

***BCC Reader On-Site Repairs Performed by Digital Angel (DA).
April 18th 2007***

Summary.

In late March of 2007, the BCC reader (**Serial # 2**) experience hardware failures relating to the Auto Tune circuit. Note that this system was the production reader during the 2006 out migration and proved to perform well.

It was at that time the reader was replaced with another unit (**Serial #3**). Although transceiver #3 appeared to working well, it was noticed after the fact that this unit was generating an excessive amount of spurious tag codes therefore skewing the number of actual detections for this site. At this point, PSMFC had only 1 spare transceiver at their disposal, (**Serial #1**) and was the first transceiver produced. This transceiver had not been thoroughly evaluated for performance therefore was not regarded as a fully functional hot spare.

Not knowing how to correct this spurious tag problem and very little options left, prompted immediate action to repair and or upgrade all non functioning transceivers in order to restore the necessary amount of spare units in the event of another failure.

The following describes the repair activities performed by Digital Angel and facilitated by PTAGIS field personnel on the BCC Readers. All repairs and adjustments were made on-site at the BCC facility.

Status of Readers and On-Site Repairs performed by Digital Angel.

Serial # 3. (Determined to be the most up to date unit possessed by PSMFC).

- This unit has a high PIT tag detection rate but generates an excessive amount of spurious tag codes (STAGS).

Corrective action:

On April 18th, DA made adjustments to the receiver pcb in order to reduce the number of STAGS without reducing the PIT tag detection rate. Adjustments that were made are as follows:

Adjusted R-42 on Receiver. This is the 2-4 Khz amplitude adjustment.

Adjusted R-27 on Receiver. This is the “High Pass Filter Cutoff Frequency” adjustment.

These adjustments were the only known calibration adjustments by PTAGIS O&M up until DA’s visit.

DA then made further adjustments to potentiometers that had previously been deemed “Factory Set” at their facility. PTAGIS knew about these additional adjustments but had no information on what they did and how to calibrate them. Adjustments that were made are as follows:

Adjusted R-17. This pot adjusts the gain for the first stage of the amplifier.

Adjusted R-xx This pot adjusts the 2-4 Khz phase shift delay.

Adjusted R-xx This pot adjusts the gain for the third stage of the amplifier.

It was determined that the adjustments made did not significantly, or at all, reduce the rate of STAGS generated by the reader.

At this point, it was thought that the reader’s internal software and or the decoding algorithm may need to be reworked in order to circumvent this STAG problem. DA also made mention that this reader had a 50 percent duty cycle relating to the antenna drive circuit and that the other 2 units, Serial 1 and 2 have a 60-40

percent duty cycle. *It is somewhat unclear, as to which duty cycle should be considered as the optimum. This issue should be resolved and goes in suite with the standardization of all readers.*

Current disposition of Reader Serial #3: Continues to generate STAGS at the same rate prior to making all the above listed adjustments.

Repairs made to Serial #1.

- This reader failed on March 25th, 2007. The failure was directly related to the Auto Tuning circuit.

Corrective action:

DA Replaced Auto Tune PCB and recalibrated circuit. Functionality to the circuit was then restored.

After the system was tuned and recalibrated, it was observed that the FDX-B input had an excessive amount of noise or hash in the signal. As to be expected, this was of concern. Per DA, the signal to noise ratios observed on this input would more than likely have a negative impact on detection efficiencies and may generate an excessive amount of STAGS. *This concern was substantiated by a reduction in read range*

At this point, an extreme effort was made in determining why the signal was noisy. One observation was that the antenna drive signal was not as clean as it should be. The attention focused on the drive FET's on one side of the driver circuit. DA at this point swapped out the FET's from another pcb in an attempt to correct the situation but this did not cure the problem.

The reader was left in place and operating overnight, then re-evaluated the next morning. After review of the reader's performance over the course of 11 hrs, the reader had generated 51 STAGS. At this point, a stick test was performed in order to evaluate the reading efficiency. Stick test results were favorable. Reading efficiency was at 72 percent but the STAG generation was very apparent.

The issue with the noise on the FDX-B input at this point had not been resolved. The focus then shifted to repairing serial #1.

Repairs made to Serial #1.

The timer tag circuit on the diagnostics pcb was installed along with timer tag cables. The CPU pcb was replaced in order to correct the problem of not being able to change the reader ID.

After the above repairs were made, the reader was attached to the antenna, then tuned and calibrated. All indications at this point were that the reader was quiet and should perform well. Read range was near optimal and noise levels were within acceptance. Although the reader had physical differences from the other 2, this reader would have been a suitable candidate for use as a production reader or at least a good working spare. The reader should have been stick tested at this point but the focus was shifted to the ailing #2 transceiver.

With direction from DA, components from reader #1 were swapped into serial #2 in order to isolate the noise issue with exception of the Auto Tune pcb, the coarse capacitor switch bank and the variable capacitors. The root cause of the problem was not found during this exercise. NOTE: All pcb's and modules that originally belonged to serial #1 are now in serial #2. The components were not re-installed into the reader they had originally come from.

When this reader was re-evaluated after the component swap, it also had acquired the noise bug in the FDX-B signal. Still unexplained, numerous attempts were made to correct the noise issues that are now observed in Serial #2 and #1.

Late that night, it was found that the tag detect cable was picking up interference from the antenna drive leads. The cable was re-routed and this appeared to reduce the interference seen on the FDX-B input. Unit serial #2 was then left overnight and re-evaluated the next morning. It appeared that soon after we had left that night, the interference had come back and that our read range had significantly been reduced. PTAGIS O&M then retuned and calibrated the unit and eventually re-established a suitable read range.

April 20th,07. Unit serial #2 was not performing well at all when arrived back on-site. Stick tests on this unit proved to be good in that the number of hits per tag was more than sufficient although the overall detection rate was at 50 percent. This reader is currently in use at the site and will remain in operation until a superior reader is available.