Amateur Digital Modes

What are they?
How do they work?
MT-63 and NC ARES

Joe Wallace, K4EIT

What are digital modes?

- Methods to transfer digitally assembled information via radio waves (using software, etc.)
- Digital data converted to audio for xmt
- Signal (carrier) is modulated with the audio
- Data transferred can be voice, text, files, etc.

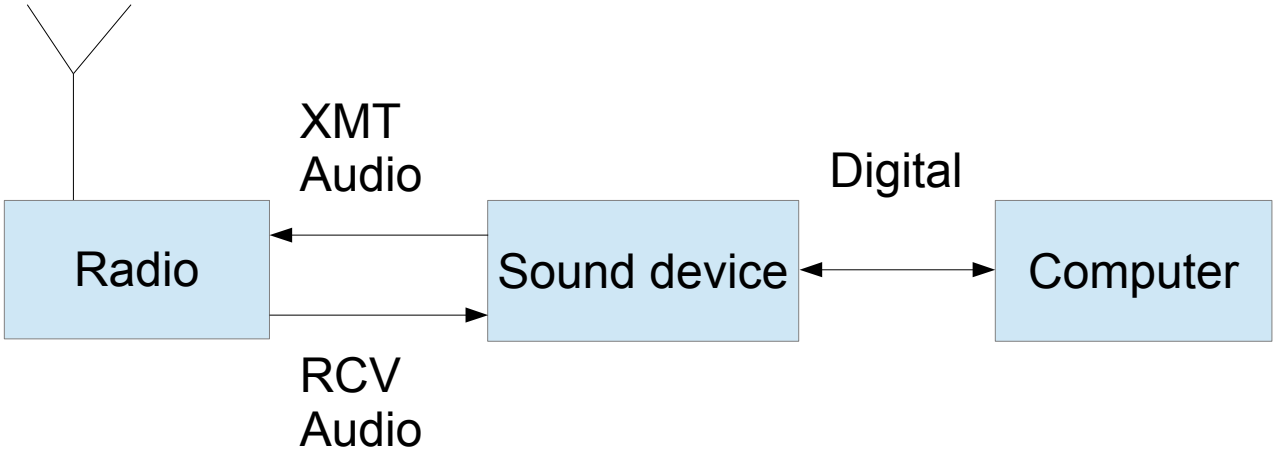
Advantages of digital modes?

- Transfer files & text point to point, or one to many
- Error correction for certain modes
- Lower power settings than voice modes
- Original data “might” be transmitted in native form
- Less subject to noise, interference & fading
- Easy log of information sent & received

What is Error Correction, and why use it?

- Disturbances in analog communication cause errors in the received information
  - noise, interference and fading
- ARQ – **A**utomatic **R**epeat **R**equest
  - Data is sent in packets
  - Rcvr acknowledges properly received packets
  - If no ACK, the xmtr sends again
- FEC – **F**orward **E**rror **C**orrection (channel coding)
  - Data is encoded in a using redundancy

What does it take?



Radio – HF Rig, VHF, HT, etc. (xmt/rcv audio and PTT)

Sound device – Signalink, rig built-in (ex. IC7200), direct cables, sound card, air gap

Computer – Pentium or newer (suggested), FLDIGI (or other)

Common Problems

- Receiver bandpass too tight
- ALC high, xmtr overdrive
- Receive / transmit audio level adjust
- Audio adjustments in several places
- Proper config for PTT
- Proper mode selection on waterfall
- User of squelch in application
- Power out too high (high duty cycles)
- Most digital modes in USB

Why does NC ARES care?

- Digital modes to augment voice modes
- MARS already standardizing on MT-63
- NC ARES SET 2013 directed use of MT-63
  - SET Simulated Emergency Test
  - Exercise could have been better

MT-63

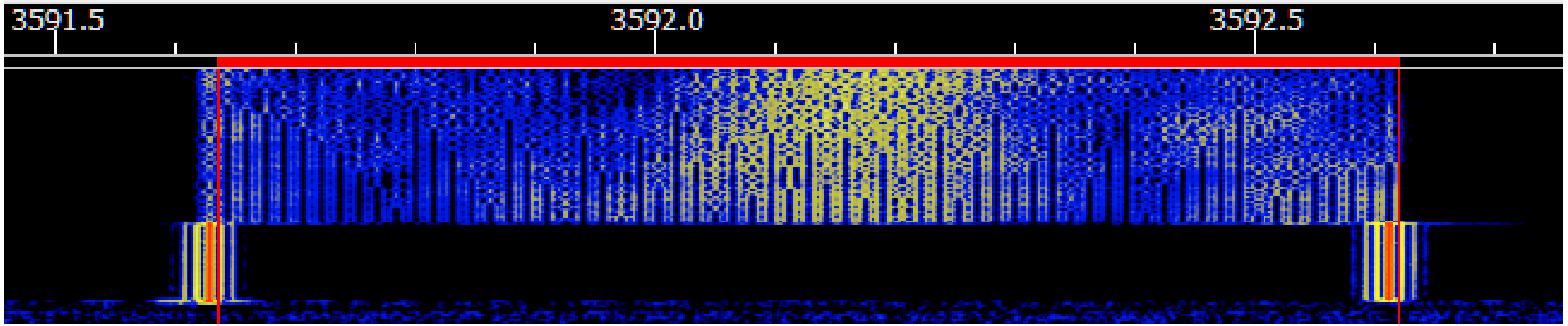
- MT63 is an “orthogonal frequency division multiplexed mode consisting of 64 parallel carriers each carrying a part of the transmitted signal”. There are 3 bandwidths and baud-rates that fldigi implements in MT-63:

- 500 Hz - 5 baud - 5.0 cps (50 wpm)
- 1000 Hz - 10 baud - 10.0 cps (100 wpm)
- 2000 Hz - 20 baud - 20.0 cps (200 wpm)

MT-63

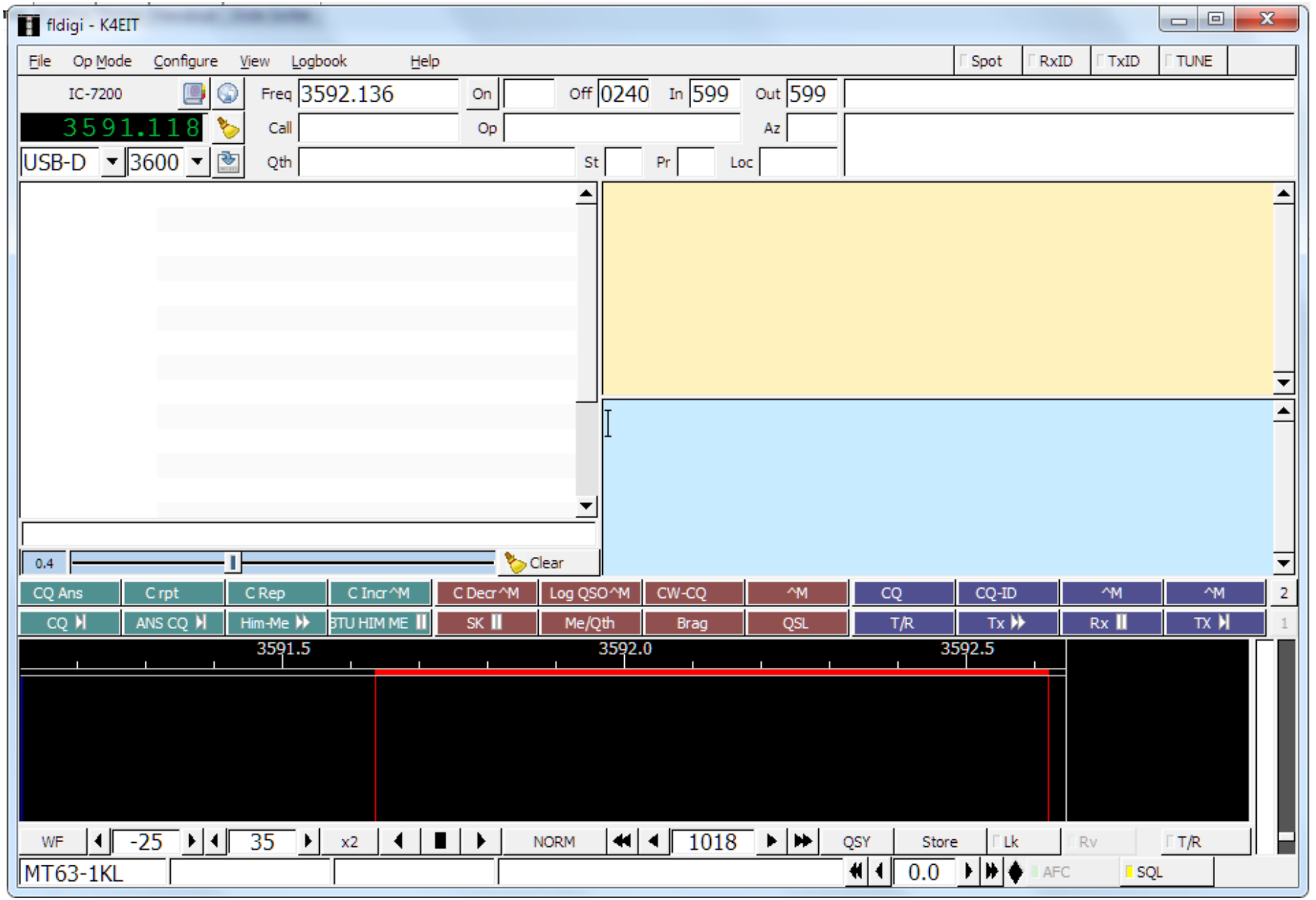
- The lowest frequency transmitted is always 500 Hz. If you have a scheduled MT63 qso or are trying to copy what you think is MT63 you should tune the signal so that the lowest observable signal is at 500 Hz. Fldigi is capable of decoding signals that are mistuned by as much as +/- 100 Hz.

MT-63



- The MT-63 signal on the “waterfall”
- 64 channels, aka. “tones” (different than other modes)
- each character is spread over many tones (to avoid interference such as other radio transmissions) and over several seconds (to avoid bursts of noise, such as lightning)

FLDIGI


fldigi - K4EIT
File
Op Mode
Configure
View
Logbook
Help
Spot
RxID
TxID
TUNE
IC-7200
3591.118
USB-D
3600
Freq 3592.136
On
Off 0240
In 599
Out 599
Call
Op
Az
Qth
St
Pr
Loc
0.4
Clear
CQ Ans
C rpt
C Rep
C Incr ^M
C Decr ^M
Log QSO ^M
CW-CQ
^M
CQ
CQ-ID
^M
^M
2
CQ
ANS CQ
Him-Me
STU HIM ME
SK
Me/Qth
Brag
QSL
T/R
Tx
Rx
TX
1
3591.5
3592.0
3592.5
WF
-25
35
x2
NORM
1018
QSY
Store
Lk
Rv
T/R
MT63-1KL
0.0
AFC
SQL

Demonstrate!

- Saved audio files can be replayed later
- Components – FLDIGI and Audio files
- Audio files were edited in Audacity

Hope it works as planned!

MT-63 Tests

- First test with MT-63 500S
  - Install FLDIGI
  - Configure for transceiver and soundcard
  - Familiarization with MT-63 mode
- Second test follow on for MT-63 500S
  - Test transmit and receive with MT-63 500S
  - Soundcard calibrations (Checksr.exe)
- Third test use NC ARES mode MT-63 1000L
  - Check FEC for all stations, perfect copy of test message
  - Resolve remaining configuration problems

What did we learn?

- MT-63 implements FEC, and it works
- Open the receive bandpass (remove filters)
- Minimize ALC (do not overdrive xmtr)
- Transmit prepared messages (highlight buffer)
- Soundcard calibration is important
- 80M better than 10M for local testing
- 20W or less power worked well
- Error correction delays xmt characters (secs)
- Test and Practice, Practice, Practice to learn it!

How Can I Participate?

- TAARS Net for Learning Digital Modes
- Objective: Explore the digital modes, and become proficient operators.
- Thursday Evening at 8pm (TAARS net at 9pm)
- Coordinated via voice
  - EC VHF (146.655) PL 131.8, and (linked)
  - Hertford VHF (147.330)
- Very Informal!
- Users of all levels
- learn or **teach**

References

- http://www.ncarrl.org/ares
- ARRL “Intro to Emergency Communications”
  - Course EC-01
- FLDIGI application and website
  - http://www.w1hkj.com/Fldigi.html
- Wikipedia
  - http://en.wikipedia.org/wiki/MT63
  - http://en.wikipedia.org/wiki/Error_correction
- MT-63 Technical Information
  - http://web.archive.org/web/20081217173125/http://www.qsl.net/zl1bpu/MT63/Technical.htm

Thanks!

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Thanks for your attention. I hope you found this interesting, and informative.