6. THEORY OF OPERATION

WOOIL TELCOM CO., LTD.
FCC ID: OIZKF-101
EXHIBIT #: 8A

Circuit Composition And Operation Theory

The basic explanation for the circuit composition

KF-101 consists mainly of the one board controlling the analog circuit parts and the digital circuit parts for the other control.

Receiver

KF-101 transmission parts are composed in the double conversion system, which has the 1st IF Frequency of 21.4MHz and the 2nd IF frequency of 455KHz. With the frontend circuit which has an excellent band characteristice and skite characteristice, the 1 pole MCF used in the 1st IF, and the 3 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 Frontend

The signal received by the antenna will be transmitted to the frontend through the antenna switching circuit consisted of L47, L46, C438, C436 and C437. The frontend consists of the RF amplifier transistor Q11 and input/output band pass filter. Each input/output band pass filter has the bandwidth of approximately 10MHz, 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 frontend is provided to the base of the 1st mixer Q12. The 1st L/O signal provided from the PLL circuit is supplied to the emitter of Q12 and converted to the 1st IF 21.4MHz.

1st IF Filter and 1st IF Amplifier

The signal covered by Q12 to 21.4MHz, the 1st frequency, changes its impedance through L47 and then is infused to the fundamental MCF which has the center frequency of 21.4MHz and the band width of +/-3.75KHz.
Here, the signal reduces the image and other unwanted signal for the 2nd IF, and changes its impedance again through the R108 and C117. Then the signal is infused to the Q13, the 1st IF amplifier. The signal infused to the Q13 is amplified approximately by 20dB in order to acquire the required reception sensitivity, and infused to the IC1 which functions as the 2nd mixer, the 2nd IF amplifier, and the FM detector.

2nd Mixer, 2nd IF, FM Detector (IC11)

The receiver IF signal of 21.4MHz, which has been infused to IC11 is mixed with the 2nd L/O signal of 20.945MHz, and converted to 455KHz, the 2nd IF frequency. The receiver signal converted to the 2nd IF frequency passed through the CF2, the ceramic filter of 455KHz again. After the limiting inside the IC11 and the FM demodulating by the quarter detector inside the IC11, the signal offers the output through the 9th pin of the IC11.
The 2nd L/O signal of 20.945MHz which infused to the IC11 filters and uses directly the crystal of 20.945MHz. The squelch circuit is composed to detect the noises from the received signal demodulate in the 9th pin of the IC11. For this purpose, the noise filter is using the OP. amplifier inside the IC11.

De-Emphasis

The audio signal which has been FM demodulate in the IC11 supplies to R124, C136, C137, R125 which function as the De-emphasis.

Audio Power Amplifier (IC33)

The received audio signal which has been adjusted to the appropriate volume in the VR1 is supplied to the 2nd pin of the IC33 and amplified approximately by 20dB. Then, it turns up the speaker with the maximum output of 0.3Watts.
The 7th pin of the IC33 is the audio mute terminal. If a voltage supply to the 6th pin of the IC33 is supplied to this terminal, the IC33 stops functioning as the audio power amplifier regardless of the signal supplied to the 2nd pin of the IC33, and there is no sound emitter from the speaker.

Transmitter

The transmission part of the KF-101 is designed to amplify the RF signal oscillated and modulated by the synthesizer to approximately below 500mW(ERP) by the power transistor of Q44.

Pre-emphasis (IC6)

The voice signal input from the microphone is pre-emphasized at the IC6A. The signal which comes out of the IC6B is limited to a certain amplitude for the voice signal not to exceed the allowable band width assigned for transmission.

TX Power (Q44)

The transmitted signal of approximately 7mW, combined at the PLL module is supplied to the base of the Q44 amplifier. The transmitted signal amplified to 0.5 Watts here passes the TX LPF of the 2nd characteristice of the L44 and the L45, and RX/TX switching takes place by the D45. After this, the signal is provided to the antenna the TX LPF of the 1st characteristice, consisted of the L47.

Frequency Synthesizer

Voltage Control Oscillator (VCO)

The VCO of the KF-101 oscillates 462.5625MHz under the transmission condition and 441.1625MHz under the reception condition. The VCO consists of the colpit oscillator of the Q202, and contains the oscillator frequency of approximately 21.4MHz during the transmission / reception conversion. That is since the VCO should oscillate relatively low frequency during reception compared to transmission, the D21 is directly biased by the Q21.
Therefore as a result, the C204 is added in parallel to the resonance circuit of the VCO to oscillate a low frequency. During transmission, a relatively high frequency should be oscillated compared to reception. Therefore, the D21 is adversely biased by the Q21, and as a result, the C204 which is added in parallel to the resonance circuit of the VCO is removed to oscillate the desired transmission frequency.
The VCO is controlled by the IC21 PLL IC in order to oscillate the accurate frequency. The output frequency of the VCO is supplied to the IC21 PLL IC immediately. At the IC21, TCXO(12.8MHz) by the TCXO-1 is compared to the output frequency of the VCO. The VCO is controlled through the loop filter consisted of the ,R224, C236 and the C237 in order to oscillate the stable frequency wanted for the radio.
The VCO controlled voltage which has passed the loop filter supplies to the D22 variator diode, and the VCO an oscillate the PLL programmed frequency by the capacity variation in the D22. In addition, the L23 on the VCO circuit functions as frequency for the VCO to be properly controlled by the IC21 PLL IC.

RX/TX Buffer Amplifier (Q24, Q25)

The RF signal oscillated at the VCO is provided to the Q12 RX 1st mixer through the Q24 during the reception, and is provided to the Q43 power driver amplifier through the Q25 during the transmission.

PLL Frequency Synthesizer (IC21)

The PLL synthesizer of the KF-101 consists of the signal loop PLL circuit with the reference of 6.25KHz. The IC21 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 12.8MHz TCXO of the TCXO-1 is connected to the pin 11 of the IC21 to oscillate the frequency of 12.8MHz. The TCXO(12.8MHz) is the temperature compensation circuit to maintain the frequency within the allowable error range even under a low temperature of -20℃.
The phase detector sends out the output power to the loop filter through 3rd pin of the IC21. If the oscillation frequency of the VCO is low compared to the referenced frequency, the phase detector sends out the 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 = 74010

CPU and Memory

Most of the control functions of the KF-101 are controlled by the IC3 CPU. The IC3 CPU has the internal ROM in the capacity of 2Kbyte, and the program for the operation of the IC3.

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