The following is a brief response with supporting detail regarding the changes made by WJ to the hardware design of the SX20xx readers. This does not address the various firmware changes that occurred in conjunction with the hardware changes. Both software and hardware revision histories are necessary to fully understand the extend of these changes. Reasons for hardware changes from Rev 2 to Rev 4:

The changes fall into three main categories. The most important category is that of design optimization for improved spectral efficiency (i.e. a better RF spectrum output, mor "clean") to allow use of the same basic reader design for Japan. The Rev 2 unit had plenty of performance margin against the US FCC ISM regulatory requirements but was marginal when compared against the more stringent Japan regulatory needs. The change amounted to a passive resistor change that trades modulation depth and spectral width. Specifically the improved spectrum came at the cost of a lower modulation depth. The spectrum/mod depth trade-off was optimized and a new resistor value was chosen.

The second category of changes was manufacturing improvements. This category includes the correction of documentation errors as well as minor passive element and tuning procedure changes. These small changes improve the cost of making the units and does not affect RF, Digital or DC performance. One example was to make use of some extra PIC signals for added information to aid in the tuning of the unit. In this case a detector voltage was reported to improve (i.e. reduce) VCO tuning alignment time. Another example was the choice of standard passive component values that are readily available in production. Some of the initial values were chosen by engineering and are no longer available.

The third category includes design optimization for improved unit performance. Specifically the power amplifier bias voltage references were improved for more consistent performance at lower reader bias (Vcc) levels. Additional the antenna open circuit protection circuit was improved—faster response time. This included changing the op-amp model used in the DC control loop circuit. A number of resistor, diode and capacitor values were changed to improve voltage reference precision, reduce noise and stabilize reference circuits. This unit is designed for operation with very little voltage overhead. As such the internal regulation voltages that are used as references throughout the unit need to be precise. Some of the initial circuits needed further optimization.

Table 1 shows the master list of WJ's hardware changes from Rev 2 and through the release of Rev 4.

Revision 3		
SX2000, SX2001, SX2010, SX2020		
DCN / Mod Sheet	Effectivity Date	Changes
		Incorporates all Revision 2 MOD sheets
		Modulator and Power Amplifier Supply voltages improved (replaced zeners with precision reference circuits)
DCN101210	3/18/04	Unused PIC signals ADI and ADQ deleted, one of the two available pins is routed to allow PIC to report detector voltage to computer (improves VCO alignment time)
Revision 4		
SX2000, SX2001, SX2010, SX2020		
DCN / Mod Sheet	Effectivity Date	Changes
		Incorporates all Revision 3 changes
		Op Amp U202 (changed for Antenna Protect Circuit in Rev 2 MODs, DCN101210), is now powered by +5V regulator instead of directly from +6V line
		Lowered bias voltage on crystal oscillator to improve spurious emissions.
DCN101219	4/7/04	Changed ouptut diplexer/output coupler tuning capacitors to eliminate use of nonstandard values used in DCN101210
		Improved antenna protect status byte integrity during single tag read commend (accomodates new firmware and is backward compatible)
		Resistor value changed to improve quality of +6V monitor signal for PIC at higher unit bias levels
		Changed resistor value to increase modulation depth.
		Added capacitor to improve stability of Zener reference circuit.
		Resistor value changed to optimize bias on crystal oscillator.
DCN101232	4/21/04	Resistor value changed to prvent noise on detector diode signal from reaching PIC
DCN101244	Initiated 4/29/04	Removed C257 from No Load list on BOM (C257 was a non-existent reference designator)

WJ COMPANY PRIVATE 03 May 2004

TABLE 1—Excerpt From Formal Changes Log Provided to Alien In May 2004