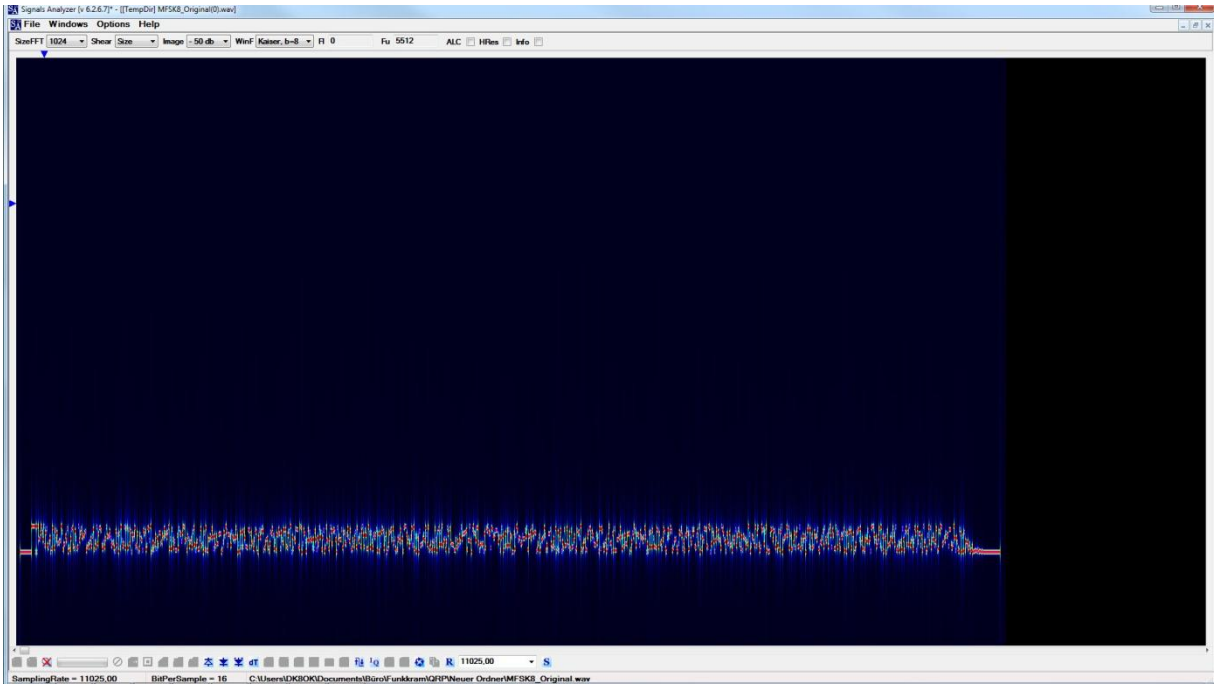
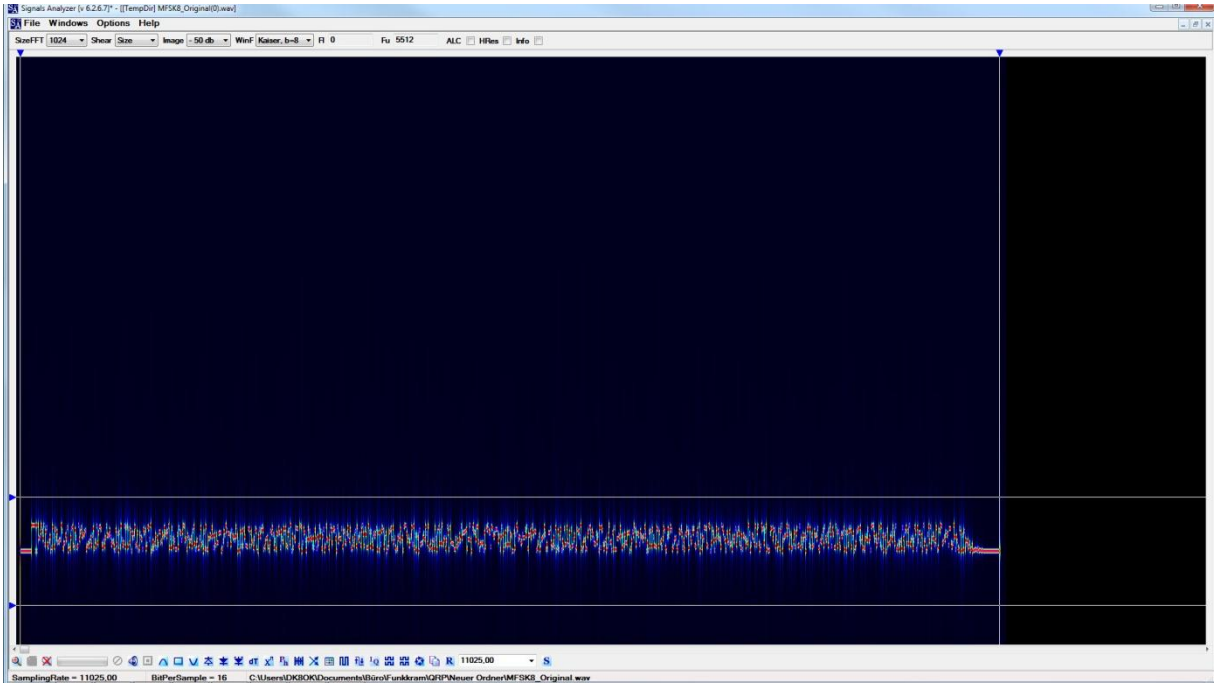
Signals Analyzer – some Examples, Step-by-Step [to be continued]

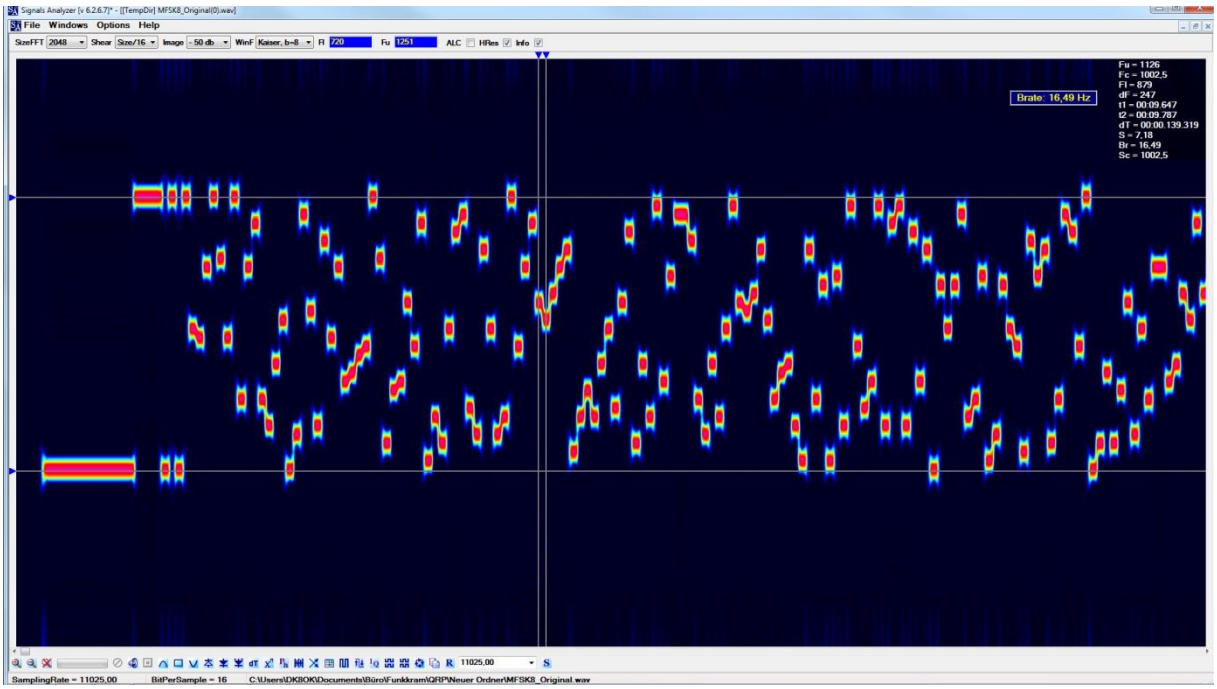
1. → Open the WAV file with SA (File > Open file…)



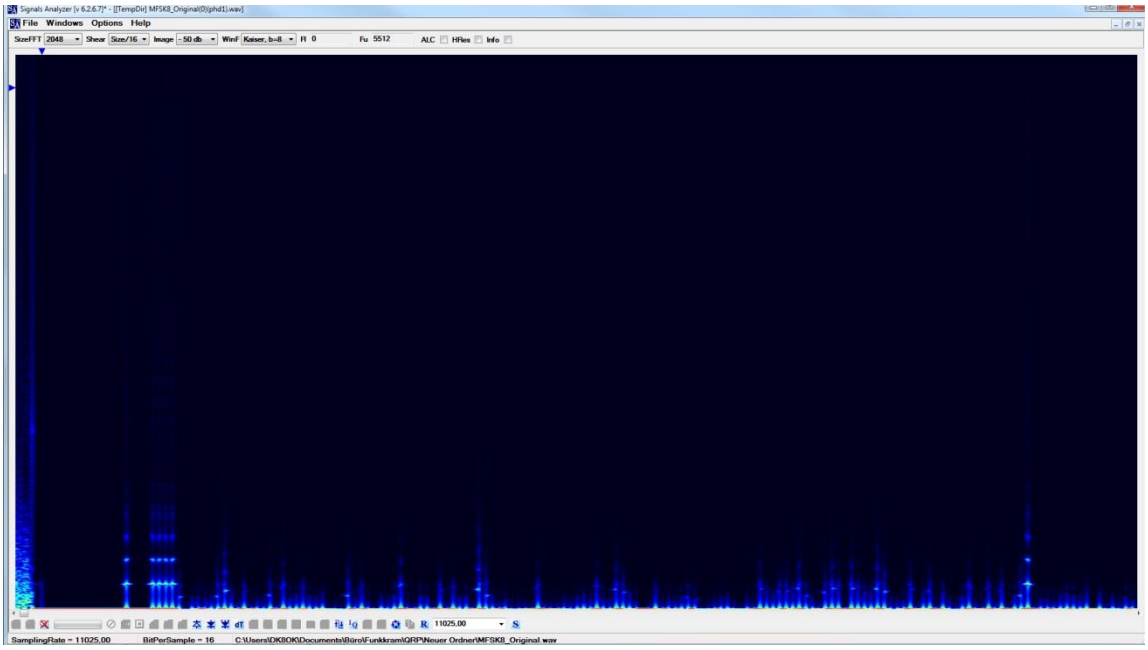
2. → With the left mouse button pressed, “frame” a part of the signal.



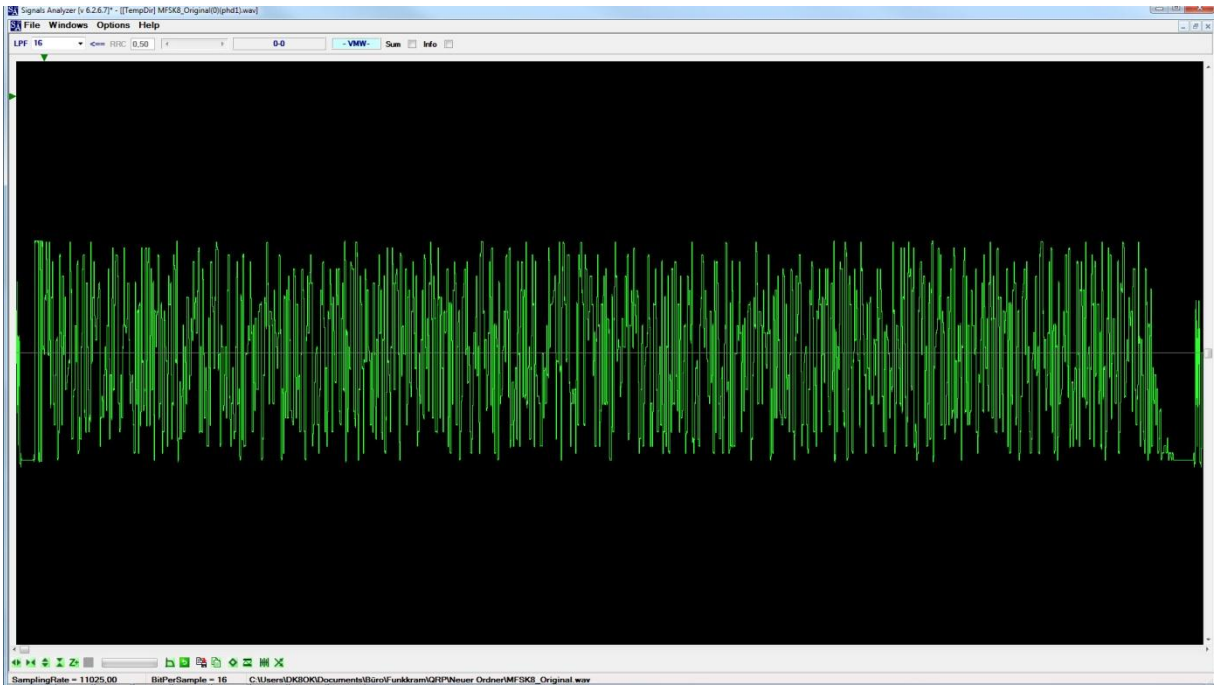
3. → Trim the signal with „Size FFT“, „Shear“ „Image“, „ALC“, „HRes“ in the upper part of the window and „+“ and „-“ on the lower left.
   → Place the rulers to measure the bandwidth of the signal and the time of one element.
   → Click “Info”, and those information will appear in the upper right: e.g. 247 Hz width, one element measured with 139,319 milliseconds.
   → Click right mouse button, and then in the menue “Auto define parameters”. This will calculate the bitrate (“Brate”, here 16,49 Hz).
   With “MFSK”, also the space between the tones (in Hz) is automatically calculated and shown (“S = 7.18”)



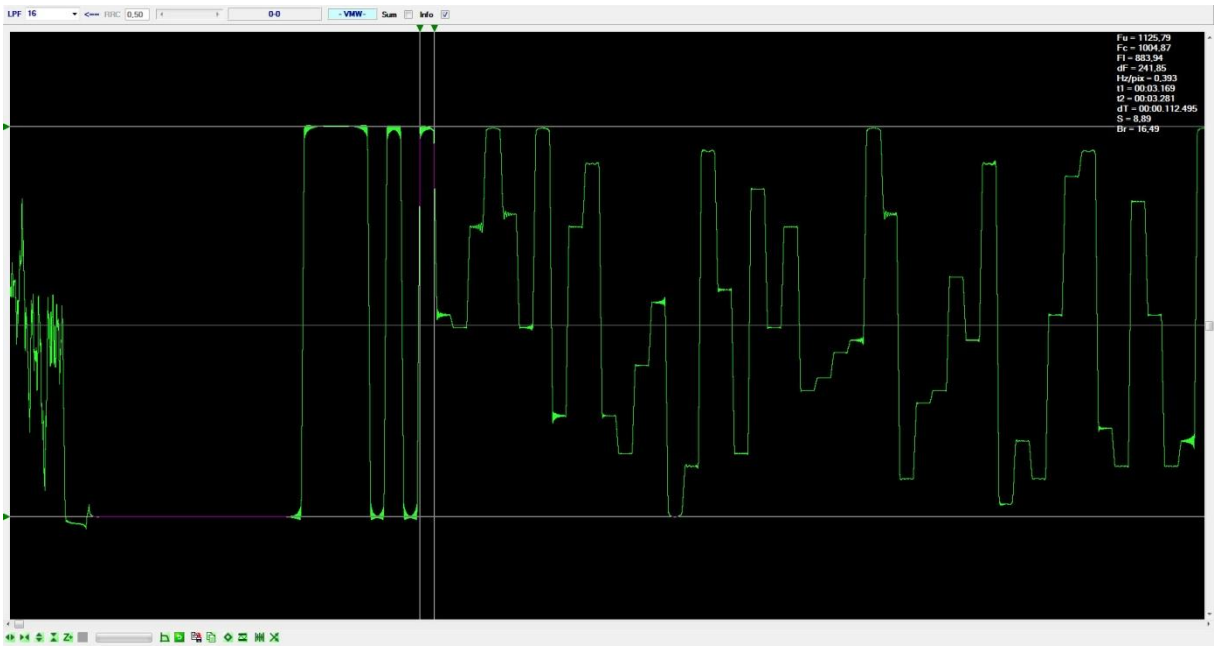
4. → Click the icon “Phase detector” in the bottom and …



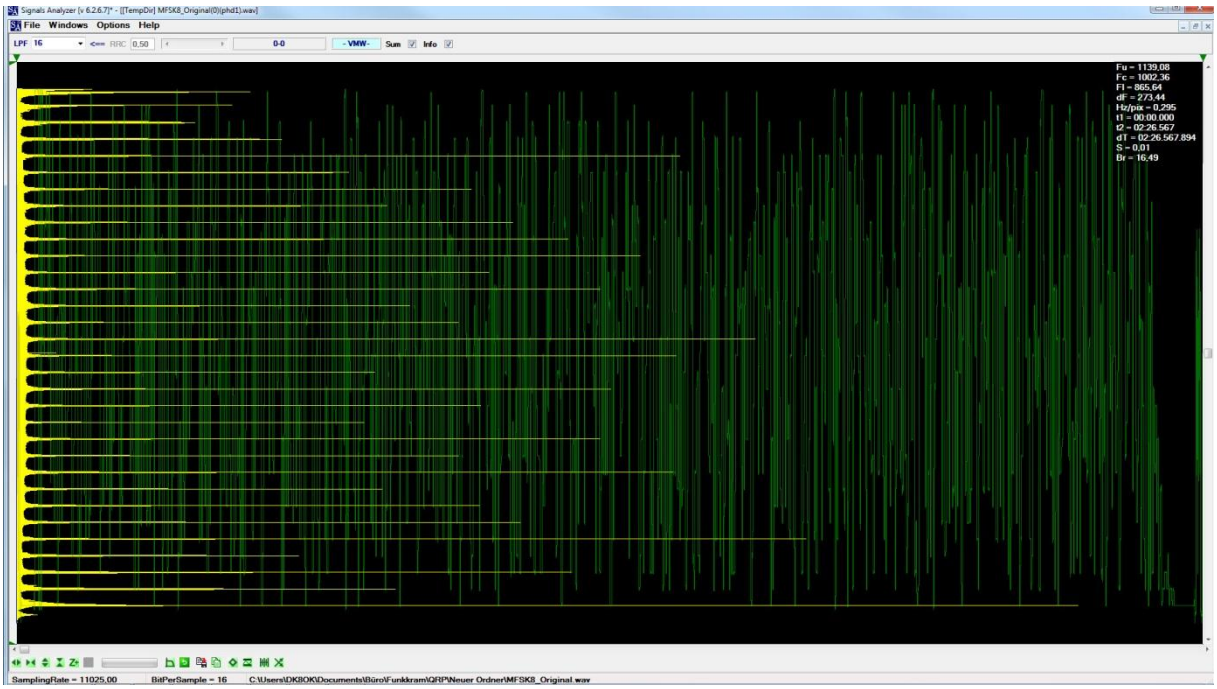
5. → … click right mouse button to open a menu.
   → Click “Wave Form module” in this menu.
   This will show precisely each tone …



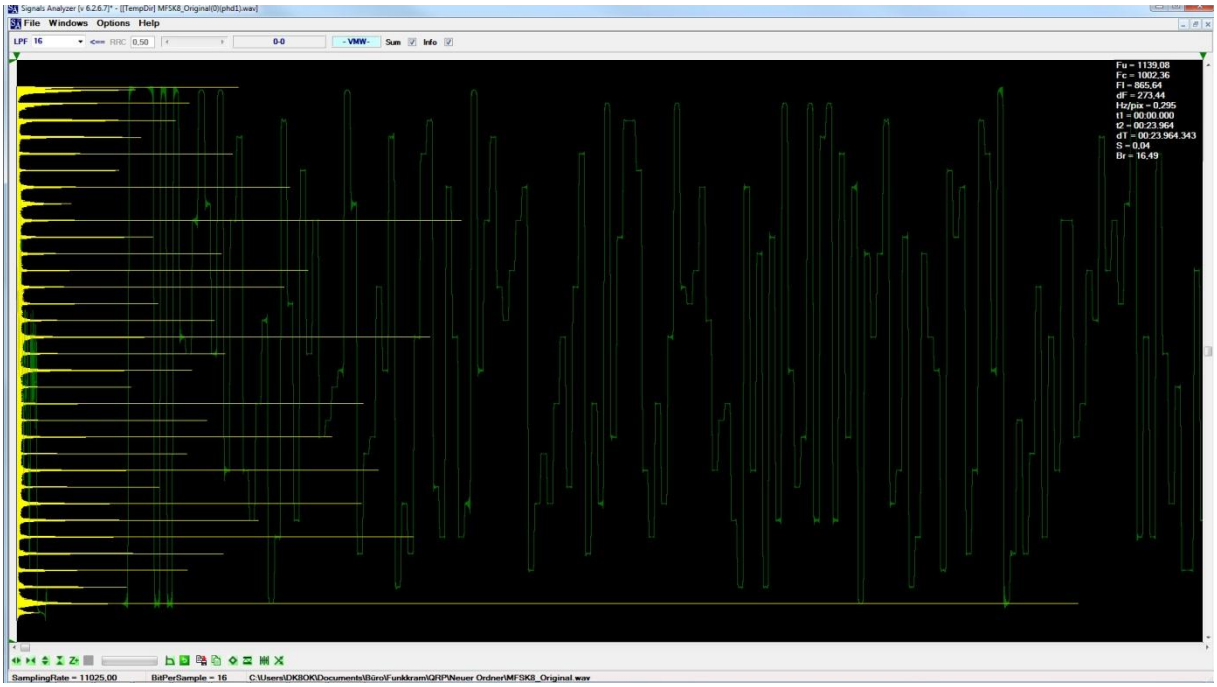
6. … which can be better seen, when magnified vertically and horizontally, etc.



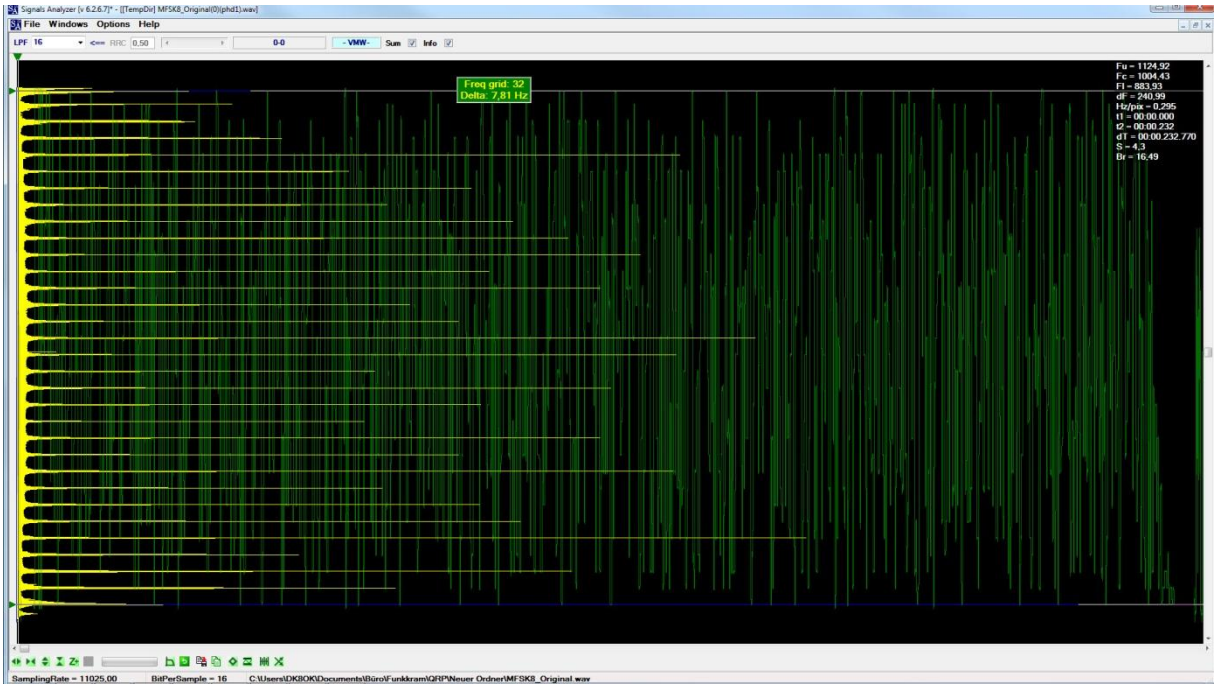
7. → Change back from zoom to previous scale.
   → Click “Sum”. This will add a vertical diagram, showing each tone, and it’s number of occurrences by the length.



8. This magnification will show the principle.

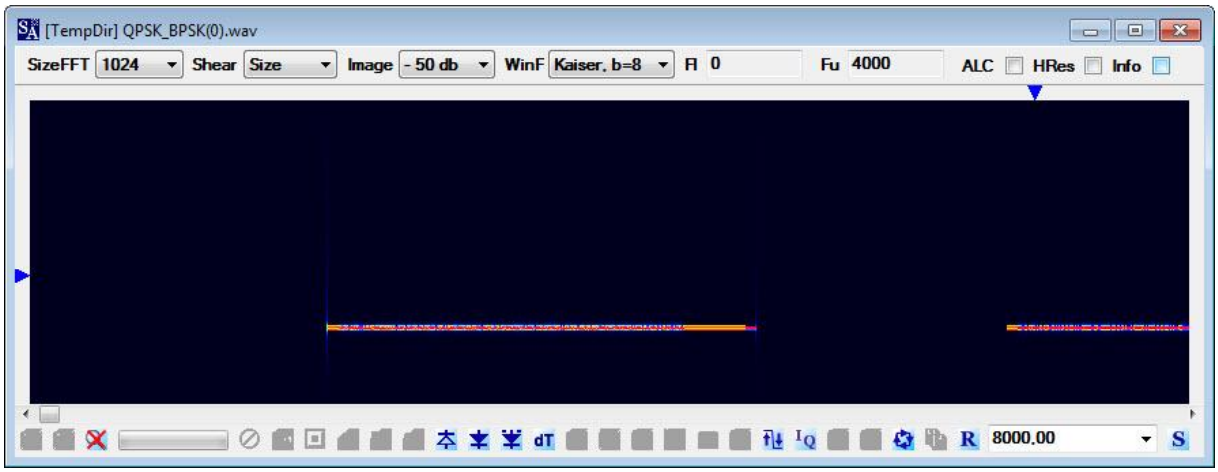


9. → Place one frequency ruler on the highest peak, and the other on the lowest peak.
   → Open menu with right mouse click, and click “Count freqs”. This will show the “grid” number (i.e. the number of tones, being “32”), plus the difference between each tone in Hz (7.81 Hz).
   During these measurements, the Hz/pix value should be around 0.5 to 0.3 (here: 0,295).

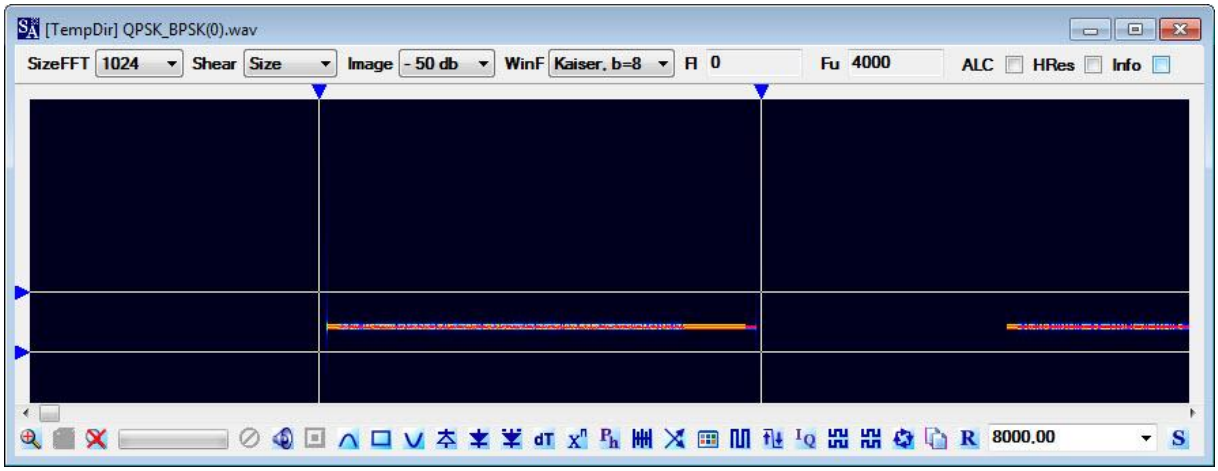


Analyzing an (Q)PSK-Signal

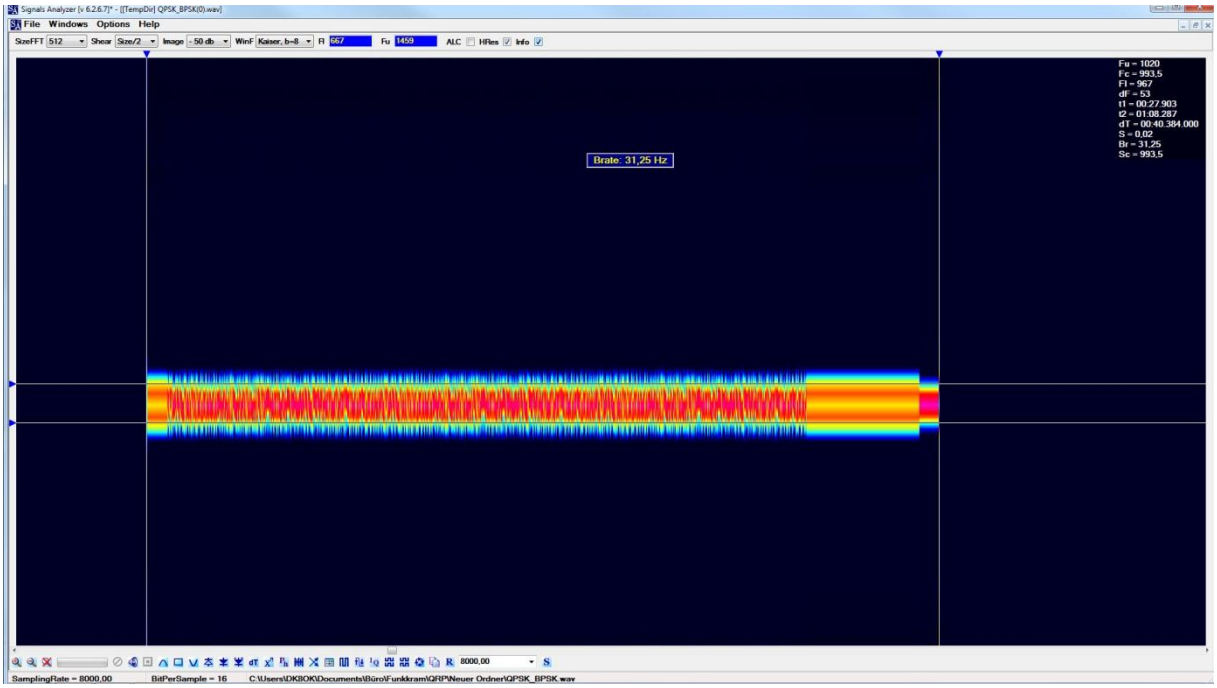
1. → Open the WAV file with SA (File > Open file…)



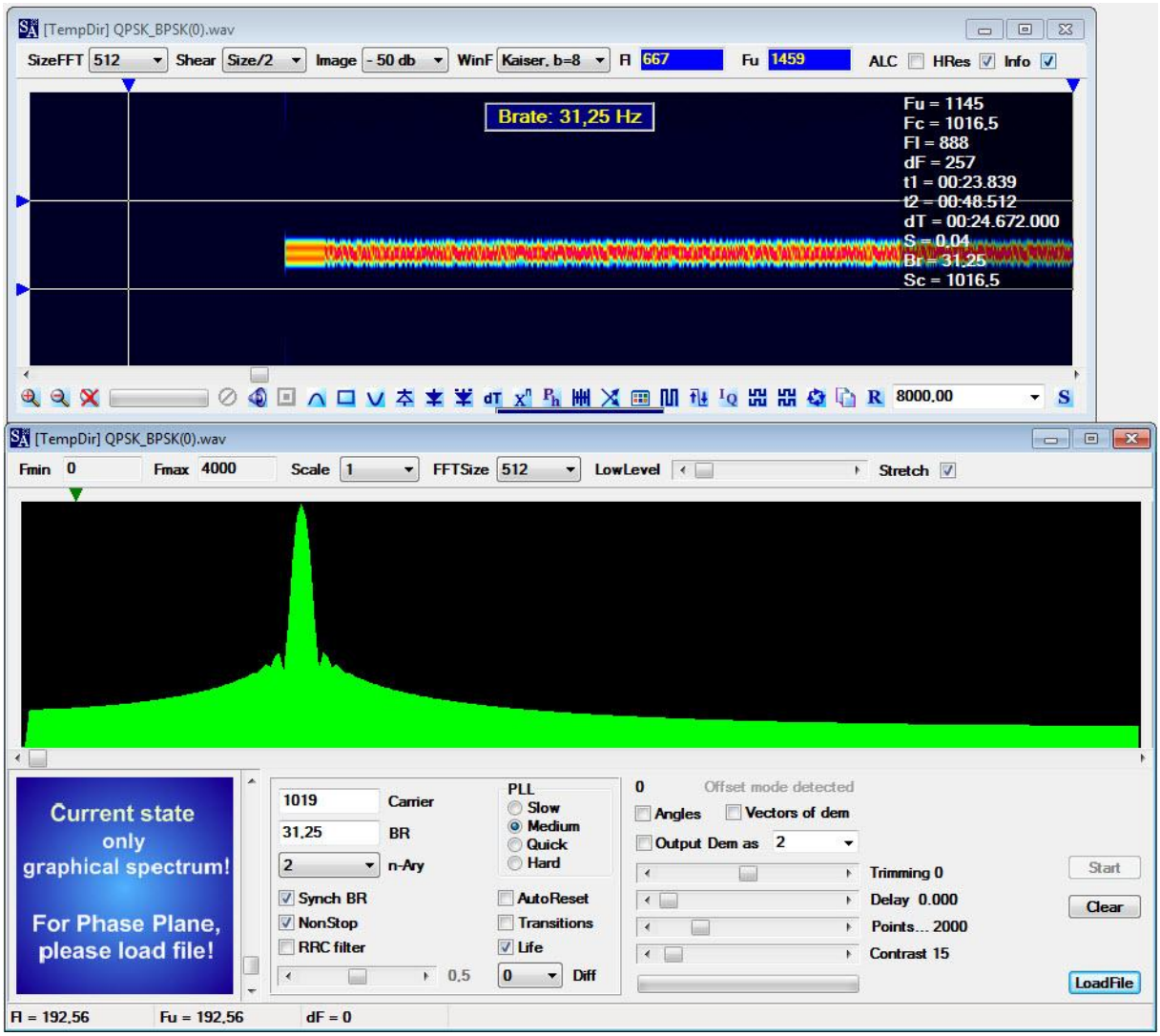
2. → With the left mouse button pressed, “frame” a part of the signal.



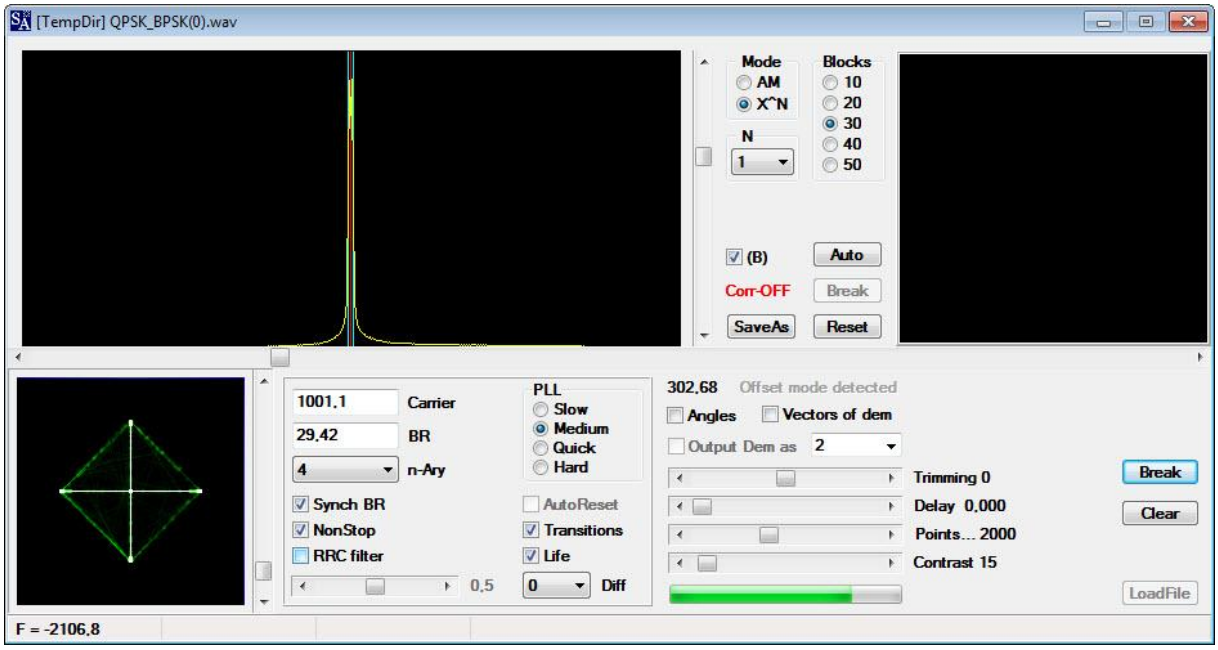
3. → Trim the signal with „Size FFT“, „Shear“ „Image“, „ALC“, „HRes“ in the upper part of the window and „+“ and „-“ on the lower left.
   → Place the rulers to measure the bandwidth of the signal and the time of one element.
   → Click “Info”, and those information will appear in the upper right: e.g. 53 Hz width, one transmission measured with 40,384 seconds.
   → Click right mouse button, and then in the menue “Auto define parameters”. This will calculate the bitrate (“Brate”, here 31,25 Hz).



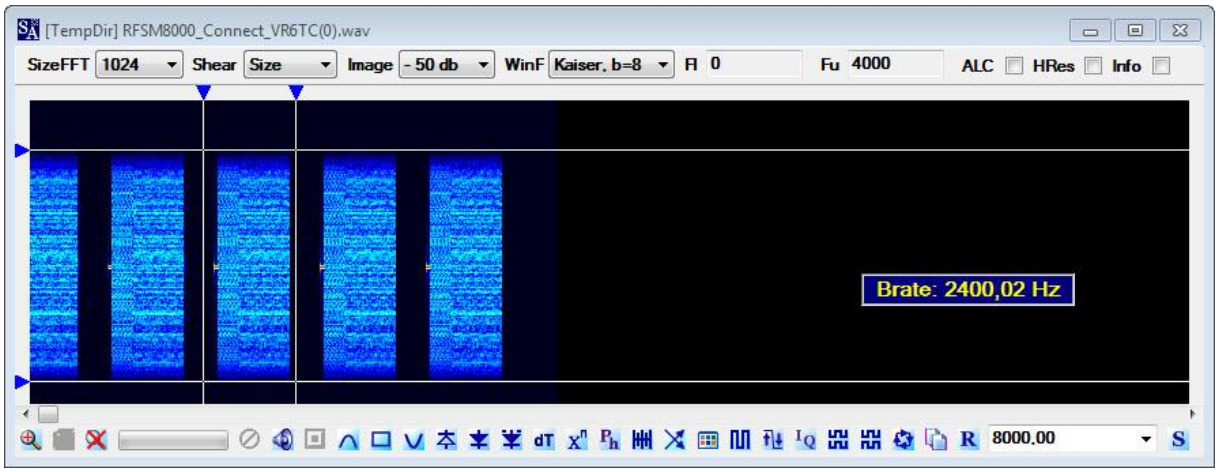
4. → Click the icon “Phase plane” in the bottom. This will call the first window, where carrier frequency (1019 Carrier) and bit rate (31,25 BR) are automatically set. Click “LoadFile”, and select that file you want …



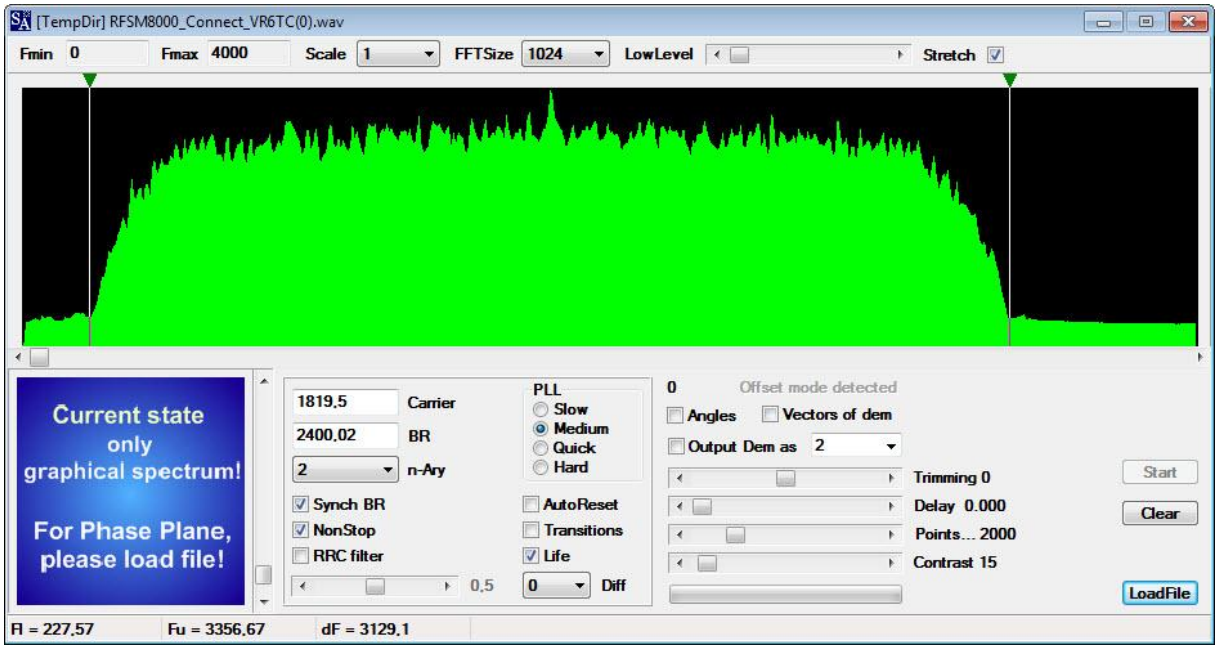
5. → … click “LoadFile”.
   → Choose from menue “n-Ary” the most probable number of phase (change them, if you don’t get a clear picture).
   The phase plane can be seen in the wind at the bottom left, here QPSK with four phases (4-PSK), and “transitions” between phases clicked.



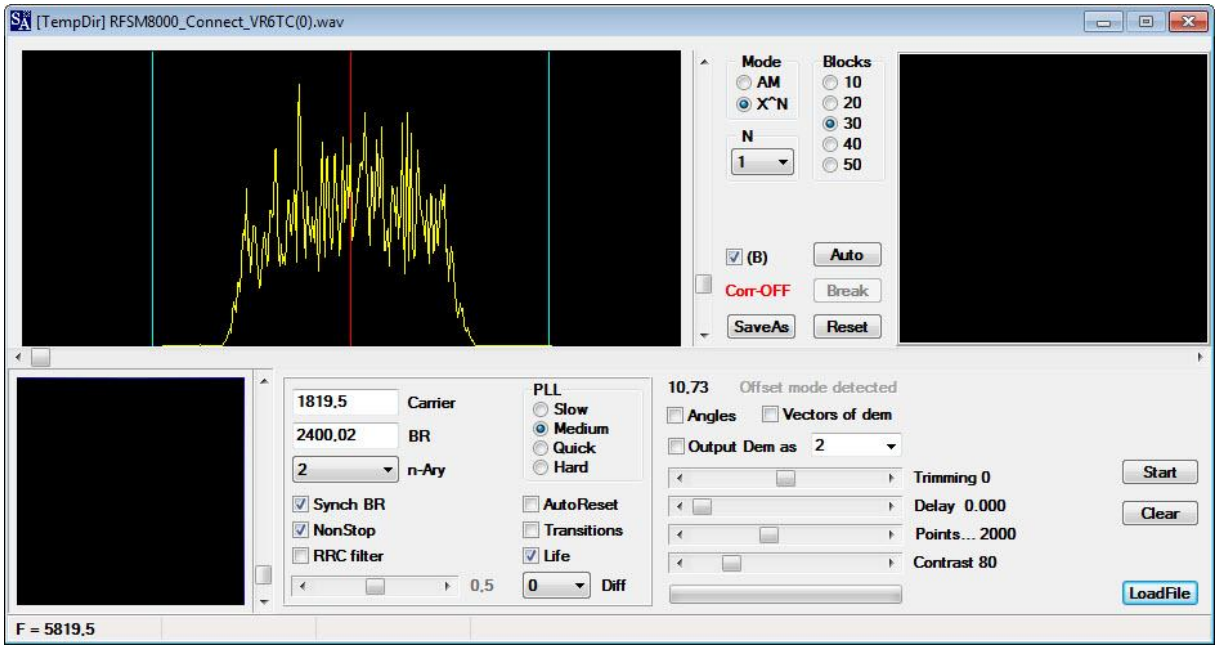
6. With a broad signal, you also start with “framing” and measuring of bit rate (2400,02 Hz).



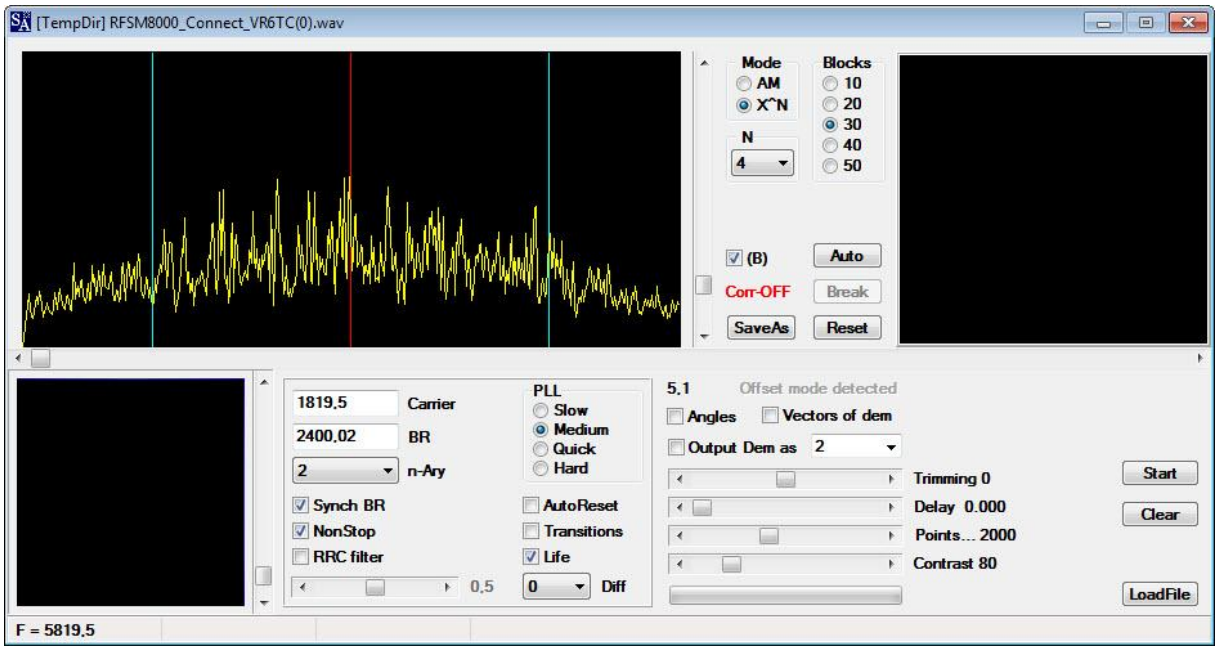
7. → Click “Phase plane” in the bottom.

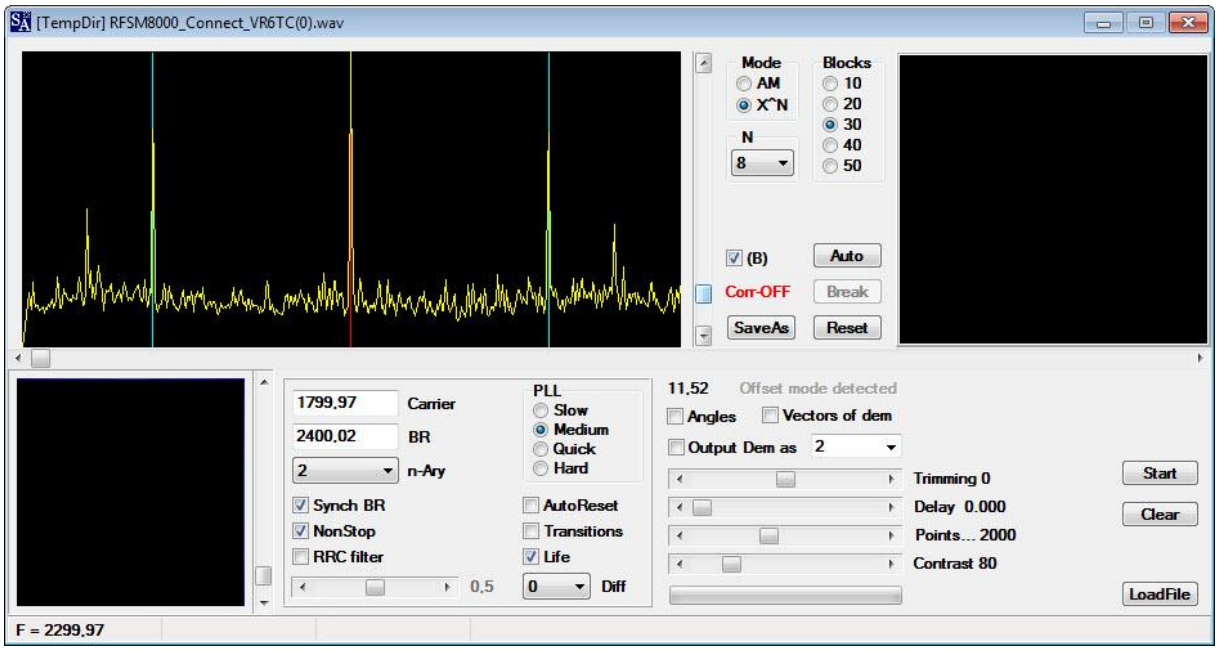


8. → Click “LoadFile”. You won’t see one clear peak of the carrier with its sidebands in the window.

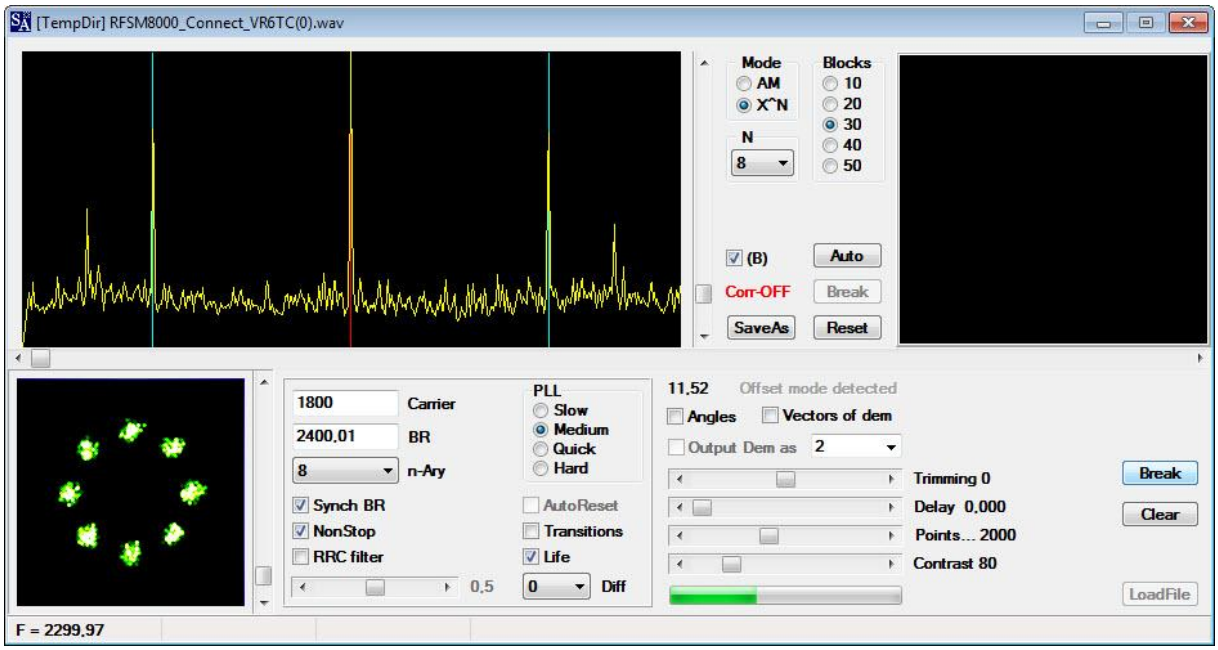


9. → Change “N” (above right) from 1 to a number, which presents you with a clear peak and its sidebands. Here you eventually end after “1” and “4” at “8”. Thus, this is an 8PSK signal.



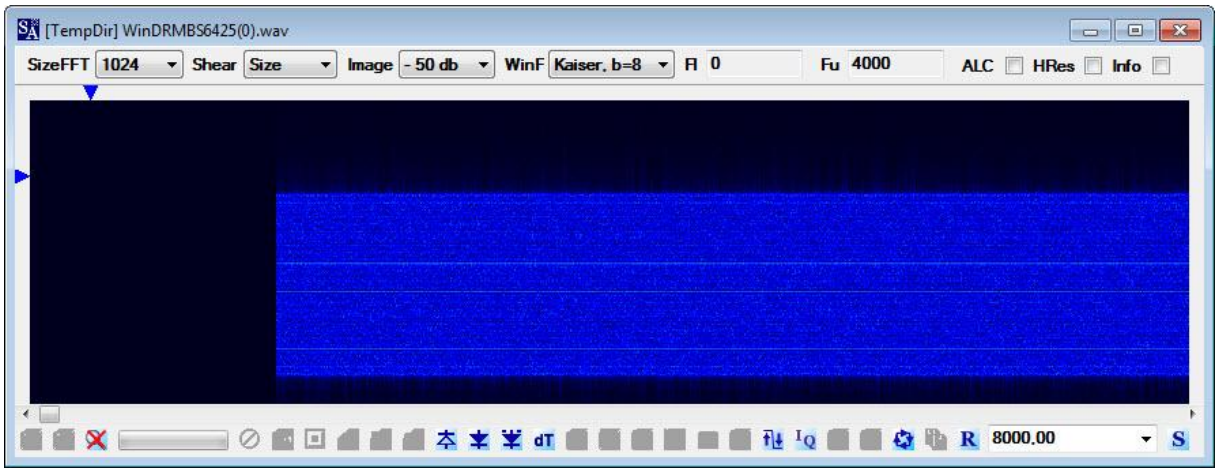


10. → Click “Start”, and the phase plane show eight phase states – here without “Transitions” being clicked.

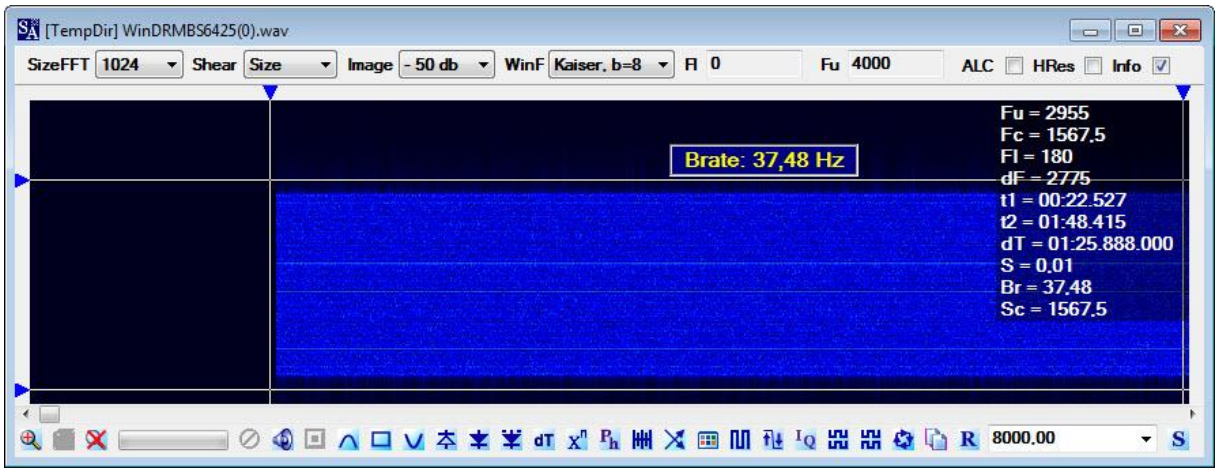


Analyzing an OFDM-Signal [WinDRM, 64PSK]

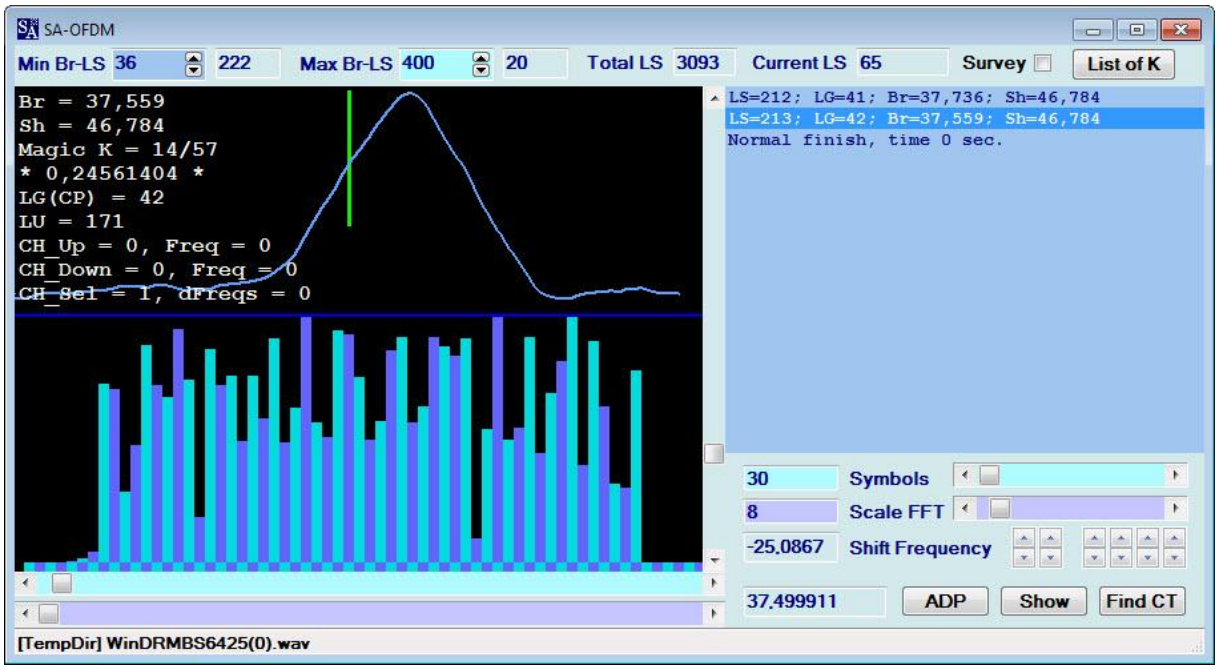
1. → Open the WAV file with SA (File > Open file…)



2. → With the left mouse button pressed, “frame” a part of the signal – not too tight with the frequency rulers, as then one later gets a wrong bit rate!
→ Click right mouse button, and then in the menue “Auto define parameters”. This will calculate the bitrate (“Brate”, here 37,48 Hz). Click also “Info”.

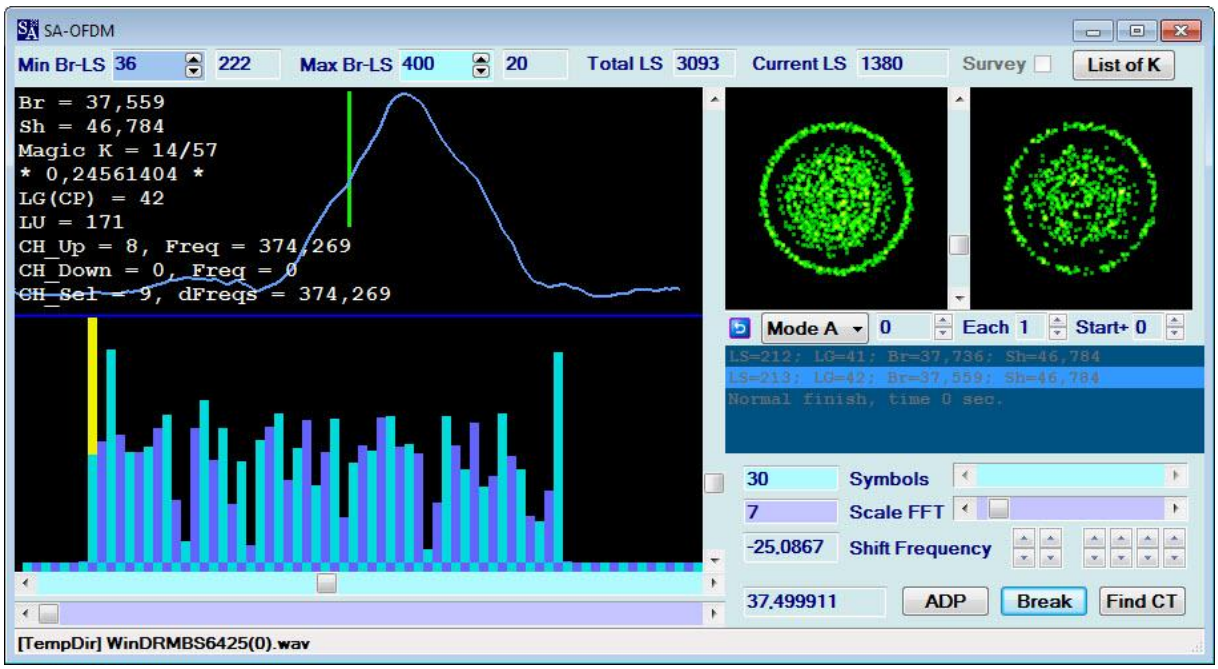


3. → Click “OFDM”-module.
   → Click “Find CT”.
   → Click “ADP” to find exact baud rate (here: 37,559 Bd, shift 46,784 Hz).
   → With the sliders, trim both the left windows so as in the picture below. Use also slider “Scale FFT” to fully see all channels.

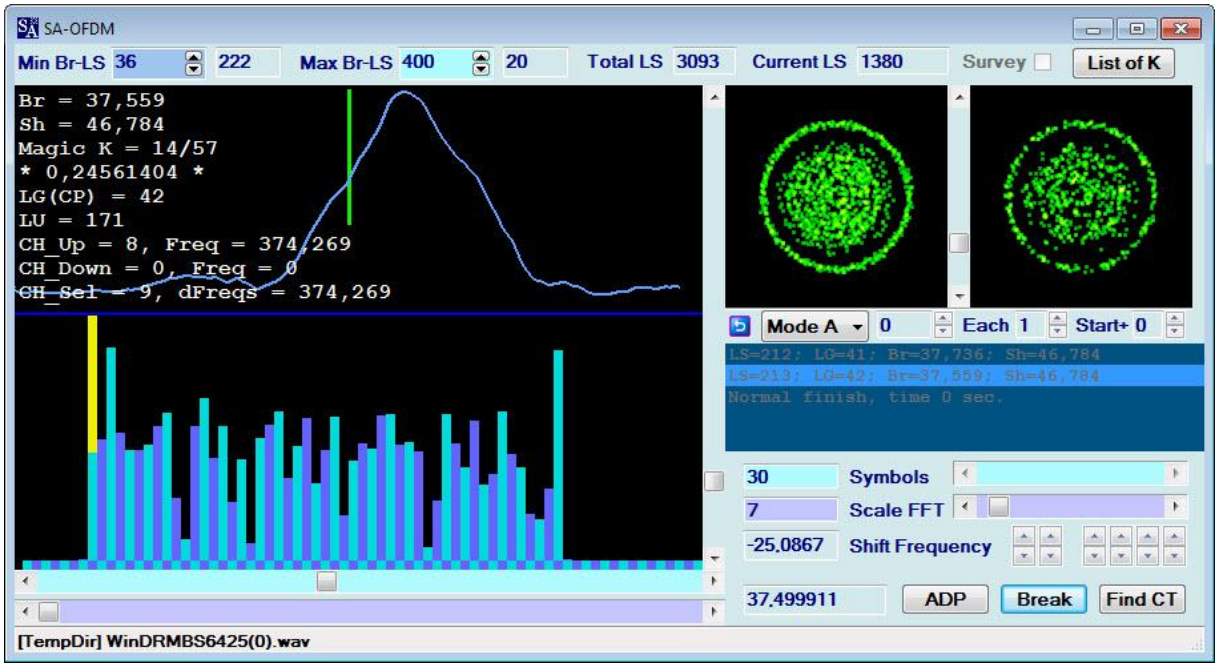


4. → Click with the left mouse button into the first channel, which will be prolonged in green.

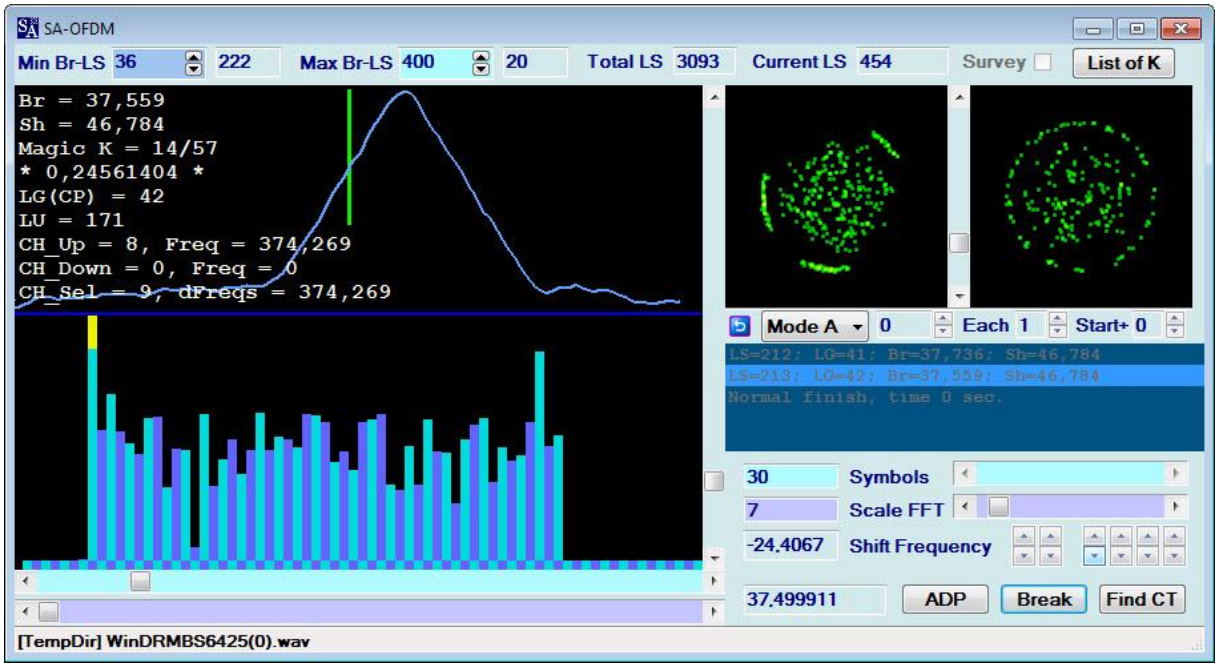
5. → Double-click the last entry in the upper right window (here: “LS=213; LG=42 …) , and the phase plane will appear.
   → Click “Show”, and the phases will build up.



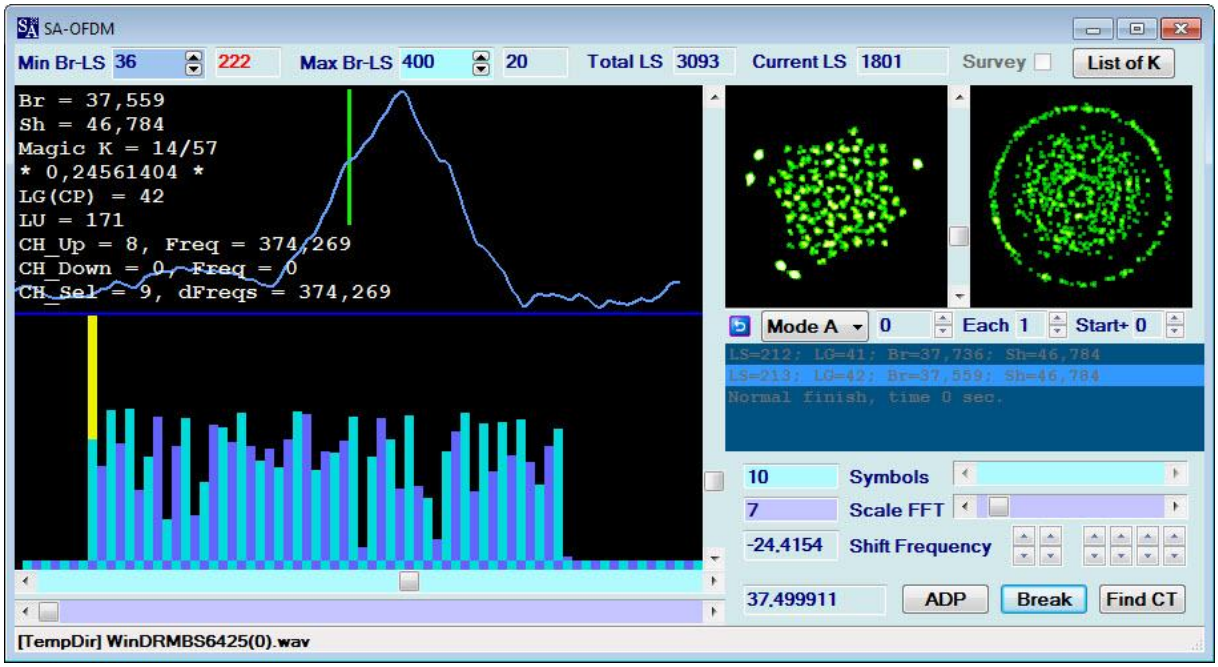
6. As the “Shift Frequency” (here: -25.0867 Hz) is just calculated by the software, it has to be *corrected manually and very carefully* in almost each case to get a stable phase plane. This can be a bit tricky. But this picture tells that you are approaching the correct value …



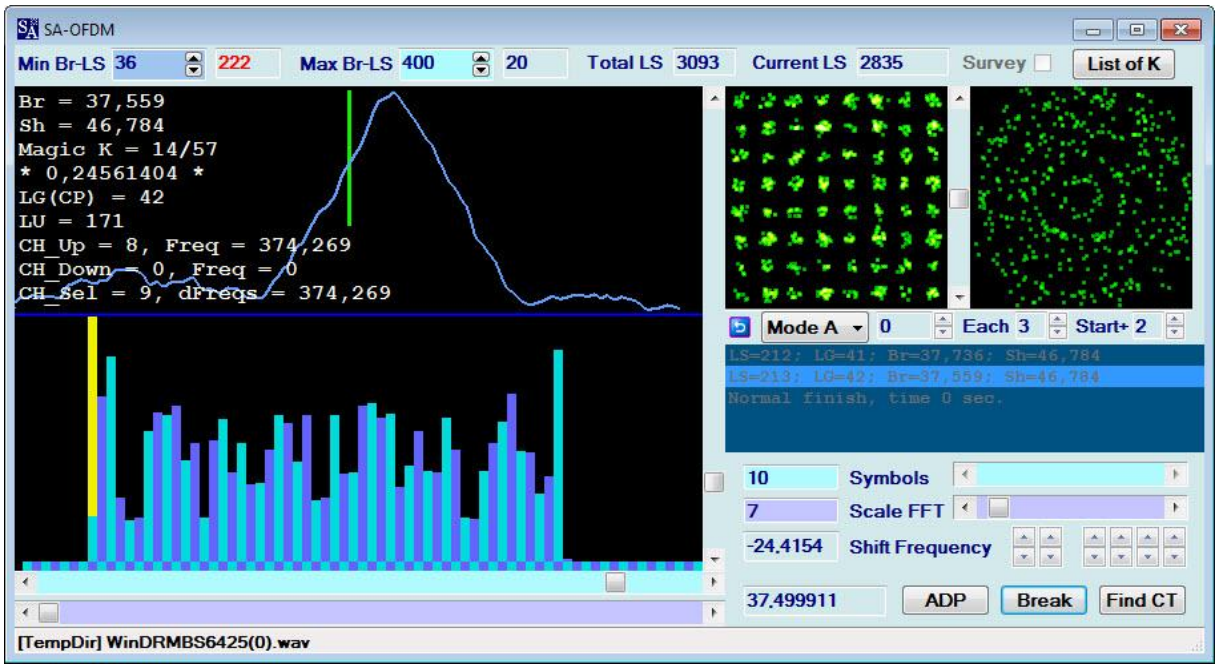
7. … further and further …

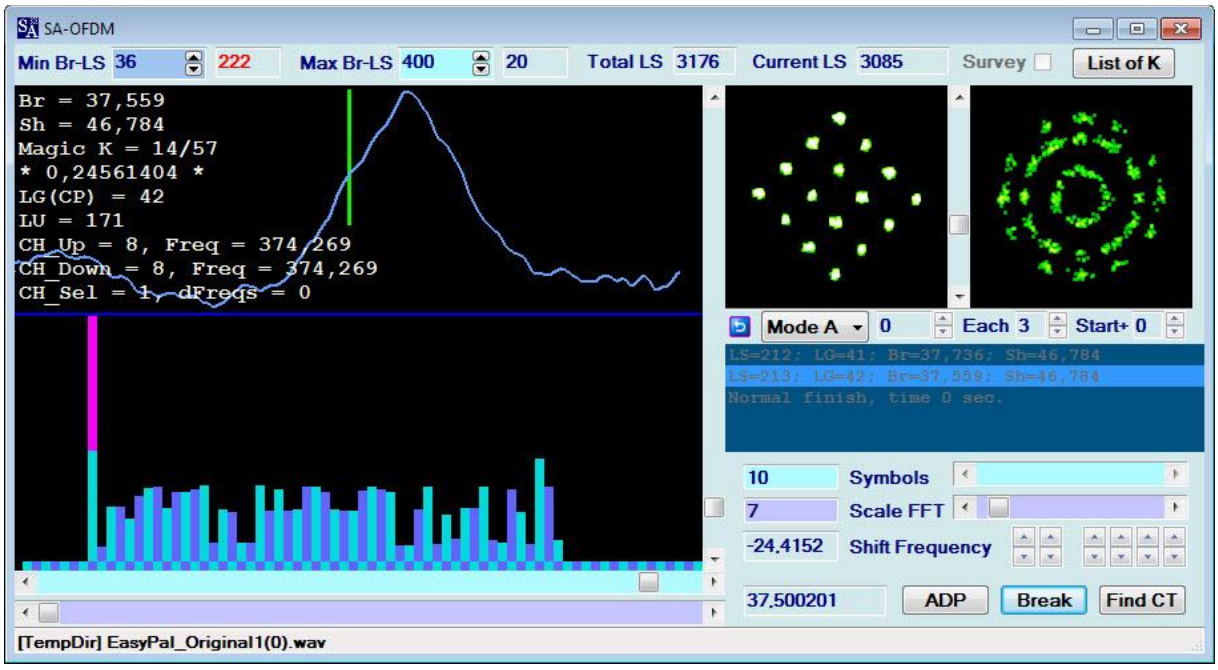


8. … until reaching a steady phase plane like this.
It shows a star-like center (main data) plus five outer phases for synchro etc.



9. → Change “Each” and “Start+”, until you get a steady phase plane as shown below. Thus, this is a 64-PSK signal.





16-PSK (WinDRM)