Circuit Descriptions

This exhibit contains, on the following six pages, the circuit descriptions for this equipment as follows:

Exhibit 8A - Means for Frequency Stabilization

Exhibit 8B - Means for Modulation Limiting

Exhibit 8C - Means for Attenuation of Higher Audio Frequencies

Exhibit 8D - Means for Attenuation of Spurious Emissions

Exhibit 8E - Means for Limiting Output Power

Exhibit 8F - Modulation Techniques

Means for Frequency Stabilization

Frequency stability is maintained by a reference oscillator/programmable temperature compensation circuit located in the frequency synthesizer IC U201. The oscillator is a Colpitts design with an amplifier on the IC. The 16.8 MHz crystal, varactor and feedback capacitors are external circuitry. A control voltage applied to the varactor via the programmable compensation circuit maintains the frequency stability to within +/- 2.5ppm over temperature. Frequency tuning, also from the programmable compensation circuit, has 128 steps of resolution.

Each 16.8 MHz crystal is numerically coded providing its unique characteristic over the temperature range. With this information an equally unique compensation is programmed into the programmable compensation.

Means for Limiting Modulation

Modulation limiting is accomplished within U451. The limiting action itself occurs at the rails (i.e., 5V and ground). Using an opamp with feedback, very hard limiting is obtained. The limited modulation signal is then input through a low-pass filter to an electronic attenuator within U451 in order to adjust for variations in modulation sensitivities of the frequency synthesizer.

The electronic attenuator is controlled by the radio logic circuit. To keep the deviation constant over RF frequency range, the microcomputer adds the proper correction factor to the attenuator.

Means for Attenuation of Higher Audio Frequencies

The output of the limiter is applied to a low-pass filter. The filter is a fifth-order switched capacitor filter with the roll-off corner at 3000Hz. The output of the low-pass filter is input to the electronic attenuator.

Means for Attenuation of Spurious Emissions

The output of the final transistor feeds a low-pass filter in order to attenuate harmonics of the output frequency as well as spurious outputs. The filter is a seven pole 0.1 dB ripple Chebyshev.

Means for Limiting Output Power

The transmitter line-up consists of four stages of amplification. The second stage device is power controlled by regulation of its collector voltage. A DC pass device which is controlled by a comparator circuit provides the proper voltage to the collector.

The comparator circuit receives a reference voltage from a PWM output of the microcomputer. The final RF stage of the module provides a feedback signal which is proportional to the output RF power.

Modulation Techniques

The transmitter is capable of the following type of modulation:

1. Modulation of PL, DPL, and DTMF.

Direct FM of PL, DPL and DTMF is generated by the radio microcomputer by a multi-state tone encoder. The modulation signal is processed through a five pole switched capacitor filter with a frequency response shown in Exhibit 9B. The output of the filter is input to the electronic attenuator circuit.

The data signals are generated in the same manner. The audio signals and the data signals are summed together prior to the deviation adjust circuit.

The microcomputer adjusts the attenuator to compensate for modulation sensitivity variations of the synthesizer. This assures 15% of full system deviation for PL and DPL, and 60% of full system deviation for DTMF.