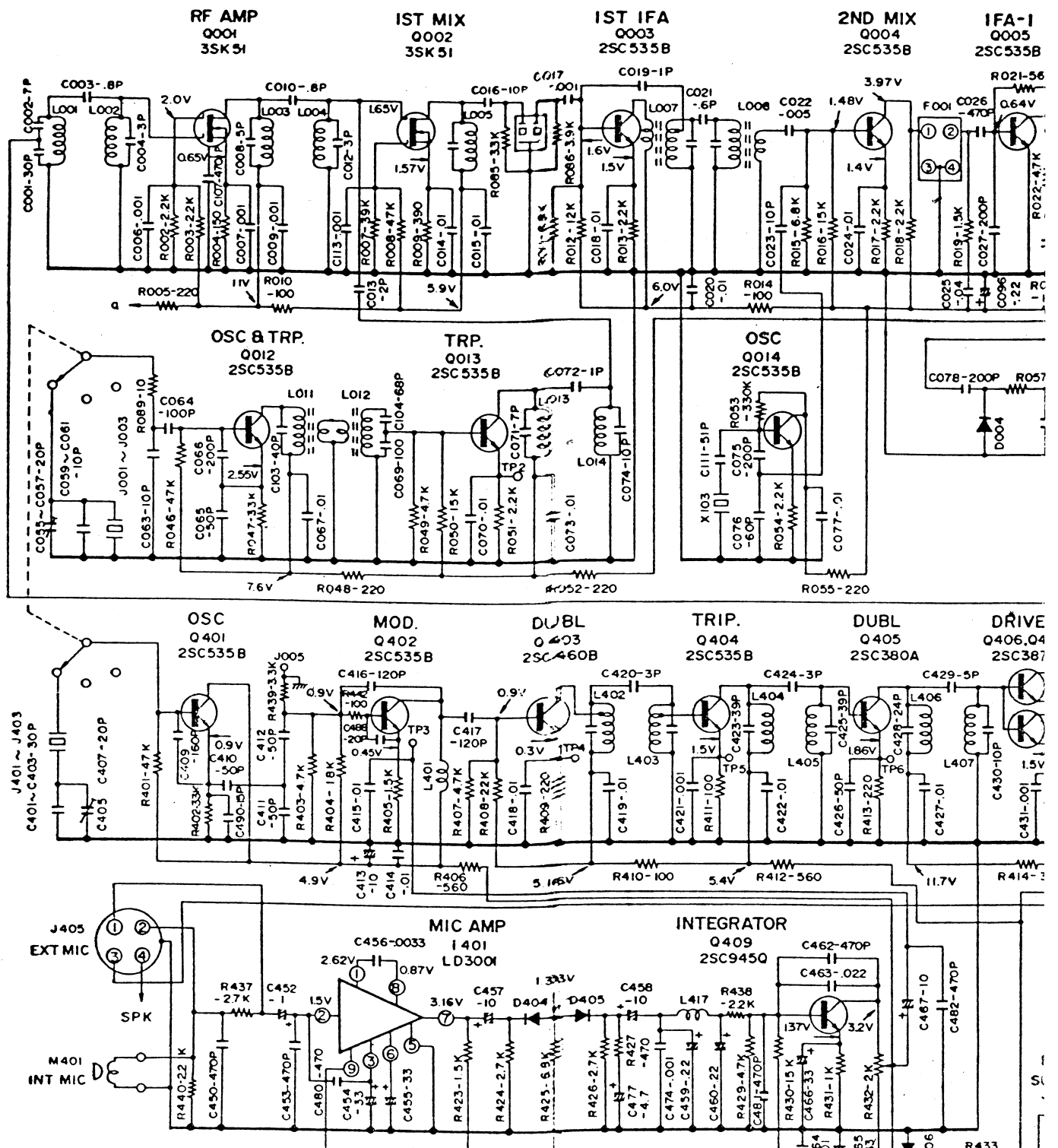
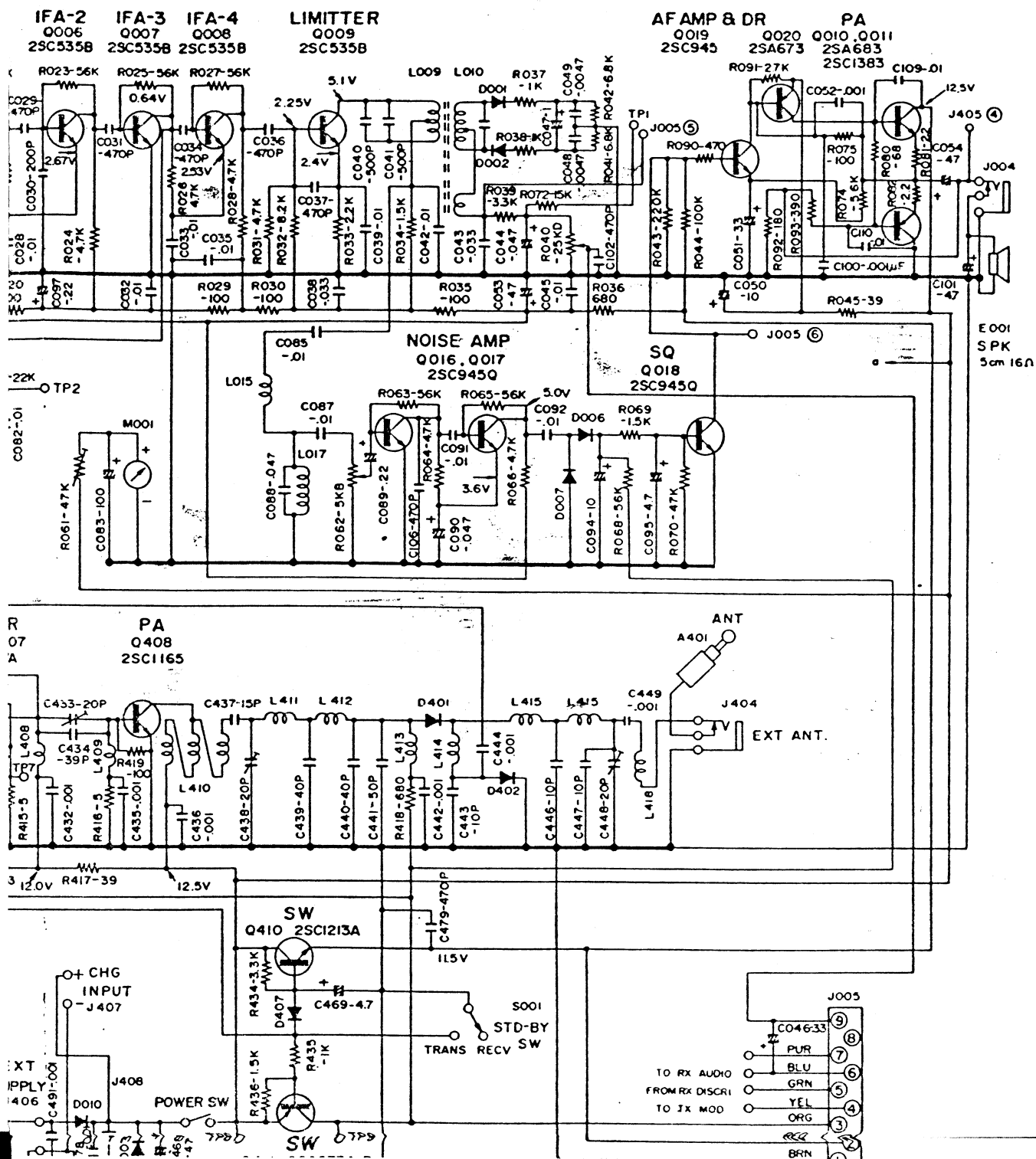


C830L SCHEMATIC



001



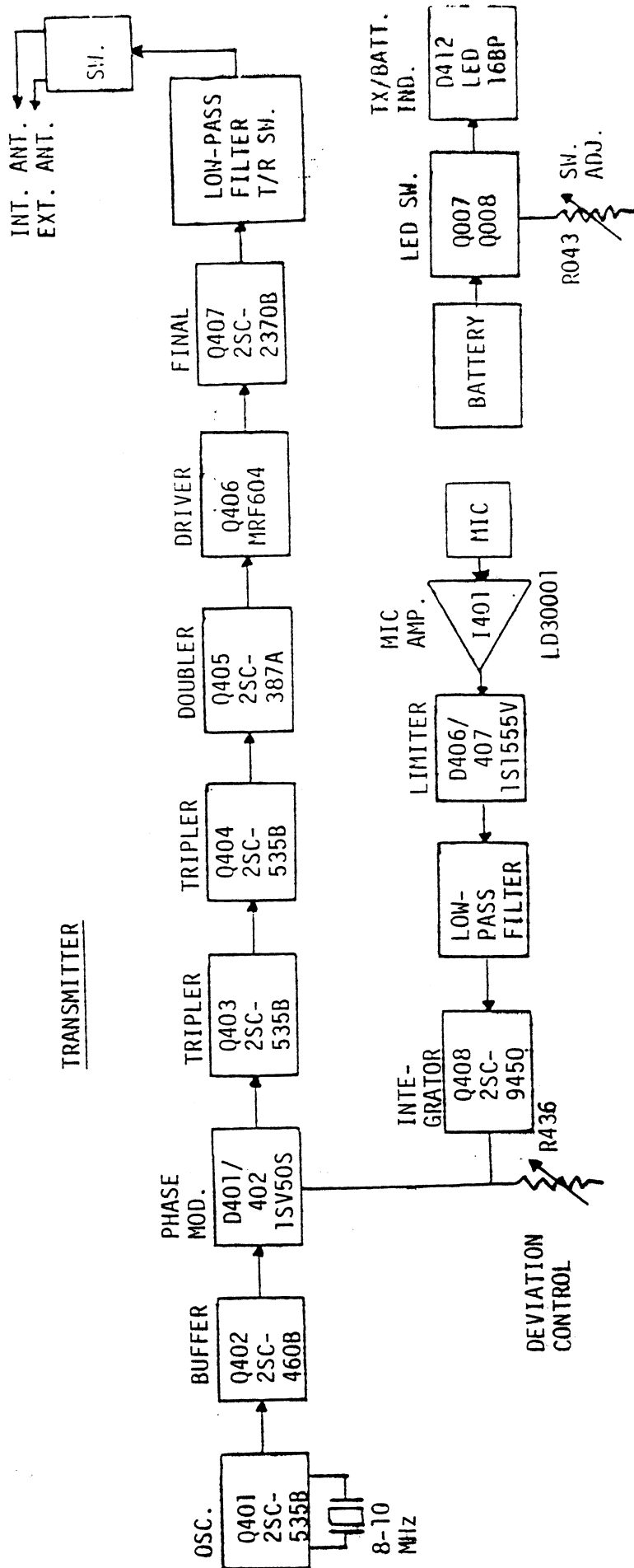
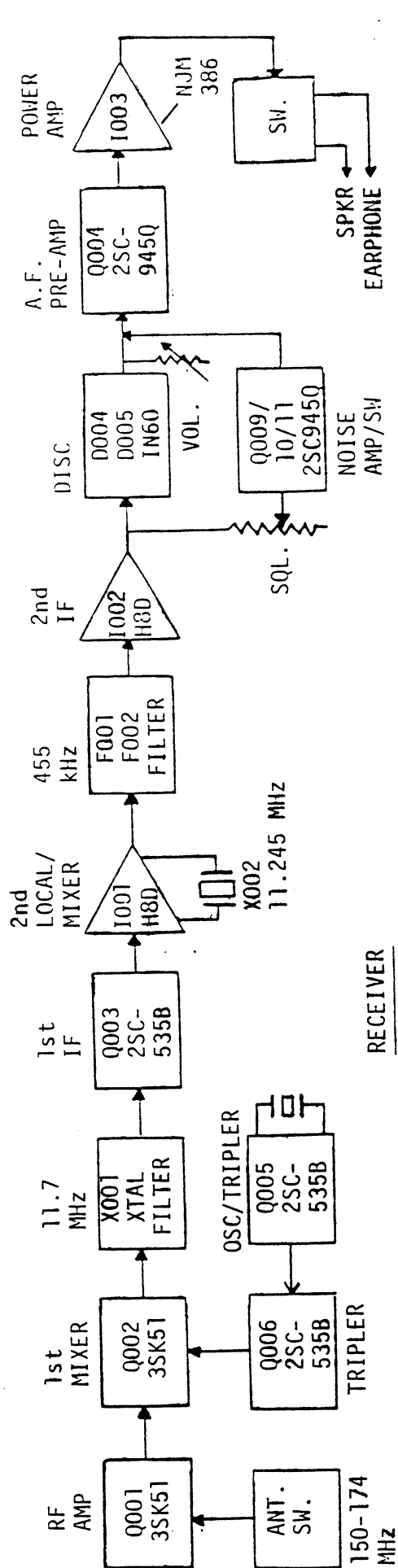


FIGURE 3. 831L BLOCK DIAGRAM

THEORY OF OPERATION

TRANSMITTER

The transmitter is designed for narrowband FM (phase modulated) transmission in the frequency range of 148 to 174 MHz. A crystal controlled oscillator provides for selection of up to six frequencies.

GENERATION OF PHASE MODULATED SIGNAL: The oscillator is crystal controlled and generates the initial RF signal in the frequency range of 8.22 to 9.67 MHz. The RF signal is then applied to the phase modulator, together with the audio modulating signal. The audio modulating signal varies the capacity of the varactor diode (phase modulator), in turn causing the applied RF signal to be shifted in phase at an audio rate.

The angular phase shift produced by the modulator without distortion is relatively small. Therefore, the oscillator frequency is multiplied 18 times to obtain the desired deviation ($\pm 5\text{kHz}$) at the output frequency. Two tripler stages and one doubler provide the necessary 18 times frequency multiplication, followed by a driver and the RF power amplifier.

The RF power amplifier develops the output signal applied through a tri-filar wound filter to the four-section pi-network. The pi-network in turn matches the output impedance of the power amplifier to the 50-ohm antenna, as well as providing the selectivity to attenuate spurious and harmonic signals which might appear in the output.

INSTANTANEOUS DEVIATION CONTROL: The transmitter contains an "instantaneous deviation control" (IDC) circuit. This circuit limits the output deviation to $\pm 5\text{kHz}$, preventing overdeviation when a higher than normal microphone output occurs.

The audio signal from the microphone is amplified, and applied through a peak limiter, low-pass filter, and an integrator circuit, to the phase modulator. The phase modulator has an inherent 6 dB/octave pre-emphasis characteristic, and under normal output levels from the microphone, the transmitter FM carrier output is pre-emphasized to 6 dB/octave.

The speech amplifier characteristics are such that a 6 dB/octave pre-emphasis is applied to the audio input. The peak limiter will have no effect on the audio signal until the microphone output increases to a point where overdeviation would occur. Therefore, the non-limited pre-emphasized signal is applied through the filter to the integrator, which has a 6 dB/octave de-emphasis characteristic. This affects the pre-emphasis applied in the speech amplifier, resulting in a "flat" output being applied to the phase modulator. The 6 dB/octave pre-emphasis characteristic of the phase modulator then becomes the only factor affecting the deviation-versus-modulation-frequency characteristics of the transmitted signal.

If the microphone output level increases to a point where overdeviation would occur, the limiter "clips" both positive and negative peaks of the audio waveform. This results in an essentially square wave signal of constant amplitude, removing the 6 dB/octave pre-emphasis from the speech amplifier. The limited audio waveform is then reshaped in the low-pass filter, and applied to the integrator. As the signal at the integrator input is of constant amplitude, the output will be de-emphasized at 6 dB/octave as applied to the phase modulator. This then offsets the inherent 6 dB/octave pre-emphasis characteristic of the phase modulator, resulting in a transmitter FM carrier output where frequency-deviation-versus-frequency is essentially flat.

RECEIVER

The receiver is a double conversion super-heterodyne, designed for narrowband FM reception in the frequency range of 148 to 174 MHz. A crystal controlled first local oscillator provides for selection of up to six operating frequencies.

The input signal is amplified by a single RF stage and applied to a mixer where it is heterodyned with the output of the first local oscillator and converted to the first IF, 11.7 MHz. The 11.7 MHz signal is then amplified and applied to the second mixer where it is heterodyned with the output of a second crystal controlled local oscillator, and converted to the second IF, 455 kHz.

The 455 kHz signal is applied through a selective filter to shape the IF passband, amplified by a hybrid IC (I002) and applied to a limiter and FM discriminator. The limiter removes any vestige of amplitude modulation, while the FM discriminator functions to recover the modulation, producing an audio output in response to a corresponding frequency (or phase) shift in the 455 kHz IF signal. The FM detector output is then amplified and applied to the speaker.

NOISE ACTUATED SQUELCH: A "noise-actuated" squelch circuit is included to silence the receiver output when no carrier is present. This is accomplished by amplifying and detecting the "noise" component in the 455 kHz output to produce a DC level. This DC level is then applied to inhibit the audio amplifier. The inhibiting level is removed, opening the audio channel, when a carrier is received and the "noise" component decreases due to the quieting action of the limiter. De-activated for ON/MUTED private channel operation.

TONE CODED SQUELCH: The Model C831L can be equipped with an optional tone-coded encoder/decoder to provide a "private channel" facility. The "private channel" permits the receiver to remain muted until a signal is received containing a specific sub-audible tone, at which time the audio channel is opened and the transmission is audible. In this manner transmissions from other users of a shared frequency will not cause the receiver to respond. The same circuit is used to generate the sub-audible tone applied to the transmitted carrier.

1. Specifications

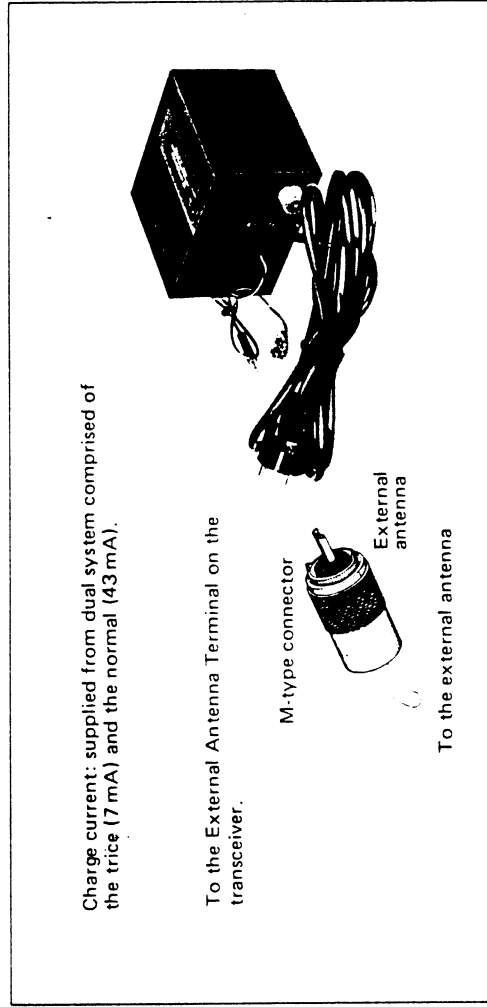
ITEM	C831L	C731L
General		
1. Type	VHF Business use	UHF Business use
2. Number of Channels	6CH max.	
3. Frequency range	138 ~ 174 MHz	450 ~ 512 MHz
4. Supply voltage	DC 12.5V $\pm$ 20% (Negative ground) 8 pcs Normal Battery or 10 pcs Ni-Cad Battery	
5. Power consumption	Transmission	850 mA
	Reception	Less than 170 mA
	Standby	Less than 23 mA
6. Internal speaker	6 cm Dynamic	
7. Dimensions	213.5 mm(H) $\times$ 77 mm(W) $\times$ 42.5 mm(D)	
8. Weight	900 grams (including batteries)	
Transmitter Section		
1. Type of emission	16F3 (Max. Dev. $\pm$ 5 kHz)	
2. RF power	3W	2W
3. Output impedance	50 Ohms	
4. Type of modulation	Reactance modulation	
5. Spurious emission	50 dB	
6. Mod. distortion	10% max.	
7. Hum & Noise	40 dB	
8. Frequency stability	0.001%	0.0005%
Receiver Section		
1. Receiver system	Double conversion superheterodyne 1st IF 11.7 MHz 2nd IF 455 kHz	
2. 20 dB QS sensitivity	0.5 μ V	
3. Squelch sensitivity	0.35 μ V	
4. Mod. acceptance bandwidth	$\pm$ 7 kHz	
5. Selectivity (EIA)	70 dB	
6. Intermodulation	60 dB	
7. Aduio output power	0.5W (10% THD) 0.8W (max. volume)	

- Built-in Speaker**
- Built-in Microphone**
- Press-To-Talk Switch:**
Pressing this switch puts the transceiver into the transmission mode.
- Retractable Antenna:**
 - * For operation, extend the antenna to its full length.
 - * When an external antenna is used, retract the antenna to its minimum length.
 - * The antenna can be removed from the unit by turning it counterclockwise.
- Transmission/Battery Indicator:**
This indicator lights in green when the transceiver operates in the transmission mode. If the indicator is lit in red during reception, it indicates that the batteries are over discharged and require charging or replacement.
- Channel Selector:**
The Channel Selector can accommodate up to 6 channels for both transmission and reception. Plug in sockets are provided to accommodate crystal for these channels.
- Volume Control:**
Clockwise rotation of the Volume control increases output volume level.
- External Mic Jack:**
The External Mic Jack is designed to accept the external microphone Model MP408. When the external microphone is plugged into this jack, the built-in microphone is automatically cut out. For built-in mic operation, keep the external microphone pulled out of the External Mic Jack. Use of the MP435 Mic/Speaker will further enhance clarity in communication. When the MP435 is used, place the Speaker Switch (described later) to the OFF position.
- External Antenna Terminal:**
This terminal accepts an external antenna with the impedance of 50 ohms.
- Mic & Speaker Switch:**
This switch controls the audio output to the built-in speaker.
ON position: Output sound will be heard from the built-in speaker. When using the built-in microphone or the external mic MP408, switch in this position.
OFF position: Output sound will not be heard from the built-in speaker. When using the Mic/Speaker MP435, switch in this position. If the MP435 is not used, the output is available on pin-3 of the external mic jack.
- Power/Mute Switch:**
The center position of this switch turns off the entire power of the unit. Setting the switch to the "ON" position turns on the power of the unit. Even if set to "ON/MUTE" position, power is turned on. If Tone SQL unit is built in, receiver AF output is controlled at this position by the Tone SQL control not by Noise SQL Control.
- Squelch Control**
This control minimizes unpleasant white noise which is present when there is no input signal to the transceiver's receiver input. Turn this control gradually clockwise until white noise is not heard any more when no signal is being received.
- Battery Compartment Cover/Cover Locking Screw**
- External Charger Receptacle**
- Earphone Jack**
- External Power Supply Jack**

4-4 Fixed-Base Operation

- * The transceiver can be operated by both the built-in batteries and an external power source. For fixed-base operation, however, it is advisable to use the external power source which requires no care about battery consumption.
- * When an external antenna is used for fixed-base operation, retract the built-in retractable antenna to its minimum length.

When Using the Base Master (CSA):



- * Do not operate the transceiver while charging.
- * When using the Base Master (CSA), the use of rechargeable batteries is essential.

5. Channel Expansion

Crystal elements for the expansion channels of the C831L/C731L may be installed at your dealer.

- * Crystal element for transmission (Type HC25/U):

$$f_o(T) = \frac{f_t}{18} (C831L) \quad f_o(T) = \frac{f_t}{36} (C731L)$$

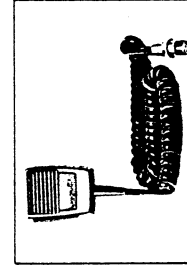
where $f_o(T)$: frequency of transmission crystal element (MHz)
 f_t : desired transmission frequency (MHz)

- * Crystal element for reception (Type HC25/U):

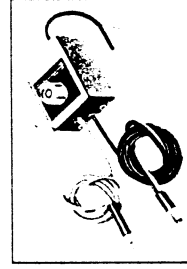
$$f_o(R) = \frac{f_r - 11.7}{9} (C831L) \quad f_o(R) = \frac{f_r - 11.7}{27} (C731L)$$

where $f_o(R)$: reception crystal-element frequency (MHz)
 f_r : desired reception frequency (MHz)

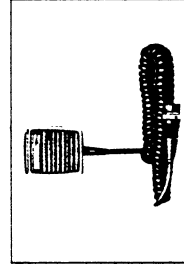
6. Accessories for C831L/C731L



MP 408:
 * Compact external microphone



CMA Mobile Master:
 * Car adapter; * Built-in power line filter and antenna coupler incorporated; * Magnet mount provided.



MP 435:
 * Microphone/Speaker



CSA Base Master:
 * AC charger; * Built-in antenna coupler incorporated; * Trickle/Normal switchable charging; * Input: AC 220V, 50/60 Hz; * Charging current: trice — 7 mA, normal — 43 mA.