

New Horizons REX Data Set Review – KEM1 V3.0 Raw & Calibrated

Reviewer: Dustin Buccino
 Jet Propulsion Laboratory
 Planetary Radar and Radio Science

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1. Executive Summary

Two data sets from the New Horizons Radio Science Experiment (REX) were provided and reviewed:

- nh-a-rex-2-kem1-v3.0
- nh-a-rex-3-kem1-v3.0

Two previous versions of the dataset (v1.0 and v2.0) were reviewed in February 2020 and May 2020. The version 3 dataset contains the complete set of data. These data are in good quality shape, as expected from the previous reviews. I believe the dataset is certifiable in its current state, but recommend two documentation updates to *dataset.cat* and *rex_activities_kem1.pdf*.

2. Review Details

Data

REX data come from the two sides of the instrument:

- Side-A, 0x7b1, Righthand Circularly Polarized
- Side-B, 0x7b3, Lefthand Circularly Polarized

The documentation for the dataset says the complete set of REX data for this mission duration are not all downlinked yet, however, this dataset contains more data than the previous dataset, including 2 updated experiments and 8 new experiments. Of important note is the actual experiment data from MU69 (radiometry + bistatic/ionosphere) remains unchanged, only additional engineering data from calibrations and radio path characterizations is new.

Table 1. Data the reviewer was able to find in the dataset and correlate with the documentation.

Date	V1.0	V2.0	V3.0	Experiment	Comments
2018-09-09		New	Updated	Radio Path Characterization	RCP + LCP
2018-10-21		New	Updated	Radio Path Characterization	RCP + LCP
2019-01-01	New	Updated	Identical	MU69 radio brightness and ionosphere detection attempt	Identical to V2.0
2019-01-02	New	Updated	Identical	Sky background radio brightness	
2019-01-04		New	Identical	REX Test Patterns	
2019-02-02		New	Identical	Radio Path Characterization	
2019-03-21		New	Identical	Radio Path Characterization	
2019-04-19		New	Identical	Radio Path Characterization	
2019-05-07		New	Identical	Radio Path Characterization	
2019-06-12		New	Identical	Radio Path Characterization	
2019-07-10		New	Identical	Radio Path Characterization	

Date	V1.0	V2.0	V3.0	Experiment	Comments
2019-08-08			New	Radio Path Characterization	RCP + LCP
2019-09-04			New	Calibration Campaign	RCP + LCP
2019-09-09			New	Calibration Campaign + Radio Path	RCP only
2019-10-19			New	Radio Path Characterization	RCP + LCP
2019-11-14			New	Radio Path Characterization	RCP + LCP
2019-12-21			New	Radio Path Characterization	RCP + LCP
2020-01-09			New	Radio Path Characterization	RCP + LCP
2020-02-11			New	Radio Path Characterization	RCP + LCP

I noticed no issues with the data in my review. I was able to extract In-phase and Quadrature (IQ) values from the FIT data and radiometer values from the FIT data. I examined the calibrated dataset in more detail than the raw dataset – both datasets contain the same number of data files.

As an example, I examined the 2020-10-19 Radio Path Characterization data. I was able to estimate REX residual frequency from both sides of the instrument:

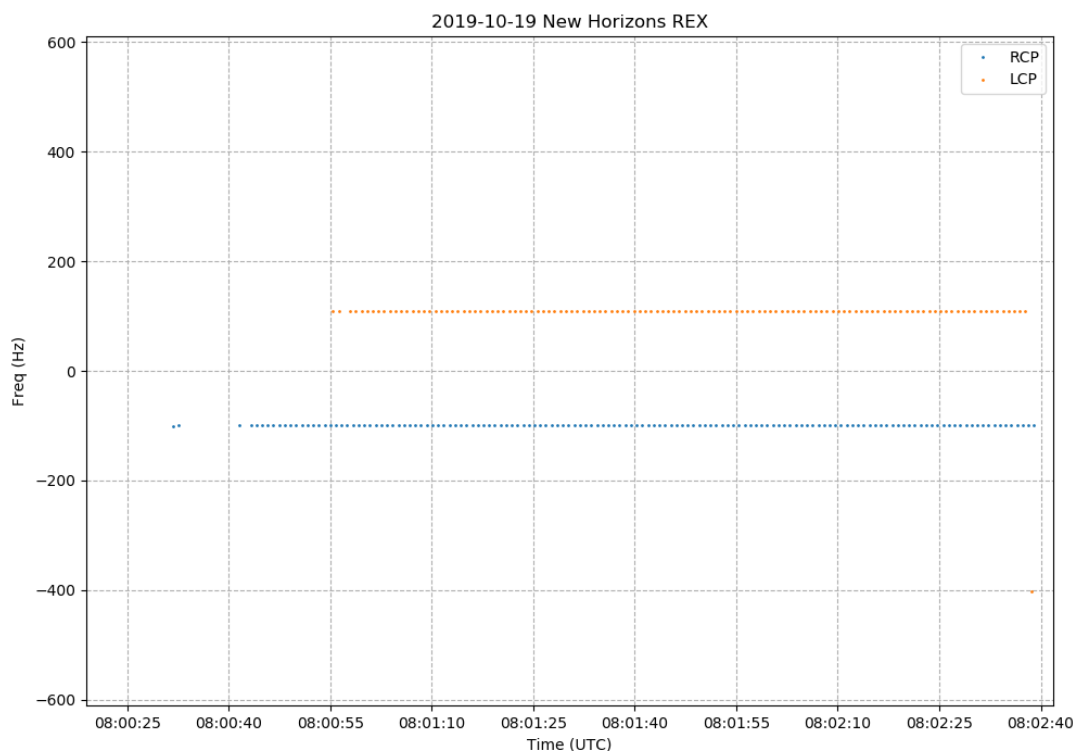


Figure 1. Frequency estimates from REX data on 2020-10-19.

Documentation

dataset.cat – Under “Version” subsection it states that the version includes data acquired up to 04/30/2020, however, the dataset only contains REX data from the spacecraft up until 02/11/2020 and DSN uplink data up until 03/10/2020.

rex_activities_kem1.pdf – document describes the REX activities in more detail.

On page 2 and 3 the document states there was radio path characterization on:

- 08/01/2019, however, the apparent date is 08/08/2019 (DOY 220)
- 10/03/2019, however, the apparent date is 10/19/2019 (DOY 292)
- 10/24/2019, however, the apparent date is 11/14/2019 (DOY 318)
- 12/05/2019, however, the apparent date is 12/21/2019 (DOY 355)
- 01/06/2020, however, the apparent date is 01/09/2020 (DOY 009)
- 02/10/2020, however, the apparent date is 02/11/2020 (DOY 042)
- 03/02/2020, however, the apparent date is 03/10/2020 (DOY 070)

On page 3 it states there was calibration campaign on 08/22/2019, however, the apparent date is 09/04/2019 (DOY 247). This calibration campaign includes a radio path characterization on 09/09/2019 (DOY 252) which should also be stated in the header.