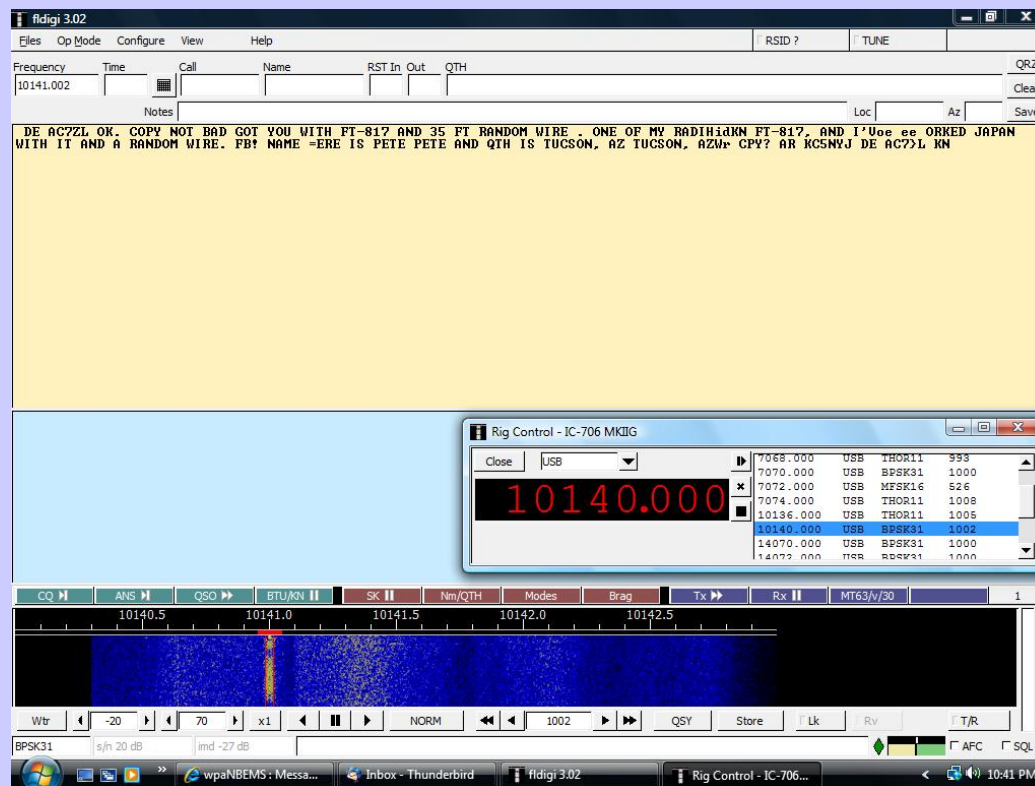
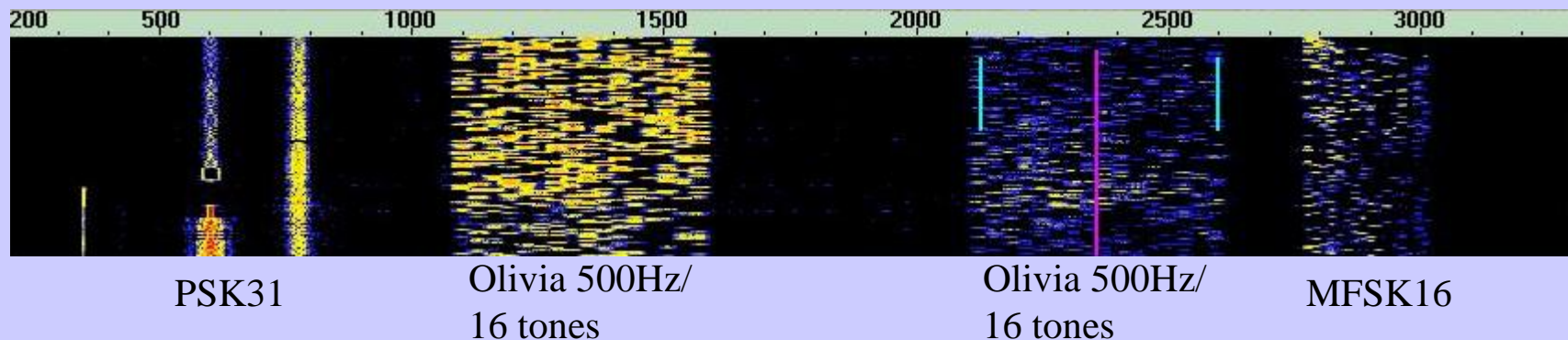


NBEMS/FLDIGI

Digital Sound Card Modes and Operation



Advantages of Digital Modes:



- **Low Power** - never need to run over 50 watts, 5 -30 watts is almost always sufficient
- **Software is FREE**
- **Spectrum efficiency**
- **Great for reliable rag-chew**
- **Many modes** - choose your mode depending on conditions
- **Bottom of the solar cycle** - works well, even under very poor conditions where phone QSO's would be impossible!
- **Emergency Communications**
- **It's FUN**



Hardware

- Windows, Linux or Mac OSX Computer
- Transceiver
- Sound Card Interface?
- Or, maybe just a \$8 computer microphone?



To start playing around... all you need is an inexpensive computer microphone! Just plug a mic into your sound card mic input and place the mic element somewhere near your radio speaker. Listen and watch your display and practice differentiating the various modes.

Sound Card Interfaces and USB Sound Cards

- Sound Card Interface connects from your computer sound card to your radio, provides RF isolation and automates the PTT when you transmit (PTT via either VOX or Serial)

- **USB Sound Card** provides the same connection and function, but it has it's own built in sound card (only 2 cables)



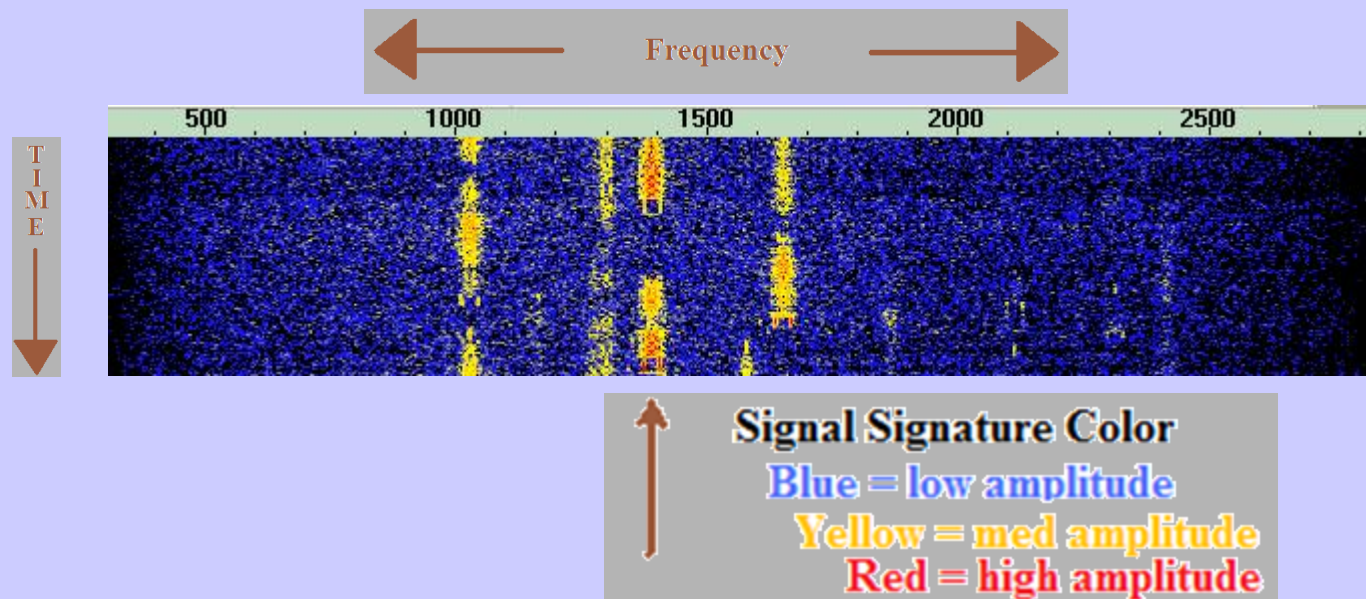
The Signalink USB Sound Card has the advantage of it's own independent sound card, and volume controls on the device. Only requires two cables (provided), one for the connection to your radio and the other (USB) to connect to your computer.

Note: Radio cable interface can be wired for connection to data/acc jack on the back of most modern rigs or can be interfaced to the mic jack of any transceiver.

Is this is a Waterfall?



Here is a REAL waterfall...



The digital waterfall is a visual representation of time, frequency and amplitude.

Recommended Digital Modes for EmComm with the NBEMS FLDIGI Software

- DominoEX11(FEC) – fast turn around time, good for moderate HF conditions and non-mission critical messaging
- Olivia 16/500 – slow but very accurate under poor HF conditions
- MT63 1k/long interleave – relatively fast and best suited for detailed situation reports and formal messages under moderate to good HF conditions
- MT63 2k/long interleave – very fast and extremely effective on VHF/UHF FM and no need for direct sound card to radio interface

Accuracy, speed and audio bandwidth all come into play and various modes all have their advantages and disadvantages!

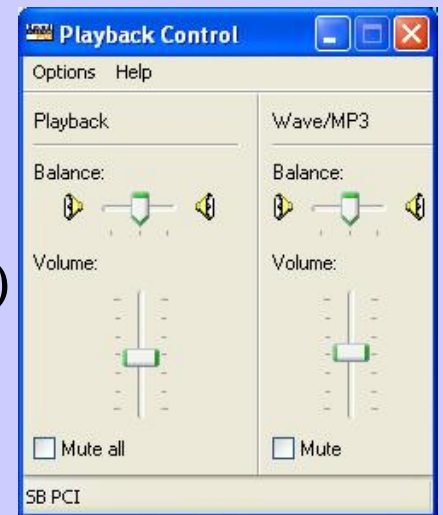
Audio Level Settings

Turn that thing down!

Distortion and non-linear operation (splatter) is caused by overdriving your sound card audio into your radio and it makes a mess on the waterfalls of receiving stations!

Follow these instructions for setting your audio levels with any digital mode:

- Set your radio RF output to full power
- Adjust your sound card master volume and wav volume down (double-click the speaker icon)
- Set your radio meter to ALC (Auto Level Control)
- Transmit audio from FLDIGI, then adjust your master and wav volume to where the ALC meter just begins to register



Check out www.youtube.com for great instructional videos!

Keyword search: PSK31 Transmitter Level Adjustment

(The video concentrates on level settings for PSK31 but this procedure applies just as well to all sound card digital modes)

Sound Card Calibration

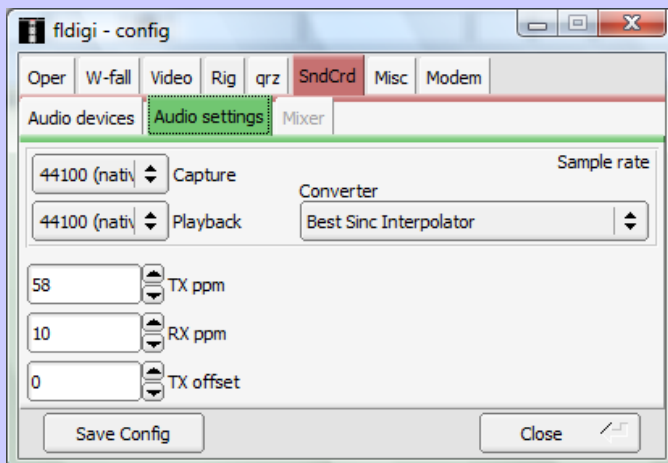
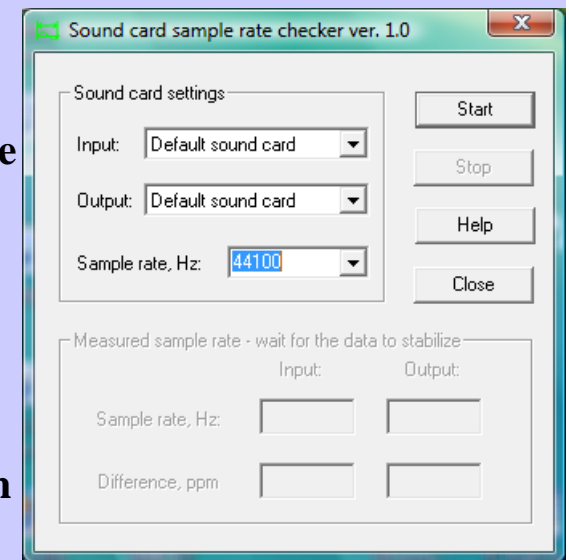
CheckSR

<http://www.mixw.net/files/CheckSR.exe>

Sound card accuracy is much more critical on Olivia and MT63. The difference between your sound card transmit and receive accuracy is measured in parts per million (PPM) based on a given sample rate. If there is a discrepancy between your tx and rx sample rate, the result is the person on the other end of the QSO may not properly decode your transmitted text or may have to retune to your signal after every exchange.

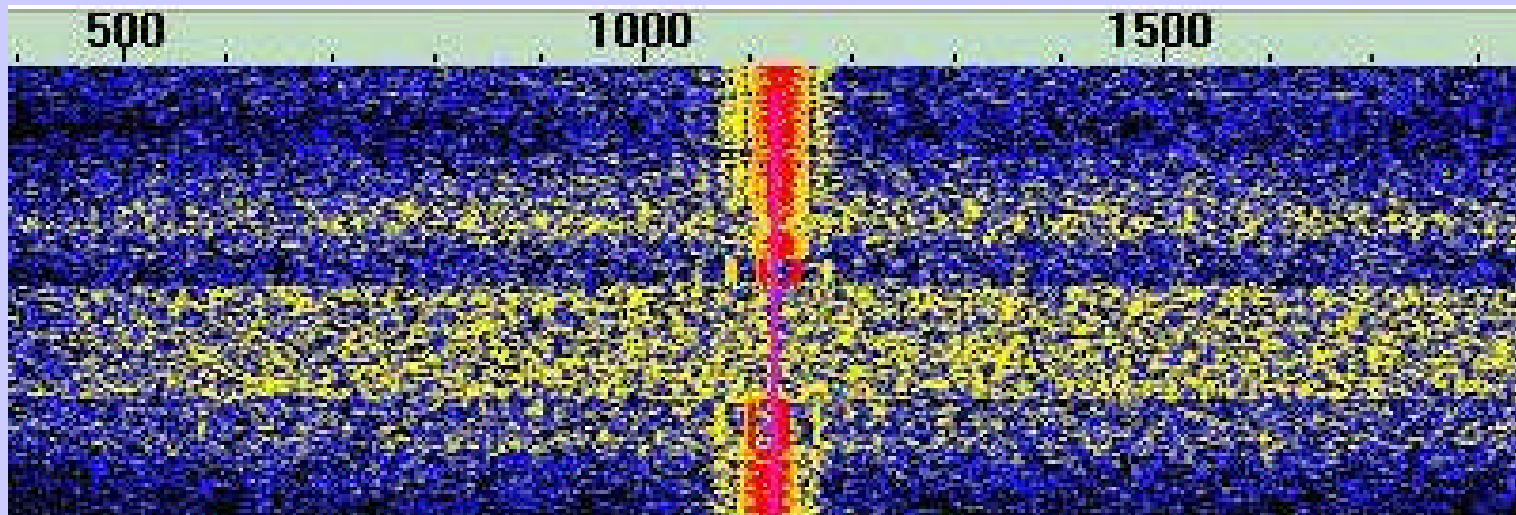
CheckSR is a free program that makes the calculation for your given sound card offset error. Run the CheckSR application for your sound card native sampling rate. Let the program run for about 5 minutes, then click stop and record the numbers.

Enter the figures in the appropriate fields under the FLDIGI sound card settings tab.



Unwanted Shift

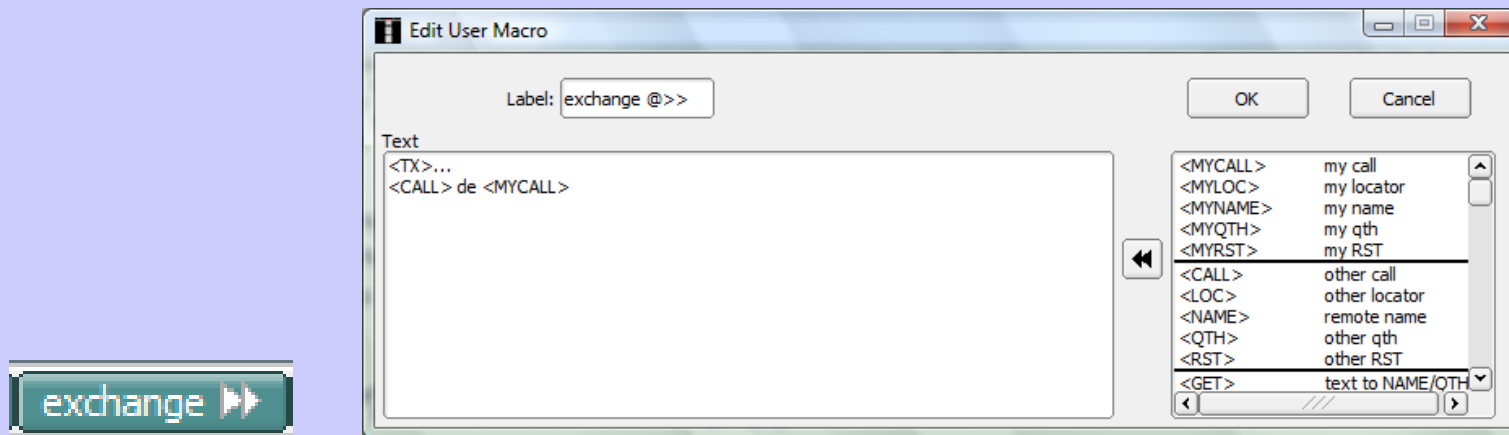
Sound Card error shift as a result of improper sound card calibration



You will notice the slight shift from the two stations signals. Most PSK31/63 software will automatically track slight shifts with the AFC (Automatic Frequency Control) setting. NBEMS/FLDIGI is one of the best in this respect. But AFC is not available with Olivia and MT63, so sound card calibration can be critical.

What are Macro's?

Macro's allow you to automate some of the QSO functions and commonly sent text. Macro's can be easily customized.

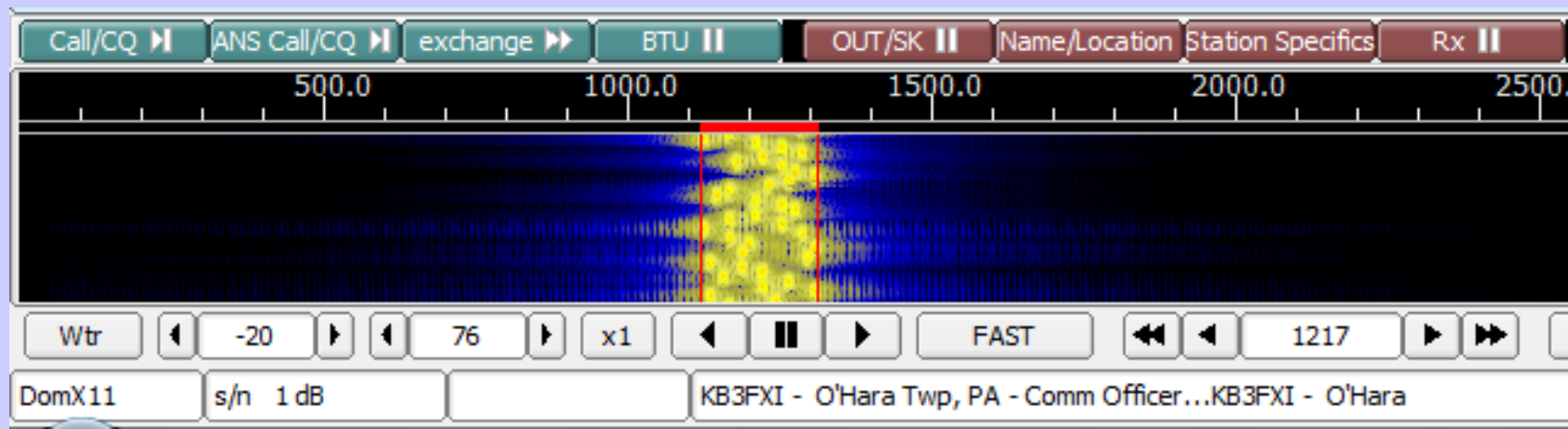


A right-click on the macro buttons on most programs brings up an editing function that allows you to change the macro text or functions. The macros allow the operator, for example, to send preformatted text and information with a single mouse click. The macros also automate transmit and receive functions from the computer to the transceiver.

The wpaNBEMS group is working on a standardized macro set that can be easily imported into the NBEMS/FLDIGI software.



DominoEX11(FEC)



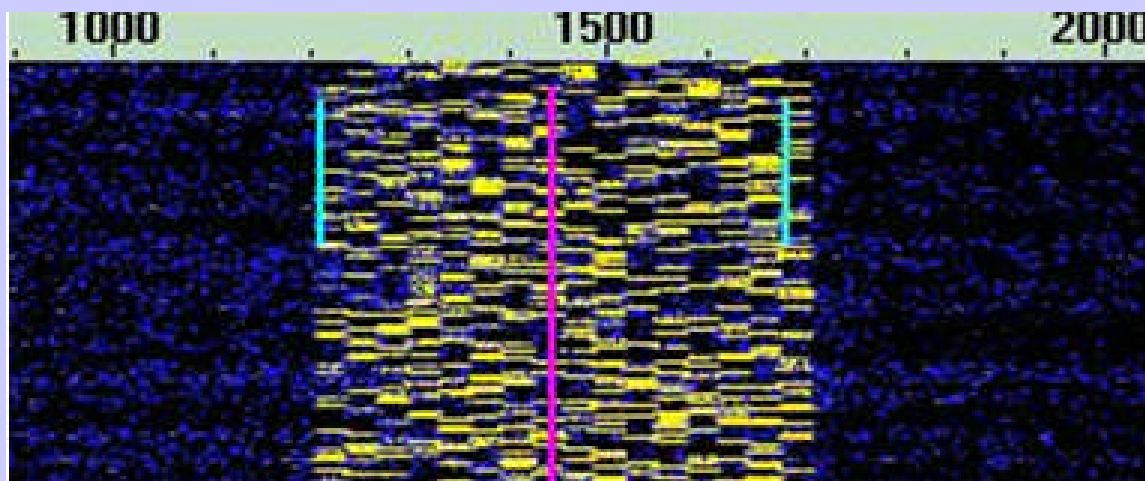
DominoEX11(FEC) was chosen for use in keyboard to keyboard transmissions, assuming that HF conditions are moderate to good. This mode provides a reliable means of sending and receiving short messages. Tuning is not as critical as other modes.

Although DominoEX is fairly robust, it is not recommended for mission-critical transmissions. This mode does incorporate forward error correction (FEC), but it is more susceptible to errors than Olivia or MT63.

Other advantages of DominoEX are that it is relatively narrow (200 Hz), fairly accurate and subtext can be programmed in by the sending station which is automatically sent during keyboard inactivity while still in transmit mode.

An example of subtext might be a tactical call and location, as seen at the bottom right hand corner of the screen shot.

Olivia 16/500



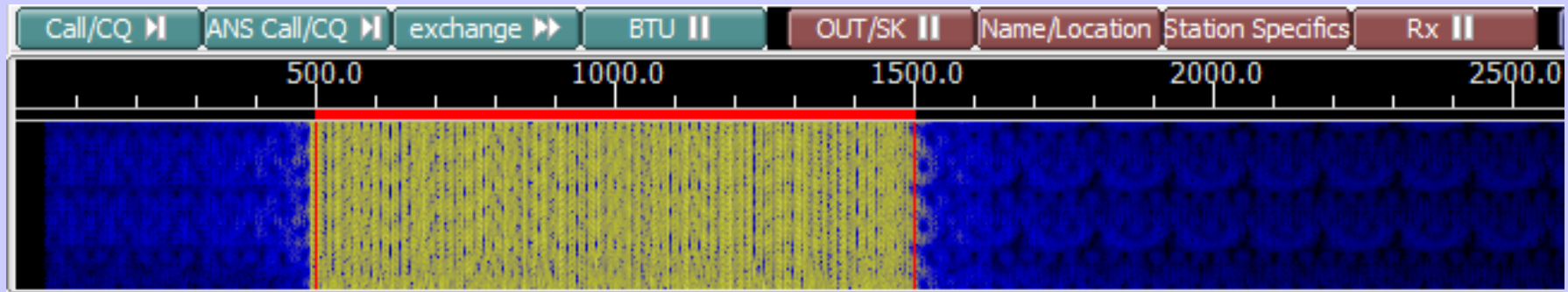
Olivia 16 tones, 500 Hz mode was chosen for use in formal short message handling. Although the mode is relatively slow (about writing speed), it is very accurate, even under extremely poor conditions.

A large amount of forward error correction is utilized in this mode, making it suitable for mission critical messaging when used by properly trained operators.

Sound card calibration is critical, but once the proper calibration procedures are performed, the settings are saved and accuracy is retained without the need for further adjustments, unless the sound card is replaced.

See the QST article in the December 2008 issue for a very good explanation of just how well this mode performs under even the worst HF conditions.

MT63 1k, Long Interleave

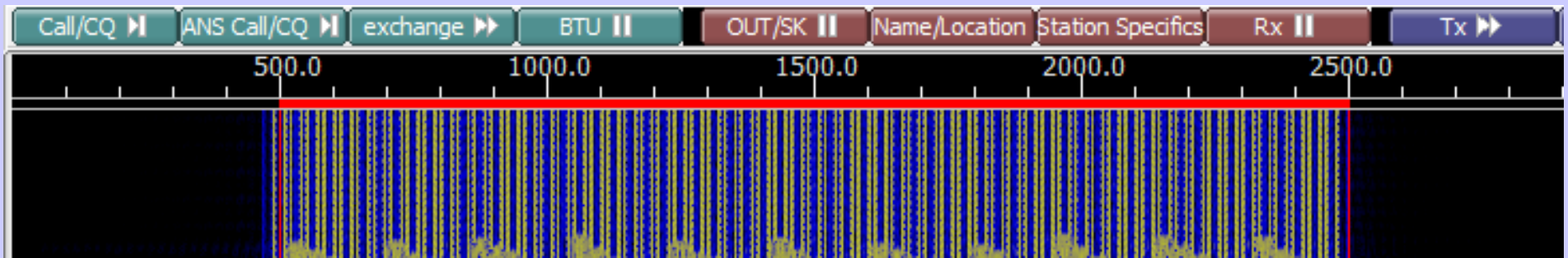


MT63 1k long was chosen for portable, mobile and fixed station operations on HF USB under moderate to good conditions. It is our primary mode for detailed situation reports and database transmissions on HF for the following reasons:

- Very effective under moderate to good RF conditions
- Extremely accurate decoding (major duplication of data and forward error corrected)
- Works extremely well under QRM and QRN conditions
- Excellent for sending larger situation reports or databases
- Can be used with audio coupling but direct interfacing is recommended for all digital HF operations

Tuning procedures and sound card calibration are critical with MT63 on HF, so the mode requires some training and practice. But once the use of the mode is mastered, it is extremely efficient. The speed at which MT63 1k long operates, makes it possible to send detailed reports that would not be practical using voice transmissions at writing speed.

MT63 2k, Long Interleave



MT63 2k long was chosen for local portable, mobile and fixed station operations on FM channels (repeater or simplex). It is extremely well suited for detailed situation reports and database transmissions for the following reasons:

- Can be used very effectively without a sound card interface (audio coupling)
- Extremely effective, even under very poor simplex RF conditions
- Extremely accurate decoding (major duplication of data and forward error corrected)
- Very forgiving on sound levels and requires no tuning when used on FM
- Excellent for sending larger situation reports or databases

MT63 2k long has been in use in Western Pennsylvania in several drills and public service events since 2005. The mode performs extremely well even under very adverse conditions. The fact that all one needs is a hand held transceiver and a computer (no need for sound card interface or any other hardware) makes the widespread adoption of this mode, for use on FM simplex and repeaters, a very attainable goal.

What is Audio Coupling...

Audio coupling simply means that there is no direct wired interface between the transceiver and the computer. Transmitted audio is picked up from the computer speakers by manually keying the transceiver microphone. Received audio is picked up by the computer microphone from the received audio of the transceiver.

While this method can be used with limited success on HF on various digital modes, it is most effective using MT63 2k long over FM channels and MT63 1k long on HF.



The majority of the wpaNBEAMS testing group are using the audio coupling method with great success, weekly. Audio coupling has also been used in the field here in WPA during the Rachel Carson Trail Challenge and during several drills in O'Hara Township.

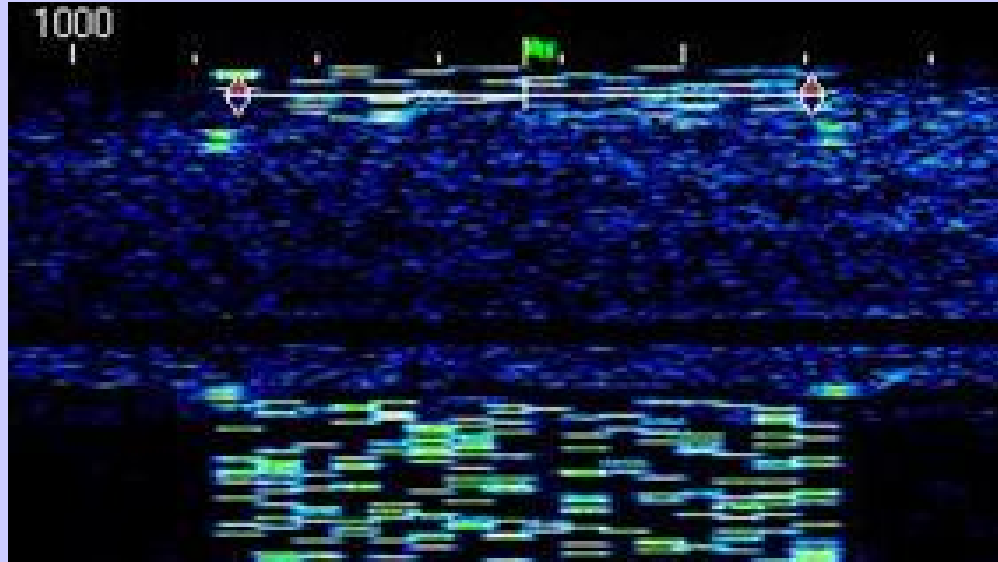
The major advantage with MT63 2k long and audio coupling is that the operator needs only a laptop computer and a transceiver. There is no need for the purchase of any other interfacing hardware.

Some Waterfall Screen Shots...

Olivia

Olivia – 500 Hz

16 tones



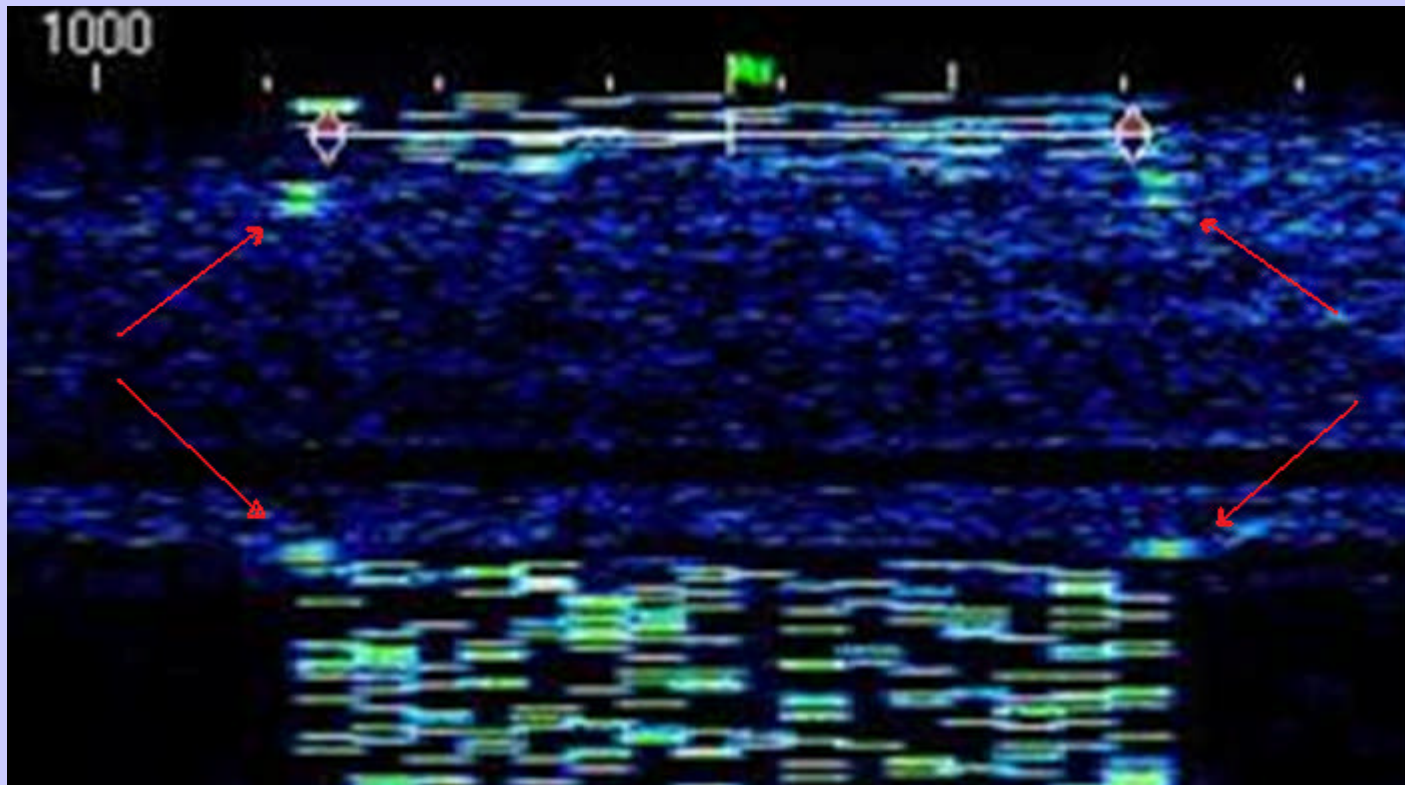
Our standard is 16/500 but other common Olivia operations are transmitted in 250, 500 and 1000Hz bandwidths. Tuning and sound card calibration are critical on this mode, but Olivia is capable of maintaining near 100% copy under extremely adverse conditions.

All Olivia signals can be identified by two sets of alternating marker tones at the beginning of each transmission, unlike MFSK which transmits only the lower marker tone. The trick to decoding Olivia is determining the proper combination of bandwidth and tone settings.

Olivia

Olivia – Screen Shots

500 Hz wide



Here you can see the start and end marker tones on Olivia.

Olivia

Olivia – Screen Shots

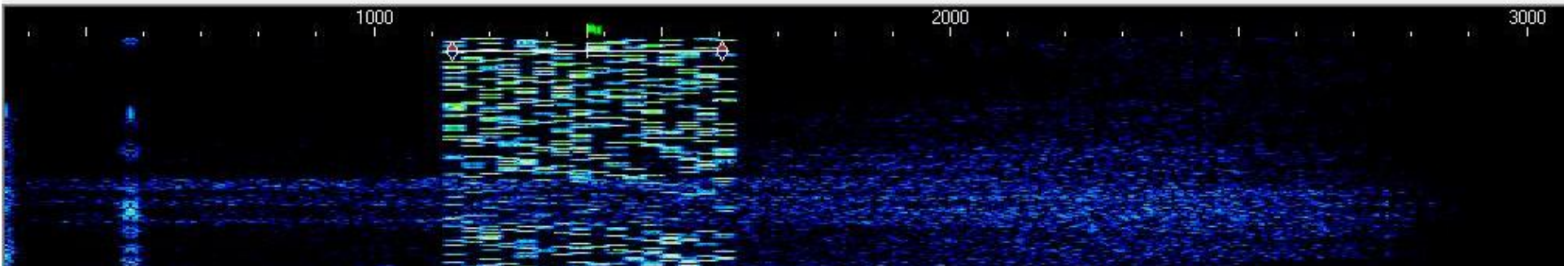
500 Hz wide

02:00:31 David **KB3FXI** de Bob **KC9IGZ**

100% copy your last, excellent sigs out of Pittsburgh Dave. The flagpole keeps me out of the HOA's crosshairs hihi.. Works quite well, need to get some more radials on it, 2/3 the way done on that little side project. The 40M coil does get it closer to the correct length, as does the extra section. As it is now, 80 meters is actually quite pleasing in performance..

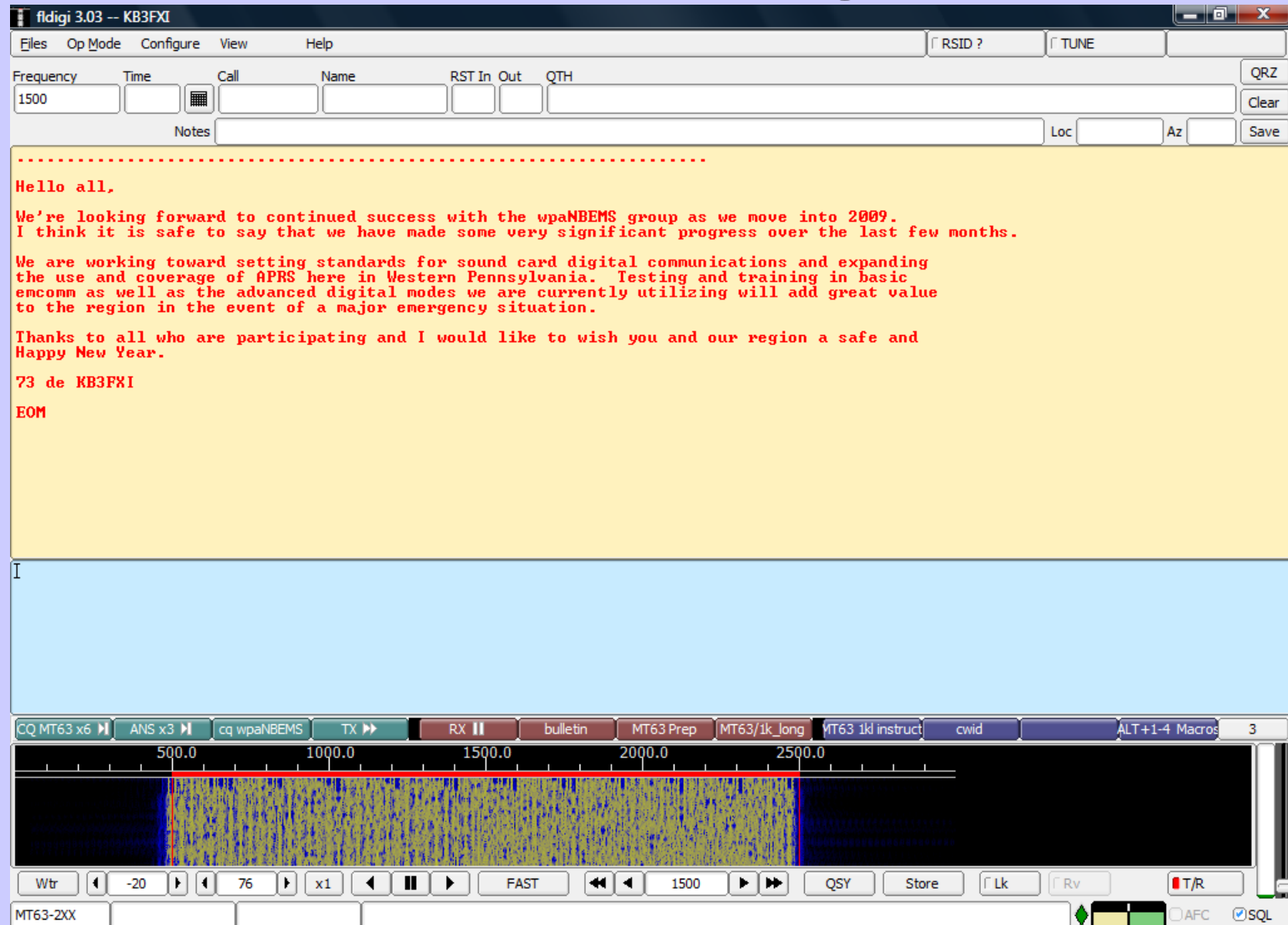
As it stands, furthest contact is Cyprus 🇨🇵, that was a stunning QSO :)

This mode might be a bit slow, but I swear I have seen it do some amazing



Here's a DEEP fade with no loss on text!

MT63 – 2k long



Actual text received 100% by 5 stations during NBEMS testing. Transmit time, 35 seconds.

NBEMS

The NBEMS testing continues with our group and all properly licensed Amateur Radio Operators are encouraged to join in on our testing schedules.

Please visit www.pa-sitrep.com/NBEMS for details on our schedules and for information on downloading, calibrating and using the software. Links to the site are also available in the qrz.com profile of KB3FXI.

Here are some useful links to sites with more information on NBEMS:

Official NBEMS Site:

<http://www.w1hkj.com>

WPA NBEMS Site:

<http://www.pa-sitrep.com/NBEMS>

CheckSR Sound Card Calibration Application:

<http://www.pa-sitrep.com/checksr/CheckSR.exe>

Youtube Video on Audio Level Settings for Sound Card Digital Modes:

<http://www.youtube.com/watch?v=I3CwHaX7t5M>

wpaNBEMS Yahoo Group E-Mail List:

<http://groups.yahoo.com/group/wpaNBEMS/>

QuickMix Audio Level Profile Software:

<http://www.ptpart.co.uk/quickmix/>

Digital Modes – Sight and Sound (identify different digital modes):

<http://www.w1hkj.com/FldigiHelp/Modes/index.htm>

**Thank you for your participation,
and I hope to see you on the
waterfall!**

This presentation may be distributed or used freely, without modification.

Feel free to contact the author of this presentation, David J. Kleber (KB3FXI) with any questions, comments or corrections. Contact information is current on QRZ.com.

Special thanks to the ARRL, W3YJ, O'Hara Township EMA, wpaNBEMS working group and all those who have supported the effort to utilize sound card digital modes for use in Amateur Radio Emergency Communications.