

*FCC Part 90 Certification
Airtech Information & Communicatons
UHF-FM Handheld Transceiver AT-400B*

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Attachment J. Operational Instruction

3. THERORY OF OPERATION

INTRODUCTION

AT-400B 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 save mode to reduce battery current drain during standby.

The Block Diagram RF and Control Circuit Diagrams for AT-400B 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. The reference oscillator frequency is stabilized by the thermistor TH303 and drives a divider to produce a comparison frequency. 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 7bit 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 15, 16) and an open drain lock detect output (pin 7) compares divided VCO frequency with the comparison frequency. It generates a correction voltage that is applied to a low-pass filter consisting of R305, R306, R307, R401 and C315, C316, C317, C318, C401 then sent to the VCO circuit.

*** VCO CIRCUIT**

The transmit/receive frequency is directly generated by the Colpitts oscillation circuit contains Q402, Q405. The oscillation frequency is variable by applying the VCO control voltage to variable to variable capacitors D401, D402, D403 and D404, 407, 408, 409. To switch between the transmit and receive frequencies, Q402 turn on, and Q401 (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 through CON601.

U601 contains a low-pass filter that has a 6dB/oct response between 300Hz and 3 kHz and eliminates hamonics

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 Q202 and then fed to power module U201.

*** POWER AMPLIFIER CIRCUIT**

U201 is provided approximately 7.5V DC power source.

RF power output is adjusted by variable resistors VR501 (High Power) and VR502 (Low Power).

Signals from U210 is supplied through antenna switch D201 to a low-pass filter made up of L101, L102, L103 and C101-C104, then applied to Antenna Jack.

3) RECEIVER

*** ANT SWITCHING CIRCUIT**

Signals from antenna connector fed to the antenna switching circuit through the low pass filter consisting of L101, L102, L103 and C101-C104. 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 L104.

*** RF AMPLIFIER CIRCUIT**

The signals from the switching circuit are fed to the RF amplifier Q101 through a band pass filter made up of molded coil, varactor diode and capacitor.

*** FIRST MIXER CIRCUIT**

The amplified signals are fed to Gate 1 of the first mixer Q102 through C123.

First local oscillator signal is supplied to Gate 2 of Q102 from the PLL circuit through C122 to convert the RF signals into 21.4MHz first IF signal.

*** 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 X101 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 filters FL102, FL122 which has excellent selectivity, then fed to U101 (pin 5) again to be amplified and detected. Narrow /Wide band are switched by diode D107, D108, Q106, Q107

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 C699 and R690. The signal is then applied to audio power amplifier U607 through the volume control SVR601 to obtain enough power to drive the speaker.

Part of the recovered noise signal is fed to the integrated operational amplifier inside U101, which, with R122, R123, C148, C149 makes up a low pass filter. The DC signal detected by U101 (pin13) reaches the integrated DC amplifier in U101 which has hysteresis to prevent jitter. The sensitivity of squelch is adjusted by VR101.