SIM-PSK User's Guide

June 2014

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Introduction

Operating new DSP techniques (Digital Signal processor) , *SIM_PSK* is an experimental computer program, designed to facilitate basic amateur radio communications when using a weak signal with the *SIM31*, a new QRP digimode specially designed for making reliable, confirmed QSOs under extreme conditions on all amateur bands.

"*SIM31*" stands for "**Structured Integrated Message BPSK 31 bauds**".

This new mode is sharing many advantages with popular modes such as PSK31 and JT9.

It is designed to establish human to human contacts by exchanging full structured info with possible plain text option; But moreover, it also allows to initiate contacts with full automatic stations , even under noisy and **as weak conditions as -18db S/N on 3000 Hz bandwidth**.

SIM needs a narrow bandwidth of less than 45Hz, No need of external modem; just a windows compatible sound card.(Using a 48KHz high quality sound card model could be a very good choice)

Compared to other digimodes, SIM31 is probably the only one to have that new kind of "Automatic QSOs mode" with possible translation functionality **(Automatic translation of included structured messages only)** Languages: English, French, Russian, Dutch, Spanish, Italian, German, Portuguese...

Remark : for the moment, due to our software limitation, only Latin characters are used even for Russian. Sorry guys.

Then, you can set your software in **Automatic mode** <Auto SIM QSOs>, and initiate a "full automatic call" SIM-PSK will reply to the callsign who just answered (manually) to your callsign ; afterwards, it will detect and fill in all received infos concerning the current QSO, (Name, QTH, LOC, RSQ ...),

at the end, **all infos about the QSO will be saved into the SIM Logbook and optionally uploaded automatically, in real time, to one or more services of your choice : eQSL.cc. , HRDLog.net, HAMQTH.com and HAMLog.eu.**

The program does all that automatically, without any operator assistance...

Note: it's recommended never leaving your transceiver working alone without any presence!!

As you can guess, it is **only possible to upload a QSO** in real time when you have enabled this option, and if an internet connection is available.

Remark : **uploading your ADIF File** into an amateur radio service (eQSL.cc, LOTW ...) could be made later, at the end of your contacts if you prefer ; up to you, it's in the menu tag "Log" .

SIM_PSK also implements a new mode "**SIM63**" running at twice the baudrate of SIM31.

System Requirements

An usual sound card equipment as for most digital modes

- SSB transceiver and antenna
- Computer running Windows XP or later, but it should also run under Linux, OS X, and probably FreeBSD and other Unix-like operating systems.

(Linux : Any info and help about resolution of serial port and audio problems is welcome)

- 1.0 GHz or faster CPU and 100 MB of available memory
- Monitor with at least 1024 x 780 resolution (more is better)
- Audio input and output devices supported by your operating system
- Computer-to-radio interface is using a serial port, to switch on/off your PTT line, and/or communicate with the "CAT" control.
- Or VOX for T/R switching.
- Audio or equivalent USB connections between transceiver and computer
- No need to synchronise your computer clock to UTC.

Installation and Setup

1. SIM_PSK can be downloaded from the *SIM31*Home page:
   http://www.on4nb.be/sim31.php
   NB: To have the best decoding performance and the last enhanced options, please make sure to get the newest daily version (V6XXX) available from the SIM31 Home page.
2. It's necessary to **download the .rar file for the first installation**.
3. Create manually a directory of your choice (preferably at the root C:\ ).
4. Example c:\SIM31\   (only at first installation)
5. Remark :DO **NOT** place this directory under the windows directories.
6. Unzip the .rar file , 5 files should be copied into the created folder :
   sim_psk.exe
   pskreporter.dll   (for PSK-Reporter option)
   sim_users_guide.pdf   (English user's guide)
   sim_users_guide_fr.pdf   (French user's guide)
   SIMCQ.wav (sound alert when a SIM31 frame was received)
7. Create manually a **sim_psk.exe shortcut** on your desktop.
   NB: If SIM_PSK has already been installed, for daily updating, you just have to download and replace sim_psk.exe into your c:\SIM31\   folder, in order to keep your shortcut valid for the new release.
8. Run the created shortcut to start up *SIM_PSK*.
9. When starting the program a pop up window allows to set up your interfaces parameters...

Audio and other TX settings

SIM_PSK31   GENERAL INTERFACES SETTING

Input Sound Driver: Mixage stéréo (IDT High Definition Audio CODEC)

Output Sound Driver: Enceintes et casque (IDT High Definition Audio CODEC)

Output Sound Level: 90 % (Recommended : 50% to 95%)

PTT (RTS/DTR)
COM Port : NO COM PORT   RTS: PTT   DTR: 0

CAT
RIG CAT as : ICOM IC-375   INPUT: Microphone   ☑ ENABLE PTT BY CAT
☐ RTS =1, DTR=1
COM Port : COM4   19200 bauds   1 bit stop   (Auto Power)

Manual typed Hexa String for Radio CAT Options Initialising : (Antenna,Power,Filter, ...ect) see your Trx-manual

CAT TX ON Hexa String : FE.FE.12.E0.1C.00.01.FD   54.58.3B .. HEXADECIMAL

CAT TX OFF Hexa String : FE.FE.12.E0.1C.00.00.FD   52.58.3B .. HEXADECIMAL

Manual typed Hexa String for Radio CAT Exit Options : refer to your Trx user's guide , Cat Commands

(PLEASE CONTACT US IF THE CAT COMMANDS ARE NOT CORRECT)   OK   Cancel

1.Select your sound driver from the list, if it doesn't appear in the list, check if you have more than 14 drivers installed ; in this case you should erase some of them which are not used to reduce the number of drivers ; then all should be ok.

Important : for an optimal decoding, your "eye's diagram" must be synchronised.
In other words, your signal and those received from other stations must be generated exactly at the same speed, 31.25 bit/s, to be perfectly synchronised.
A shifting eye's diagram indicates that both signals are generated at different frequencies!
To avoid possible weakness, you are invited to set the system sound card "**raw sampling" at 48000 Hz**. When running under Windows, open the Sound control panel, Click on "Properties", then "Advanced", and select **"16 bit, 48000 Hz (DVD Quality)"** for both the "Recording" and "Playback" devices.

When using the Windows default sound card, be sure to **turn off the system sounds**, so unwanted system sounds are not transmitted on the air.

2. It is recommended to set the DAC output level of your sound card from 50% to 90%.

3.Both modes *SIM31* and PSK31 require a **zero beat frequency** for a correct operation; correcting TX / RX frequency shift could be required if the transmission and reception seem slightly different. (refer to your transceiver user's guide).

NB. For most of the new transceiver models, there are generally no frequency offset problems between TX and RX (less then +/- 1 Hz offset).

4. USB auto-powered : for some USB interfaces, it is necessary to force the state of RTS and DTR to 1 to provide it the needed power.

SIM_PSK Main Window :

To set up the output audio level adapted to your transceiver, click the "Tune" button on the main screen. The Transceiver will be switched in transmit mode for a few seconds, with a steady audio tone equivalent to the level of a real sim31 signal, as used during a QSO.

Listen to the generated audio tone, using the RF monitoring of your radio, or any other method. The tone should be perfectly smooth and constant, with no clicks or glitches. Increase the mixing control of the audio output to reach the maximum possible RF output example 100 watt, and then decrease the setting until the RF output will fall back to about 30%.This will be a good audio level to drive your TX transceiver. So, 30 Watts will be a good choice for a 100 Watt CW Transceiver.

SIM31 is a QRP digital mode

Please take care not to saturate the transmitter audio input, by choosing a too higher audio level on your sound card output ; moreover, make sure to suppress any unwanted RF signal, which would return back to the transceiver. A bad audio level could generate some spurious and interferences which could be spreading far around your transmitted signal.

Don't forget it! Consider that you should be responsible of any disturbance.

Input signal level

It must be adjusted, referring to the yellow vertical barograph; try to adjust the level, **slightly under** 0 dB level .

The background noise should be clearly displayed into the low part of the spectral view.

Set up a too low signal level can alter the decoding performance, and the accuracy of internal estimation of the signal/noise (S/N) ratio displayed.

With the same PC and sound card driver, the optimal settings, once they are established, must remain optimal for all other digital modes, regardless of the used software.

NB: it is well known that with BPSK31 as SIM31, you have to reduce the radio AGC gain to the minimum,   to decrease signal distortions.

Any other DSP function can also affect the received or transmitted signal, so we should first turn off all this AF functions options, of course before making any adjustment of level inputs / outputs.

SIM31 Personal info window

To configure your personal parameters, just select the menu "Setting" and fill in your personal info's (CALL, NAME, QTH, QRA , AGE, QSL …etc)

NB : No more than 12 characters for your Callsign, as for Name and QTH .

Those infos will be used by Macros.

SIM31> PERSONAL INFO	

CALL:	ON2TSF	(It's better, to avoid as possible the Prefix/Suffix)
NAME:	BERNARD	
QTH:	AUBANGE	+
GRID:	JM56NU	☐ Miles for distance

☑
BIRTH: 1952 AGE: 62 Y YEAR LICENSED: 1996 [AGE: XX YEAR YOUNG , LICENCED: XXX ▾]

CLUBS: EPC#1258 DMC#1258 30MDG#1258

(Example : SMC#0012 EPC#12365   30MDG#1458 …)

INFO's :
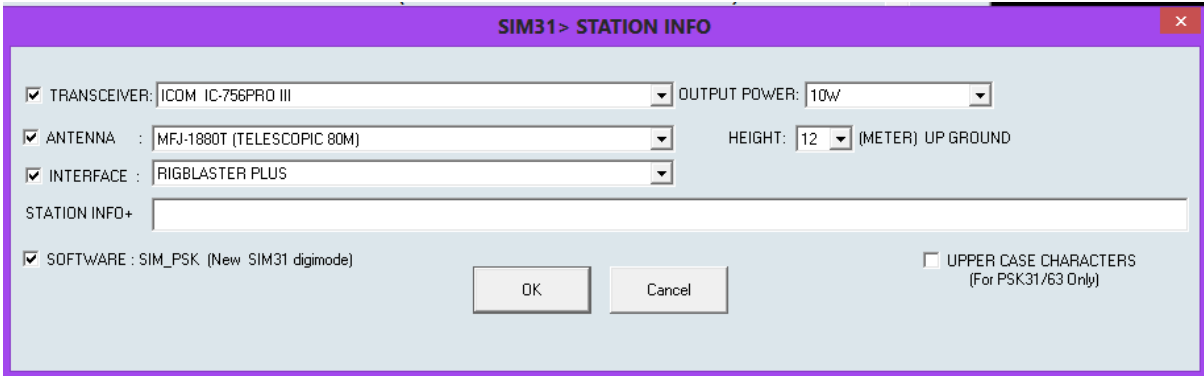☑ QRZ.COM ☐ QRZCQ.COM ☐ HRDLOG.NET ☐ HAMQTH.COM ☐ CLUBLOG.ORG

QSL VIA
My QSL card will be send via : ▾
☑ DIRECT ☐ BUREAU ☑ E_QSL.CC ☐ LOTW ☐ SWL Report accepted   OK   Cancel
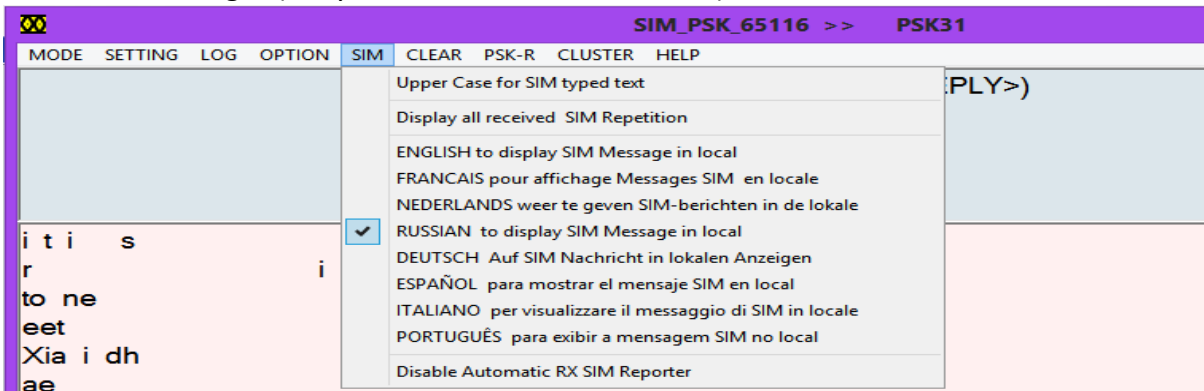
SIM31 Station info window

Dialog box for setting up your station infos (transceiver, power, antenna, height above ground...) ; those infos will be used by Macros.
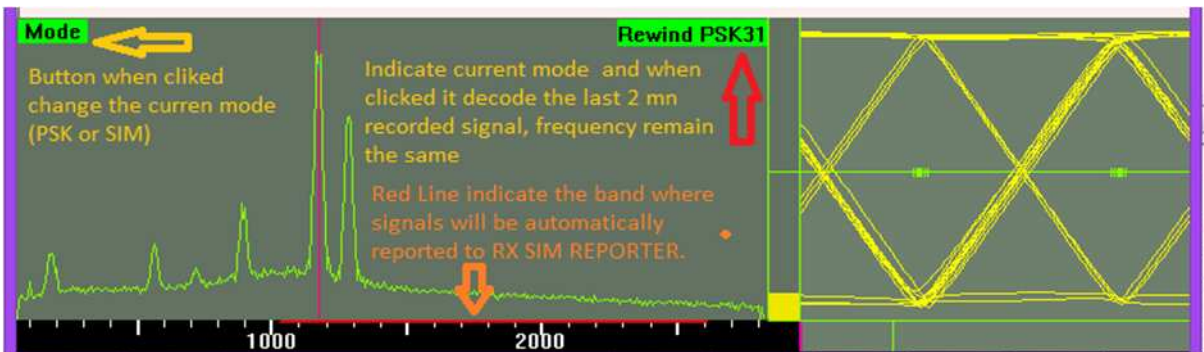

Favourite language menu

Select a favourite language that sim-psk31 will use to translate and display the received SIM31 structured messages (only macros could be translated).

Status Indicators

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On-Screen Controls

How to select a SIM station for starting a QSO

The easiest and most convenient method to select a SIM station is probably to use the automatic report window (See the screenshot below).

Automatic report window

Double-click on a callsign recently recorded, the program will prepare itself to start a QSO with this station as follows :

  a. The callsign is copied into the CALL field for answering.
  b. Rx cursor is positioned on the spectrum at the right frequency.
  c. SIM mode and baud-rate are updated.
  d. The latest infos of your Logbook are displayed (Last QSO with this station, date, Name, QTH, QRA-LOC).

Nothing else to do, just click the < ANSWER CQ > button to answer the selected station present on the air. Just two mouse clicks, without any keyboard entry, are sufficient to start a SIM31 QSO. Very easy isn't it ?

TX Macro's

SIM31 mode is mainly a structured message based mode, but it can also handle a classic "plain text" messages.

A structured message must be preferred here anyway, because it's a lot faster and more robust against noise and large spread distortions.

Most classic ham radio messages were prepared in a macro list, and coded as structured binary messages, so they could be sent faster and be less sensitive to noise and QRM.

You can choose your messages to send among the macro list content, simply by selecting each message in a "list-box".

You can also prepare messages in plain text mode, with free content of your choice.

Of course, in this case, as each letter has to be separately encoded, it takes more time for transmitting, exactly like a PSK mode.

Or, it remains possible to type a text in real time, during a contact, at keyboard, exactly like any other classic mode as BPSK31.

Making QSOs

By long standing tradition and / or legal obligations, a minimal valid QSO requires to exchange callsigns, a signal report, and several other infos which are also generally sent.
SIM-PSK is particularly designed to facilitate such QSOs, thanks to the short structured messages.
But please be fair play, don't initiate an automatic calling before having answered manually to other interesting automatic callsigns on the air.
The process works best if you use the structured formats and follow recommended standard procedures as in the following example.

Example of QSO

1. **BUTTON CQ CQ** :   CQ CQCQ DE ON2VH ON2VHF ON2VHF
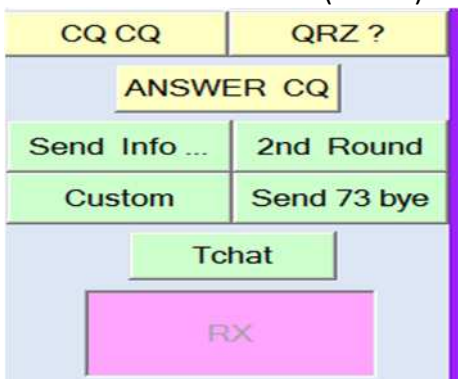
2. **BUTTON ANSWER** :   ON2VHF ON2VHFON2VHF DE F1ABL F1ABL F1ABL R-12

3. **BUTTON MY_INFO**: F1ABL F1ABL F1ABL   DE ON2VHF ON2VHFON2VHF RR-9
          Hi dear OM
          Happy to meet you in SIM31 mode
          NAME : LAURENT LAURENT LAURENT
          QTH   :
          LOCATOR :
          HW? ***** BTU ************
          F1ABL F1ABL   DE ON2VHF ON2VHF   PSE KN

4. BUTTON MY_INFO: ON2VHF ON2VHF ON2VHF DE F1ABL F1ABL F1ABL RR-12
          Hi dear OM LAURENT
          Thank you for call/answer
          NAME : MICHEL MICHEL MICHEL
          QTH   :
          LOCATOR :
          HW? ***** BTU ************
          ON2VHF ON2VHF ON2VHF DE F1ABL F1ABL F1ABL PSE KN

5. BUTTON MY_STATION (ON2VHF).
6. BUTTON MY_STATION (F1ABL).

7. BUTTON BYE 73 (ON2VHF)..
8. BUTTON BYE 73 (F1ABL).   End of QSO

Log Book

NB :With automatic QSO mode, the program does collect and save the information's automatically, and then can be uploaded in real time to eQSL.cc , HRDLog.net , HAMQTH.com and HAMLog.eu, so there is nothing to do manually during an automatic QSO. At the end of automatic traffic, we just need to check and correct any possible false info, afterwards, the Log result can be uploaded to web ham radio login services.

Format of a QSO withstructured SIM Mode:

All the fields, Callsign, Name, Qth, Locator, are initially structured in the program during setup, so, except on errors , the program should get easily and automatically all these infos during a contact, afterwards, it will display them on the screen and will write each info at the right place into reserved fields, without any operator assistance .
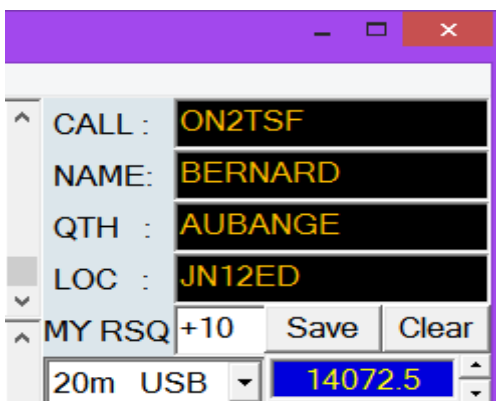
You just have to verify their authenticity, and then confirm by clicking the button <Log qso> at the end of QSO….
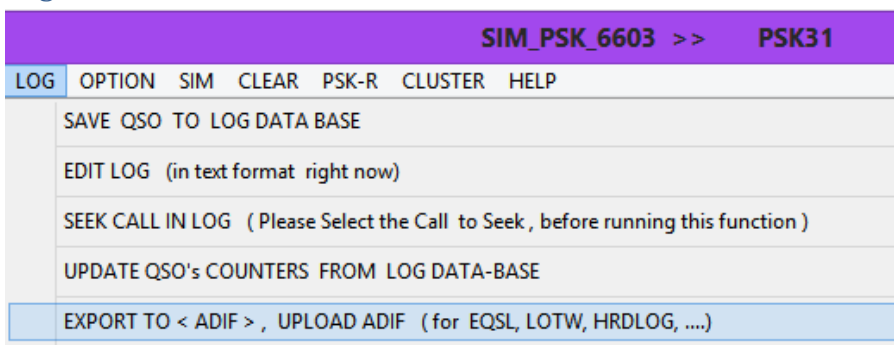
Save a QSO manually :

In some rare case, (eg for not structured messages, transmitted in plain text mode or by classic BPSK31 mode) you must double click manually, one by one, on the strings "Name, QTH, LOCATOR" in order to copy them one by one into the reserved data fields. Then you will press the button <Log qso>, for saving infos of this QSO into the Logbook data base.

Remark : double click rather on the string NAME before QTH.

Reserved fields :

Log menu

Special Mouse Commands

SIM RX REPORTER WINDOW	Double click any callsign in the SIM Rx reporter window for setting all required parameters and prepare to answer (Callsign , Mode , baud rate and frequency) so you are ready to click button <Answer CQ> to answer the selected callsign …
Received text window	Double click any callsign to write it into the CALL field before answering
	Double click any QTH to put it into QTH field (for message insertion and before saving to Log).
	Double click onto any Locator to put it into LOCATOR field (for saving it to Log).
SPECTRUM (REWIND)	Left click onto spectrum position: rewinds the last 2 minutes signal recorded and decodes it at 31 bauds default mode : PSK31 or *SIM31*.
	Right click onto spectrum position: rewinds the last 2 minutes signal recorded and decodes it in 63 bauds default mode (PSK63 or *SIM63*).

You are ready to use *SIM-PSK31*. Good DX.

Technical Description

SIM31(Structured Integrated Message BPSK31.)

Name of software: *SIM-PSK*

Modulation :   DBPSK « Differential Binary Phase Shift Keying ».

Speed :   31 bauds   , 187 char/min (or 31.25 wpm).

Pulse shape :   Similar to classic BPSK31

Bandwidth :   About 45 Hz

Code :   "varicode" able to encode characters or messages (words or full sentences.).

Demodulation :   Coherent demodulation .

Synchronization :   Automatic on signal

Error correction :   FEC (Forward Error Correction) tolerates one error bit per character

Convolution code :   NO.

Interleaved: YES

Repetition :   YES, only for some structured messages as CQCQ, QRZ, QRALOC, NOM, QTH,

Drift tolerance :   10 Hz/min (depending on signal level).

Lower limit of intelligibility: -17dB in text mode.

Until -18.5 dB in message mode

(in presence of white noise with a bandwidth of 3 kHz)

Reception mode :   Indifferent (LSB or USB)

Note: The frequency adjustment is simplified by staying in USB on all bands

Characters set :   53 "fixed code" A..Z 0..9<CR><SPACE> . , : - = + ? ' ( ) ! / @ # *

No delete character on error nor wait character.

Lowercase characters are converted to uppercase,

Special Characters :   The special characters such as "É" are converted into standard capitals characters, (in this example: "E") but can be displayed in lowercases locally

Messages: The messages used as macro by the ham radio are coded and structured.