RADIOSHACK CORPORATION
FCC ID : AAO19-1208
JOB # : 578AH0

EXHIBIT # 7A

THEORY OF OPERATION

19-1208

This PLL – controlled Business transceiver provides accurate and stable multi-channel operation.

The transceiver consists of 6 main sections:

- Transmit Stage
- Receive Stage
- Squelch Control
- Low Voltage Detection
- VCO and PLL
- Memory Backup

- **Transmitter Stage**

The audio is picked up either from the internal or external MIC, the signal is then amplified by Audio Amplifier, IC203 NJM3403 (4/4), IC203 (3/4) and filtered by a low pass filter IC203 (2/4), IC203 (1/4). The audio is adjusted with VR202 to obtain a suitable Audio frequency response, and then modulated with the carrier by VCO, through Varicap (D8).

The modulated signal output from the VCO is pre-amplified by Q12 UPA801T and IC1 M67799HA. The RF output power 0.9W, 2W and 5W to be selected by MCU Pin57, Pin58, through Resistors (R213, R214). The amplified signal then passes through a low-pass filter network, which consists of L10, C70, C71 filters out spurious emission, and the antenna switching circuit D10. The signal is filtered by another low-pass filter circuit, which consists of L21, L3, C14, C15, C8 and C16. These low pass filters are necessary to suppress the second and third harmonics. The signal is then fed into the antenna input and radiated out. The signal is also fed into another path consisting of C61, D11, R1, R9 for sampling, and is converted into a direct current voltage for the Automatic Power Control (APC) circuit Q7, IC4 TA75S01, VR204, VR205 collector current is used to maintain the output power stability.

When the unit is transmitting, the audio signal is added to the TX VCO varicap D8. The capacitance of D8 is varied following the audio signal and when mixed with the carrier to form the modulated signal.

- **Receiver Stage**

The receiver uses a double frequency super-heterodyne circuit. The first Intermediate Frequency (IF) is 21.7 MHz and the second is 450 kHz.

The RF signal is received by the antenna, and passes through a low-pass filter network L21, L3, L4, C14, C15, C8, C16 and C17 to filter out the unwanted signals, the antenna switching circuit D10 switching circuit to receive. The signal is divided to GMRS signal and Weather Alert signal by Diode (D10). The GMRS signal is amplified by Q2. This allows only the required band signal to pass through the SAW band pass filter (BPF) F2. Then the RF signal is mixed with the local oscillation frequency by the mixer Q4. A first IF (Intermediate Frequency) 21.7 MHz is produced. This IF is passed through a Diode (D12) and crystal filter F1 to further filter out other unwanted signals. It is then amplified by Q5 and the IF amplifier IC2 (MC3361), IC2 is an integrated RF amplifier which consists of a local oscillator, a demodulator, a second mixer, squelch control circuit, and RF amplifier. The 21.7 MHz IF passes through D12, then is mixed here with second mixer and converted into 2nd IF which passes through a ceramic filter F3 to filter out the residue unwanted signal at pin 5 of IC2 (MC3361) output this final IF signal and the Audio signal is output at pin9 of IC2(MC3361). The IC2 power control is decided by D14.

The audio signal is fed through CTCSS demodulator circuit IC205 CMX808 pin 12. The amplified audio output from IC205 CMX808 pin 19 then passes through a volume control VR201 and finally amplified by Audio amplifier IC201 (NJM2070) and heard in the speaker; the CTCSS signal is being checked by IC205 CMX808.

The squelch control is also controlled by IC2 (MC3361). The audio signal passes through IC2 (MC3361) internal squelch control R79, C56, and C55 form as a squelch amplifier. The ceramic filter produces a squelch signal (RF noise). This signal regulated by D2 to produce a direct current voltage as a control voltage. The control signals to the MCU mute the audio speaker path.

- **Squelch Control**

The Squelch signal converts DC by D2 and passes through VR1 to MCU IC204 pin 45. The squelch compare voltage composed by VR206, R225 and R273, the voltage passes to MCU IC204 pin 46. The MCU IC204 compares the voltage of pin 45 and pin 46 and to controls the Audio amplifier circuit which generates the voltage from MCU IC204 pin 38 to Q205, Q206 and IC201 NJM2070.

- **Low Voltage Detection**

The battery voltage divided by R230, R251 is input to IC204 for voltage level comparison. If the battery voltage drops below 6.3V, the low voltage symbols is to be displayed on LCD.

- **VCO and PLL**

These receive and transmitter both share the same PLL (Phase Lock Loop) Circuit to produce the carrier or the receive frequency. The local oscillator consists of a fundamental frequency oscillator X1. A Phase Lock Loop (PLL) IC3 (LMX1601), VCO Q10. The fundamental frequency is determined by X1 (12.8 MHz) and as the PLL reference oscillator. This signal frequency is divided by IC3 and a 12.5 kHz (GMRS) or 25 kHz (Weather Channel) signal is produced. When the VCO frequency applied to and frequency divided by IC3 produces a frequency comparable to 12.5 kHz (GMRS) or 25 kHz (Weather Channel), PLL will control the VCO. When these two frequencies are matched, a constant control voltage is output from PLL to lock VCO in desired frequency. The PLL will also output a lock indication to MCU to indicate the PLL is in frequency Lock State.

- **Memory Backup**

IC207 is an EEPROM AT93C46, which acts as a memory backup for the working channel code and the system parameters. Every time when the unit is switched on, the MCU will reset the system, clear the RAM, and recall in the memory from the EEPROM to refresh the RAM in MCU IC204.

ADJUSTMENT PROCEDURE

Step	Item	Adjustment	Procedure
1	TX Frequency	VC1	Adjust VC1 to obtain demanded TX frequency.
2	TX	L3, L10, L21	Adjust L3, L10, L21 obtain demanded TX power.
3	TX. Dev.	VR202	1. Inject an audio frequency (AF) -20dBm. 2. Adjust VR1 to obtain maximum TX deviation ≤2.5 kHz. 3. Check MIC modulation sensitivity, and it should be 2.5 ~ 10mV.
4	TX. Dev.	VR202	1. Set CTCSS 01, CTCSS 12 or CTCSS 38. 2. Adjust VR102 to obtain TX deviation with 0.55 ~ 0.8 kHz.
5	RX	L3, L4, L21	Adjust L3, L4, L21 to obtain demanded receive sensitivity.
6	RX	L3, L4, L21	Adjust L3, L4, L21 to obtain demanded image frequency.
7	SQL	VR1	Adjust VR1 to obtain demanded squelch sensitivity.