

3. THEORY OF OPERATION

INTRODUCTION

AT-100B is a micro size 90 channel portable FM transceiver constructed with a microprocessor controlled, temperature compensated Phase Locked Loop (PLL) frequency synthesizer. The radio features a double conversion receiver and a direct FM transmitter modulator. A special integrated circuit provides support to sub-audible signaling (CTCSS & DCS) and most of the receiving parts are switched off periodically in the power saver mode to reduce battery current drain during standby.

The Block Diagram RF and Control Circuit Diagrams for AT-100B shall be used in associate with the following circuit description.

CIRCUIT DESCRIPTIONS

1) PHASE-LOCK LOOP (PLL) CIRCUIT

*** REFERENCE OSCILLATOR**

The reference oscillator consists of TCX301 in U301 with a frequency of 12.8MHz. This comparison frequency is selected by decoding the first three bits of the data input from microcomputer.

*** PROGRAMMABLE DIVIDER**

The programmable divider in U301 consists of a two-modulus prescaler with a 7 bit control register followed by a 11-bit internal programmable divider. The overall division ratio is selected by a single 19-bit word located on the serial data bus.

*** PHASE COMPARATOR**

A digital-type phase comparator in U301 with output(pin 6) and an open drain lock detect output(pin 8) compares divided VCO frequency with the comparison frequency. It generates a correction voltage that is applied to a low-pass filter consisting of R309, R310, R312 and C315, C316, C318 then sent to the VCO circuit.

*** VCO CIRCUIT**

The transmit/receive frequency is directly generated by the Colpitts oscillation circuit contains Q401, Q405. The oscillation frequency is variable by applying the VCO control voltage to variable to variable capacitors D401, D402, D403, D404, D405, D406, D407, D408 and D409. To switch between the transmit and receive frequencies, Q406 turn on, and Q402 (VCO for transmission) oscillates when the T/R pin is low.

2) TRANSMITTER

*** MIC AMP CIRCUIT**

Voice signal from the microphone are applied to microphone amplifier U601 pin 6 through J601 pin 5. U601 contains a low-pass filter that has a 6dB/oct response between 300Hz and 3kHz, and eliminates harmonics above 3 kHz. The pre-emphasized audio signal is applied to VR303 from U606 pin 22 to adjust maximum frequency deviation.

*** VCO AND AMPLIFIER**

The VCO signal output is amplified by Q403, Q408 and then fed to power amplifier Q301.

* **POWER AMPLIFIER CIRCUIT**

Q202 provides approximately 7.5V DC power source. Amplified transmit signal is applied to the base of the first stage amplifier of U201 through capacitor C223. RF power output is adjusted by variable resistors VR501 (High Power) and VR502 (Low Power).

Signals from U201 are supplied through antenna switch D201 to a low-pass filter made up of L201, L202, L203 and C202-C206, then applied to Antenna Jack.

3) RECEIVER

* **ANTENNA SWITCHING CIRCUIT**

Signals from antenna connector fed to the antenna switching circuit through the low pass filter consisting of L201, L202, L203 and C202-C206. In receive mode, D201 is turned off, isolates the antenna from the transmitter circuit and matching circuitry, so that the incoming signals are fed to the RF amplifier through L101.

* **RF AMPIFIER CIRCUIT**

The signals from the switching circuit are fed to the RF amplifier Q101 through a band pass filter made up of T101, D103, D104, T102 and D105, D106.

* **FIRST MIXER CIRCUIT**

The amplified signals are fed to Gate 1 of the first mixer Q102 through T103, T104 and D111-D114. First local oscillator signal is supplied to Gate 2 of Q408 from the PLL circuit through C125 to convert the RF signals into 21.4MHz first IF signal. The VCO oscillates at the first local frequency.

* **IF CIRCUIT**

The first IF signals from Q102 are fed to the matched pair crystal filter FL101, then IF signals are amplified in Q103. And those signals are fed to U101 which is composed of the second local oscillator, second mixer, limiter amplifier, quadrature detector and active filter circuit. The second local oscillator at 20.945MHz with X102, and is fed to the second mixer with the first IF signals to convert into 455kHz second IF signals.

The second IF signals leave through pin 3, and are fed to external ceramic filter FL102 and FL122 which has excellent selectivity, then fed to U101 (pin 5) again to be amplified and detected. The detected AF signals are output from pin 9.

* **AUDIO AND SQUELCH CIRCUIT**

The detected audio signals are put through a 6dB/oct de-emphasis circuit made up of C673 and R688. The signal is then applied to audio power amplifier U606 through the volume control SVR601 to obtain enough power to driver the speaker.

Part of the recovered noise signal is fed to the integrated operational amplifier inside U101, which, with R117 and C150, makes up an active filter that rejects audio signals through high pass filter C148, C149 and R122. The sensitivity of squelch is adjusted by VR101.

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