Birth of a new digimode: SIM-PSK31

Since end of september 2012 is born a new program named SIM-PSK31. It's using BPSK phase modulation and was made freely available for the ham radio on the web page
http://www.on4nb.be/sim31.htm
This program was conceived and designed by an from OM Tunisia : NIZAR BEN REJEB.
He holds a title in Electronic Engineering and a Masters in Computer Science.
Nizar began to focus on the principles of digital transmission and mainly the phase modulation, 28 years ago already.
When he discovered the PSK, he regretted the bad presentation and unreliable texts obtained, due to bad propagation, QRM, QSB and other noise which alter the audio signal.
His obsession became to improve its favorite mode: PSK31, and this is what led to the birth of the SIM mode.
The acronym "SIM" was chosen due to the principle that he imagined:
As the characters were coded by 1 and 0 levels, why not code the same way, entire words or even whole sentences which are most commonly used in ham-radio transmissions ...
In fact, this principle is only that the continuity of the amateur spirit that animated the marconistes when they invented the Q code to simplify and speed up communications in Morse code ...
It is this thinking that gave birth to the "structured messages, integrated BPSK"
⇨ S I M pour **S**tructured **I**ntegrated **M**essage BPSK31.
The benefit of this principle is to transmit any embedded message in a very short time, just the time needed to send few control characters...
On one hand, the time savings can reach from 1 to 5 or more, depending on the "weight" of the structured message to be transmitted, and secondly, the message can not be altered by bad conditions of propagation, since the message is included into the program present on each one of the PCs, at the transmission and reception side.
Of course some windows for "Chat" mode are planned to avoid limiting the freedom of the amateur, so it is possible to choose your own messages, and even have a full discussion.
(Remark : chat doesn't mean full duplex !)
A few years ago, Nizar began to create small independent modules. The first goal was to practice and test his basic knowledge of the digital data processing by computer, A few years ago, Nizar began to create small independent modules. The first goal was to practice and test his basic knowledge of the digital data processing by computer, then to create his own development tools.
He wanted to simulate the operation of a new digital mode, as it would have done at university, when he was engineer student.
Nizar therefore began by creating two separate modules, one to simulate and generate a "wav file" , the other would allow to decode in real time that audio signal..
The coding used for his tests was very long, 16 bits per character in text mode only.
In theory, everything seemed ok, but when Nizar wanted to decode a real reception PSK31, the decoder was not able to decode due to various problems on the received signals, and which he had not considered ... binary shifts, frequency glidings , phase noise etc.
Therefore, he was first necessary to obtain correct operation when decoding PSK31, before trying to improve it. This is why the mode "PSK31" was integrated from the start in the SIM-PSK31 program.
In tests that followed, Gaussian noises have been mixed with WAV sound to get closer of real conditions, and gradually things have evolved until the present form of the software SIM-PSK31.
But to obtain that, the varicode had to be completely modified, to make it less sensitive to noise and QRM !

What makes the SIM mode much more efficient than others existing codes BPSK is due to the next points:

- ➢ Choosing a varicode: less sensitive to noises by the use of interleaved fields
- ➢ Error Correction: The BPSK is here reinforced by a FEC (Forward error correction). It corrects a number of errors due to a binary corruption, and ionospheric distortions ...
- ➢ Use of a digital squelch which analyzes the coherence of the signals. It compares the probability of a correct decoding of the received signal, by comparing with a binary coding in accordance with the SIM varicode adopted, instead of working on an audio analog level.
  That choice allows to decode very weak signals, embedded in noise, and sometimes undetectable on the audio spectrum or on a waterfall. This may occur when there is a deep QSB.

Through to these innovative ideas, the program has already convinced more than 1200 stations around the world in less than a month!
It is now available as a free download since end of september on the web page www.on4nb.be/sim.htm
The positive feedback received show that the results are already very appreciated by users ; but of course, there are still improvements to do.
First, there are new ideas sent to us from ham radio, and changes asked in functionalities. We try to achieve it when there is a benefit to the program, or if it increases flexibility. .
Very soon, the SIM-PSK31, will probably receive a more friendly interface, and the integrated messages list will be improved.
yes, believe it, Nizar will not stop there, there are still developments in perspective !

Since the early trials, Nizar could count on several Belgian ham radio ready to develop and test SIM mode :
At first it was mainly ON2TSF, Bernard whom began as a pioneer, before being joined by several others OM's . Here are the most active: ON7TV Michel, ON5DVO Didier, ON6LP (EA5GVJ) Paco and myself, ON4NB Dany whose website provides an updated history on a daily basis and some help files.

A webpage is dedicated to downloading updates, and these pages are in French and English.
Since mid-October, two other stations : F4VOT Luc and ON3VMC Vincent, have installed a cluster dedicated to the SIM mode.
Since version 5294, the program also has a feature that reports all "SIM traffic" in real time to PSK-Reporter . the presence of the station in SIM mode, is then broadcasted and it lets you know at the same time instantly where you are received.
In some time, the program will reach its maturity ; So, Nizar has already an another project :
When he will no more have to spend all his time in programming, he is decided to abandon its SWL status and to get his ham radio license.
He could test by himself the SIM mode and answer your calls.

Aspects of the program:

I have already mentioned above some technical aspects of SIM, and what led Nizar to this concept, but compared to other programs PSK, this mode has also several interesting advantages that you might discover by yourself using the program :
For example, the SIM-PSK31 does not use the usual waterfall; the received audio signals are represented by peaks, displayed on an audio spectrum, calibrated in frequencies.
The audio spectrum width, having about 3 KHz , covers all the SSB receiver bandwidth.

When you click on a peak, the program will automatically center the cursor on the correct frequency of the selected signal.

A mode "Split" still allows you to transmit on the same frequency, even if during the reception you have to follow your correspondent whose frequency is gliding.

Then the "eye diagram" helps you, showing if it is really a BPSK decodable signal .

In fact, the software SIM-PSK31 is the only program which is displaying on the side of audio spectrum an "eye diagram", by which you can get instantly useful information about the validity of the received signal :

> Signal Type : conformity of modulation, PSK, QPSK, FSK, etc..
> Speed : Compliance of bitrate, 31.25 Hz ... 62.5 Hz
> Accuracy : bit synchronization, immediate detection of a drift on the diagram. ....
> Monitoring : decoding quality, visible distortions in place of straight lozenges
> Diagnosis : identifying defects
>

You will find hereunder in appendices, a few screenshots demonstrating the features that make from SIM-PSK31 an ideal educational program .

thanks to the eye diagram, it allows to explain, through the easiest phase modulation (BPSK), the basics of digital techniques to students, to students or members of a club radio, who want to learn about digimodes.

The program requires no installation, so it can be easily adjusted ; just a few parameters to set up, then click on a crest and here is how appears a correct screen in mode SIM-PSK31 :
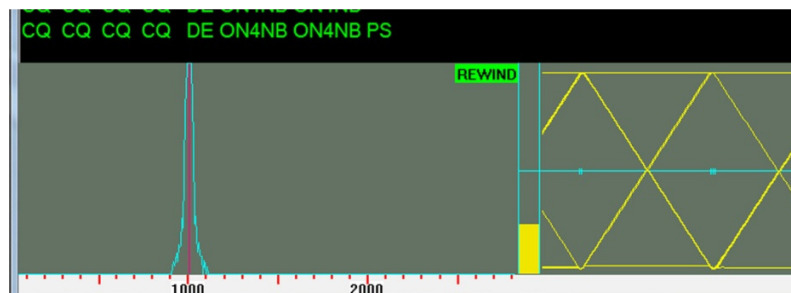
Many PSK users often have their habits . Each one has its own program and considers it as the best, simply because he knows it better than others ; but the SIM-PSK31 software is open, in which we try to adapt the features suggested by users.

 So in trying to meet the demands, this program could be adapted to each usage for daily use...

In other more specific cases, eg. contests, the SIM mode being quite new, it is probably not yet usable, due to the too reduced number of users. (currently less than 1,700 of which are also SWL), but the time savings that can bring the mode SIM is an attractive argument that could be a valuable ally in future contests. Therefore nothing would prevent to add a macro "special contest", in which all the details are structured as a single message, thus promoting the rapid transmission, robustness in difficult conditions, ease of use, but conforming to the protocol used in the Contests...

finally, do not forget that the messages list remains open ; it can change according to your requests.

But of course it's important for the program not becoming too heavy with endless lists of messages...

Publication based on an original text and with agreement of Nizar Ben Rejeb.

With 73's of the team's testers : ON2TSF, ON7TV, ON5DVO, ON6LP (EA5GVJ) ON4NB

Formatting and translations: ON4NB

ANNEXES :

SIM-PSK31 is the only software that includes an "eye diagram" allowing you to control :
- ➢ The presence of lozenges confirms that it is really a PSK mode.
- ➢ The frequency is correct (cursor centered) no interference.
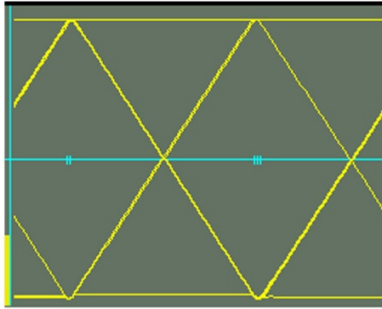- ➢ Good binary synchronization signal (diamonds do not slip)
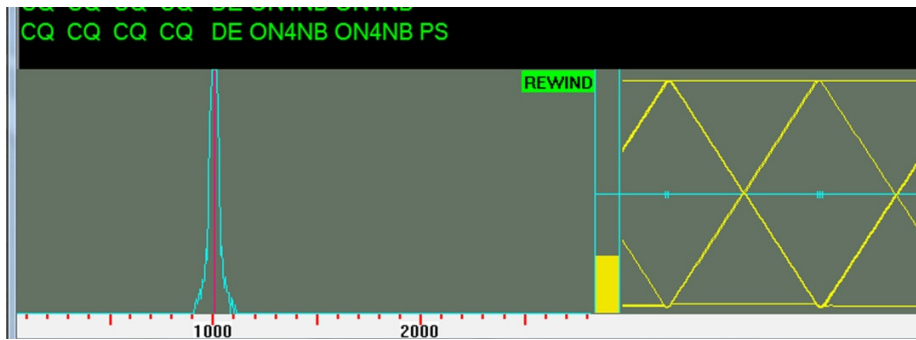
- ➢ Presence of noise on the signal ... (bad signal despite strong audio level diagram)
- ➢ Due to the noise, the program SIM-PSK31 indicates by mistake an incorrect mode "PSK63".
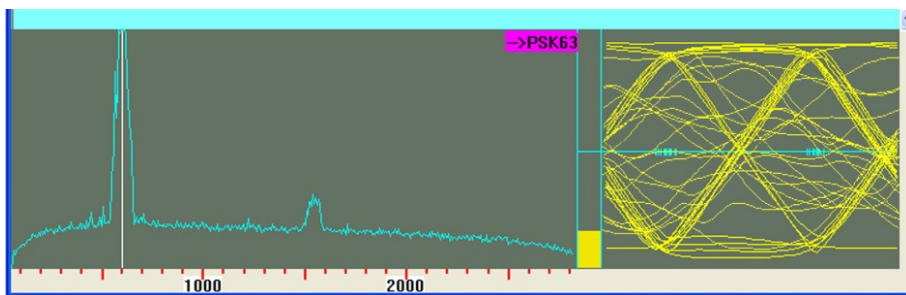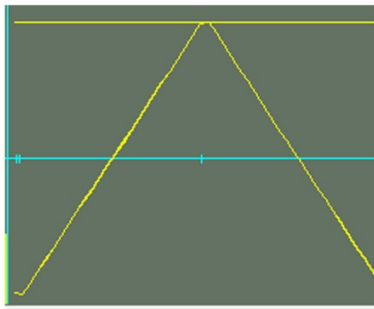

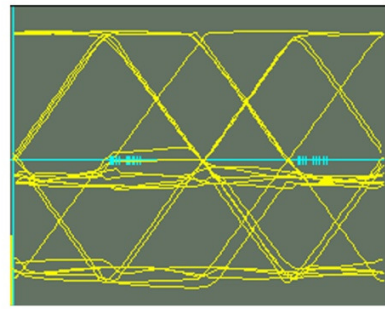- ➢ Below: no signal on this frequency, the eye diagram shows only noise
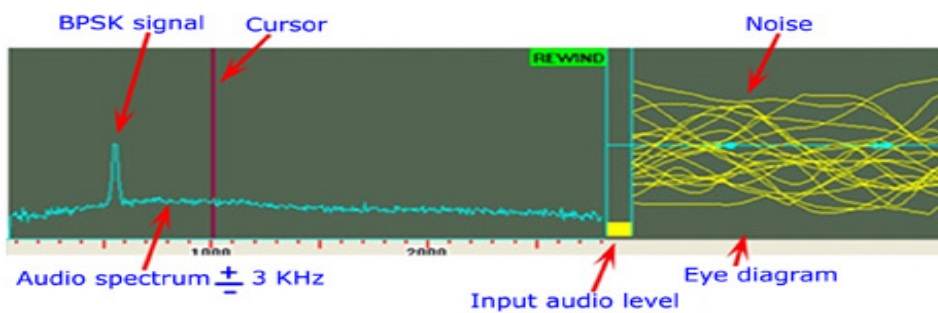
Detection of a non-adapted bitrate SIM / PSK31
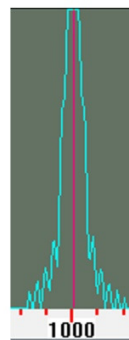
31 => 31 OK   31 => 63   63 => 31

31 Hz   63 Hz

1000   1000

Bandwidth : PSK31 - PSK63

These files are available on the site: http://www.on4nb.be/sim_help.htm

ON4NB – Octobre 2012