Micro Transceiver IC-174

Technical Parameters:

- The sensitivity of receiving path of the transceiver at a signal / noise ratio of 10 dB-not worse than 3 mV.
- Output power - not less than 300 mW.
- Input impedance is 75 Ohms.
- Output power of the transmitting path at a load of 75 Ohms impedance is not less than 200 mW.
- Maximum current consumption from the voltage source 11..15V when working on the transmission - 250 mA.
- Maximum current consumption from the voltage source 11..15V when working at the reception - 100 mA.

Operation

Common to the receiving and transmitting paths are the VFO and the oscillator at frequency 500 kHz. It possible to simplify the switching paths in the transition from reception to transmission by using of two electromechanical filters (Z1, Z2) 500 KHz.

In the receiving mode, the signal from the antenna goes to the bandpass filter on the elements L2, L3, C3-C5 and then to the first gate of the field-effect transistor VT1 (RF Gain). To regulate the RF gain use the R5 potentiometer. From L4C9 through the communication coil L5 signal goes to the DA1, which contains RF amplifiers, RF, IF. AGC, mixer, VFO, detector and voltage regulator. The DA1 chip allows converting the SSB signal and amplifying it to the level required for normal operation, both headsets and speakers.

VFO works in the frequency range 1330...1430 MHz. The frequency is tuning by capacitor C12 – it works with L6C12C13. The applied EMF Z1 determines the selectivity of the receiving path. L8C21 circuit adjusted to the frequency 500 kHz. To be able to receive SSB and CW signals, the output 14 DA1 chip should have RF voltage and frequency 500 kHz being from the generator that built on DA3. From pin 12 DA1, the RF signal (resistor R1 regulates its level) goes to the speaker.

When working on the transmission the signal from the microphone comes to the pin 9 of DA3, which performs the functions of a microphone amplifier, balance mixer and DSB signal amplifier, (trim resistor R18 regulates its level). The Z2 filter suppresses the non-working sideband.

The generated SSB signal goes to the DA2, where it is amplifying and mixing with VFO (goes to the pin 5 from the buffer stage on the VT2 transistor). L10C46 allocates the signal of the operating frequency. Then it amplifies by the internal amplifier circuits DA2. In the receiving mode, it is not working and regulates by the voltage coming through the resistor R24. The trim resistor R22 sets the optimal signal level at the output of the RF amplifier.

The terminal amplifier is VT3 transistor. The signal comes to gate of VT3 through a band-pass filter on the elements L11, L12, C49-C51. The L14C55 has the average frequency of the operating frequency band. From the communication coil L15, the signal goes either to the antenna or to an external linear power amplifier. The switching TX/RX modes is by SB1 button. One group of its contacts commutes the power circuit + 12V TX and -12V RX, the second-closes the common wire input of the receiving path.

Most radio components of a transceiver placed on a printed circuit Board. In those places on it, where the conductors are connected, which connect the elements that are outside the Board, the header pins are mounted.

Assembly details

Coil	Necessary components	Quantity of turns
L2, L3, L4, L12, L11	SB12 toroid 12mm. wire 0.1mm	30 turns
L10	SB12 toroid 12mm. wire 0.1mm	30 turns. the branch of L10 comes from the 10th turn, counting from the end connected to the DA3 chip
L5, L9	SB12 toroid 12mm. wire 0.1mm	6 turns
L6	SB12 toroid 12mm. wire 0.16mm	20 turns
L7	SB12 toroid 12mm. wire 0.16mm	6 turns in the middle of the form
L8	SB12 toroid 12mm. wire 0.1mm	90 turns (branch comes from the middle of winding)
L13	SB12 toroid 12mm. wire 0.12-0.16mm	5 turns
L14	SB12 toroid 12mm. wire 0.12-0.16mm	40 turns
L15	SB12 toroid 12mm. wire 0.12-0.16mm	10 turns
Throttle L1	Standard choke 22 uH	

Attention! After adjustment all coils must be fixed with glue with not-acetone. The acetone's glue may damage the toroid.

Adjustment

To adjust the transceiver we will need the following generators: RF and AF, frequency counter, RF voltmeter. Before switching on the device set R22 resistor to the lowest position according to the scheme, R5, R11, R16, R18 - to the middle, R25 - to the far right.

The adjustment of the receiving path begins with checking the RF amplifier. To do this generate a signal amplitude 250 mV from any RF source and connect it to the pin 9 of DA1 chip. Then provide an unmodulated signal with a frequency of 499 kHz and a level 10 mV to the pin 2 of the same chip. This signal mixes with oscillations of 500 kHz getting from the quartz oscillator. In this case, you should listen to the tone frequency of about 1 kHz the speaker. Adjust the maximum volume by tuning the L8C21,

VFO. After that needs to adjust the VFO frequencies in the range 1,330…1,430 kHz. To do it connect the frequency counter to the collector of the transistor VT2. Adjust VFO to required range by adjusting C13 and L6. The tuning of VFO is by variable capacitor C12. The RF voltage of the heterodyne on pin 5 DA1 should be 50…100 mV, on the collector of the transistor VT2 – 1…2V, on pin 5 DA2 – 250 mV (adjust by capacitor C41). Then, connect RF generator to pin 6 of DA1 (1,900 KHz, 50…100 μV). Tune the VFO to 1,400 kHz, and listen to the tone on speakers. Get the maximum volume of it by changing of values of capacitors C15 to C18

Adjustment of RF amplifier. Connect the generator with signal 1,880 KHz, 20..30 μv to the input of the transistor VT1. Achieve the maximum output signal by adjusting L4C9. Then, adjust L2C3 and L3C5 respectively to the frequency 1,850 and 1,910 kHz. After that, check the sensitivity of the receiving path from the input. It should not be worse than 3mV.

Further, regulate the **transmitting path**. After closing the microphone input, the RF voltmeter checks the residual voltage of the carrier frequency on the pin 8 of DA3. Make it minimal by adjustment of resistor R16. Then, supply a RF voltage (amplitude 30 mV) to the microphone input. On the pin 8 of the chip DA3 should be DSB signal amplitude 1..2V. Get a maximum RF voltage at the pin 1 of DA2 by selection of capacitors C38, C39

To maximize the gain of chip DA2 tune the resistor to the top position on the scheme. At VFO's RF voltage of 250 mV on pin 5 of DA2 and the level of the SSB signal 0.2..0.3V on the pin 1 – should be a signal frequency within the 160-meter range with an amplitude of more than 100 mV on output of the mixer (pin 15).

The L10C46 adjusted to a frequency 1,880 kHz (the maximum voltage at the pin 12 of DA2). The L11C49 and L12C51 adjusted accordingly on the frequency of 1,850 and 1,910 kHz.

When adjusting the **output amplifier** – connect the dummy antenna - a bulb for a voltage 13.5 V and a current 0.16A and an RF voltmeter to the coil L15. By adjusting the R25 needs to set voltage ~0.5V on the gate of the transistor VT3. By choosing a capacitor C55 and adjusting the coil L14 needs to get a frequency 1,880 kHz.

Finally, the transmitting path adjusted on the control radio. The resistors R16, R18, R22, R25 are set to such positions that the noise of DA2, DA3 chips would be minimal, there would be as little as possible the rest of the carrier frequency signal and there would be a complete closing of the transmitting path in the reception mode. In addition, correct the rest current of the transistor VT3 if necessary – the maximum level of undistorted output signal is set.