Optimizing Your PSK31 Signal

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Presented at SEAPAC
Seaside Oregon
June 19, 2004

PSK31 Optimization

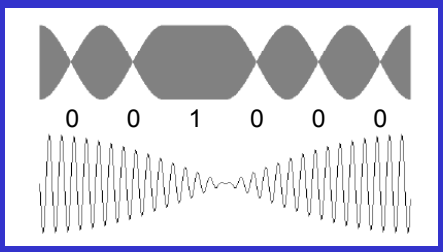
- The PSK Signal
- Setting Audio Level - Conservative and Aggressive Methods
- Interfacing
- Software - Features & Tools
- Operating - Receiving, Transmitting, IMD RST
- Other Modes

Typical Station Setup for Sound Card Modes

Binary Phase Shift Keying - BPSK31

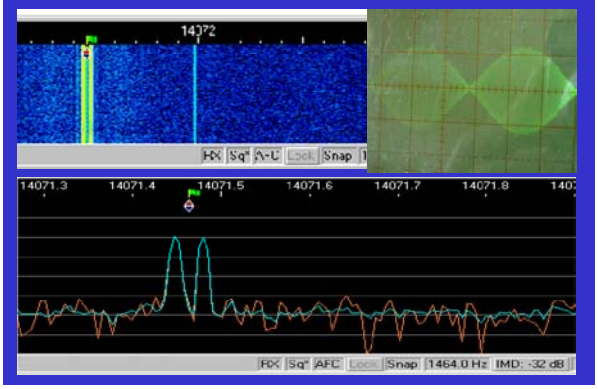
- Phase modulates an audio "carrier" at 31.25 baud
- Reverses phase 180 degrees (BPSK)
- Reduces signal level at phase shift time to reduce spurious frequencies
- Uses variable length encoding - most used characters are encoded into small word lengths

BPSK Signal Envelope

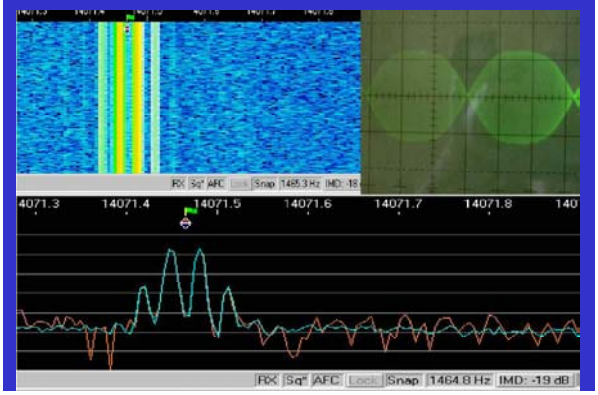


Varicode "Space" character = 1
where 0 is a Phase Reversal and 1 is no reversal
must have at least two 0 between characters

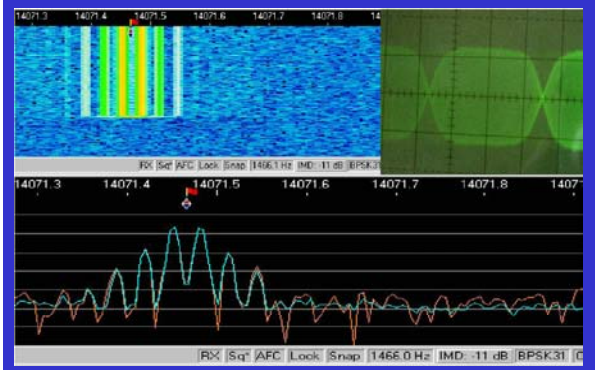
IMD -32 dB Good Signal



IMD -18dB Poor Signal



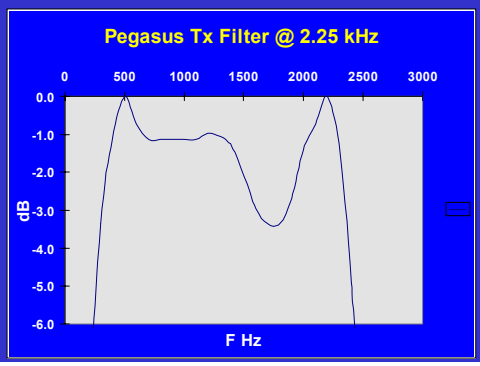
IMD -11dB Very Bad Signal



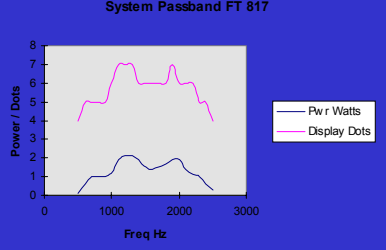
PSK SIGNAL BASICS

- A clean signal has unwanted sidebands at -24 dB or better
- Overdriving the signal may imcrease power output, but does NOT improve copy.

Stay Within Your Transmit Audio Passband



Stay Within Your Transmit Audio Passband



Setting the Audio Drive Level

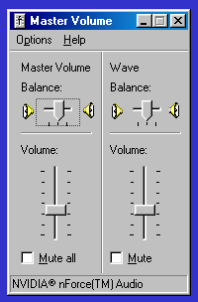
- Adjusting the audio drive level is the proper way to set power output.
- You do NOT improve the signal quality by reducing the power level setting on the transceiver - you only reduce the power of an improperly adjusted signal

Setting the Audio Drive Level

- Adjusting the audio drive level can be done at the:
  - PC using the WAVE control slider
  - Interface if you have a level control pot
  - Transceiver Mic Gain

PC Output Audio Control

- The WAVE output is the one used to generate the PSK signal
- The WAVE and Volume work together
- Mute all other sources



Interface Level Control

- If your interface has a level control potentiometer, use this for fine adjustments rather than the PC panel
- If your interface has an internal level control potentiometer, use the PC WAVE slider for audio level control

Transceiver Mic Gain

- The transceiver Mic gain can also be used to control audio drive level.
- Normally this is set for proper phone audio level and left alone when using psk.

How Much Power?

- Protect your transceiver finals - normally run at no more than 50% of rated CW output (peak)
- Turn off Compression
- Run with minimum ALC

Convervative Method

- Pick a waterfall frequency in the middle of your rig output filter - typically 1200 Hz
- Set your rig power control to 100%
- Turn off Compression
- Transmit an IDLE signal (no typing, buffer empty)
- Adjust audio drive level to produce an output of 25% (ave) or 50% (peak) of rated CW output.
- ALC should be at low or zero level

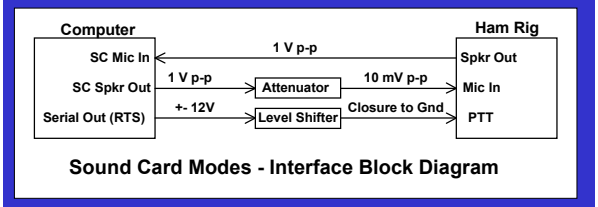
Why Derate Power So Much?

- The PSK signal will run at 50% duty cycle when in IDLE, and up to 90% when transmitting data.
- The transceiver audio path must stay linear (no or little ALC or Compression).

Aggressive Method

- Use an IMD monitoring device such as the PSK Meter or the IMD Meter
- Turn off Compression
- Set the rig output control to 50%
- Transmit an IDLE signal
- Adjust the audio drive level to produce an IMD of -24 dB or better - typically run at -30 dB

Basic Hardware Interface

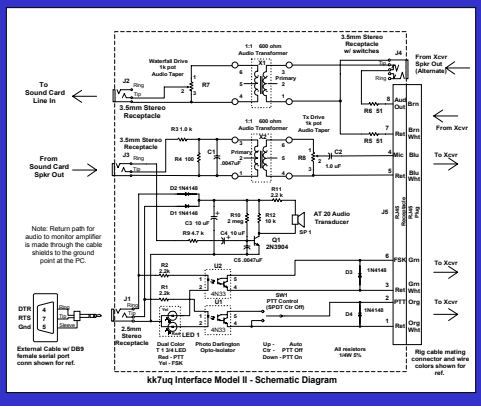


Sound Card Modes - Interface Block Diagram

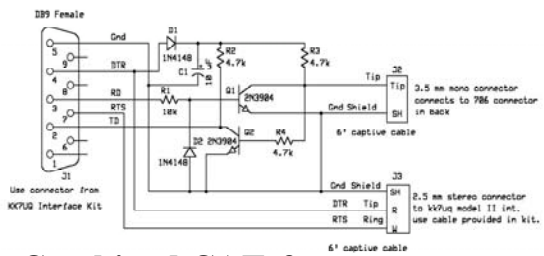
Optimizing Sound Card Interface

- Provide audio drive potentiometer control on the interface
- Provide waterfall drive potentiometer control on the interface
- Provide audio monitor on the interface
- Incorporate CAT control with sound card interface to use single Serial Port

Sound Card Interface



kk7uq Interface Model II - Schematic Diagram



Combined CAT & Sound Card Control

When you set up MixW CAT
set RTS to PTT
set DTR to always ON
set Baud Rate to 9600

VOX for rig control?

- VOX could be used to "key" the rig instead of a serial port control line
- Difficult to do in practise:
  - Audio drive level to trigger VOX reliably may exceed level which gives a clean signal
  - Any PC audio keys the rig
- Positive PTT control is more reliable
- Exception: the Signal Link interface built in "VOX" does key reliably with out overdriving the rig audio

Software Features Help Optimize PSK Operation

- Macros
- Log
- Sound History
- Multiple modes
- Transceiver control using CAT
- Multiple receive windows

Example: MixW Software

Macros

- Single click creates full typing function
- Example Macro "CQ"
  <TX>
  CQ CQ CQ CQ DE KK7UQ KK7UQ KK7UQ
  CQ CQ CQ CQ DE KK7UQ KK7UQ KK7UQ
  CQ CQ CQ CQ DE KK7UQ KK7UQ KK7UQ PSE K
  <RX>
- Optimized Macro "CQ"
  <CLEARTXWINDOW> <TX>
  cq cq cq cq de kk7uq kk7uq kk7uq pse -k-
  <RXANDCLEAR>

Macro "Start QSO"

- Basic Macro "Start QSO"
  <TX> <CALL> <CALL> <CALL> DE <MYCALL>
  <MYCALL> <MYCALL> …
- Optimized Macro "Start QSO
  <CLEARTXWINDOW> <TX>
  <CALL> <CALL> <(NAME)> de kk7uq (Clint) fb
  <NAME> ...

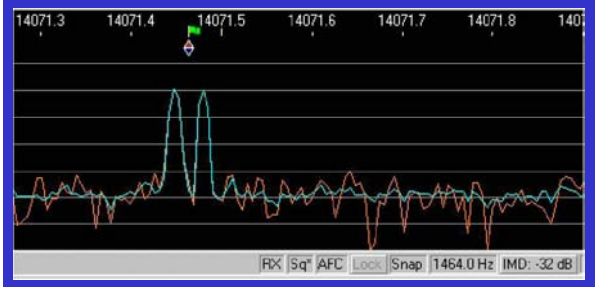
Macro "73"

- Basic Macro "73"
  73 <CALL> <CALL> DE <MYCALL> <MYCALL>
  QSO LOGGED AT <SAVEQSO> <TIME> <DATE>
  SK <RX>
- Optimized Macro "73"
  73 <NAME> <CALL> de kk7uq sk
  <SAVEQSO> <RXANDCLEAR>

Waterfall or Spectrum Display

- Use waterfall when looking for CQ
  - Can see entire band and history
  - Easy to spot CQ's
- Use Spectrum when in QSO
  - Can see quality of signal
  - Can estimate RST better
  - Can determine S/N of signal

Spectrum Display



Above spectrum shows S/N about 35 dB, harmonic is about -33dB

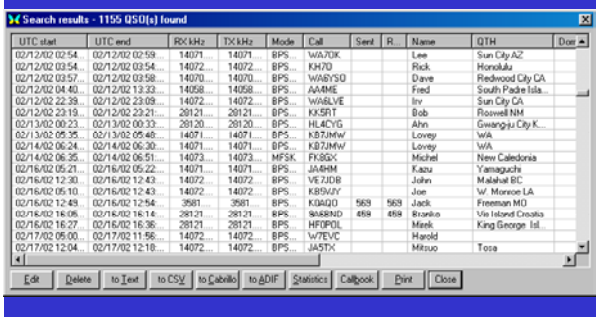
Sound History

- Feature of some sound card software
- Stores 20 seconds (or more) of sound card output
- Activated by holding down SHIFT key and clicking on signal
- Plays back last 20 seconds to receive window
- Great for searching for CQs

Built in Log

- Logs QSO data from screen
- Name / QTH of previous contact pop into fields on new contact
- Tracks actual frequency if using CAT
- Mode automatically entered
- Can export to other logs or Cabrillo

MixW Log Entries



Transceiver Control Using CAT

- Software controls & monitors transceiver frequency and mode
- Logged frequency is accurate
- In some cases, can activate PTT via CAT

Operating Methods

- Receiving
- Transmitting
- Upper vs lower case
- RST reporting
- IMD measurement
- Working DX

Receiving

- Looking for CQ - use sound history
- Use LOCK to hold frequency on new station
- Put AFC ON

Transmitting

- Calling CQ
  - Keep length short, repeat about every 8 seconds
  - Use lower case to speed it up
  - cq cq cq de kk7uq kk7uq kk7uq cq pse k
  - Use Auto CQ
- Calling a station
  - Keep length short, use his call once
  - W7WJK de kk7uq kk7uq pse k

Transmitting

- Compact macros
  - Keep length short
  - Use lower case wherever possible
- UPPER vs lower Case
  - lower case is faster because of variable length encoding

RST - "R"

- R readability 5 95 - 100% copy
- R4 90 - 95% copy
- R3 75 - 90% copy
- R2 50 - 75% copy
- R1 under 50%

RST - "S" Strength

Use Spectrum Display - estimate S/N

@ S/N of 6 dB per S unit

S9 54 dB	S6 36 dB	S3 18 dB
S8 48 dB	S5 30 dB	S2 12 dB
S7 42 dB	S4 24 dB	S1 6 dB

"T" - Signal Quality

- T9 IMD -24 dB or better
- T8 IMD -20 dB to -24 dB
- T7 IMD -15 dB to -20 dB
- T4 IMD worse than -15dB

IMD

- What is IMD?
- Giving an IMD Report
- Things to look out for
- Take the IMD with a grain of salt
- Let your eye be your guide

What is IMD?

- IMD - Intermodulation Distortion
- Measures "linearity" of audio path of the PSK signal through the transmitter and the receiver
- A software tool built into most PSK software

IMD Measurement

The strength of the primary signal compared to the 3rd harmonic above is -19 dB hence IMD is -19 dB

Giving an IMD Report

- Monitor the IMD measurement at the bottom of the screen
- Signal must be in IDLE (no typing, buffer empty)
- Check the S/N of the signal - it should be above 36 dB to get an accurate report

Things to look out for

- If S/N is too low, the IMD will be reported low
- If S/N is too high, the IMD will be reported low - because the receiver is clipping the signal - adjust the RF gain

Take an IMD measurement with a grain of salt

- If you are given a low IMD (say -19 dB) :
- Have them use the spectrum display and check the S/N

Let Your Eye Be Your Guide

- If the signal you are monitoring has S/N about -20 dB and IMD is about the same number:
- If the signal looks clean i.e. straight sides, no apparent side bands, then the real IMD is probably -24 or better.

Working DX

- Split operation using LOCK on your TX signal and RX on the DX station
- Strong signals - poor copy - look at tuning indicator to see if wide phase distortion - probably multi path
- Use short calls

Other Modes

- QPSK vs BPSK
- BPSK63
- MFSK
- RTTY
- Hellschreiber