Spire ANTEX File Description

Spire Global Inc.

Issue/Revision	*Date*	*By*	*Description*
1.0	2021-09-01	Spire	Initial version

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1 Overview

1.1 Description

The receiver antenna phase center offsets are provided in an ASCII format following ANTEX version 1.4. An example of the information relevant to one Spire antenna type is shown below. In this example, the antenna phase center offsets from the ***geometric center*** in the XYZ Spire spacecraft body reference frame are (1.39, 7.10, -177.76) millimeters for the zenith-pointing LEMUR3.1.0 POD antenna.

```
                                                            START OF ANTENNA
LEMUR3.1.0 POD                                              TYPE / SERIAL NO
CHAMBER              UPC                        3    20-DEC-16 METH / BY / # / DATE
     5.0                                                    DAZI
     0.0 100.0   5.0                                        ZEN1 / ZEN2 / DZEN
    12                                                      # OF FREQUENCIES
  2016    12    20     0     0    0.0000000                 VALID FROM
  2099    12    20     0     0    0.0000000                 VALID UNTIL
                                                            SINEX CODE
# ANTENNA FRAME: [ 1  0  0; 0 -1  0; 0  0 -1 ]             COMMENT
   C07                                                      START OF FREQUENCY
      1.39      7.10   -177.76                             NORTH / EAST / UP
```

Figure 1: Example of antenna phase center information

Antenna phase variations are also contained in the same file, but are not currently utilized in Spire processing. Within the ANTEX file, the antenna phase center variations are provided as a function of zenith and azimuth angle in the antenna reference frame. The definition of each antenna reference frame is provided as a matrix under the "COMMENT" section of each antenna, which can be used to transform a vector in the spacecraft body frame to the antenna frame. For all antenna frames, the z-axis is perpendicular to the antenna face and points outward. In the example provided in Figure 1, the listed antenna reference frame matrix implies that the antenna x-axis is aligned to the spacecraft body frame x-axis, the antenna y-axis is aligned to the negative spacecraft body frame y-axis and the antenna z-axis is aligned to the negative spacecraft body frame z-axis. Zenith angle is defined as the angle from the antenna z-axis and has a range from 0 to 100 degrees. Azimuth angle is zero at the antenna x-axis and is positive when moving towards the antenna y-axis.

1.2 Mapping of Satellite Bus Version to ANTEX Antenna Type

A mapping of each major satellite bus version to the antenna type contained in the ANTEX and RINEX files is provided below.

Satellite Bus Major Version	ANTEX/RINEX Antenna Type
LEMUR2 v3.0-3.3	LEMUR2.3.0
LEMUR2 v3.4 +	LEMUR3.1.0

1.3 ANTEX Version Change Log

Version	Date	Description
1.0	2017-11-01	Initial
2.0	2021-09-03	Adopted proper ANTEX/RINEX naming conventions for frequency codes; Added offsets for more Spire frequencies