EXHIBIT B.1

FULL NAME AND MAILING ADDRESS OF MANUFACTURER OF DEVICE AND APPLICANT FOR CERTIFICATION

MANUFACTURER:

Addison Technologies
dba E-Code
113 WestHoover Avenue
Suite 101
Meas, AZ 85210

APPLICANT:

Mr. John Coulthard,
Vice President for Manufacturing

EXHIBIT B.2

FCC IDENTIFIER:

N3S2001B01

EXHIBIT B.3

INSTALLATION/OPERATING INSTRUCTIONS

**SPIDER DEMO READER
OPERATING NOTES 1.0**

Batteries: The Box contains four AA alkaline batteries that are expected to last about 100 hours. When the series battery voltage falls to below 4.75 volts, the panel power light will no longer illuminate thus indicating low battery. The circuit will operate at the 4.75-volt detection point.

To measure or replace the batteries, remove the two screws from the bottom of the housing then slide the cover off of the lower assembly. The added thickness of the panel laminates makes the cover a little tight – work it back and forth as you lift. Unplug the ribbon cable from the circuit board. The circuit board is mounted to the back panel; lift the circuit board and back panel out as an assembly to access the batteries.

Antennas: The reader unit has two independent radio receivers each with its own antenna jack. The two radio channels are logically or'd together so that a detection from either radio will suffice to recognize a tag. Two radios provide the benefit of spatial diversity so that detection is significantly more reliable.

The use of two antennas also allows the user to tailor the shape of the near detection zone. For example, one antenna could be placed on each side of a passageway or for room detection in a rectangular room, two antennas will allow placement at offset centerline positions in or above the ceiling for good coverage.

The demonstration antennas are basic tuned dipoles. In situations where there exists a metal surface to mount an antenna to, a monopole antenna may be a good choice; Certain monopole designs can offer better gain than a basic ¼ wave stub which is about the same as the tuned dipole.

In situations where the detection area is afar but in a know direction, then greater range can be had from a beam antenna such as a Yagi type which is commonly used for TV reception. An example might be detecting trucks at a loading area. In that case, the antennas and reader might be mounted on a building as much as 500-1000 feet from the detection area. One antenna might be deployed for horizontal polarization and the other with vertical polarization.

The antenna lead-in cable may be 100 feet or more if the application dictates that. With longer lead-in cable, it would be necessary to use 1/4 inch or larger coax in order to minimize cable losses. The antenna connectors are standard SMB type – adapters are available for connection to BNC connectors.

It is also possible to use very small antenna loops internal to the box itself. Internal antennas would be less efficient and would probably reduce the operating range by about half. In some situations the reduced range might be an acceptable trade-off. We have not experimented with board mounted antennas.

In general the reader antennas will work best when mounted high and when a couple feet or more separates the two antennas. The dipole antennas are best mounted away from metal for uniform coverage. Operation near metal may be necessary in some situations and may work quite well subject to some simple experimentation. It is best to mount the two antennas at right angles with respect to one another in order to pick up tag signals at either polarization; although, indoors, with lots of multi-path, it's probably not very important how the antennas are oriented.

The dipole arms are best oriented at right angles to the lead-in cable; though that's not critical if mechanical considerations restrict the deployment of the antenna arms. Virtually any arrangement of the leads will work; though less optimal geometry will yield a bit less range and possibly less uniformity of coverage. The antennas can be mounted with staples or wire ties or tape.

Detection Range: Tests were conducted to determine the open-field maximum detection range for the system with optimal dipole antenna orientation. In this test, the tags were three feet above the ground and lying flat on a masonry surface. The reader antenna arms were taped to a yardstick that was horizontally deployed five feet above the ground and oriented orthogonal to the line of sight. In this optimal antenna geometry, the near range measured 60 feet and the far range measured 400 feet.

In any real application we must allow for non-optimal antenna orientation, multi-path cancellation and blockage effects. It is quite complicated to characterize these combined effects. We should consider that the useful operating range is specific to the environment of the application. As a general rule, we've suggested that the maximum reliable indoor range might be described as 15 feet and 50 feet for near and far range respectively; these are conservative values in most situations.

Detection range has a probabilistic character. At any particular point in space and at any particular orientation, there is a chance that multi-path cancellation will produce deep nulls that will greatly reduce the detection range. If the tag is moved a half-inch or rotated 10 degrees, such a deep null may be dramatically reduced. The use of two radio receivers and two antennas for "spatial diversity" is effective in smoothing the detection range and reducing the possibility of deep null dead spots; with two radio channels, the detection range can be more uniformly characterized.

When the tag is in motion, it will not remain at a spatial null point; a moving tag is thus protected from being missed on successive transmissions due to antenna nulls. Thus a moving tag can be considered a more reliable transmitter than one that is stationary. This can be a useful advantage for applications which use the near detection field for devices in passage detection mode applications.

Detection range will also be impacted by the analog adaptive nature of the radio detector circuits. In effect, the radio receiver is momentarily desensitized immediately after a strong radio signal is received. In a scenario with a large number of tags operating asynchronously, some tags may be near the receiver, generating relatively strong signals, while other tags are at the limit of their detection range generating weak signals at the radio receiver. If a pulse from a near tag immediately precedes a pulse from a distant tag, the weaker distant pulse can be masked. Clearly this effect will have a statistical characteristic that will depend on the number of tags present and their physical distribution with respect to the receiver.

In an effort to quantify this masking effect, tags were built with a special test program that intentionally produced a high power pulse immediately before a low power pulse. Detection ranges were measured with and without the extra high power pulse turned on. We measured 21% range degradation for low power detection due to this effect. We would expect that a desensitizing preceding pulse from a close-in tag could similarly impact the high power range.

In a further experiment along the same lines, we doubled the width of the high power preceding pulse. Range was reduced by 36% in this case. This might be roughly the worst case expected range degradation due to a tag that is quite near the receiver. Or, it may reasonably represent the effect of coincidental collusion of multiple pulses from more than one tag that is near the receiver. Naturally, this degree of range degradation would be expected to occur infrequently.

The detection range vagaries that we have ascribed to multipath nulls and preceding pulse desensitization can be effectively mitigated by the use of multiple reader units in overlapping range fields. These vagaries are also mitigated by the basic reader design having dual radio channels with pickup antennas separated in space.

Tag Operation on Metal Surfaces: A metal surface in close proximity to the tag will squelch the transmit oscillator. This squelching effect is more pronounced when the tag is transmitting low power and less significant at high power mode. We have empirically determined that for essentially full performance in low power transmissions, the tag needs to be mounted about one inch away from a metal surface. We found that with the tag mounted ½ inch from the surface the low power detection range is roughly halved.

For applications requiring only high power transmit operation, the situation is more favorable. Essentially full performance can be achieved at about ½ inch spacing. Of course, the near proximity of a metal surface will radically affect the angular distribution of the transmitted power. When there is substantial metal near the tag, the range in some directions will be much less than in other directions. That effect is generic and quite independent of the matter of oscillator squelching.

Radio Interference: Interference may be generally characterized as either a continuous or intermittent source of transmissions in the band of the receiver. Generally speaking, interference can be directly viewed on the spectrum analyzer.

When interference is continuous, the effect is to raise the "noise floor" of the receiver. When this occurs, the radio receiver will adapt to the condition by correspondingly raising the detection threshold. The result can be reduced sensitivity and reduced detection range. At the vicinity of the Ecode offices, we have seen slight variability in the tag detection range due to a low-level continuous interference signal at about 303.6 Mhz.

When considering interference due to more powerful intermittent transmitting devices, the issue becomes more related to the robustness of the communication code and the algorithms for interpreting the tag transmissions. The design of the code we use is robust against intermittent interference. But if other devices transmit for long enough intervals, they may interfere with the tag signals. A false positive is more likely to occur than missing a valid tag in the presence of intermittent interference. So far in our testing and observations, we have not seen any problems due to intermittent interference. The reader unit has a testing feature and an attenuator feature so that we can rationally deal with interference problems if and when they do occur.

Interference can produce threshold crossings at the radio output. The demo reader has test-points for directly measuring the density of threshold crossings in order to provide a means of quantifying interference that may be seen in field trials or quickly diagnosing problems. There are two test points on the circuit board – one for each radio. The test points comprise the upward bent leads of two 82K-ohm resistors at the forward edge of the RF daughterboard.

The test points present a DC signal representing the density of threshold crossings. The signal can be measured in the field with a simple DVM. As long as both antennas are similar, the readings from the two test points should be about the same. Depending on what is observed, it may be instructive to reverse the antenna leads or remove one or both antennas and repeat the meter observations. When no interference is present, typical readings are as follows:

1 tag near	15 millivolts
2 tags near	26 millivolts
3 tags near	37 millivolts
4 tags near	48 millivolts

The design also includes a provision to mitigate interference by electronically attenuating the antenna-input signal. A programming jumper on the circuit board selects the attenuated operating state. To access the jumper header, remove the cover on the box. The four-position jumper header is easily recognized. To activate the attenuator circuits, install a single programming jumper at the second position from the front. Note that with the attenuators active, the detection range is cut in half. Repeat any measurements at the test points with the attenuators on and off in order to establish whether or not they are effective in reducing interference.

The user is advised to remove the attenuator-programming jumper upon completion of testing so that there is not confusion about the detection range performance at the next occasion of usage. In the production design, we may include facility to automatically activate attenuators when needed in accordance with automated interference measurements. In the production design, we may also use the attenuators to reduce the detection range for NEAR detection under program control.

Computer Interface: The reader transmits RS-232 on the back-panel 9 pin connector. Communication parameters are 9600 baud, no parity, 8 data bits, 1 stop bit. Communication is one way only – from the reader to the computer. The reader does not respond to the keyboard. Any computer running a terminal emulation program can be used to monitor the reader's transmission.

Launch the terminal program first, set the communication parameters and COM port then turn on power to the reader. Each tag will be indicated as NEAR, FAR or GONE. Whereas the reader front panel indicators display actual tag detection events, the terminal displays the constant indications of each tags' status. The NEAR indications will time-out after two near transmissions have been missed. The FAR indications will time-out after successive far transmissions have been missed.

EXHIBIT B.4

BRIEF DESCRIPTION OF CIRCUIT FUNCTIONS AND DESCRIPTION OF HOW DEVICE OPERATES, INCLUDING DESCRIPTION OF GROUND SYSTEM AND ANTENNA USED.

ECode

Instruction Manual for the *Spider Engineering Test Demo*

Table of Contents

Introduction

This manual applies to the Engineering proof of concept demo "Spider" system.

The toggle switch on the lower left portion of the front panel turns the reader on. Once the power is turned on the LED above the switch should light up and the reader will give a short beep indicating the power is on. The reader will then begin to read tags. Each tag sends out it's own signal and the reader indicates which tag it is detecting with the four LED's on the front panel. Each LED is numbered and corresponds to the tag with its number. The LED's are separated into near and far. The tag emits a fast repetitive signal for the near application and a slower repetitive signal for the far applications. The fast beeping heard on the reader indicates when the tag is within a "near" area. The slower beep is for the "far" area. When tag number one is detected the LED for number one will light up and the reader will "beep". The reader will only beep for the number one tag but for both near and far situations. Because the reader only beeps with the #1 tag the other LED's may be visually monitored.

Troubleshooting

If a certain tag is not being detected and the other tags are, the battery in the tag is most likely bad. The demo tags are disposable after the tag's battery life expires. The battery life is several years.

Batteries

The Reader contains four AA alkaline batteries that are expected to last about 100 hours. When the total battery voltage or the voltage of all of the batteries falls to below 4.75 volts, the panel power light will no longer illuminate thus indicating low battery. The circuit will operate down to the 4.75-volt detection point.

To measure or replace the batteries, remove the two screws from the bottom of the housing then slide the cover off of the lower assembly. Unplug the ribbon cable from the circuit board. The ribbon cable may be a little tight so working it back and forth as you pull will help. The circuit board is mounted to the back panel. Lift the circuit board and back panel out as an assembly to access the batteries. To test the voltage of all the batteries a DVM or Digital VoltMeter will be needed. The voltage of the four batteries together will need to be tested, not just one of them. The leads of the DVM when touched to the positive and negative side should indicate the voltage of all of the batteries. The positive lead from the battery case is the one towards the outside of the battery case and corresponds to the positive side of the battery it touches. The negative lead is the other lead. To replace the batteries lift the Velcro up and pull the old batteries out. Sometimes a flathead screwdriver may help in taking the batteries out.

Test Equipment

Test Equipment Needed:

Digital Voltmeter (DVM)
Spectrum Analyzer

The Digital Voltmeter is used to measure the voltage of the battery pack. (The Troubleshooting section explains the procedures in testing the batteries.) The Spectrum Analyzer can be used to monitor any interference signals.

Test Data

We have tested the distance for each tag and the reader. The test results will be recorded on the test data sheet (Appendix A).

Antennas

The reader unit has two independent radio receivers each with its own antenna jack. The two radio channels are combined together so that detection from either receiver will suffice to recognize a tag. Two radios provide the benefit of spatial diversity so that detection is significantly more reliable. The use of two antennas also allows the user to tailor the shape of the near detection zone. For example, one antenna could be placed on each side of a passageway or for room detection in a rectangular room, two antennas will allow placement at offset centerline positions in or above the ceiling for good coverage.

The demonstration antennas are stub antennas. Larger dipole antennas provide greater detection range.

In situations where the detection area is afar but in a known direction, even greater range can be obtained from a beam antenna such as a Yagi type which is commonly used for TV reception. An example might be detecting trucks at a loading area. In that case, the antennas and reader might be mounted on a building as much as 500-1000 feet from the detection area. One antenna might be placed in a horizontal location and the other in a vertical location.

The antenna cable should not exceed 100 feet. With longer lead-in cable, it is necessary to use 1/4 inch or larger coax in order to minimize cable losses. The antenna connectors are standard SMA types.

In general the reader antennas will work best when mounted high and when a couple feet or more separates the two antennas. It is best to mount the two antennas at right angles with respect to one another in order to pick up tag signals; although, indoors, with lots of multi-path, it's probably not very important how the antennas are oriented.

If dipole antennas are employed, the dipole arms are best oriented at right angles to the lead-in cable; though that's not critical if mechanical considerations restrict the deployment of the antenna's. Virtually any arrangement of the leads will work; though less optimal geometry will yield a bit less range and possibly less uniformity of coverage. The antennas can be temporarily mounted with staples, wire ties or tape.

Detection Range

Tests were conducted to determine the open-field maximum detection range for the system. In these tests, the tags were two feet above the ground and lying both horizontal and vertical. The reader antenna was the stub antenna. Near range measured 10 feet and the far range measured 80 to 100 feet. Using a dipole antenna mounted 5 feet above the ground, the near detection range was 60 feet and the far range was 400 feet.

In a real application there is a possibility of interference, blockage of the antennas, or other problems. The useful operating range is specific to the environment of the application. As a general rule, we've suggested that the maximum reliable indoor range might be described as 5 feet and 50 feet for near and far range respectively; these are conservative values in most situations.

Metal Interference

Tag Operation on Metal Surfaces: A metal surface in close proximity to the tag will greatly reduce the transmit signal. This effect is more pronounced when the tag is transmitting low power and less significant at high power mode. For essentially full performance in low power transmissions, the tag needs to be mounted greater than one inch away from a metal surface.

For applications requiring only high power transmit operation, the situation is more favorable. Good performance can be achieved at about ½ inch spacing. Of course, the near proximity of a metal surface will radically affect the angular distribution of the transmitted power. When there is substantial metal near the tag, the range in some directions will be much less than in other directions.

Computer Interface

The reader transmits RS-232 on the back-panel 9 pin connector. Communication parameters are 9600 baud, no parity, 8 data bits, 1 stop bit. Communication is one way only – from the reader to the computer. The reader does not respond to the keyboard. Any computer running a terminal emulation program can be used to monitor the reader's transmission.

Launch the terminal program first, set the communication parameters and COM port then turn on power to the reader. Each tag will be indicated as NEAR, FAR or GONE. Whereas the reader front panel indicators display actual tag detection events, the terminal displays the constant indications of each tags' status. The NEAR indications will time-out after two near transmissions have been missed. The FAR indications will time-out after successive far transmissions have been missed.

		Appendix A Test Data Sheet					
			Reader #:				
			Date Sent:				
			Distance in feet				
Tag #		**Indoor**			**Outside**		
		Near	Far		Near	Far	
1							
2							
3							
4							