6. DIGITAL MODES – AI6JB

Chapter 6 Digital Modes

ARRL General Class
Sections 6.4 Receiving & Transmitting Digital Modes

Receiving & Transmitting Digital Modes

Most digital modes on HF are transmitted as USB signals

- Exception … RTTY uses LSB

Modem or software must be configured to correct baud rate and receiving tone frequency to receive data, even if the signal is strong and seems to be tuned correctly

Since PSK31 uses a single tone, either USB or LSB will work (most use USB)

Bandwidth of Digital Modes

Like other amateur signals, digital mode bandwidth is defined by the FCC … §97.3(a)(8)

- Bandwidth of signal changes with the symbol rate
- As symbol rate increases, so does the bandwidth needed for the signal needed to transmit them … see Table 6.2 for details

Most common method of generating / transmitting these modes is to connect to audio output from computer sound card to microphone of an SSB transceiver

Bandwidth Comparison of Digital Modes

Bandwidths are approximate for the highest commonly used symbol rate and are not specifications

Be careful when operating near the edge of a data signal band. Using LSB for an FSK mode, the sidebands will be *below* the displayed carrier frequency of you radio.

MODE	BANDWIDTH (Hz)
PSK31	50
FT8	50
RTTY	200
MFSK16	300
JT65	350
DominoEX	524
Olivia	1000
WINMOR	1600
MT63	2000
PACTOR-III	2300
PACTOR-4	2300

FSK = Frequency shift keying

Transmitter Duty Cycle

Most amateur transmitters are not designed to operate at full power for an extended period of time

- CW only operates at full power 40-50% of the time
- SSB only operates at full power 20-25% of the time
- FM modes operate at full power the entire transmission time!

Extended transmissions may be enough to exceed a transmitter's average power rating

- Reduce transmit power to prevent overheating (usually to 50% of max.)

Digital Mode Signal Quality

Digital modes can generate interference (like phone and CW)

For digital modes that use an SSB transmitter to transmit audio frequency shift keying (AFSK), the most common problem is supplying too much or too little audio from the computer to the radio's microphone input

On waterfall displays, the vertical lines represent spurious emissions … caused by overmodulation of the transmitter

MFSK16 (another variation of FSK, m = multi) is a method of signal modulation that extends the radio teletype (RTTY) two-tone technique to multiple tones, producing fewer errors

ALC and Digital Modes (automatic level control)

Used for preventing excessive drive to amplifier inputs

ALC circuits reduce gain when power levels get too high

- However, it comes at a price. The signal compression can result in distortion.
- Resist temptation to turn up gain

For digital signals, distortion caused by ALC makes the signal harder to decode and creates spurious emissions, similar to overmodulation

When in digital mode, your ALC system should be either disabled or the input level and gain turned down to the point where the ALC does not activate.

QUESTIONS?

ONLINE EXAM REVIEW AND PRACTICE QUESTIONS:

http://www.arrl.org/examreview