CIRCUIT DESCRIPTION

Circuit Composition and Operation Theory
The basic explanation for the circuit composition

ATT-701 consists mainly of two parts controlling the RF circuit parts and the digital circuit parts.

Receiver

ATT-701 receive parts are composed in the double conversion system, which has the 1st IF Frequency of 21.7MHz and the 2nd IF frequency of 450KHz. The front-end circuit, the 1 pole MCF used in the 1st IF, and the 4 pole ceramic filter in the 2nd IF, the reception interrupting factors such as the image and the sensitivity repression are reduced for the more stable reception.

RF Front-end

The signal received by the antenna will be transmitted to the front-end through the antenna switching circuit consisted of C88, L13 and D11. The front-end consists of the RF amplifier transistor Q21 and the high pass filter block. High pass filter block primarily diminishes the other signal rather than the 1st IF image and other signal within the reception band and amplifies only the necessary signal within the RF.

1st Mixer

The receiver signal, which has been amplified in the RF front-end, is provided to the base of the 1st mixer Q22. The 1st L/O signal provided from the VCO circuit (Q14, Q23) is supplied to the emitter of Q22 and converted to the 1st IF 21.7MHz.

1st IF Filter and 1st IF Amplifier

The signal converted by Q22 to 21.7MHz, the 1st frequency, changes its impedance through L17 and then is infused to the fundamental MCF which has the center frequency of 21.7MHz and the band width of +/-12.5KHz.
Here, the signal reduces the image and other unwanted signal for the 2nd IF. Then the signal is infused to the Q25, the 1st IF amplifier. The signal infused to the Q25 is amplified approximately by 20dB in order to acquire the required reception sensitivity, and infused to the U2 which function as he 2nd mixer, the 2nd IF amplifier, and the FM detector.

2nd Mixer, 2nd IF, FM Detector (U2)

The receiver IF signal of 21.7MHz, which has been infused to U2 is mixed with the 2nd L/O signal of 21.250MHz, and converted to 450KHz, the 2nd IF frequency. The receiver signal converted to the 2nd IF frequency passed through the CF2, the ceramic filter of 450KHz again. After the limiting inside the U2 and the FM demodulating by the quarter detector inside the U2, the signal offers the output through the 9th pin of the U2.
The 2nd L/O signal of 21.250MHz, which infused to detect the noises from the received signal, demodulates in the 9th pin of the U2. For this purpose, the noise filter is using the OP. Amplifier inside the U2.

De-Emphasis and 300Hz HPF (IC102)

The audio signal which has been FM demodulated in the IC102 is supplied to the IC102 which function as the De-emphasis and 300Hz HPF.

The IC102 has the 300Hz HPF with the 1st characteristics. And The De-emphasis characteristics with the corner frequency of approximately 200Hz, IC102-B and IC102-A has the 300Hz HPF with the 6th characteristics, they functions as a normal De-emphasis and also reduce the signal such as CTCSS to unwanted noises from the speaker.

Audio Power Amplifier (IC6)

The received audio signal, which has been adjusted to R7, 8, 9, is supplied to the IC6 and amplified approximately by 20dB. Then, it turns up the speaker with the maximum output of 0.3Watts.
The 6th pin of the IC6 is the VDD.

Transmitter

The transmission part of the ATT-701 is designed to amplify the RF signal oscillated and modulated by the synthesizer to approximate below 300mW(ERP) by the power transistor of Q12, 17, 18, 20.

Pre-emphasis and 300Hz HPF, Limiter (IC503)

The voice signal input from the microphone is pre-emphasized at the IC503-D and at the same time, the signals below 300Hz are reduce to minimize the influence to the CTCSS tone. The signal, which comes out of the IC503-C is limited to certain amplitude for the voice signal not to exceed the allowable bandwidth assigned for transmission.

TX Power (Q12, 17, 18, 20)

The transmitted signal amplified to 0.3Watts here passes the TX LPF of the 6'Th characteristic of the L10, C89, L14, C19, L9 and C73. And RX / TX switching takes place by the D7, D11.

Frequency Synthesizer

Voltage Control Oscillator (VCO)

The VCO of oscillates 462.5625MHz under the transmission condition and 452.8625MHz under the reception condition. The VCO consists of the colpitts oscillator of the Q14, and contains the oscillator frequency difference of approximately 21.7MHz during the transmission / reception conversion. That is since the VCO should oscillate relatively low frequency during reception compared to transmission.
Therefore as a result, the C80, C96 is added in parallel to the resonance circuit of the VCO to oscillate a low frequency. During reception, a relatively low frequency should be oscillated compared to transmission.
The IC3 PLL IC controls the VCO in order to oscillate the accurate frequency. The output frequency of the VCO is supplied to the IC3 PLL IC immediately. At the IC3, 21.250MHz by the X2 are compared to the output frequency of the VCO. The VCO is controlled through the loop filter consisted of the R73, C120, C113, R74 and the C20 in order to oscillate the stable frequency wanted for the radio.
The VCO controlled by the voltage, which has passed the loop filter supplies to the D9 varicap diode, and the VCO and oscillate the PLL programmed frequency by the capacity variation in the

D9. In addition, the L12 on the VCO circuit functions as frequency for the VCO to be properly controlled by the IC3 PLL IC.

PLL Frequency Synthesizer (IC3)

The PLL synthesizer of the signal loop PLL circuit with the reference of 12.5KHz.
The IC3 PLL IC includes all the functions such as the reference oscillator, the driver, the phase detector, the lock detector, and the programmable divider.
At the reference oscillator, the 21.250MHz are connected to the pin 10, 11 of the IC3 to oscillate the frequency of 21.250MHz.
The phase detector sends out the output power to the loop filter through 3rd pin of the IC3.
If the oscillation frequency of the VCO is low compared to the referenced frequency, the phase detector sends out he output power in positive pulse. If the oscillation frequency of the VCO is high, phase detector sends out the output power in negative pulse. Therefore, the VCO can maintain the frequency set.

The programmable divider maintains the desired frequency with the control from the CPU. The dividing ratio, "N" to oscillate the desired frequency is as below:

N = VCO oscillation frequency / reference frequency

If the desired frequency is 462.5625MHz

N = 462.5625MHz / 0.00625MHz = 37005

CTCSS Processing

RX CTCSS Tone processing

The received CTCSS tone is sent out through 9th pin of the U2, and supplies to the C540. The voice band signal, which can affect to the reception of the CTCSS tone, is decreased enough at the IC502. The CTCSS tone received at the IC502 is supplied to the 11th, 13th pin of the IC4(CPU), and receives the desired CTCSS tone.

TX CTCSS Tone processing

The CTCSS tone generated by IC4 is combined with the TX voice signal through the IC503, and supplied to the RV2 TX deviation control volume.

CPU and Memory

The IC4 CPU controls most of the control functions.