New Horizons REX Data Set Review – Extended Mission KEM1 Raw & Calibrated

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1. Executive Summary

Two data sets from the New Horizons Radio Science Experiment (REX) were provided and reviewed:
- nh-x-rex-2-kem1-v1.0
- nh-x-rex-3-kem1-v1.0

These datasets have been previously reviewed in August 2019 but at the time did not contain any REX data. The datasets now contain REX Side-A (RCP) data from the MU69 bistatic & thermal emission along with one background measurement. These data are in good quality shape, as expected from the previous reviews. Minor clarifications to some of the documentation are recommended in both datasets (since the documentation between the two is nearly identical).

2. Review Details

Data
Data coverage is as follows:
- 2019-01-01 05:48:30 → 05:58:19 (Thermal Emission Scan and Bistatic Detection)
- 2019-01-02 03:18:53 → 04:37:37 (Background for Thermal Emission Scan & Radiometric)

The data is from REX appid 0x7b1 (Side-A, RCP) only. I was able to process the REX Side-A data and compute power and frequency estimates from the IQ samples. I detect no signal at 1 second integration time in the IQ samples.
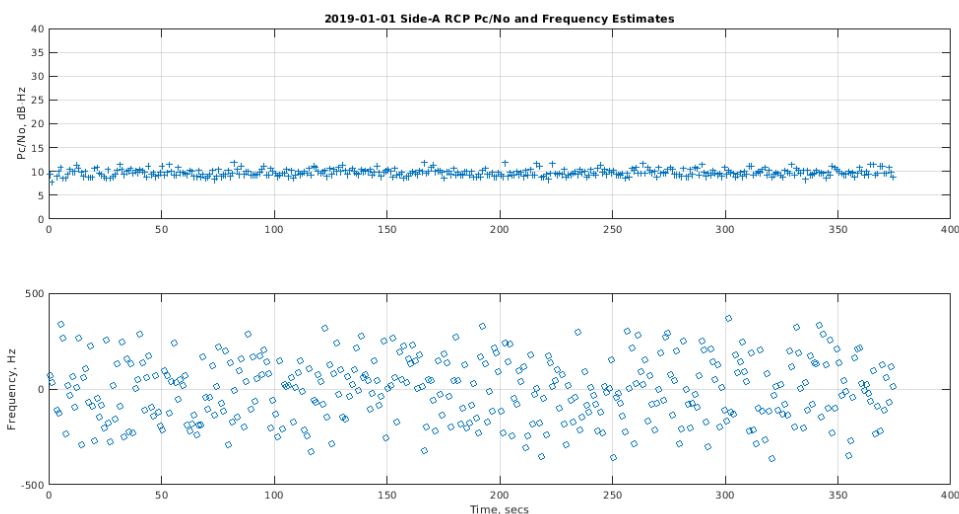

Figure 1. Signal-to-noise and frequency estimates from 2019-01-01 thermal emission & bistatic detection of MU69.
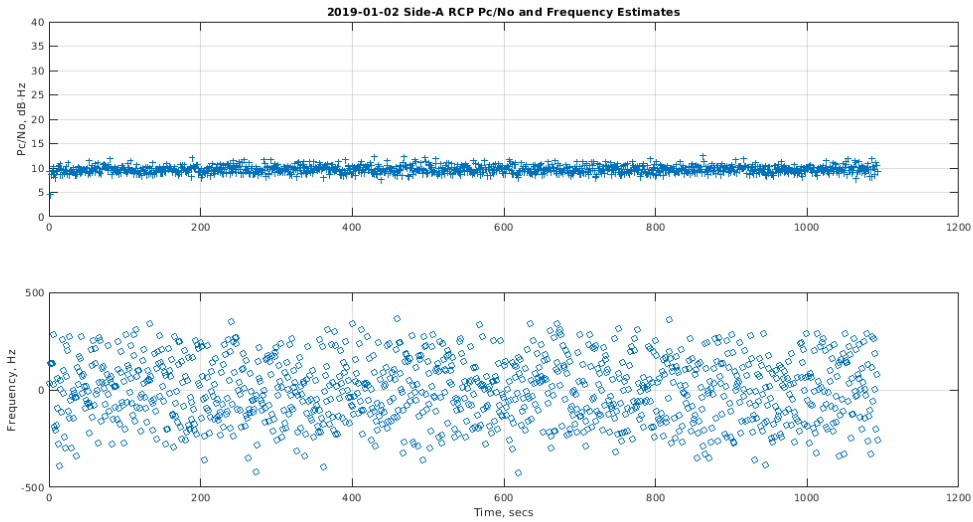
Figure 2. Signal-to-noise and frequency estimates from 2019-01-02 background thermal emission scan.

This would not be entirely unexpected, as reflections from the object would be very weak and require longer integration times. No signal would be expected in the IQ samples from the thermal emissions scan.

A quick glance at the radiometer data makes sense, where the scan has a higher value than the background
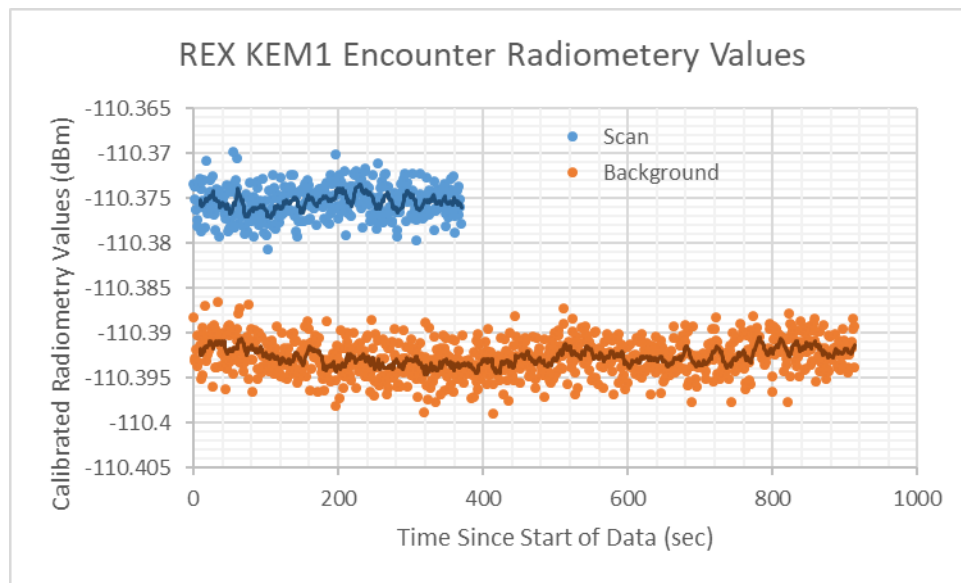

Figure 3. REX Radiometer Sample #1 Counts from the Encounter and the Background Scan.

The DSN uplink data ("data/tnf" folder) is as I expect for the encounter and was reviewed previously. The *tab files match the binary data within the *tnf files exactly. The data contain uplink compensation

and offset as expected. New files after Jan 1, 2019 are provided for the encounter and are complete for the activities described in *rex_activities_kem1.pdf*.

Documentation
Most of the documentation included in this archive has been previously reviewed.

dataset.cat – Under the "ABSTRACT_DESC" keyword it states that only data prior to 12/31/2018 are in the dataset, however, there is clearly data taken after. The statement should be updated, and perhaps also included in the data quality/coverage subsection.

rexdsnjoin.csv – contains the sequence of DSN uplinks for REX. The file only covers until 2017 and does not include the KEM1 encounters. It should be updated to reflect the DSN activities for KEM1.

seq_rex_kem1.tab – tabular events for REX during the encounter sequence. The file was updated since the last review and looks good now.

rex_activities_kem1.pdf – new document describes the REX activities in more detail. It includes all the REX activities in the encounter sequence, but not all of these are included in the dataset. This is okay but as recommended above dataset.cat should be updated to reflect the partial dataset.