EXHIBIT A

[FCC Ref. 2.1033(b)(4)]

"Technical Description"

Exhibit A(1)-1 to A(1)-3

FRS THOMSON 3-5800 TECHNICAL DESCRIPTION

OCTOBER 14, 1999

A). GENERAL DESCRIPTION

The 3-5800 FRS radio is a self-contained transceiver unit with integral antenna intended for use as a general communication tool. It is designed to operate on the first three of the fourteen channels allocated by the FCC for the unlicensed family radio service. The useable range, while dependent upon terrain and other radio propagation principles, is typically two miles. The 3-5800 uses the maximum transmit power allowed to help ensure the maximum communication range. Features include a side mounted on/off/volume control, a transmit/receive LED indicator, a channel selection button with LED indication of the selected channel, a page button and an integral speaker and microphone. The unit is equipped with an external speaker/earphone option connector. Three AA alkaline batteries that are readily available in retail outlets supply operating power. An automatic power savings feature allows the typical standby battery life to extend to more than 10 days.

B). FREQUENCY DETERMINING CIRCUITS

The fundamental frequency for both the transmitter and the receiver local oscillators are controlled by a phase lock loop (PLL) circuit U2 (Toshiba TB31202). The frequency of operation of the voltage controlled oscillator (VCO), composed of Q1 and Q16 operating in cascode, is phase locked to a voltage controlled crystal reference (VCXO) operating at 10.475 MHz (X1). Compensation for both temperature and power supply variations on the crystal reference is accomplished by measuring the ambient temperature and supply variation through an analog to digital converter (ADC) circuit composed of the comparator (U5D) and thermister (R13). The microcontroller (U1) then converts these measurements to a correction voltage output through a digital to analog converter (DAC) to maintain the frequency of the VCXO within the +/- 2.5 ppm requirement.

The VCO is locked to the fundamental of the transmit signal in the transmit mode and is locked to the receive 1st LO (Fundamental channel frequency minus 21.4 MHz) in the receive mode. The crystal reference frequency is fed through a doubler circuit to generate the 2nd LO of 20.950 MHz.

C). TRANSMITTER CIRCUITS

The transmitter amplifies the 0 dBm signal from the VCO to approximately 27 dBm that is fed to the antenna. The transmitter is a three stage amplifier composed of Q7, Q2 and Q3. The first two stages are operated class A and the final is operated class

B in full saturation to help prevent unwanted amplitude modulation. The fundamental transmit signal is fed through an elliptical low pass filter (5-pole, 2 zero) in order to suppress the harmonics to below –60 dBc. The desired frequency modulation of the carrier is accomplished by modulating the current in the VCO directly with the microphone audio signal. The microphone audio is conditioned with a three-pole high pass filter at 300 Hz (U5A), a hard clipper circuit (U5C) to limit maximum deviation to +/- 2.5 kHz and a three-pole low pass or splatter filter at 2.8 kHz (U5B). The low pass filter insures that the occupied bandwidth of the FM modulated signal meets FCC requirements under all input conditions.

D). RECEIVER CIRCUITS

The received signal from the antenna is band limited to 600 Mhz by the transmitter harmonic filter. The desired signal is fed to a low noise amplifier (LNA – Q8) centered from 460 to 470 MHz that provides approximately 15 dB of gain. The output of the LNA is filtered with a SAW filter (SF1) with passband of 460 to 470 MHz and stopband attenuation of 50 dB. The filtered receive signal is one input to the 1st mixer, the other mixer input (1st LO) is the output of the VCO at the desired channel frequency minus 21.4 MHz. The output of the mixer is tuned to the 1st IF of 21.4 MHz. The 1st IF is transformer coupled for impedance matching to a crystal filter centered at 21.4 MHz with a bandwidth of 15 kHz. The filtered 1st IF is then amplified by Q6 and fed to the 2nd mixer input of the multi-function receiver IC (U3). The 2nd LO (20.950 MHz) is generated by frequency doubling the output of the 10.475 MHz VCXO that is the reference frequency for the PLL. The 2nd mixer output of 450 kHz is filtered through a 4 section ceramic filter that in combination with the 21.4 MHz crystal filter provides approximately 55 dB of adjacent channel attenuation. The 450 kHz 2nd IF is then amplified, limited and fed to a quadrature detector for FM demodulation. The resulting audio output signal is bandpass filtered from 300 to 3 kHz (U4 A&B) and amplified to provide 200 mW of audio power (U6) which differentially drives the eight ohm speaker. A squelch circuit is provided (U3 pins 10 through 14) to mute the receiver noise under low signal conditions. The squelch circuit amplifies and detects noise in a narrow bandwidth at approximately 5 kHz. When the detected noise exceeds a threshold set to trigger at approximately 12 dB SINAD receive signal strength, the audio output is muted.

E). TRANSMIT/RECEIVE SWITCH

When the radio is in the transmit mode, pin diode switches D9 and D10 are both turned on (representing less than 0.7 ohms). D9 allows the transmit signal to pass to the antenna and D10 shorts one leg of a T matching network (L14, L15 and C81) to ground in the receive path. This results in a parallel tuned circuit high impedance being presented to the transmit signal so that the receive path does not load the transmit signal. In the receive mode, both D9 and D10 are off, resulting in the antenna signal being coupled into the receive LNA through the 50 ohm T matching network and the unwanted load of the transmit final amplifier is reduced to less than 1 pF by D9.

F). RADIO CONTROL CIRCUIT

A microprocessor (U1) is used to control the transceiver. User stimuli is provided through tack switches for PTT (push to talk), call and channel change. Pressing the PTT switch instructs U1 to switch to the transmit mode. This is accomplished by loading the proper channel counter information through a 3-wire serial link to the PLL IC (U2), turning on power to the PLL and VCO, microphone and transmit audio circuits and the transmit RF amplifiers. Pressing the call switch causes the microcontroller to transmit a warbling tone for approximately 5 seconds on the current channel selected that is used to notify another person with an FRS radio that you wish to communicate. Pressing the channel switch (active in receive mode only) results in U1 incrementing the channel frequency by one channel from the channel previously selected in the order of 1,2,3,1...

In receive mode the microcontroller periodically switches on the VCO and receiver power and checks for a valid received signal by monitoring the squelch circuit output. If a valid signal is present, the audio output is turned on and receive power is maintained for the duration of the valid signal. If the valid signal is removed or no valid signal was present, the microcontroller removes power from the VCO and receiver, waits for approximately 100 ms and then checks again. This periodic cycling of the power to the receiver circuits results in a much longer battery life vs. leaving power on continuously. The total period of the cycling is selected such that the worst case delay in 'seeing' a valid receive signal is not disruptive to normal two-way voice communications.