

# B2CC Transceiver Upgrade Rationale

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PIT Tag Information Systems  
Columbia Basin | [ptagis.org](http://ptagis.org)

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## 1. Introduction

This document provides rationale for the upgrade, enhancement and standardization of the transceivers designed for use at Bonneville Dam Powerhouse-2 Corner Collector (B2CC).

**Maximum accuracy, uptime and reliability of the PIT Tag interrogation equipment is essential, as there is only one chance to read the PIT Tag code for each fish. Implementation of these enhancements will help achieve this goal.**

B2CC is an important data collection site for researchers in the Columbia River Basin (CRB). In the effort to minimize downtime and/or degraded interrogation performance, standardization and optimization of the transceivers is imperative. In the event of a malfunction, an optimally performing transceiver must be available for immediate deployment. The performance of the system is measured by “hits per tag” (the number of times a PIT Tagged fish is successfully read as it passes through the B2CC antenna), along with “read range” (how far from the antenna a PIT Tag will start to be read). PSMFC working with DA and NMFS has established minimum standards for these performance parameters. When a transceiver falls below these standards, we need to have a replacement transceiver ready to install that meets the standards. This is essential if the site is to maintain the integrity of the data that PTAGIS collects for the fisheries community.

The B2CC transceivers are the most technologically advanced in the world; their development was necessary to enable detections in the huge antenna (17' by 17') that surrounds the exit flume of the corner collector at the Bonneville Dam. There are four transceivers, but each is unique because they were researched and developed as incremental prototypes and were improved during the development process. The B2CC transceivers are not in production.

In order to detect the modulation of a 12-mm tag in such a large antenna, these transceivers need to be more sensitive than the ones located at other PIT Tag monitoring sites throughout the Columbia River Basin. Unfortunately, a byproduct of that sensitivity is that these transceivers sometimes record PIT Tag codes that are not always real, as environmental electromagnetic noise sometimes produces a pattern that meets the basic definition of a tag. In an attempt to limit the number of these nonsense or spurious tag codes from being recorded in the permanent data files collected at the site, PSMFC has written a custom version of MiniMon (the PTAGIS data collection software). This non-standard version of MiniMon presents a maintenance burden, diverting PTAGIS software engineers from their tasks. The B2CC transceiver's weaknesses need to be overcome so that PTAGIS software engineers only need to maintain one production version of MiniMon for use in the CRB. An attempt will be made to minimize and/or eliminate spurious tags as stated with Software Item #6.

Enhancing the remote control capabilities of the B2CC transceiver would also be beneficial. This would translate into increased uptime and potentially more PIT Tag

detections. It also would translate into lower maintenance costs, as the number of visits by personnel having to travel to the site would be reduced.

## 2. Transceiver Upgrade Items

### 2.1 SOFTWARE ITEMS

#### Item 1 - Take over of the software developments for the B2CC system.

**Issue:** Enhancements, upgrades, and problem resolutions for software issues relating to the B2CC transceiver cannot currently be accomplished because the original Digital Angel sub-contractor is no longer available to provide software support.

**Resolution:** Digital Angel will assume development of B2CC transceiver software using an existing contractor who was not a contractor for this project and did not produce the existing software.

**Justification:** This will allow the remainder of the software items in this document to be accomplished.

#### Item 2 – Enhancement - Storage card #2 - The absence of the card in certain conditions generates boot loop errors.

**Issue:** As designed, the transceiver will enter a continuous boot loop with errors displayed and/or persistent errors generated. This occurs when the external storage card #2 is not available when the system tries to write the log file or if there is no log file.

**Resolution:** Revise the B2CC transceiver firmware.

**Justification:** Allows for 3 things.

1. Power cycling (turning on and off) of the transceiver will be possible utilizing the log file on storage card #2.
2. Data that are collected by the transceiver can be re-directed to this card. This would allow a user to simply extract the card and download the information from it, then re-insert the card without disrupting data collection.
3. This enhancement would also allow the card to serve as redundant back-up storage location when, if ever, the primary data collection platform becomes unavailable.

#### Item 3 – Enhancement - I/P (Internet Protocol) addressing issues and testing (Transceiver I/P address cannot be changed.)

**Issue:** PTAGIS is unable to remotely access the B2CC transceiver since the I/P address of the B2CC transceiver cannot be configured to a valid I/P address acceptable within most (including PTAGIS) networks.

**Resolution:** Revise the B2CC transceiver firmware.

**Justification:** This enhancement would reduce maintenance costs and increase system uptime. The lack of remote communication to the B2CC transceiver in some

instances necessitates road trips for maintenance personnel, during which time data could be lost. Improved remote control and remote system monitoring could significantly reduce the need for onsite visits.

**Item 4 – Enhancement - Deletion of log file in storage card #1 – The log file cannot be deleted. This is not true for storage card #2.**

**Issue:** As designed, the log file cannot be deleted from the internal flash card. If corrupted, the bad log file can (and has in the past) render a B2CC transceiver unusable.

**Resolution:** Revise the B2CC transceiver firmware to allow log file deleted.

**Justification:** Decreased downtime during troubleshooting.

**Item 5 - New Enhancement - Need command to GET transceiver ID**

**Issue:** As designed, the transceiver's internal command set does not incorporate the command to display the transceiver's unique antenna ID. It is imperative that the transceiver's ID match what the PTAGIS database is expecting. If this is ever in question, maintenance personnel need the ability to double check this setting. As of now, monitoring the file being created in the MiniMon application is the only way to know the transceiver ID. If the ID is incorrect due to transceiver malfunction (see item 8 for example), the data has been corrupted. At this point, manual (human) edits to the production data file are necessary to remove all references to the invalid transceiver ID.

**Resolution:** Revise firmware to include the GET Transceiver ID command.

**Justification:** Improved data integrity, improved troubleshooting capabilities.

**Item 6 - New Enhancement - Attach unique identifier to real time transmitted spurious tag codes.**

**Issue:** As designed, the algorithm used by the B2CC transceiver generates suspect (and more often than not, erroneous) PIT Tag codes. These are known as "spurious tag codes."

**Resolution:** Re-write the decoding algorithm to minimize and/or eliminate the generation of these codes without degrading system performance. The new decoding algorithm would also flag any remaining spurious tag codes.

**Justification:** This enhancement will improve data integrity and reduce software development / maintenance costs. Fewer bad PIT Tag codes to be culled by the MiniMon application or manually by PTAGIS staff yield higher quality data and reduced burden on PTAGIS resources.

**Item 7 – Enhancement – Eliminate unplanned reset.**

**Issue:** As designed, while the transceiver is in “Standby” (powered up but not energizing the antenna), the “Out of Tune” alarms are false. In addition, if the system randomly reboots while in the “Standby” state, by default the transceiver will return to an “Online” state, which means that the antenna is again energized.

**Resolution:** Revise the B2CC transceiver firmware.

**Justification:** Safety. At times, the transceiver will need to be put into the “Standby” state, meaning that the antenna is not detecting tags, but the transceiver itself is still active. If maintenance is being performed and the transceiver randomly resets, by default, the transceiver will return to an “Online” state and the antenna will be actively detecting tags. This situation is potentially dangerous. Lethal voltages are present in the circuitry that drives the antenna as well as the tuning circuitry. Insuring that these voltages remain absent while troubleshooting these circuits is essential.

**Item 8 – Enhancement – Save transceiver ID and current / voltage calibration values while powered-down or during system reset.**

**Issue:** As designed, the voltage and current calibration values as well as the transceiver ID value need a non-volatile storage method. In the past, random reset and/or corruption of the storage card log file have caused the transceiver to reset the calibration values to raw values and set the transceiver ID to 00. Regarding the calibration values, the information reported by the remote monitoring tools will be incorrect, requiring an on-site visit for resolution. The incorrect transceiver ID requires a manual repair before the B2CC data can be inserted into the PTAGIS database.

**Resolution:** Revise the B2CC transceiver firmware.

**Justification:** Improve data integrity and prevent unnecessary site visits required to correct the calibration values and transceiver I.D.

**Item 9 - On Site Evaluation - Review, implement, and modify as needed, the enhancements of items 1-8 (item 6 is required) on the B2CC system. Includes travel to B2CC site (est. 2 weeks) by two engineers (not a fixed price item).**

**Issue:** The enhancements described in this document require substantial B2CC transceiver firmware revisions. Simultaneous site visits by the software and hardware engineers should be made to perform final integration of the new designs as well as diligent testing of these extensive software modifications.

**Resolution:** On-site visit by software and hardware engineers to perform final integration and validation of software modifications.

**Justification:** This will insure robust software performance as deployed in the production hardware.

## 2.2 *HARDWARE ITEMS*

**Item 1 - Ensure all internal modules and associated circuits are at the latest revision level.**

**Issue:** During fabrication, incremental improvements were made and applied to construction of the next transceiver. The inconsistencies that currently exist among internal components of the four B2CC transceivers are not conducive to a reliable spare equipment base. The circuits need to be identical to perform identically.

**Resolution:** Evaluate all internal boards and modules and correct any discrepancies.

**Justification:** Could potentially cause excessive down time in the event of transceiver failure if the replacement unit does not behave like the original.

**Item 2 - Standardize all transceiver enclosures, interface ports, and internal cabling. This should include a universal grounding scheme for the DC power grounds in each transceiver enclosure.**

**Issue:** As explained in item 1, during fabrication, incremental improvements were made and applied to construction of the next transceiver. When replacing a transceiver, internal and external grounding conductors at times cannot be reconnected in the same location or in the same manner as the previous unit.

**Resolution:** Standardize all connection locations and require that all terminal lugs be of the same style along with conductors of the same gauge.

**Justification:** This will significantly decrease the down time when replacing a transceiver.

**Item 3 - Correct all mechanical differences to ensure consistency between the four transceivers**

**Issue:** As explained in items 1 & 2, during fabrication, incremental improvements were made and applied to construction of the next transceiver. Physical and mechanical inconsistencies (connector placement, test point availability, etc.) are not conducive to a reliable spare equipment base.

**Resolution:** Correct all mechanical discrepancies so all transceivers are identical.

**Justification:** This will significantly decrease the down time when replacing a transceiver.

**Item 4 - Perform extensive testing of the four units to ensure peak performance of the transceivers and all embedded functionality has been tested and documented as fully operational. The testing of the systems will include but not be limited to**

**testing at Digital Angel. Additional in-situ testing maybe required at the B2CC installation.**

**Issue:** To ensure a sound and reliable equipment base, extensive, thorough and complete testing needs to be performed after the enhancements have been made.

**Resolution:** Define quantifiable performance benchmarks that all transceivers must meet or exceed. Develop a comprehensive and rigorous test plan. The plan should include comprehensive test results for each transceiver. The test results should then be compared to the other transceivers and certified as such to ensure consistent and repeatable performance.

**Justification:** This will ensure a sound and reliable equipment base and minimize downtime.