PR Power 1B-21 Calibration Coefficients [L1B21_L1C21_HEADER]

Calibration coefficients consist of several parameters describing the PR electronic performance. They are controlled by NASDA based on the results of PR calibration data analysis.

These coefficients are applied in 1B21 (PR received power) calculations.

Calibration coefficients (Vdata Table, record size 4 bytes, 18 records)

Name	Name in the TOOLKIT	Format	Description
Transmitter gain correction factor	prCalCoef(49).transCoef	4-byte float	Transmission gain correction factor for PR
Receiver gain correction factor	prCalCoef(49).receptCoef	4-byte float	Receiver gain correction factor for PR
LOGAMP Input/Output characteristics	prCalCoef(49).fcifIOchar(16)	16 x 4-byte float	LOGAMP Input/Output characteristics

PR Power 1B-21 Ray Header [L1B21_L1C21_HEADER]

The Ray Header contains information that is constant in the granule, such as the parameters used in the radar equation, the parameters in the minimum echo test, and the sample start range bin number.

These parameters are provided for each angle bin.

Ray Header (Vdata Table, record size 60 bytes, 49 records)

Name	Name in the TOOLKIT	Format	Description
Ray Start	rayHdr(49).rayStart	2-byte integer	Range bin number of starting normal sample, see Note (a)
Ray Size	rayHdr(49).raySize	2-byte integer	Number of normal samples in 1 angle, see Note (a)
Scan Angle	rayHdr(49).angle	4-byte float	unit deg, see Note (b)
Starting Bin Distance	rayHdr(49).startBinDist	4-byte float	Distance (m) between the satellite and the starting bin sample. unit m, see Note (c)
Rain Threshold #1	rayHdr(49).rainThres1	4-byte float	see Note (d)
Rain Threshold #2	rayHdr(49).rainThres2	4-byte float	see Note (d)
Transmitter Antenna Gain	rayHdr(49).transAntenna	4-byte float	unit dB
Receiver Antenna Gain	rayHdr(49).recvAntenna	4-byte float	unit dB
One-way 3dB Along-track Beamwidth	rayHdr(49).onewayAlongTrack	4-byte float	unit rad, see Note (e)
One-way 3dB Cross-track Beamwidth	rayHdr(49).onewayCrossTrack	4-byte float	unit rad, see Note (e)
Equivalent wavelength	rayHdr(49).eqvWavelength	4-byte float	unit m, see Note (f)
Rader Constant	rayHdr(49).radarConst	4-byte float	unit dB, see Note (g)
PR Internal delayed time	rayHdr(49).printrDelay	4-byte float	set to 0

Range Bin Size	rayHdr(49).rangeBinSize	4-byte float	unit m, see Note (a), (h)
Logarithmic Averaging Offset	rayHdr(49).logAveOffset	4-byte float	unit dB, see Note (i)
Mainlobe Clutter Edge	rayHdr(49).mainlobeEdge	1-byte integer	see Note (j)
Sidelobe Clutter Range [3]	rayHdr(49).sidelobeRange(3)	3 x 1-byte integer	see Note (k)

Notes

a) The Precipitation Radar (PR) has 400 internal (logical) range bins (A/D sample points) and records "normal sample data" every other range bin from "Ray Start" in order to sample radar echoes from 0-km (the reference ellipsoid surface) to 15-km height.
The number of recorded samples at an angle bin depends on the scan angle and is defined by "Ray Size."
The Nth normal sample data can be converted to the internal logical range bin number as follows;

Logical range bin number at Nth normal sample
= Ray Start + $2\times(N-1)$

b) Scan Angle is defined as the cross-track angle at the radar electric coordinates which are rotated by 4 degrees about the Y-axis (Pitch) of spacecraft coordinates.*[1] The angle is positive when the antenna beam is rotated counter clockwise (CCW) from the nadir about the +X axis of the radar electric coordinates.

c) Starting Bin Distance is determined by the sampling timing of the PR. The distance between the satellite and the center of the Nth normal sample bin is calculated as follows:

Distance = "Starting Bin Distance" + "Range Bin Size" $\times(N-1)$

This distance is defined as the center of a radar resolution volume which extends $\pm$ 125 m .

d) Rain Thresholds are used in the minimum echo test.

e) Beam widths, both along track beam width and cross track beam width, are recorded based on the fact that the PR main beam is assumed to have a two-dimensional Gausian beam pattern.

f) "Equivalent Wavelength" = $2c/(f_1+f_2)$
where *c* is the speed of light, and f1 and f2 are PR's two frequencies.

g) Radar Constant is defined as follows, and is used in the radar equation:

$$C0 = 10\log_{10}\left[\pi^3\frac{|K|^2}{2^{10}\ln 2}10^{-18}\right]$$

$$K = (\varepsilon-1)/(\varepsilon+2)$$

ε *: the relative dielectric constant of water*

$$|K|^2 = 0.925$$

[1] If there is no attitude error, +X (or sometimes –X, see Spacecraft Orientation in Scan Status) is along the spacecraft flight direction, +Z is along the local nadir, and +Y is defined so that the coordinates become a right-hand Cartesian system.

$|K|^2$ is the calculated value at 13.8 GHz and 0 degree C based on Ray (1972). With this constant, users can convert from PR receiving powers to rain reflectivity. (See the 1C products.)

h) Range Bin Size is the PR range resolution and is the width at which pulse electric power decreases 6dB (-6 dB width).

i) Logarithmic Averaging Offset is the offset value between the logarithmic average and the power-linear average. The PR outputs the data of 1 range bin which is the average of 64 LOGAMP outputs. “Received power” in the PR1B21 output is corrected for the bias error caused by the logarithmic average and is thus equal to normal average power.

j) Main Lobe Clutter Edge is a parameter previously used as the lowest range bin for the minimum echo test. This is the absolute value of the difference in range bin number between the surface peak and the edge of the clutter from the main lobe.

k) Absolute value of the difference in Range bin numbers between the bin number of the surface peak and the possible clutter position. A maximum of three range bins can be allocated as "possible" clutter locations. “Zero” indicates no clutter.

Note: Items j) and k) are not useful for detailed examination of radar echo range profile, especially over land.