CIRCUIT DESCRIPTION

1. Tuning Range

FILE: ut344c

CB:	26.965 MHz	-	27.405 MHz	(40 Channels)
WX:	162.400 MHz	-	162.550 MHz	(7 Channels)

2. Frequency Range of the Local Oscillators

1st Local Oscillation Frequencies:

CB: 16.270 MHz - 16.7100 MHz
WX: 16.1945 MHz - 16.2095 MHz

2nd Local Oscillation Frequency:

CB: 10.24 MHz
WX: N/A

3. Intermediate Frequencies

1st IF:	CB: 10.695 MHz		2nd IF:	CB: 455 kHz
	WX: 455 kHz			WX: N/A

4. Circuit Description

A) RECEIVING OF CB BAND

This equipment is the double conversion type CB receiver. From a signal input, the above operating frequencies are coupled through the RF Amplifying (Q1) and Mixing stages (Q24, 1st Mixer) to the first intermediate frequency (10.695 MHz).

The first local oscillator signal is delivered from the PLL synthesizer (IC3) and VCO circuit (Q11 & D11). The VCO frequency is divided down by the programmable divider in the PLL IC (IC3) and compared with the reference frequency (X1, 10.24MHz). Any frequency or phase difference produces a correction signal to change the VCO tuning voltage. This tuning voltage then forces the VCO to oscillate at the frequency which required for the counter to produce a output that is in phase with change the frequency.

The reference oscillator (X1, 10.24MHz) is also used as the second local oscillator for mixing down to the 455 kHz second IF at Q25 before the signal is limited and demodulated. After the IF amplifying (Q2, Q3 and Q4) stage, AM demodulation is done by D4 and D6. Then, the demodulated signal is fed onto audio amplifier (Q10 and IC1).

Channel Selection Program

The divide ratio of the Programmable Divider in the CPU (IC3) is determined through a code converter and TX/RX mode switch in IC3 by the voltage applied to the program input terminals, pin 10 through pin 17 of IC3.

The program input voltage for pin 10 through pin 17 are delivered from channel rotary switch according to channel number selected.

TX/RX mode switch in IC3 changes the divide ration of the programmable divider by changing the applied voltage at pin 9 (high level for TX and low level for RX), to coordinate with 455kHz change in VCO frequency when changing between the two modes.

B) RECEIVING OF WEATHER BAND

WX receiver portion of this unit is employing a single conversion super-heterodyne circuit. An incoming RF signal of 162MHz band is amplified by Q700/Q701 (WX RF AMP) and then fed into Q702 (WX MIX) for conversion into intermediate frequency (455kHz).

The fundamental frequency of the WX local frequency is 16.1945kHz to 16.2095kHz and it is multiplied then times by Q716 (Frequency multiplier). Thus, the WX local frequency of 161.945 to 162.095MHz is generated. The modulated IF signal fed into the detector D709 and D711 for demodulation. The demodulated audio signal is further amplified by Q704, IC1 as well as the CB receiver circuit.

CIRCUIT FOR DETERMINING FREQUENCY

1) OUTPUT FREQUENCIES OF TRANSMITTER

Transmitting Frequency, Ft is the output of the TX Mixer (IC3). One of the inputs from Q12 is the 1st local frequency (Fvco) which is produced by the PLL Local Oscillator circuit, and the other is the TX Local frequency of 10.24 MHz produced by X1 and Q15.

The sum of these frequencies makes the TX Frequency as follows:

F1 = Fvco + 10.24 MHz

2) PLL LOCAL OSCILLATOR

Fvco, the output frequency of the VCO (Q12) is fed to a Mixer in the PLL IC (IC3), The offset frequency (Fstd) of 10.24 MHz is fed to another input of IC1. The input frequency to the Programmable divider (F1) is calculated as below:

F1 = Fvco + Fstd (10.24 MHz)

F1 is fed to the Programmable Divider in the PLL IC (IC3) and divider by N.

The frequency of 10.24 MHz which is produced by the Reference Oscillator (X1 and Q15) is divided by 2,048 at the Reference Frequency Divider in IC1. The resultant frequency, F2 is as follows:

F2 = 10.24 MHz / 2048 = 5 KHz

The output frequency oæ the Programmable Divider is compared with F2 at the Phase detector in IC3, in other words, these frequencies are phase detected by this Phase Detector, and F1 divided by N becomes equal to F2 (5 KHz) when the phase locked loop is under locked condition. Therefore, Fvco is determined by the following formula:

Fvco = Fstd 0(15,24 MHz) + 5 x N (KHZ)

Fvco is changeable at the increment of 10 KHz by varying the program divide ratio, N. For example, the divide ratio, N is programmed to 3345 at the channel No.1, therefore Fvco is calculated as follows:

Fvco = 5 x 3345 = 16.725 kHz

In the same manner, Fvco for channel No.1 through No. 40 is determined as shown in Table-A.

3) TRANSMITTER LOCAL OSCILLATOR

Transmitting local frequency of 10.24 MHz is produced by the oscillator, Q15 and the output frequency is determined by the Quarts Crystal X1.

4) CHANNEL SELECTIOR PROGRAM

The divided ratio of the Programmable Frequency Divided in IC3 is determined through a code converter and TX/RX mode switch in IC3 by the voltage applied to the program input terminals, Pin 1 through Pin 6 of IC2.

The program input voltage for Pin 10 through Pin 17 are delivered from channel rotary switch according to channel number selected.

TX/RX mode switch is IC3 changes the divide ratio of the programmable divider by changing the applied voltage at Pin 2 (HIgh Level for TX, and Low Level for RX) to coordinate with 455 kHz change in VCO Frequency when changing between the two modes.

The attached Table-A shows Frequency Chart of Ft(or Fr) and Divide ratio vs. Antenna Frequency.

CIRCUIT FOR STABILIZING FREQUENCY

Transmitter output frequency of this equipment is determined in the following formula:

$$Ft = Fvco + 10.24$$
$$= 10.24 \times N/2048 \quad (MHz)$$

Ft : Transmitter Output Frequency
Fvco: 1st local Frequency

1) 1ST LOCAL FREQUENCY Fvco AND 10.24 MHz OSCILLATOR FREQUENCY

1st local frequency Fvco is determined as below:

$$Fvco = Fref \times N$$
$$= 10.24 \times N/2048 \quad (MHz)$$

$$Fref = 10.24\ MHz / 2048 = 5\ KHz$$
$$N = 3345 \text{ to } 3433$$

At the temperature of 25 C, frequency tolerance of crystal oscillator, 10.24 MHz can be controlled within +/- 10 PPM.

Therefore, fvco becomes within +/- 10 PPM. The 10.24 MHz Crystal oscillator circuit is kept the temperature tolerance within +/- 20 PPM for the temperature range of -30 C to +50 C.

A Zener diode (D13) is used in power supply circuit insure the regulated supply of 8.9V to the osci8llator circuits of 10.24 MHz from the variation of power supply voltage of 13.8V.

2) FREQUENCY TOLERANCE AND DRIFT OF TRANSMITTER OUTPUT

As the result of the above 1), maximum frequency tolerance of the transmitter output is kept within +/- 10 PPM at 25 C. Frequency drift caused by temperature change is maintained within +/- 20 PPM at the temperature range of -30 C to 50 C.

From the above, the total frequency tolerance for a temperature variation of -30 C to 50 C, at supply voltage of 13.8V +/- 15% can be calculated as below;

+/- 10 PPM +/- 20PPM = +/- 30 PPM

Therefore, the frequency tolerance of transmitter output is maintained within +/-30 PPM = +/- 30 / 1000000 = +/- 822.15 Hz.

CIRCUIT FOR PREVENTION OF UNAUTHORIZED FREQUENCY EMISSION

This equipment has a TX-INHIBIT circuit which keep off a transmitting of unauthorized frequency. When the PLL circuit is not locked, or when programmed data is loaded with channel data except 1 to 40, or when the programmed input data from the channel selector is switched from certain channel to the next channel, it may be caused that program except formulated is produced only transiently.

However, even at the in-between channel, Pin 4 of IC3 produces low level digital signals for control. This signal is delivered to the base of Q16 which is the RF amplifier.

When this signal is in low level state, no output signal is produced from the RF amplifier Q9 and the transmitting of unauthorized frequency can be kept off absolutely.

CIRCUIT FOR SUPPRESSION OF SPURIOUS EMISSION

1) BAND-PASS FILTER

A band-pass filter which consists of L18 reduces spurious emission produced be the VCO.

2) LOW-PASS FILTER

A low-pass filter which consists of three stage pie-matched circuit (C40, C41, C42, L8, L9 and L10) well eliminates harmonics of transmitter output frequency.

CIRCUIT FOR LIMITING MODULATION

Audio signal from microphone is amplified by Q13 and IC1. The peak of the output of IC1 which may cause the modulation in excess of 95% activates the A.M.C. (or Automatic Modulation Control) Transistor Q14 to prevent modulation in Excess of 100%.

Table-A FREQUENCY CHART OF Fvco AND DIVIDE RATIO N

ANTENNA FREQ. (MHz)	CH NO.	FOR TRANSMITTING DIVIDE RATIO(N)	FOR TRANSMITTING VCO FREQ. (MHz)	FOR RECEIVING DIVIDE RATIO(N)	FOR RECEIVING VCO FREQ. (MHz)
26.965	1	3345	16.725	3254	16.270
26.975	2	3347	16.735	3256	16.280
26.985	3	3349	16.745	3258	16.290
*	*	*	*	*	*
*	*	*	*	*	*
*	*	*	*	*	*
27.385	38	3429	17.145	3338	16.690
27.395	39	3431	17.155	3340	16.700
27.405	40	3433	17.165	3342	16.710