

CIRCUIT DESCRIPTION

MRU400L is designed to operate between 450 and 494MHz, with a rated power output of 0.4 watts having emissions type of 16K0F3E.

LOCAL FREQUENCY CIRCUIT

Each of PLL assembly for TX and RX needed for operation are enclosed in Local module where TCX0 units oscillated at 12.8MHz.

In TX mode, TCX0, TX PLL module including VCO and PLL IC are activated to operate in the frequency range between 450 and 494MHz. These are well temperature compensated within +/- 1.5PPM in the temperature between -30 and +60.

RX local frequency (390.0625 - 434.0625 MHz) is produced by RX PLL module and TCX0 mentioned in the above. Modulation signal is directly applied to TX VCO so that the transmitting frequency would not contain any spurious components.

Output from TX VCO is fed and divided at PLL IC and then compared 6.25 kHz reference frequency that is generated from 12.8 MHz oscillator through 1/512 divider. Other VCO output is sent to outside of module and fed into buffer amplifier IC514 for minimizing any of electrical affection such as unintentional feedback.

TX CIRCUIT

The output coming from TX local pre-driver Q503 is amplified by power amplifier Q504 for obtaining the power level of 400 mW.

To reduce harmonics component, the output power is fed into strip line circuit for reducing more than 40dB below its carrier level. This unit equipped power control circuit consisting of stabilized voltage regulator IC503.

1. Means for Determining Frequency

This equipment employs a Phase Locked Loop (PLL: IC351, IC451 and MB1501) having with direct oscillation type TX/RX VCO (M0451/M0301). TX operation frequency and RX 1st Local frequency are determined by the PLL circuit and are respectively generated at this circuitry.

The PLL circuit is compared of the synthesizer block and the dividing ratio programming circuits for transmitter and receiver sections. The synthesizer block consists of Phase Detector, Lock Detector, Prescaler, Low pass Filter and Reference Oscillator of 12.8 MHz.

This PLL circuit has a dual modules / parallel programming "N" counter and "A" counter. Those counters are controlled by the control circuit which has the microprocessor.

The prescaler has a dividing ratio, either 128 or 129, which is determined by the module control output from the PLL circuit. Due to the functional combination of the Prescaler, "N" counter and "A" counter, the total dividing ratio is obtained as follows:

$$N \text{ (total)} = P \times N + A$$

Where P is the dividing ratio of the Prescaler

The PLL IC (IC351, 451) are connected with the 12.8 MHz External Oscillator. The 12.8 MHz reference frequency is divided into 6.25 kHz by frequency divider of 1/512 which is programmed in the PLL IC.

In the PLL circuit, the 6.25 kHz reference frequency is fed into the comparator section for comparing with the VCO oscillation frequency divided by the prescaler "N" counter and "A" counter.

The operation frequency range of this equipment is 450 - 494MHz for TX and 390.0625 - 434.0625MHz for RX.

As a result of the PLL function, the VCO will be locked to the frequency which is determined by the following formula:

$$F_{vco} = (P \times N + A) \times F_{ref}$$

Where "A" must be an integral number within the range from 0 to 128, in accordance with the requirement of PLL IC. From the above formula, the range of "N" integral number can be calculated as below;

N = 503 to 543

Dividing number determined as above is programmed in the CPU. The microprocessor reads out the programmed data and sends it to the PLL IC (IC351, 451) sequentially.

Above dividing number is the decimal number, but the programming shall be proceeded by binary number. The "A" counter has 7-bit and "N" counter has 10-bit coding register for programming.

2. Means for Frequency Stabilization

Frequency stability is depend on the following associated equipment used with this repeater system.

TCX0 Specification for MRU400
Electrical Characteristics

Power Supply: Primary 5.0V DC +/- 5%

Frequency Out: 12.8MHz

Power Out: More than 1.0Vp-p

Frequency Stability: +/- 1.2 parts in 10^{-6} (-30 to +75)

Aging: +/- 1 parts in 10^{-6} /year

Supply +/- 5%: +/- 0.3 parts in 10^{-6} /%

3. Means for Attenuation of spurious Emission

The Low Pass Filter (FT502/FT503) is installed between the RF output stage at the transmitter section to reduce the spurious harmonic emissions.

4. Means for Limiting Modulation

This transmitter is equipped with a device (IC512) that automatically and instantaneously prevents modulation deviation in excess of 100% (5.0kHz/2.5kHz).

This device, known as the Instantaneous Deviation Control (IDC) circuit is instantaneous in action for controlling the modulation wave-form introduced into the frequency modulator. The deviation limit can be set to any channel width requirement up to 5.0kHz/2.5 kHz.

5. Means for Limiting Power

The transmitter is employing a power control circuit which prevents accidental transmitting from excess of RF output power in abnormal condition.

Adjusting with RT501 allow setting the RF output power to the rated power for controlling the corrector voltage of final amplifier.

6. Means for Attenuating Higher Audio

Higher audio frequencies provided from a microphone are attenuated by the audio Low pass Filter circuit (IC509) to comply with the FCC requirements.