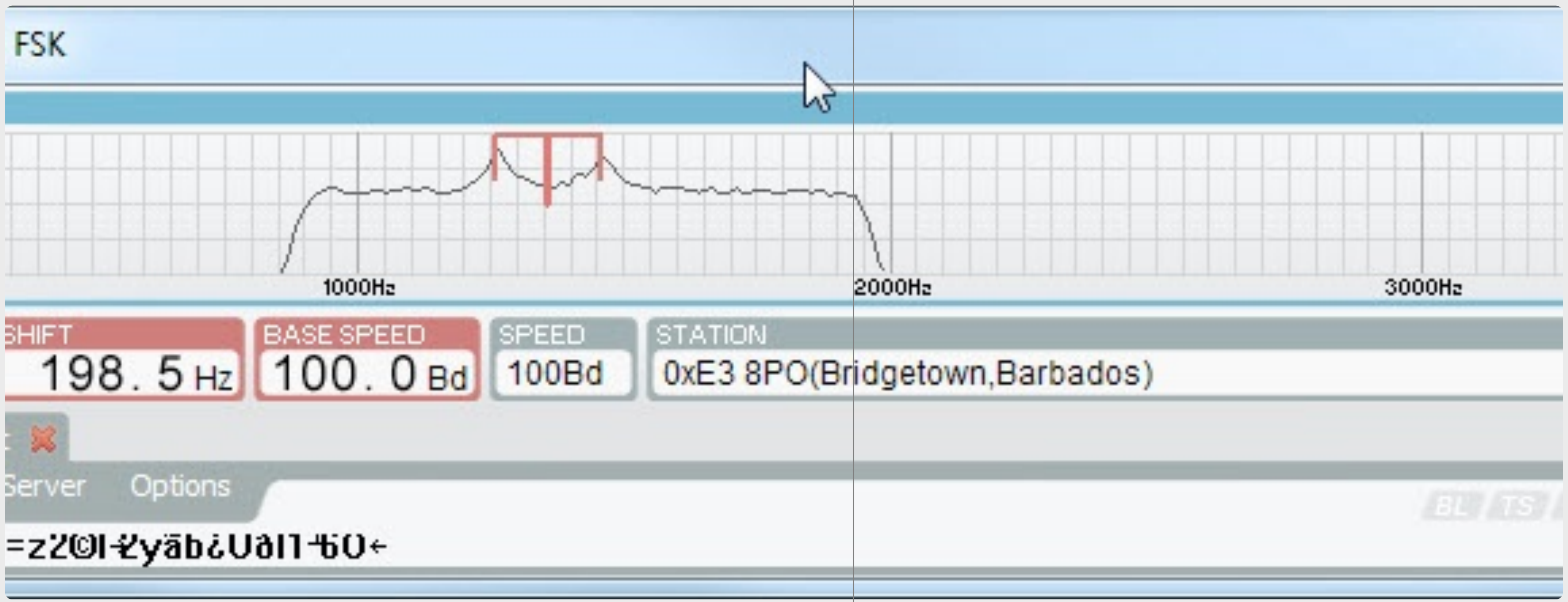


Global Wireless FSK (GW-FSK)

This U.S.-based organisation is responsible for a good part of today‘s maritime communications. Their FSK channel markers are daily visitors from numerous locations around the world. As some of their identifiers are ambigous, you have in these cases to consult a frequency handbook.

The picture gallery below presents you with a choice of some 16 Global Wireless stations with their channel marker.

It‘s a fast ship to China: 16 channel markers of GW-FSK. Have a look at the slighty differing shifts.



6379,5 kHz: 8PO, Barbados

1 von 16

CW - Morse Code

This oldest mode of wireless communications presents a hard nut to crack for most decoders. Even when given by a machine with consistens length of dit, dah, and the pause, it remains reluctant to be automatically decoded. The ever-existent noise and crackling on shortwave makes this case even mor diffcult. Rohde & Schwarz‘ GX430 excels in this field. But as ham with some knowledge on reading the code by heart, you are often disappointed by the performance of any decoder. Krypto500 plays in the middle with W-Code and GX430 in front of it.

Now for the good news: Nowadays, there is only few professional communication in CW. In the video on the right, I found some stations, mostly Navy. You will easily see that automatic decoding of CW wants a stable and clear signal. Please observe: not alle signals in these examples are perfectly keyed by the transmitter!

Dah-dah-didah di-da-dit dah: Not every CW station has gone QRT (Q-Code for: closing down)

Five examples, very different in ionospheric conditions and quality of keying. But that‘s live at HLG/Seoul, RJH66/Kyrgyzstan, RJH69/Belarus, AQP/Karachi and 4XZ/Haifa.

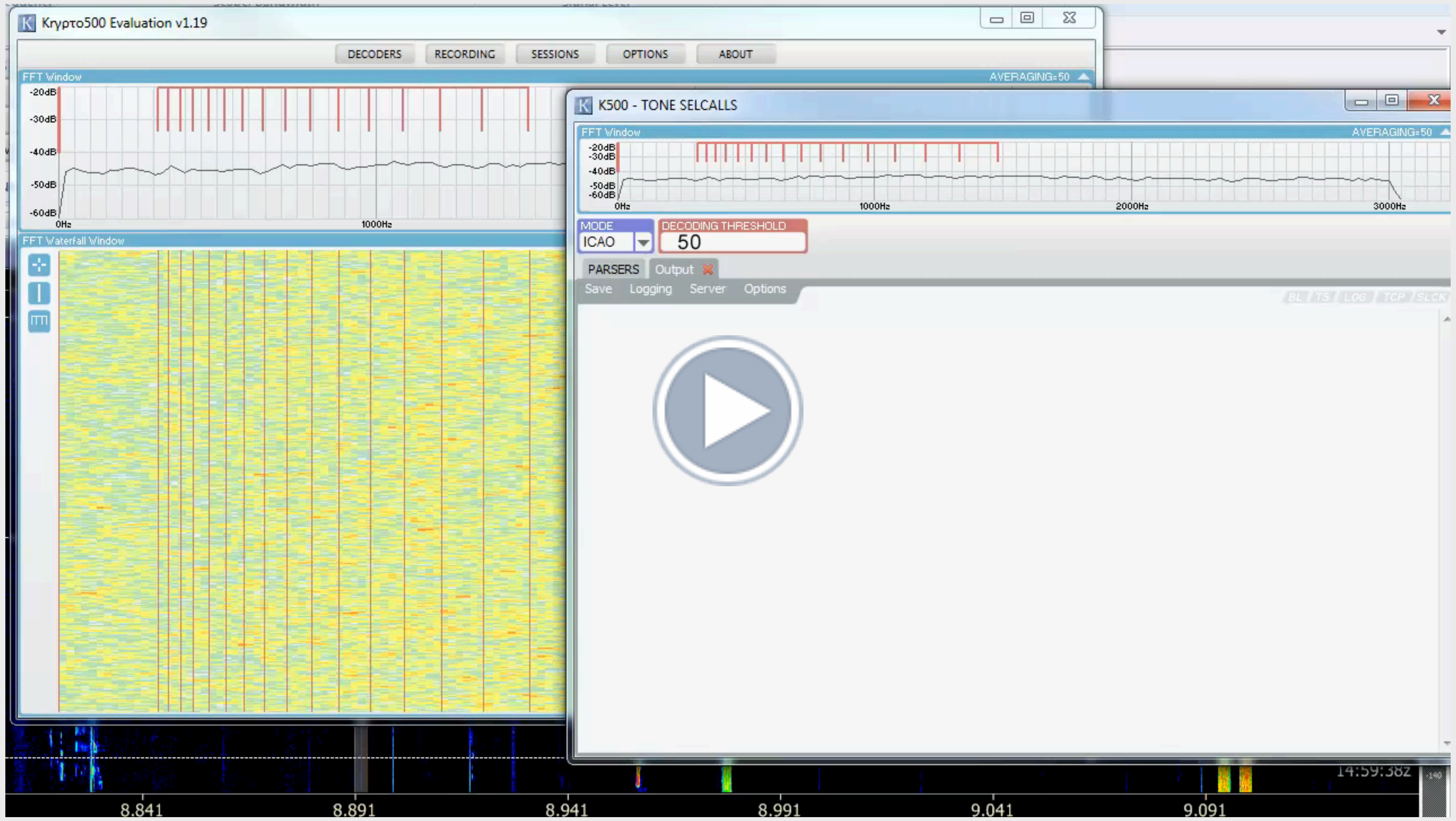
ICAO Selcall

Most airplanes do identify themselves in the aero bands by a so-called „ICAO Selcall“ check. This is a combination of a two two-tone signal, coding the „callsign“ of this aircraft by four letters, grouped into two.

The video on the right show as example Aeroflot 315 flying between Moscow and New York, and calling Iceland Air on 8891 kHz. After some exchange in voice with mentioning its selcall also in voice („echo-lima-sierra-bravo“), the airplane is transmitting its ICAO Selcall „EL-JS“.

Its decoded correctly. Inadvertently, some speech formants can also fall into the secall pattern. Hence, they are also „decoded“. Just ignorme them or change Krpto500‘s dcoding threshold.

Over Iceland: Flightnumber Aeroflot 315

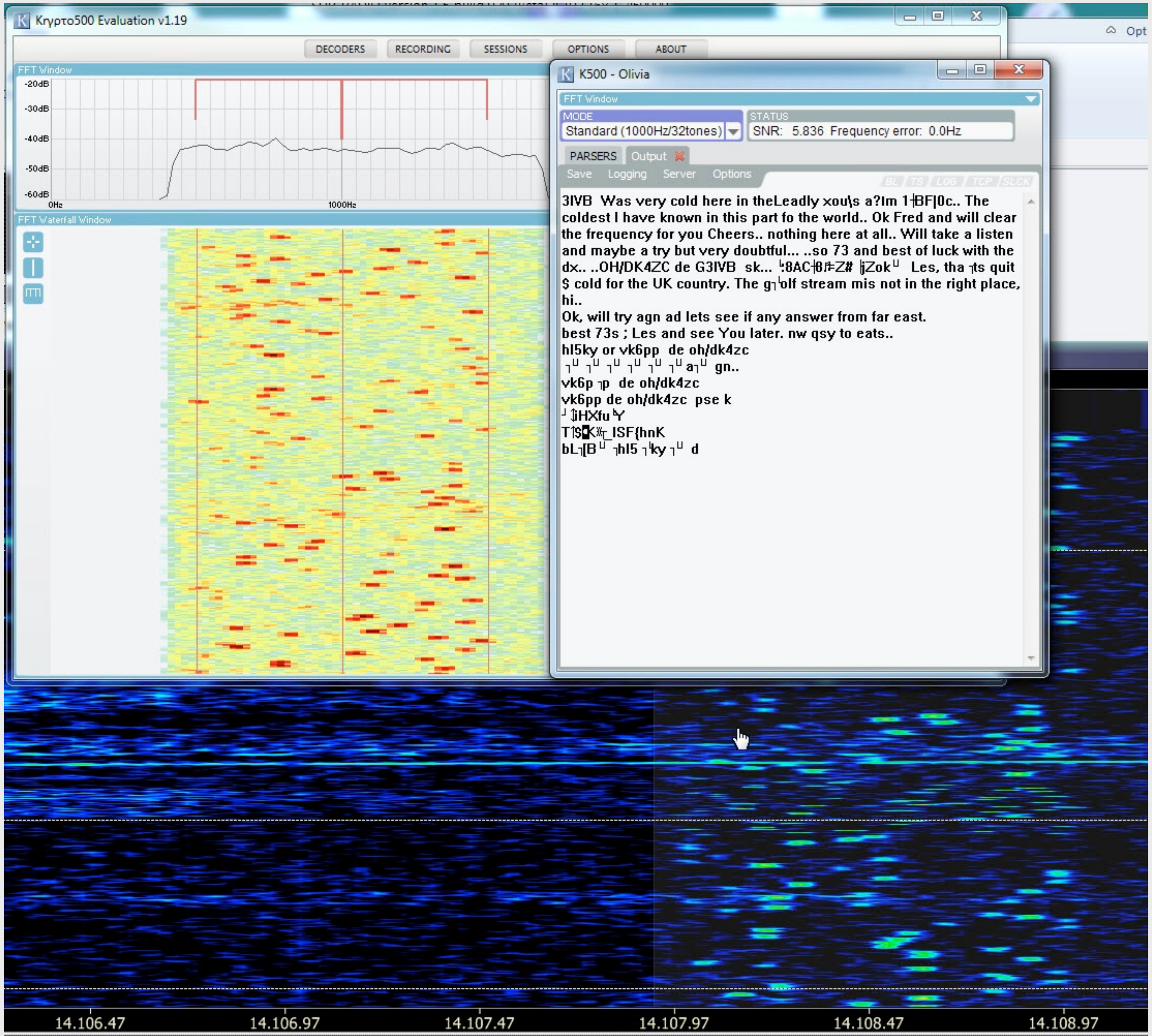


On route from Moscow and New York, Aeroflot‘s Airbus A330-343 (VQ-BQZ) does a selcall check with Iceland Air, 8891 kHz.

OLIVIA

This multi-tone mode is mostly used by hams. It refers back to the PICCOLO system which tried to keep together Britain‘s empire in the 1950s - HF-wise, at least. It‘s rather robust, and comes in different bandwidth and numbers of tones. The screenshot shows a QSO between OH/DK4ZC and G3IVB on 14107,5 kHz. Mode: standard, 32 tones.

Like music: Olivia is a multitone mode.

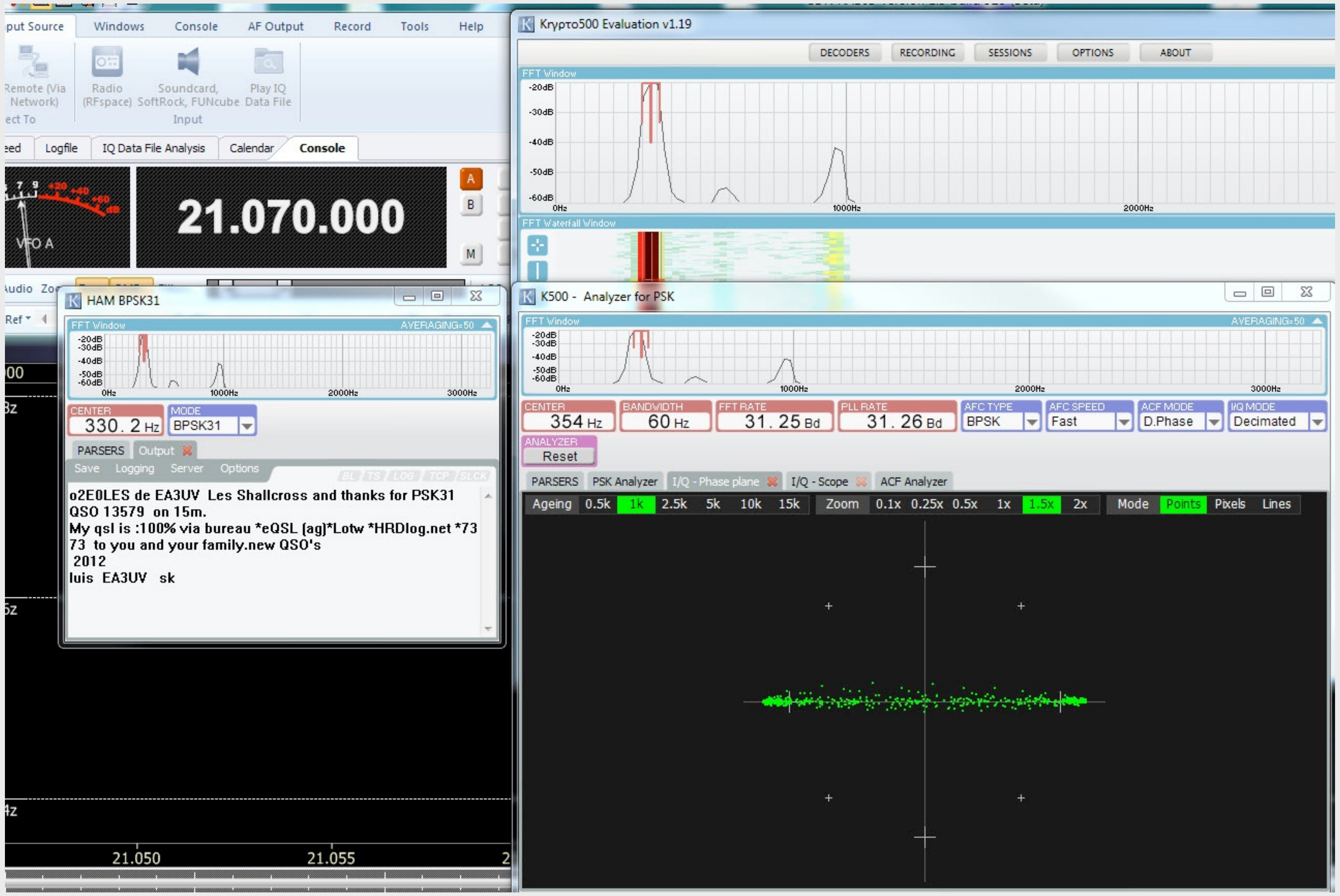


PSK31

This BPSK mode of Peter Martinez, G3PLX, nothing more than revolutionized amateur radio communications with low power. PSK31 created also a family of similar codes, some faster, some slower; some broader. Still, original PSK31 is one of the best and frequency-efficient rag-chew modes on shortwave.

On the right a QSO between EA3UV from Spain and 2E0LES from the U.K. on 15 m. The decoder window is on mid-left. On the right you find the main window, and below the phase constellation.

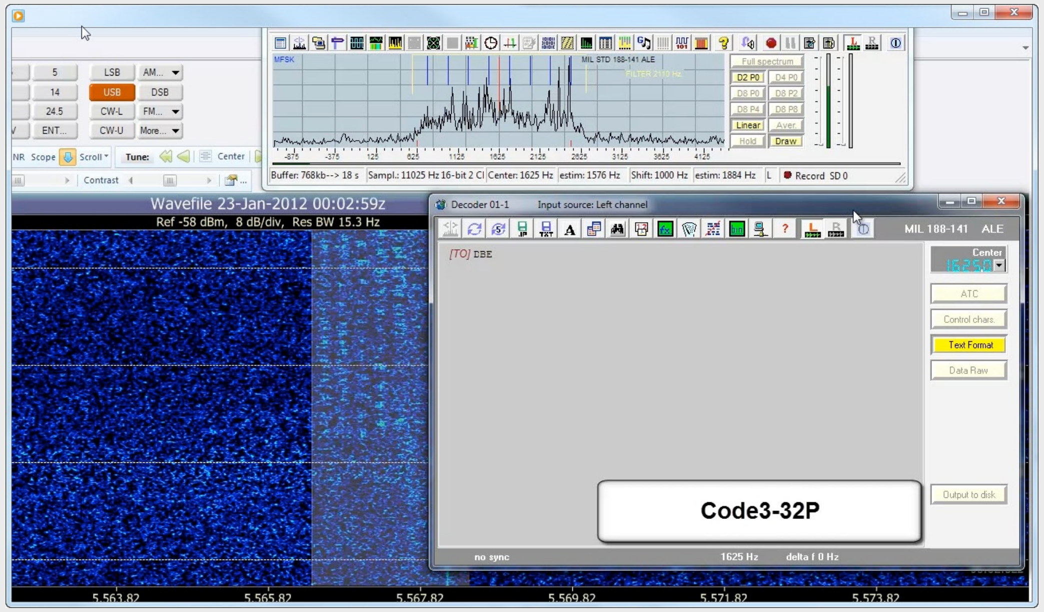
Two phases within a bandwidth fo 31 Hz: PSK31



Compare!

There is only one professional way to compare decoders: take the same test text, encode and modulate it with a signal generator, send it through a fading simulator, capable of different channel characteristics (like: „CCIR poor“), let it decode and measure the bit error rate (BER). Compare it.
As I don‘t have all this equipment, I had to find an alternative. This maybe not perfect, but will give some impression.

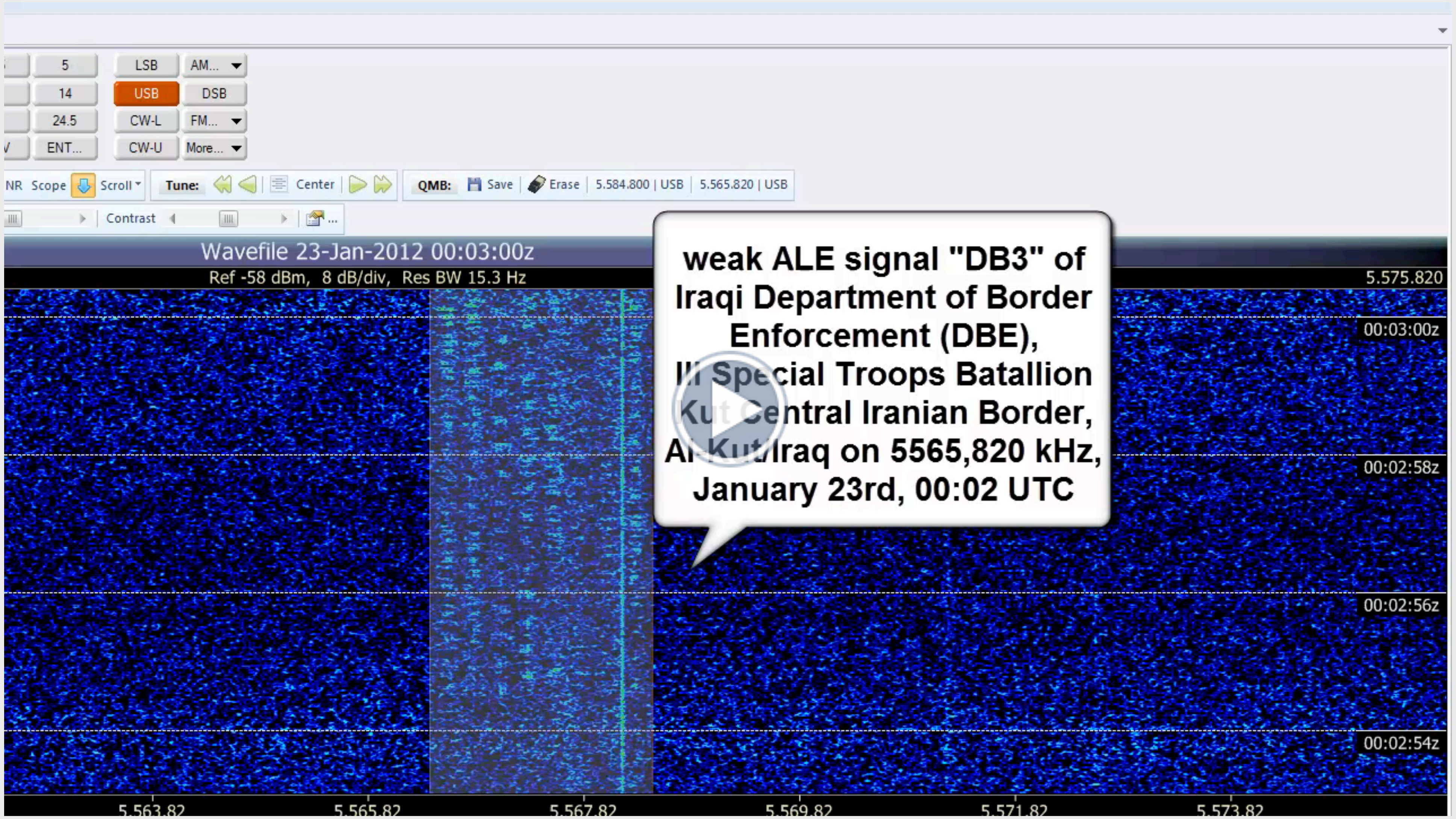
Screenshot of a comparison - see videos on the next pages



I compared several decoders at different modes. To do so, I took an HF recording on some signals live on the air with receivers like Winradio‘s ExcaliburPRO and and RFSpace‘s SDR-IP. Those same files where then played and decoded by different decoders. The results are not scientifically representative, but mostly will point into the right direction.

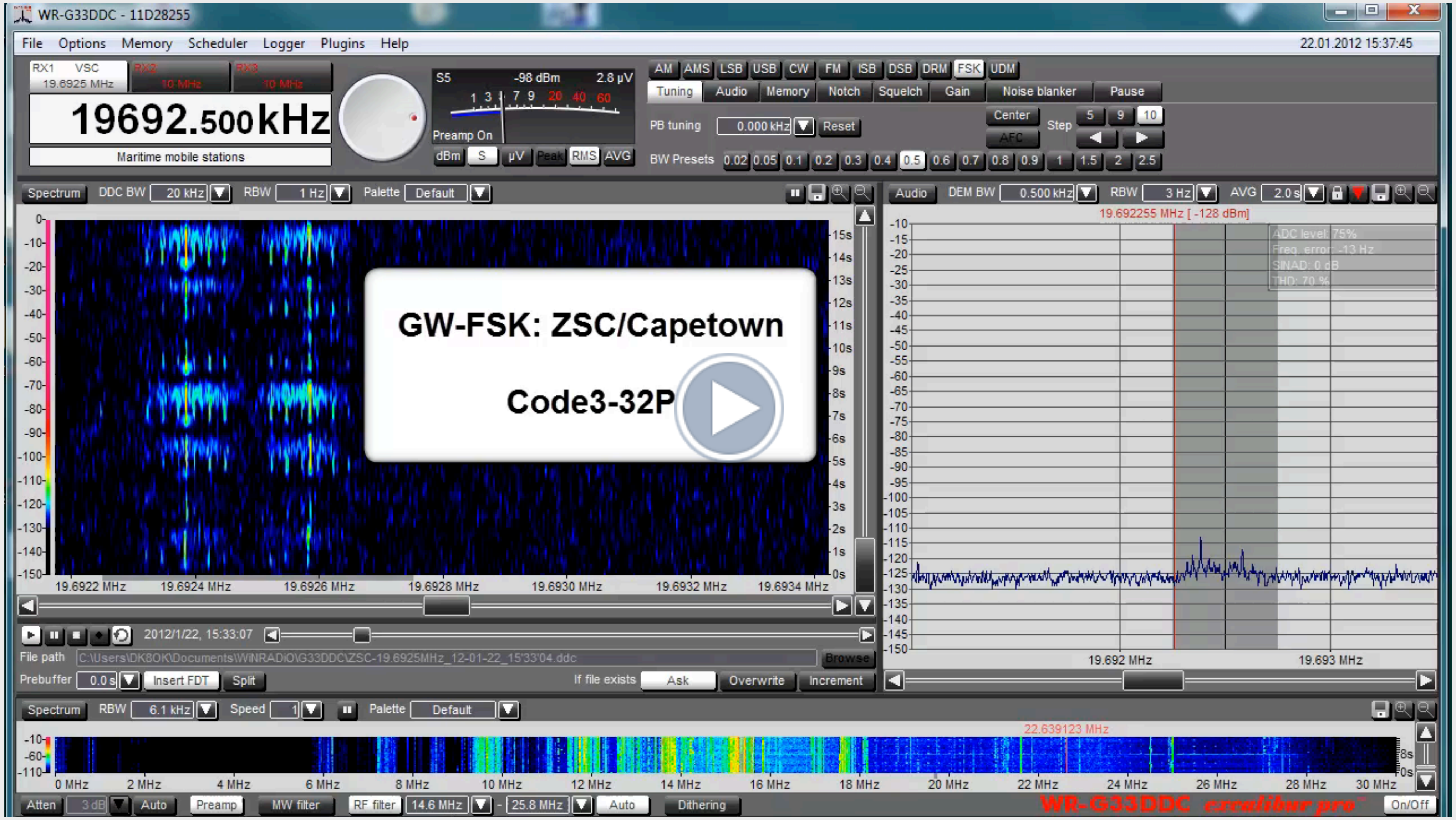
All comparisons are documented by videos - there have been made no tricks. It‘s like you looking me over the shoulder when testing and comparing.

Comparison 1: Weak ALE signal



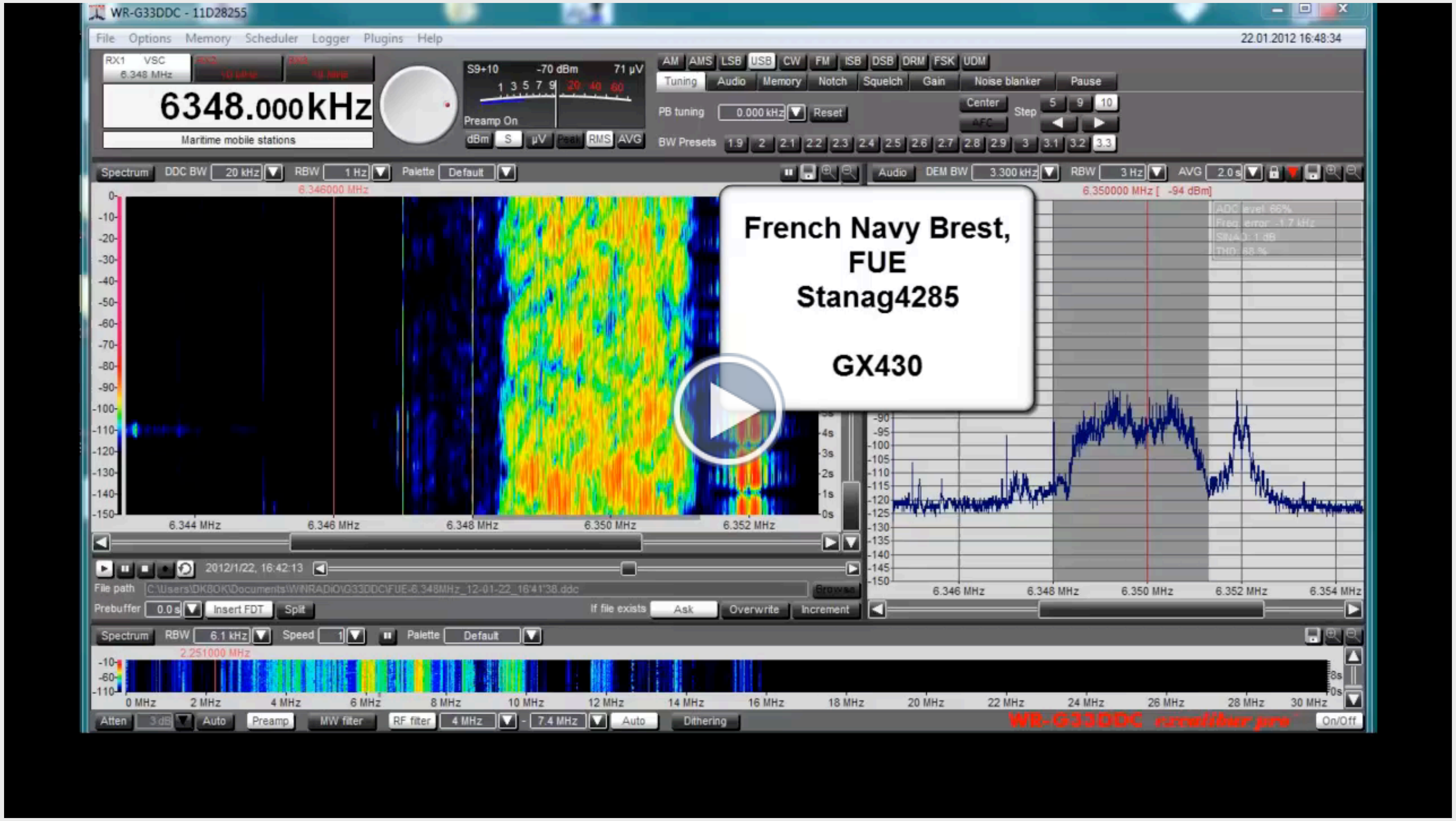
Copy of the weak ALE signal on 556,820 kHz out of Al-Kut/Iraq: first the signal, then decoding with Code3-32P, Krypto500 and W-Code. Krypto500 performs best.

Comparison 2: Weak GW-FSK signal



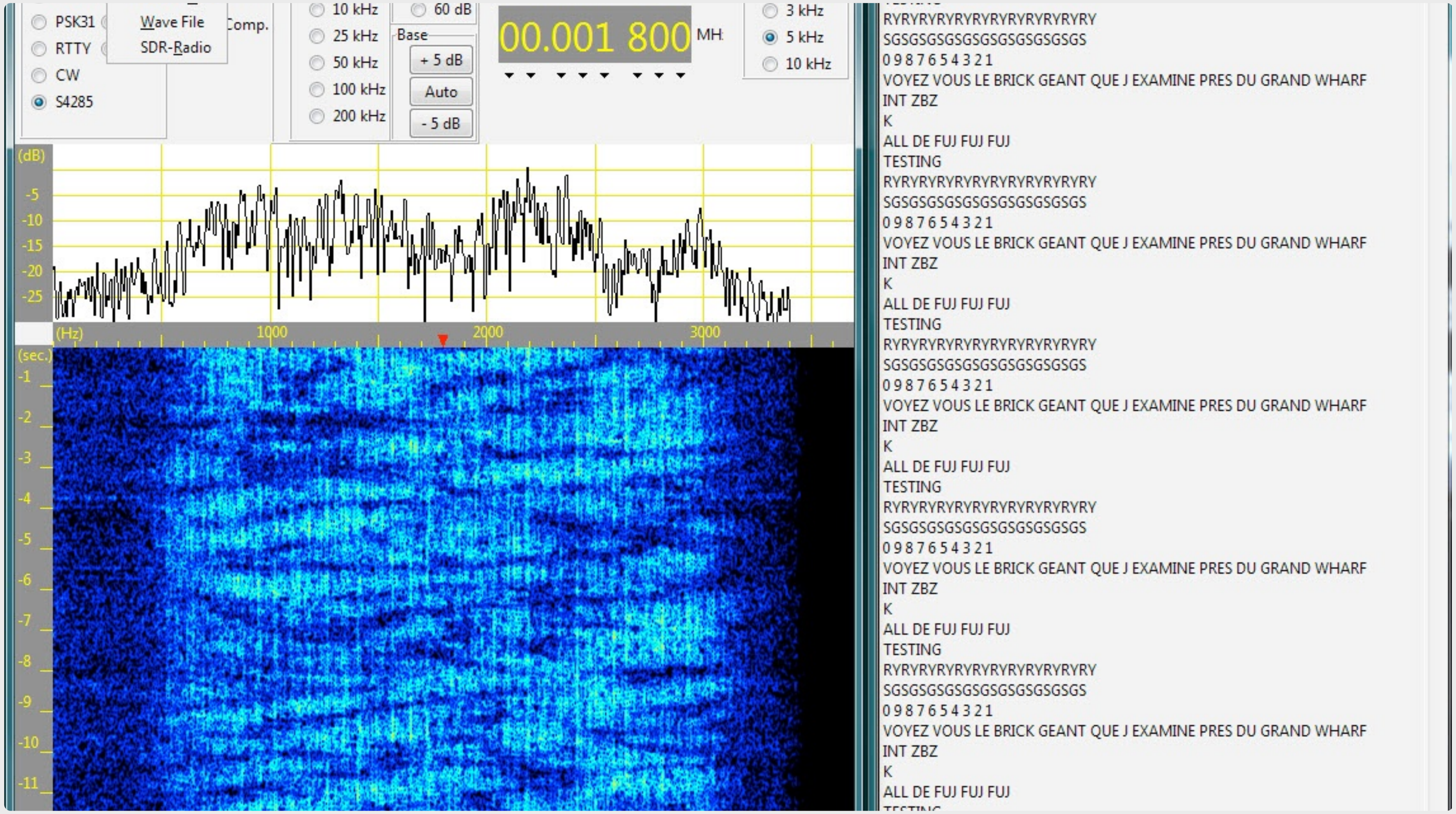
ZSC Capetown on 19692,5 kHz: Code3-32P, Krypto500 and W-Code. Krypto500 delivers fastest aquisition, followed by W-Code. Also Code3-32 P gave perfect copy, but a bit slower.

Strong STANAG4285 signal



FUE Brest on 6348 kHz in STANAG4285, strong with only slight multipath: GX430 (no decoder, but fast acquisition), Krypto500 (fast and clear decoding), Code3-32P (fast classification, slower start of nevertheless clear decoding).

STANAG4285, modest signal, strong multipath



This signal of the French Navy at Noumea/New Caledonia on 16956 kHz shows heavy multipath, placing the hardest nut to crack for all decoders. Only Sigmira (above) produced a fluently decoded output - as on the right, whereas ...