THEORY OF OPERATION for 148NW

1. FREQUENCY SYNTHESIZER

1.1 AM mode

1.1.1. The synthesizer is consisted of the following components:

PLL IC (IC1)
Crystal oscillator (X2, 10.240 MHz)
Varicap Diode (D601)

IC1 is a CMOS LS1 that contents most of the PLL block. The VCO with varicap diode D601 as a part of the oscillator tank circuit.

1.2. SSB mode

1.2.1. Voicelock Circuit

In the receive operation, the control voltage varied by the voicelock control VR402 is phased through the Voicelock gate diode D51 and is applied to a variable capacitance diode which is connected to the offset frequency oscillator crystals.

The above mentioned circuit may vary the offset frequency by means of rotating the clarifier control VR402 at the range of approximately • 1 kHz. In the transmit operation, Voicelock6 gate diode D51 is reverse biased and that separates the variable capacitance diode from the clarifier control.

The crystal X 2 (10.240 MHz) and other components at pin 7 and 8 of IC1 can make a reference frequency oscillator with internal amplifier.

1.3. VCO

TR601 is connected as a clamp type oscillator with varicap diode as part of the circuit. With appropriate control voltage on also drives, The VCO can be oscillating over the required range of 34.765 MHz to 35.205 MHz.

1.4. Carrier Frequency

The carrier frequency of 7.8 MHz oscillated by TR32 and X4.

1.5. Local Oscillator Outputs

Fist Mixer: The secondary output of VCO tank circuit L20 is injected through buffer amplifier TR20 to the base of the first mixer TR15.

Second Mixer: The oscillation output, oscillated with 7.345 MHz signal is injected into the gate of EFT1 BF964.

For example, when the unit is operated on channel No. 19, the transmitting frequency is calculated as shown in the following table for each mode.

	AM mode	LSB mode	USB mode
FL (MHz)	34.985	34.9835	34.9865

Fc (MHz)	7.8000	7.7985	7.8015

2. DESCRIPTION OF CIRCUITS

2.1. Transmitter

2.1.1. Circuit for Suppression of Spurious Radiation

The tuning circuit between the frequency synthesizer and the TX final amplifier TR36 and L35, L37, L38, L39, C149, C150 in the TR36 output circuits serve to suppress spurious radiation and SWR circuit to serve for impedance match TR36 to the antenna and to reduce spurious content to acceptable levels in the frequency synthesizer.

2.1.2. Circuit for TX Power Limiting

During the factory alignment the VR8, VR9, VR10. That the D49, D50, TR37 to compensate the temperature and bias controlling the TX final amplifier (TR36) and TX driver (TR38) these omponent is selected to limit the available power to slightly more than 4 watts. The tuning is adjusted so that the actual power is from 3.6 to 4.4 watts. For SSB circuit alignment VR11 for limiting power which depends on the input MIC signal that less or more.

2.1.3. Modulation

Modulation circuit produced each modulation signal of AM/SSB and supplies the signal to the Transmitter mixer IC5.

AM mode: the microphone feeds voice through TR23 and through TR22 and the switching TR21 to the AF power amplifier IC6 (A SoundTracker switch controls the speech signal path of the microphone amplifier TR902 . When the ST switch is set to ON, it cuts the TR902 output and directs it to a Compander ship IC901 TA31101AP for speech signal dynamic range compressing. The output of IC901 is then fed to TR23, TR22 and IC6), and through the AM power regulator (TR41, TR42). Then is fed through the collectors of Tx driver TR38 and the Tx final TR36, to collector modulation both these stages.

SSB Mode: the microphone feeds voice audio signal through TR23 and through TR22 and to the IC3 μPC1037A (Balanced modulator) (A SoundTracker switch controls the speech signal path of the microphone amplifier TR902 . When the ST switch is set to ON, it cuts the TR902 output and directs it to a Compander ship IC901 TA31101AP for speech signal dynamic range compressing. The output of IC901 is then fed to TR23, TR22 and IC3 μPC1037A). IC3 mixes 7.8015 MHz for USB and 7.79850 MHz for LSB with voice audio signal then produce DSB wave removes 7.8015 MHz or 7.79850 MHz (depends on USB or LSB) carrier signal, through the crystal filter and only the signal wanted band is applied to IC5 TX mixer.

2.1.4. Circuit for TX Modulation Limiting

A portion of the modulation voltage is rectified by TR24 that attenuated the input signal from microphone, from the AM power regulator (TR41, TR42). The signal is fed back to TR26 (AMC Controller) and through TR34 loop keeps the modulation will not exceed 100 percentage for input approximately 40 dB. The AMC is adjusted by VR501.

2.2 RECEIVER

2.2.1. AM Mode:

The AM RF signal (26.965 to 27.405 MHz) picked up by the antenna is magnified by TR14 and fed to the first mixer TR15.The signal is the then mixed up with the first local oscillator frequencies 34.765 to 35.205 MHz. That produces the first IF frequency 7.8 MHz. The first IF signal passing through the crystal filter FT2, is fed to the second mixer FET1 (BF964) for mixing up with the second local oscillator frequency 7.345 MHz. That produces the second IF frequency 455 KHz. The second IF signal, after filtered by the ceramic filter and magnified by TR16, TR17, TR52, TR18, is demodulated by D22 for speech signal recovery. The recovered speech signal is then magnified by TR19 and IC6 KIA7217AF and fed to the speaker. Thus completes the speech signal receiving.

When the SoundTracker switch is set to ON, The recovered speech signal through TR19 and TR901 and to a Compander chip IC901 TA31101AP for speech signal dynamic range expanding. The output of IC901 is then fed to IC6 TA7217AF for remaining processing.

2.2.2 SSB Mode:

The SSB RF signal (26.965±Δf to 27.405±Δf MHz) picked up by the antenna is magnified by TR14 and fed to the first mixer TR15.The signal is the then mixed up with the first local oscillator frequencies 34.765 MHz±1.5 KHz to 35.205 MHz±1.5KHz. That produces the first IF frequency 7.8 MHz. The first IF signal passing through the crystal filter FT2, is fed to the IF amplifier by FET3 J310, then passing through the crystal filter FT3, and magnified by TR16, TR17, TR52, TR18. The 7.8 MHz signal is mixing with the 7.8 MHz±1.5KHz carrier signal by TR19, and produces the speech signal Δf. The recovered speech signal is then magnified by TR19 and IC6 KIA7217AF and fed to the speaker. Thus completes the speech signal receiving.

When the SoundTracker switch is set to ON, The recovered speech signal through TR19 and TR901 and to a Compander chip IC901 TA31101AP for speech signal dynamic range expanding. The output of IC901 is then fed to IC6 TA7217AF for remaining processing.

The first IF frequency is 7.8 MHz.

For the above two modes, the squelch is controlled by TR12 and TR13.

3. Front panel illumination

The front panel is illuminated by an Electroluminescent (EL) lamp. Which is a flat panel light source driven by 180 Vp-p, 400 Hz AC voltage. This AC voltage is generated by a high-voltage EL lamp driver IMP803. The brightness of the light sources on the front panel (including the EL lamp, the LED channel display, the meter lamp, etc.) is controlled by a light dimmer VR 404.