5. Tune-up Procedure

Transmitter programming is performed with the PC-based Radio Service Software (RSS).. The RSS runs under Microsoft Windows 95/98, 2000, ME, XP, or NT and allows the Transmitter to be programmed for operating frequencies, CTCSS and DCS signaling, and modulation type. Analog test modes may be selected by the Radio Service Software, as well as test modes specific to P25 digital operation.

Transmitter settings are divided into two categories, Transmitter Wide options, which apply to all channels, and Channel Wide options, which can be programmed differently for each channel. When the Transmitter menu is selected from the main screen, both the Transmitter Wide and Channel Wide options for the current channel are displayed.

The RSS may be used to save a Transmitter configuration to disk. This function allows the user to save a “standard” configuration, and use it as a starting configuration for all Transmitters. An archive of configurations from each radio system in operation may also be kept so that replacement radios can be programmed easily.

5.1. Transmitter Wide Settings

Several options may be set which affect the operation of the Transmitter on a global basis.

5.1.1. Frequency Band

There are four Frequency Bands available for Transmitters:

VHF	136-174 MHz (0.5-8.Watt)
UHF Low Band	380-406 MHz (0.5-8.Watt)
UHF Mid Band	406-470 MHz (0.5-8.Watt)
UHF High Band	470-512 MHz (0.5-8.Watt)

When the Frequency Band is changed, the **Frequency** field in every Transmitter channel will be changed to the lowest frequency in the band.

5.1.2. Unit ID

This field contains the unique Transmitter unit ID in Hexadecimal. (There is no need to enter an initial ‘$’character.) The default value is $1. The spin button to the right of this field allows you to incrementally change the ID. This unit ID will be transmitted in the source ID field along with every P25 voice frame if the transmitter is keyed using the Microphone PTT and each Transmitter should have a different number.

5.1.3. Secure Hardware Equipped

This setting is not used for Repeater Transmitters, but is used for Daniels P25 Base Transmitters. Correct repeater operation does not require that an encrypted signal be decrypted.

5.1.4. Holdoff Delay

This feature is to allow the use of a Tone Panel in analog mode. When enabled, it prevents the tone panel signal from interfering with the audio signal. The transmitter is activated 250ms after the rear connector PTTs (or the microphone PTT) are keyed. When disabled, the transmitter is activated immediately after the rear connector PTTs (or the microphone PTT) are keyed. This is the default configuration.

5.1.5. Hang Time

Hang time is a selectable time delay, which can be enabled to keep the transmitter keyed after its PTT input is released. It can be used to keep an RF channel open in low signal conditions when the receiver might by squelching intermittently. It is also commonly used at the end of the transmission to keep the transmitter keyed long enough to provide confirmation that the repeater has been activated by mobile radios. The duration of the hang timer is selectable in 250ms increments from 0 (disabled) to 3.75 sec. Note that the Hang Time is applied only when the radio is keyed by the ANALOG_COR* or DIGITAL_COR* inputs, not from the front panel Mic connector or the PTT signal from the M-3 subrack.

5.1.6. Squelch Tail

It is possible to add a burst of noise (a “squelch tail”) to the end of each transmission. This will occur for the duration of the hang time. When the transmitter is used in a repeater configuration in digital repeat mode, it may be difficult for mobile radio users to hear that they have successfully “hit” the repeater, since P25 radios usually operate in a “silent squelch” mode. The squelch tail noise is an audible indicator that the repeater was indeed keyed.

Note that the squelch tail noise is applied only when the radio is keyed by the ANALOG_COR* or DIGITAL_COR* inputs. It is not applied when the transmitter is keyed by the PTT signal from the MT-3 subrack nor from the front panel Mic connector. In addition, if the radio is keyed again before the hang time has expired, the squelch tail noise will not be sent until the hang timer is set again by removal of the keying source.

5.1.7. Timeout Options

The transmitter provides a selectable timeout timer for each channel, which causes the transmitter to be de-keyed after the selected interval of continuous transmission has been completed. Two transmitter timeout values are provided, and one of the timeout values may be used in each of the 32 programmable channels. The range of values is from 15 to 465 seconds in increments of 15 seconds, or Infinite Time may be chosen.

These selected Timeouts can then be used in the Timeout Value field in each Transmitter Channel Setting. These fields are used to program the parameters for a single Transmitter channel only. There are 32 different available channels labeled A1 - A16 and B1 - B16. The parameters for each channel are independent of parameters in other channels.

5.2. Channel Wide Settings

The transmitter may be programmed with up to 32 channels, each with a different frequency, channel bandwidth and modulation type. The channels are arranged in two banks of 16 channels each, referred to as Bank A and Bank B. In this manual, a specific channel is referred to by its bank and channel i.e. B12 would refer to channel 12 in bank B. The following are all the settings that may be programmed on a per-channel basis.

5.2.1. Channel Name

Each channel may be assigned a text name of up to 11 characters. The name is stored in the radio, but is never broadcast. It is provided as a means of identifying the channel during configuration. The channel name will default to the bank and channel number (i.e. “A1” for bank A, channel 1).

5.2.2. Channel Type

Each MT-4D Transmitter can be programmed in analog only, P25 digital only, or mixed mode. P25 signaling is a purely digital mode, compatible with other APCO P25 radios. Analog mode is for transmitting analog FM modulated signals. Mixed Mode is both Digital and Analog signals. The audio signal may also be injected at the CNTL BUS jack on the front panel for interfacing to MT-4D Receivers.

5.2.3. Frequency

The transmitter’s frequency may be set here. The Radio Service Software will only allow frequencies within the operation band (set in the Transmitter Wide options above) to be entered.

5.2.4. Timeout Value

This option allows selection of one of two preset timeout timer values. Each of the two preset values is set in the Transmitter Wide Settings panel, in the section called Timeout Options. If the transmitter is keyed continuously for longer than the selected time, it will be de-keyed. To reset the timeout timer, the applied PTT* signal or ANALOG_COR* or DIGITAL _COR* signal must be removed for a period at least as long as the hang time.

5.2.5. P25 Squelch Settings: Network Access Code

For P25 channels, the transmitted Network Access Code can be set here. The Network Access Code (NAC) is a 12 bit field embedded within every P25 voice call.
NACs are primarily used for two purposes:

1. They allow a large system coverage area to be serviced by separate repeaters.
2. They allow multiple repeaters to service multiple systems with overlapping coverage areas. NACs achieve these functions by minimizing co-channel interference. This is done by keeping the receiver squelched unless a signal with a matching NAC arrives.

The NAC's 12 bit field ranges from 0 to 4095 (hexadecimal $0 to $FFF). The default value is $293 and two values are defined for special functions in the receiver.

1. When a receiver is set for NAC $F7E, it unsquelches on any incoming NAC, but changes the NAC to the one programmed in the transmitter.
2. If a repeater receiver is set for NAC $F7F, it also unsquelches on any incoming NAC. The P25 repeater will repeat any NAC that it receives.

P25 Squelch Settings: Talk Group ID

The transmitter's Talk Group ID can be set here. This applies to P25 signals only.

The Talk Group Identifier (TGID) is a 16 bit field embedded within every P25 voice call. The purpose of a Talkgroup is to allow logical groupings of radio users into distinct organizations. The TGID's 16 bit field ranges from 0 to 65,535 (hexadecimal $0 to $FFFF). Three of these values are set up for special functions.

1) The default value of $1 should be used in systems where no other talkgroups are defined.
2) A value of $0 corresponds to "no-one" or a talk group with no users.
3) A value of $FFFF is reserved as a talk group which includes everyone.

Analog Signaling Settings: Signaling

This setting may be set to No Tone, CTCSS or DCS. When either CTCSS or DCS Squelch Type is selected, additional combo boxes appear to allow selection of a particular tone or code.

Analog Signaling Settings: CTCSS Tone

This field allows selection of any of 42 EIA CTCSS tones.

Analog Signaling Settings: Reverse Burst

For CTCSS channels only: When this field is set to "Enabled", each transmission is terminated with a short burst of CTCSS tone with its phase reversed 180 degrees. This allows suitably equipped receivers to squelch their audio circuits before the transmitted carrier is dropped, giving a silent squelch operation.

Analog Signaling Settings: DCS Code

This field allows selection of any of 83 DCS tones.

5.2.6. Turnoff Code

For DCS channels only: When this field is set to “Enabled”, each transmission is terminated with a short burst of 136 Hz tone. This allows suitably equipped receivers to squelch their audio circuits before the transmitted carrier is dropped, giving a silent squelch operation.

5.2.7. Analog Squelch Settings: Invert DCS

This setting is in effect when the Squelch Type is set to DCS. It may be set to Normal DCS or Invert DCS. When Invert DCS is selected, the transmitter will broadcast a DCS signal whose polarity is reversed. This should not be required unless the distant receiver has its DCS configured with the wrong polarity, typically when DCS has been installed as an after-market option.

5.2.8. Analog Bandwidth

This setting should be changed to match the channel spacing and bandwidth of the analog channel. This setting is visible only when the Channel Type field is set to Analog or Mixed Mode.

5.2.9. Audio Pre-emphasis

For analog channels, the standard 6 dB/octave pre-emphasis curve may be either disabled or applied to the transmitted audio. Pre-emphasis is applied to audio from the balanced audio input, the microphone input, and the audio input on the CNTL BUS jack on the front panel.