

### **EXHIBIT 3:      System Functional Description**

## Watkins-Johnson R1920 PCS Repeater Description

The WJ R1920 PCS Repeater is used to extend basestation coverage to shadow areas caused by hills, large buildings, and other structures that can obstruct PCS signals.

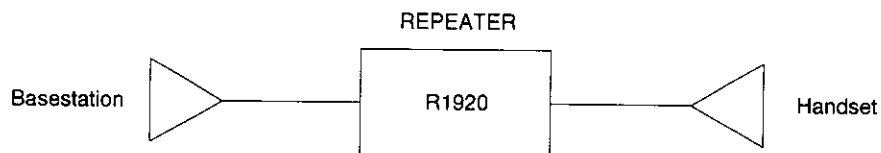
The repeater receives the basestation signal via an antenna (donor). The signal is amplified and filtered by the repeater and ultimately retransmitted via a second antenna (server). The entire process is duplicated for the reverse path where the handset signal is amplified and filtered and retransmitted to the basestation. The technique provides PCS coverage in areas where there was insufficient signal strength.

The family of WJ repeaters all are designed with the same architecture. For example 3 models exist to cover the 6 PCS frequency bands (A through F).

Model	Frequency Band
R1920 AD	A & D (1930-1950 Mhz Forward, 1850-1870 Mhz Reverse)
R1920 BE	B & E (1950-1970 Mhz Forward, 1870-1890 Mhz Reverse)
R1920 CF	C & F (1970-1990 Mhz Forward, 1890-1910 Mhz Reverse)

### Description

In the normal configuration the repeater is connected to antennas. One antenna is pointed at the basestation and the other is used to retransmit the basestation signal to the desired coverage area.



The repeater receives the basestation signal from the forward path through a diplexer. The signal is amplified by a Low Noise Amplifier (LNA) and then mixed down to an IF frequency. A local oscillator (LO) is generated by a VCO, synthesizer chip and 10 Mhz oscillator. The LO is used by both mixers. At the IF frequency of 160 Mhz the signal is amplified, attenuated and filtered by a SAW filter. The signal is then upconverted back to the original frequency. The signal is filtered by a ceramic band pass filter to help eliminate the LO and then amplified. The forward path is then amplified again by the Power Amplifier (PA). The amplified signal is passed through another diplexer to ensure that this signal does not affect the reverse path. The entire scheme except for the PA is repeated for the reverse path that amplifies the handset signal.