THEORY OF OPERATION

GENERAL

This product is a digital compass with 40-channel, crystal controlled mobile transceiver which consists of a PLL-synthesizer circuit, a receiver circuit, a transmitter circuit. Power is supplied by a car battery (13.8 VDC). Refer to the Block and Schematic Diagrams as you read the following descriptions.

PLL SYNTHESIZER

This product uses a Phase-Locked- Loop (PLL) circuit to synthesize local-oscillator frequencies for receiving and transmitting. Two separate oscillator for receiving and transmitting can be controlled by the programmable PLL IC U501. U501 divides the frequency of the crystal Y501 to a reference frequency (2.5KHz) and compares the frequency which was divides by a proper time in U501 from generated by the LO of receiver and transmitter.

Transmitter LO

The transmitter LO is consist of Q502, C530, C520, C518, C516, C517, T502 and D502, any channel change will cause the DC voltage changing of U501 P14, this will modify the generating frequency of TX LO, the LO signal is amplified by Q504 and Q505 then feed to RF transmitter circuit.
Receiving LO
The receiving LO circuit is consist of D501, T501, C507, C508, C506, C504, C505 and Q501, like the transmitter circuit, the generated frequency is controlled by the programmed data, the LO signal couples to receiving circuit through C503.

Receiving circuit

The RF signal is picked up by antenna and feeds to RF amplifier Q1 through C3, C8 and a bypassed attenuator (L1, Q21, and Q18), the amplified RF signal is send to Q2 through T1 , here the RF signal and LO signal are mixed in Q2, and the IF signal is generated. The IF signal is feed the Q3 through the filter CF1, the IF signal and 2nd LO signal are mixed in Q3. The second IF 455KHz from Q3 is amplified by Q4 and Q5, then the audio signal is detected out by D3 and C29.
The audio output pass through ANL circuit (R33, R32, R31, D4 and C87) to the amplifier U1, the amplified audio signal is divided to two way, one way is to the headphone power amplifier U10, the another is to the audio power circuit through C123.

AGC circuit

AGC circuit is consist of Q6 and C27, the IF picks up by C27 affects the DC level of Q6 connector, this output will also affect the every RF and IF amplifier, this change would keep the receiving circuit to be linear to ensure the audio is not distorted when the RF signal from 1uV to 1V.

RF gain

The attenuation ratio is changed follow the voltage changing of the base of Q21, VR4 is used to change the DC level of the base of Q21.

Squelch

U1B is a comparator which used to compare the DC level generated by VR3 and the AGC level, the output high or low level will make the audio U1 amplifier to be in or out working status.

Transmitter

The transmitter LO feeds to the RF filter Q9 and T$, T5 then couples to Q10 the sends to amplifier driver Q11 and RF power amplifier Q12, the RF power then pass through the filter C48, L8, C49, L9 and C2, L2 to the antenna.

RF modulation

The audio picked up by the MIC couples to Q26 and the filter circuit, the AMC Q15 and Q16 is employed to ensure the modulation to be below 90%, the audio from Q26 feeds to IC3 then mixes with the DC in the modulation transformer, the amplified AF signal sends to Q12 and Q11 as AM modulation through D6.

MCU control (U303)

The MCU is used to detect the RX and TX and sends the data to the PLL for transmitter and receiver LO control , and drive the LCD to display RX/TX status. The compass data is also generated in MCU and displayed on LCD.

EEPROM (U302)

EEPROM is used the keep the data in memory and last status when the power was not available.

EL driver

U301 is a EL driver, it inverts the DC power to an AC power to drive the EL, the EL light can be controlled by the VR301.

Digital compass

The control data sent by the MCU to drive U601 and U602 which generates a large current pulse to revise two compensation coils in the magnetic filed sensor which used to pick up the earth magnetic, two sets of sensor is combined in the U603. The output data feeds to the DC coupled amplifier u604 and generates two data as the X axis and Y axis which is used to used a direction indicator. This two data are sent to MCU, and the MCU displays the direction detected.