ANITA-4 ADU5 Calibration Note

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1 Introduction

The ADU5 are differential GPS systems which determine payload attitude from the relative positions of four GPS antennas. In order for the attitude determination to work the ADU5 needs to have a good description of the reltive position of the four antennas. The recommended way of achieving this is using the ADU5 in calibration mode to determine these antenna offsets.

There is Windows software to do this calibration but we would like to generate the calibration files using the flight computer, to allow for the possibility of an in-flight calibration. This Windows software generates a series of binary files, the purpose of this note is to describe those files and how to create them.

1.1 Binary File Types

The binary file types are all described in the ADU5 Manual [**?**]. The three file types are:

- B file type – collected satellite measurement stuff
- E file type ephemeris files
- A file computed attitude

1.2 Generating the binary files on the flight machine

These binary files are constucted from the ADU5 Raw Data Messages. On the flight machine there is (will be) a program called `makeCalibAdu5DataFiles` that performs the following tasks:

1. Turn off all messages
2. Query RID RIO [To check it is an ADU5]
3. `$PASHS,RCI,001.0` [Set recording interval to 1 second]
4. `$PASHS,ELM,10` [Elevation mask to 10 degrees]

5. `$PASHS,PDS,OFF` [Special setting for calibration]

6. `$PASHS,OUT,B,MBN,SNV,PBN,ATT,BIN` [Turns on output]
   The options given are:

   - MBN = Satellite measurement data [B file]
   - SNV = Ephemeris data [E file]
   - PBN = Position, velocity, DOP data [?]
   - ATT = Attitude data [A file]
   - BIN = Binary format

7. After data taking completes turn ON PDS and disable binary messages

1.3 Flight software structures

There are two sets of flight software structures, one set corresponds to the binary format of the ADU5 serial messages. The other set corresponds to the binary format of the output files. It should be trivial to write a set of functions in gpsToolsLib that convert from one to another. These structs are briefly described in Table 1.

Serial Structure	Output Structure	Comment
RawAdu5MBNStruct	RawAdu5BFileSatelliteHeader+ChanObs	Satellite measurement data
RawAdu5SNVStruct	E file	Ephemeris data
RawAdu5PBNStruct	RawAdu5BFileRawNav	Position, velocity, DOP data
RawAdu5ATTStruct	A file	Attitude data
	RawAdu5BFileHeader	Header information

Table 1: The structures used by the GPS calibration

1.4 Binary file format

The b-file format should consist of the following structures:

1. RawAdu5BFileHeader – One per file
   Now we loop over basically each second:

   (a) RawAdu5BFileRawNav – One per epoch (each second is an epoch)
   Now we loop over the satellites [the number in the RawAdu5BFileRawNav]

      i. RawAdu5BFileSatelliteHeader

      ii. RawAdu5BFileChanObs [in theory the can be more than one per satellite, the number is in the RawAdu5BFileHeader and seems to be 1]