

## CIRCUIT DESCRIPTION VHF – LOW BAND

The paging receiver circuit is composed of 15 main sections:

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|---------------------|--------------------|
| 1. Antenna circuit  | 9. HPF             |
| 2. RF amplifier     | 10. Squelch        |
| 3. Band Pass Filter | 11. Audio volume   |
| 4. PLL IC           | 12. AF PA          |
| 5. Loop filter      | 13. Decoder        |
| 6. VCO              | 14. D/D, Driver IC |
| 7. First mixer      | 15. EEPROM         |
| 8. IF IC            |                    |

- 1. Antenna Circuit**  
The loop antenna ( ANT 1 ) and telescoping antenna ( ANT 3 ) are built into the pager and are designed to receive the VHF low – band signals. The tuning frequency is automatically adjusted by the control voltage obtained from the PLL IC ( A3 ). The antenna loop is adjusted by CV1 and the telescoping antenna is a pre – select tuned circuit for the designated band.
- 2. RF amplifier**  
The RF signal couples through C3 to the input of the cascade amplifier ( Q1, Q2 ). The amplified signal is filtered by coils L1, L2, and L3
- 3. Band Pass Filter**  
The band pass is tuned for resonance at the RF carrier frequency. The tuning frequency is automatically adjusted by the control voltage obtained from IC ( A3 ). The bandwidth will be 3MHz to 5MHz, which will cover one band. The unwanted frequency will be attenuated by this filter.
- 4. PLL IC ( A3 )**  
The receiving frequency is determined by the data supplied from the decoder CPU ( A202 ). The control voltage is obtained by comparing the VCO local oscillator frequency and the 12.8MHz reference oscillator frequency.
- 5. Loop filter**  
The control voltage from A3 is supplied to the loop filter via a analog switch ( A4 ). The loop filter consists of R21, R22, R23, C35, C36, and C37 which eliminates unwanted high frequency interference.
- 6. VCO**  
The oscillator frequency is regulated by the control voltage and is supplied to the multiplier circuit through the buffer circuit. The oscillator frequency is set to  $\frac{1}{2}$  of its 1<sup>st</sup> local frequency. 1<sup>st</sup> local frequency = receive frequency - 21.6MHz.
- 7. First mixer**  
The amplified RF signal and the injection signal in the VCO are fed into the 1<sup>st</sup> mixer ( Q3 ). Two signals are mixed with the resulting 21.6MHz and fed into the crystal filter ( FL2 ).

8. IF IC ( A1 )  
The IF IC consists of: 2<sup>nd</sup> oscillator, 2<sup>nd</sup> mixer, IF amplifier, demodulator, filter amplifier, voltage regulator, and LVA ( low – voltage – alarm ).
- A) 2<sup>nd</sup> oscillator  
The 2<sup>nd</sup> oscillator circuit consists of a series resonate quartz crystal ( 21.145MHz ) and IC ( A1 ).
- B) 2<sup>nd</sup> mixer  
The output signal ( 21.6MHz ) from FL2 and the output signal ( 21.145MHz ) from the 2<sup>nd</sup> oscillator are mixed for a resulting signal of 455KHz.
- C) IF amplifier / demodulator  
The output of the 2<sup>nd</sup> mixer is routed through a ceramic filter ( FL3 ), internal IF amplifier, and demodulator stages
- D) Filter amplifier  
After demodulation, the audio signal is fed into the HPF ( for tone and voice ) and the BPF ( for noise amp. ). The output signal of the HPF is fed into the LPF consisting of R50, R51, R52, C65, C66, C67, and the internal filter amplifier of A1. The LPF attenuates and filters frequencies over 3KHz.
- E) Comparator  
The filtered signal is then converted to a digital signal, the output is on A1 pin 15.
- F) Voltage regulator  
The battery voltage is regulated by A1 and Q7. The voltage regulator supplies 1.0V to the receiver circuit.
- G) LVA  
The LVA circuit produces a low battery signal to the decoder CPU ( A202 ) when the battery voltage drops below 1.1 volts
9. HPF  
The high pass filter ( HPF ) consists of A2, C62, C63, C64, R42, R43, and R44 which eliminate the CTCSS tones from being amplified by the audio circuitry.
10. Squelch  
The squelch circuit consists of the BPF ( A2 – D / A, C51 thru C56 and R27 thru R30 ), noise amplifier ( Q8, Q9 ), and detector ( Q10 thru Q13 ). The squelch sensitivity is controlled by variable resistor RV1.
11. Audio volume  
The audio signal is controlled by R105 and R106 thru R108 in 4 audio volume levels. The output of audio signal is supplied by the AF PA through the buffer amplifier ( Q106 ).
12. AF PA  
The audio IC ( A102 ) and associated components form a complementary amplifier circuit for the alert tone and voice message. Transistors Q108 and Q109 provide additional current handling for driving the speaker SP1.

13. Decoder

The decoder consists of two clock oscillators ( A104, A105 ), tone detector module (A201 ), and CPU ( A202 ).

A) Clock oscillator

The pager operates with two clock oscillator circuits. The main clock circuit frequency is 1.2288MHz and is controlled by A202 pin 16. When the pager is operating with the battery save function, the main clock oscillator is stopped for a period of time and the pager is in the "SAVE" mode. The SUB clock circuit oscillates continuously and provides a means for the internal timer operation.

B) Tone detector ( A201 )

The tone detect module ( A201 ) consists of a alert generator circuit and tone detector circuit.

C) CPU ( A202 )

The CPU will control various functions based on the EEPROM such as, tone parameter setting to detector IC ( A201 ), frequency parameter setting to the PLL IC ( A3 ), various switching operations, and the CPU output of the detector IC and timing of ESGA and ESGB.

14. D/D, Driver IC

The regulated 3.0V is developed through L101 and the associated voltage multiplier circuitry in the A103. The voltage multiplier drives a switching circuit which sends pulses to L101. D102 rectifies the pulses and C109 filters them generating a regulated 3.0V. This is distributed to the decoder IC ( A201, A202 ), EEPROM ( A101 ), clock oscillator ( A104, A105 ), and PLL IC ( A3 ). A103 provides the functions for the LED ( D101 ) and vibrator ( MR101 ) option.

15. EEPROM

The EEPROM ( A101 ) will retain all programmed information such as: channel frequencies, tone frequencies, tone combinations, alert cycles, scan, timing, and etc... When the paged is turned "ON", A202 will detect the required information from the EEPROM.