

# Getting Started with MT63

June 2007

MT63 is a complex multi-tone mode of transmitting and receiving data over a radio. There are currently 3 programs that operate this mode. Getting started and keeping costs minimal, we will use a freeware program written by IZ8BLY, Nino Porcino, (<http://xoomer.alice.it/aporcino/>) who wrote the original MT63 terminal program distributed to the ham community. His product was based on the MT63 source code developed by Pawel Jalocha SP9VRC. Technical information about the mode is at the end of this document for those that want a glimpse of the theory.

Some advantages of MT63 include: not requiring the purchase of a separate terminal node controller (TNC) (\$400 or more); MT63 performs better under poor propagation conditions; simultaneous MT63 and voice/AMTOR transmissions are possible without loss of data and MT63 places less wear and tear on transmitters due to a lower Average Power when transmitting.

MT63 is also far more immune to unintentional man made interference (QRM), jamming (QRJ) as well as natural interference (QRN) than the majority of existing conventional radiotelegraphy modes.

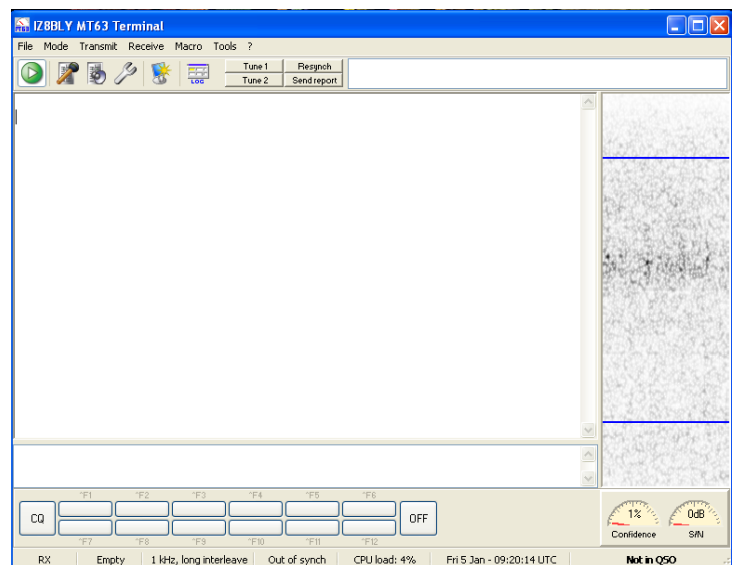
Certain factors are necessary for the MT63 program to operate effectively:

- a. MT63 requires a sound card equipped computer fast enough to handle the MT63 program (Pentium 200 MHz or Better). Many notebook PC internal audio electronics will not work.
- b. For a receive-only station, only a cable from the speaker or accessory audio output of the radio to the microphone input of the computer soundcard is required (most radios will provide too high a signal to the computer so a means of attenuating the signal may be needed to prevent overdriving the sound card input or you may need to use the line input.)
- c. For transmit capability, the software parameters need to be set to show your call sign, correct settings for COM ports and so forth. Also, an interface is highly recommended be used to isolate the computer from the radio. One can be built rather easily or purchased inexpensively.

## Let's get started...!

- **First, download the IZ8BLY software from <http://xoomer.alice.it/aporcino/MT63/index.htm>**

- **Simply unzip and run the "mt63\_v20\_setup.exe file" and it will install itself. The window shown on the right is what you should see when you first launch the program**

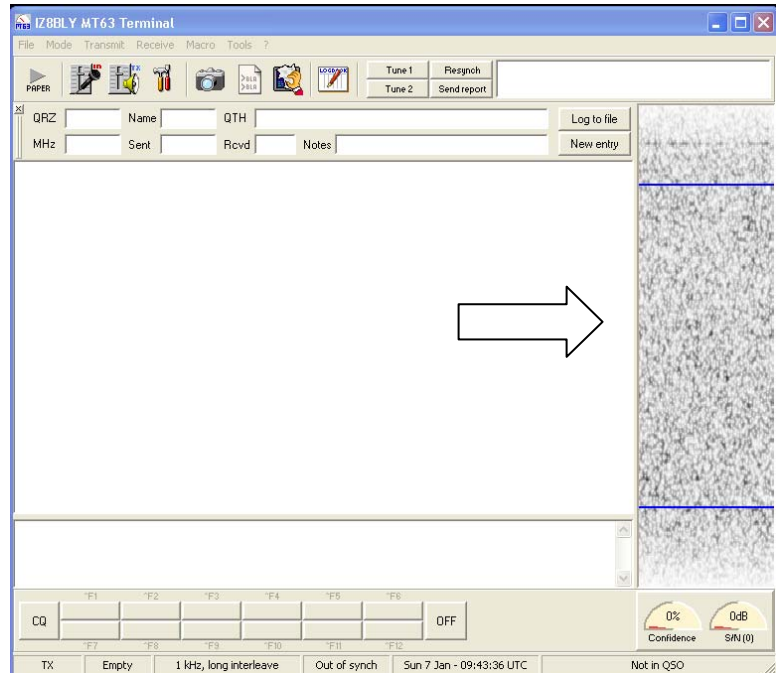


- **FOR RECEIVING, you need to find an audio source from your transceiver/receiver to connect your received audio into the PC soundcard microphone or line input. Many newer units have**

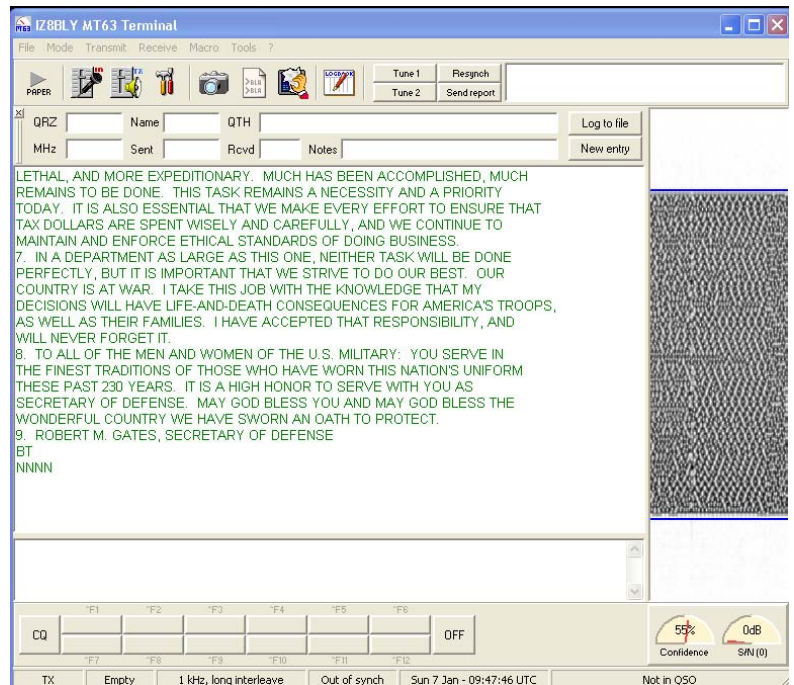
accessory jacks on the back for TNC/MCP/etc. output connections but if not, just hook it to the speaker or headphone connection. Make sure your soundcard settings are set to use the mode (microphone or line) you have connected.

- Now you are set to Receive MT63!

- If you have successfully wired the audio out from your receiver to the PC soundcard input, you should see noise scrolling from right to left on the pane to the right side of the MT63 screen as shown ...

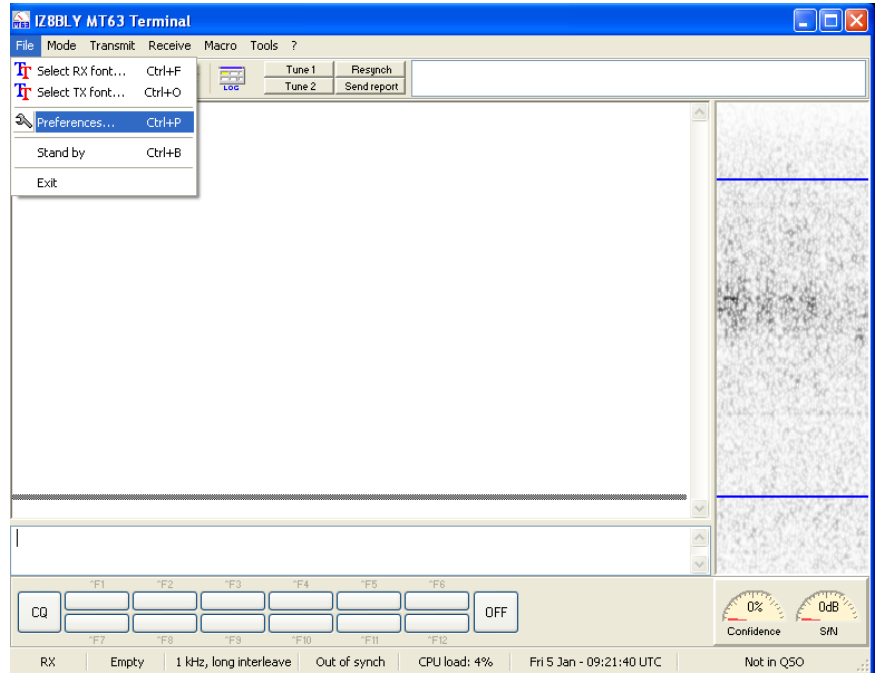


- When the receiver is properly tuned to an MT63 signal ('between the lines'), the two 'meters' on the bottom right should start reflecting both an increased 'confidence level' and 'SN' reading and you should start seeing text appearing on the text pane on the left & center of the window as shown in the green text ...

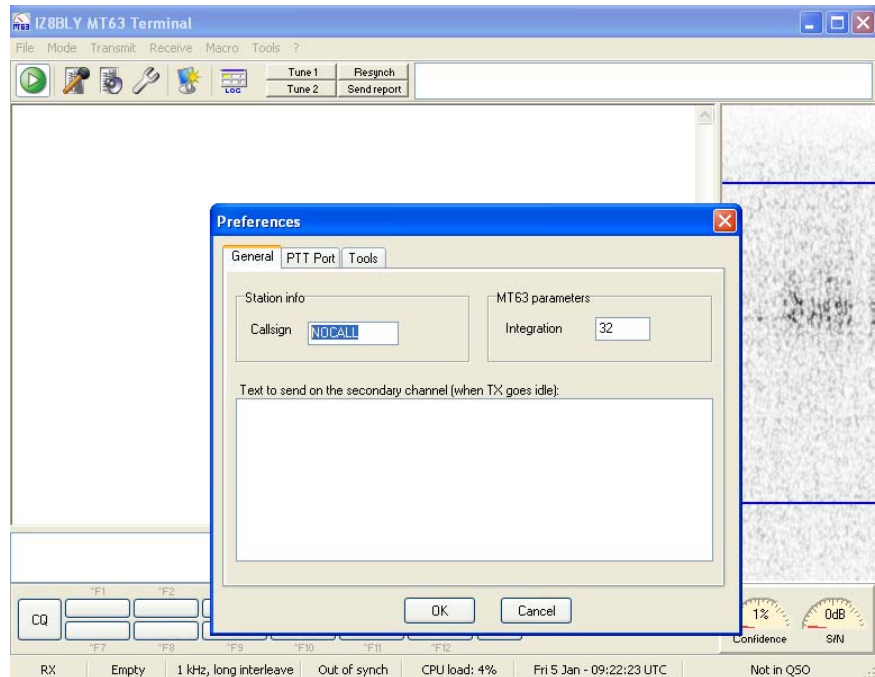


- **FOR TRANSMITTING**, from the PC Soundcard speaker or line output you will need to identify either an auxiliary audio input to the transceiver/transmitter or feed it into the microphone connection. If the program does not perform correctly 'out of the box', you may have to open up your PC sound settings window from the control panel and adjust the playback and recording levels appropriately. (Make sure that you set the transmit level appropriately so it does not overdrive the transmitter or you will 'splatter'.) Hint: A real easy method to inject the transmit tones is to just put the radio microphone in front of the PC speaker (if there is little to no background noise)!

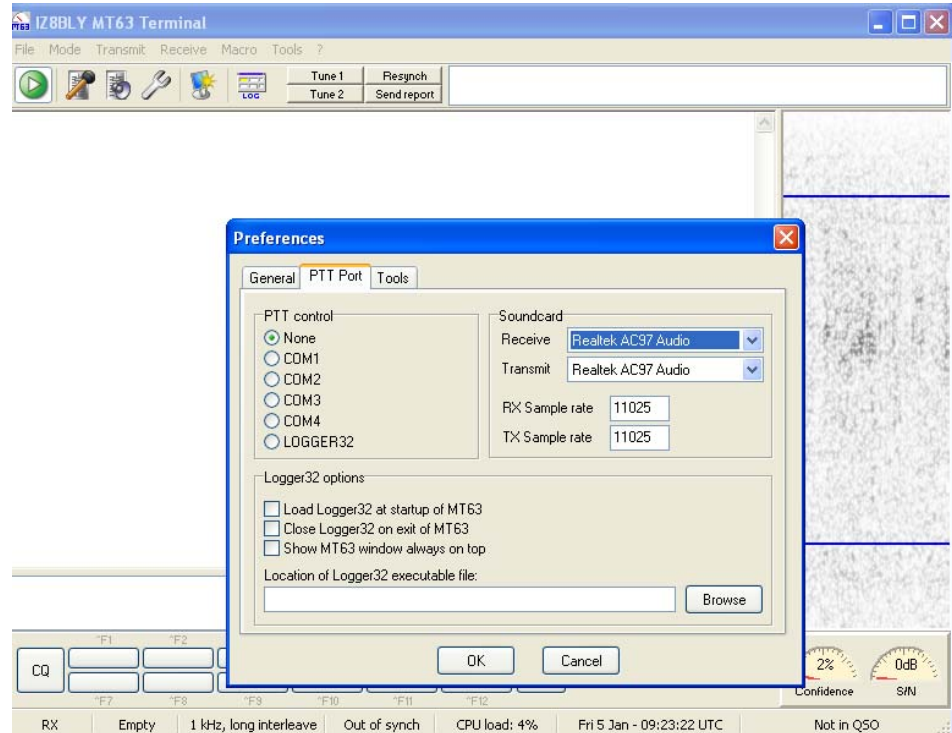
- Additionally, you will need to set up the transmit parameters in the program. To do so, click on the *File > Preferences* task bar menu as shown...



- Click **File>Preferences** and hit the **General** Tab. Fill in your data mode **Call Sign**.



- Select the 'PTT Port' Tab and select your active com port that will connect to the PC if you are going to use PTT control for transmitting. Also select your PC Soundcard settings. Leave the RX and TX Sample rates at the default value.



- To transmit text, simply paste it into the lower transmit pane.

**Now you're set to really operate both ways!**

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**Note:** MT63 requires a 200MHz PC or higher. If your computer is too slow to run MT63 Terminal, open the IZ8BLY.INI file and add/modify the following lines:

```
BlockLenMultiplier=1  
WaterfallSlowDown=0  
WaterfallEnabled=on
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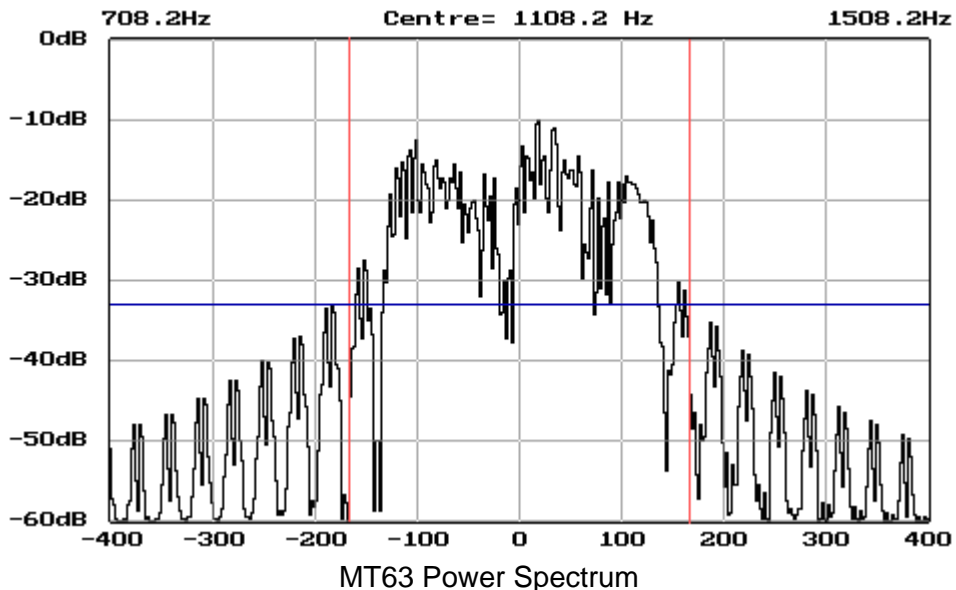
First try by giving values up to 20 to "BlockLenMultiplier": this will make the waterfall flicker more but will be less CPU intensive. Giving values greater than 0 to "WaterfallSlowDown" will make the waterfall display skip some lines in order to save CPU time. If still does not work try "WaterfallEnabled=off" which will completely skip the plot of the waterfall display. You can still use the "offset" information reported on the status bar for a perfect tuning.

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## MT63 Technical considerations...

MT63 is intended for conversational use between one or more radio stations, providing good performance under poor conditions, and consequently utilizes a Forward Error Correction (FEC) rather than Automatic Repeat reQuest (ARQ) process.

The MT63 modem, constructed around a high speed DSP processor (either in a dedicated external DSP unit or in PC software using the PC sound card)) transmits 64 tones spaced 15.625 Hz apart, in the 1 kHz bandwidth. The base-band signal occupies from 500 Hz to 1500 Hz. All 64 tones are differential bipolar phase shift keyed at 10 baud. Since the Walsh FEC code is 64 bit, the character rate is the same as the symbol rate, so the throughput with FEC is ten 7-bit ASCII characters/sec (about 100 WPM). The following diagram illustrates the 1 kHz wide MT63 spectrum:



There are two other bandwidths that can be used, 500 Hz, and 2 kHz, where the tone spacing and baud rate are halved or doubled, and the throughput halves or doubles respectively. Unless otherwise indicated, this description is of the default 1 kHz version.

There are four interleave options that can be used; none, very short, short, and long. The very short interleave option basically does away with the FEC feature of MT63. This could be used for keyboard-to-keyboard operations where some errors are allowable. The default interleave is long.

In addition, an optional doubling of the interleave period improves the temporal resistance (e.g. to burst noise) at the expense of increased time delay through the encoder and decoders. The different speeds are achieved by scaling all the timing factors, although the lowest carrier frequency remains constant at 500 Hz.

<b>Bandwidth</b>	<b>Audio Range</b>	<b>Symbol Rate</b>	<b>Char Rate</b>	<b>Interleave/char</b>
500 Hz	500 - 1000 Hz	5 baud	5 char/sec	6.4 or 12.8 sec
1000 Hz	500 - 1500 Hz	10 baud	10 char/sec	3.2 or 6.4 sec
2000 Hz	500 - 2500 Hz	20 baud	20 char/sec	1.6 or 3.2 sec

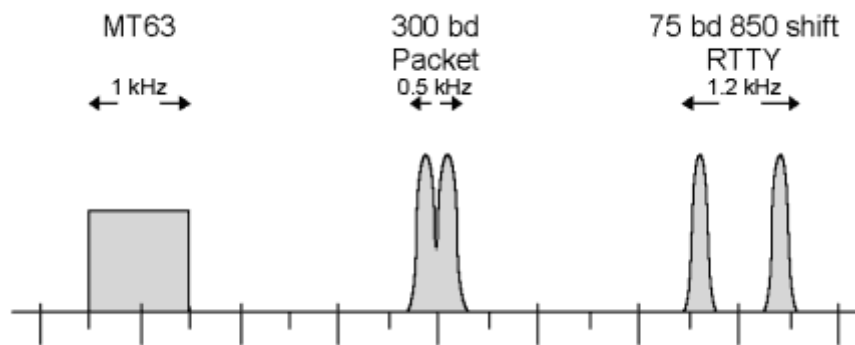
The user data from keyboard or file, (the data code is 7-bit ASCII), is further encoded into 64 bits using a Walsh/Hadamard function to provide a highly robust FEC technique with high

redundancy. The Walsh function ensures that up to 16 of the 64 bits can be corrupted, yet decoding will still produce an unambiguous result.

The MT63 signal is spread both in the time domain (temporally) and the frequency domain (spectrally). To ensure that noise bursts and other time domain interference artifacts have minimal effect, each encoded character is spread over 32 sequential symbols (3.2 sec). To ensure that frequency domain effects, such as selective fading and carrier interference have minimal effect, the character is also spread spectrally by using all the tones across the width of the transmission.

## Bandwidth

Because it has 64 tones, the MT63 transmission is quite wide (usually 1 kHz), and it has a harsh rushing sound. It has sharply defined edges, so it is possible to fit two MT63 transmissions in the width of an SSB transmission. Yes, MT63 is still less than half the bandwidth of an SSB transmission.



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One final technical note: If you want to use any of the soundcard digital mode programs and don't want to have to reset the in/out volumes on either the digital mode program or your other programs, here is a freeware program called *QuickMix* that will allow you to set up multiple audio profiles for the different audio applications you use. Find it at <http://www.ptpart.co.uk/quickmix/>

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For additional information over and above that available on the mentioned websites listed in the text on page 1, please visit the Navy-Marine Corps MARS (NMCM) National Website training area at <http://navymars.org/national/training/digital.htm> and download the Digital Modes I and II documents. Digital Modes III talks about formulating and sending a point to point message in the NMCM program.

Good luck and enjoy!

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*This document was created in Jan 2007 by Gary J Takis, NNN0KUL, WA, to support the SHARES Digital Broadcast program startup and revised in June 2007. The information on this document was compiled from the MT63 software vendors mentioned and many other public websites covering the MT63 operating mode. Suggestions for improvement are encouraged and should be sent to [NNN0KUL@navymars.org](mailto:NNN0KUL@navymars.org).*