

AMATEUR RADIO FACT SHEET / DISCUSSION POINTS

TOPIC: **Digital Throughput Versus Voice**

In a massive disaster vast numbers of messages must get through, in order to maintain common operating picture, situational awareness and effective command and control. Even with pedestrian amateur radio digital systems, such as Packet (AX.25), MT63 and others, the throughput of digital communications far outpaces what can be reliably and faithfully delivered by voice communications. Essentially, voice communications are not only hampered by normal static and poor signals in communications systems, but also **require data entry at the receiving end**, in the form of either handwriting or typewriting to create a written version of the data that can be promulgated to others. Normal handwriting can't keep up 20 words per minute (wpm) for long. Most typists are in the range of 40-70 words per minute -- and it is exceedingly rare that this level of throughput can be maintained using voice channels.

By comparison, digital systems have inherently **far higher throughput**. Digital systems come in at least two flavors: "broadcast" (non-ARQ) and "error-corrected" (ARQ -- "Acknowledge-Request"). (Broadcast signals can be further broken into those with forward error correction and those without, but neither can be guaranteed error-free.) As the name suggests, broadcast systems have no inherent security! Error corrected systems typically require a form of acknowledgment / non-acknowledgment and handshaking to allow repeat transmission of frames ("packets") of data that were found to have errors in the transmission. Typically such error-corrected transmissions are a one-to-one transmission, whereas non-error-corrected modalities allow for broadcast from one-to-many, but without an ironclad guarantee of perfect transmission.

Table 1-1 compares an estimate of voice transcribed throughput to one relatively high speed broadcast-type (non-error-corrected) radio digital mode, and the error-corrected modes utilized by the proven WINLINK email amateur radio transmission system. Figure 1-1 shows graphically the same data.

TABLE 1-1 COMPARISON THROUGHPUT, VOICE VERSUS BROADCAST OR ERROR CORRECTED AMATEUR RADIO

MODE:	VOICE	MT63-2K ("Broadcast")	WINLINK Error-corrected
Most apparent limiting factor	writing/typing speed of receiving station		
Peak sustained throughput, words per	30 wpm (estimate sustained accurate)	200 wpm ⁱ My testing: 240 wpm	PACTOR P3 2,400 wpm estimate ⁱⁱ WINMOR > 1000 wpm (actual)

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min (word=5char)	typist radio copy speed)		measurement of large file)
Estimated 50-word messages per minute	0.30	2.0	WINMOR - measured 3.02 ¹
Advantage over VOICE	1.0	566% faster	906% faster (for large files 6,800% faster) ²

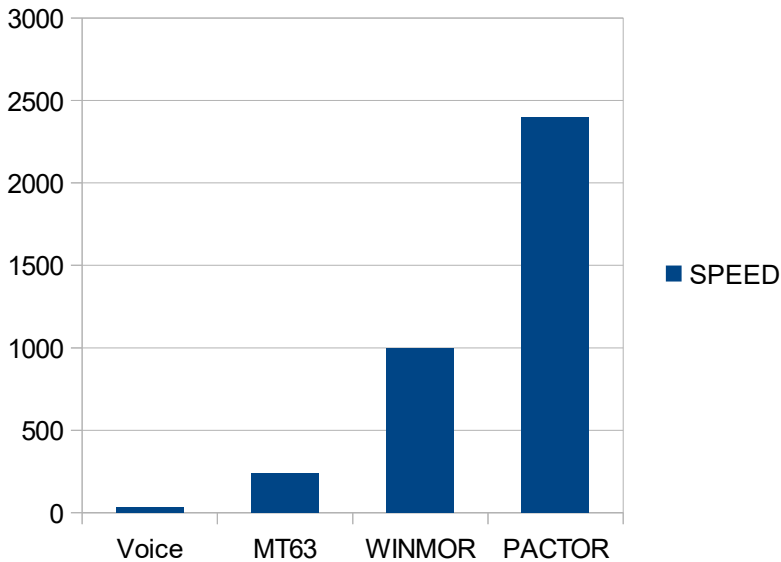


Figure 1-1. *Speed in word per minute of voice versus several digital modes, for “record” communications (which must be written down accurately). Voice compares rather poorly, because it is basically limited by a 30 wpm typical typing speed copying actual radio comms.*

1 Actual test results carried out with optimal signal strength, twenty 250-character (50 “word”) individual email messages

2 Actual test results carried out with optimal signal strength; 30,000 word file for “large file”

- i See <http://www.w0btu.com/wm2u/mt63.html> and <http://www.arrl.org/mt-63>
- ii <http://www.arrl.org/pactor-iii>