

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886**

October 4, 2016

*Telephone: 781-981-5414**Fax: 781-981-0590*

To: EDGES Group
From: Alan E.E. Rogers
Subject: First data from extended ground plane.

Following the augmentation of the low band ground plane in September 2016 the low band receiver was removed, the defective 3-position switch replaced and the receiver reinstalled. The data analyzed in this report is from 2016 day 258 through day 274 with missing data on days 271 through 272 due to a power failure at the MRO.

Figure 1 shows the spectra from 52 to 97 MHz with 5 physical terms removed and no beam correction. For comparison Figure 2 shows the data from 2015_290 through 2015_298 with 5-terms removed and no beam correction. From this comparison it is clear that the extended ground plane has made the large improvement expected shown in the comparison of beam effect shown in simulations figures 3 and 4 for the extended and original ground planes respectively each with 5 terms removed.

1] Effect of the hut

There is not enough data yet to see the ripples in the spectra at GHA 19 and 20 hours shown in Figure 2d of memo 208. Figure 5 shows the FEKO simulated spectrum for the extended ground plane with hut included.

The simulation also shows additional structure in comparison with Figure 3 which is large enough to be visible, but is not seen in Figure 1. This calls into question the accuracy of the FEKO simulations with the hut and more checks on the meshing and other details in FEKO are needed.

2] Resonance at 70 MHz.

Memo 208 shows evidence for a “possible” resonance at 70 MHz in the data with the original ground plane. Originally it was thought that the feature at 70 MHz could be even stronger in the data from the extended ground plane as a dip at 70 MHz is clearly evidence at GHA = 5 and in the average spectrum in Figure 1. However, with 4 physical terms are removed from 60 to 97 the dip at 70 MHz is less evident in Figure 6.

Extensive tests for a possible source of a resonance at 70 MHz have been made with FEKO. The most recent tests include a study of the weather sensors which are mounted at the ends of a “T” structure 30 m north of the hut. The height of the “T” is 64 cm and width is 40 cm. While this structure forms a quarter wave top loaded dipole resonant at 70 MHz it has vertical polarization and FEKO simulations fail to produce a significant effect on the beam chromaticity.

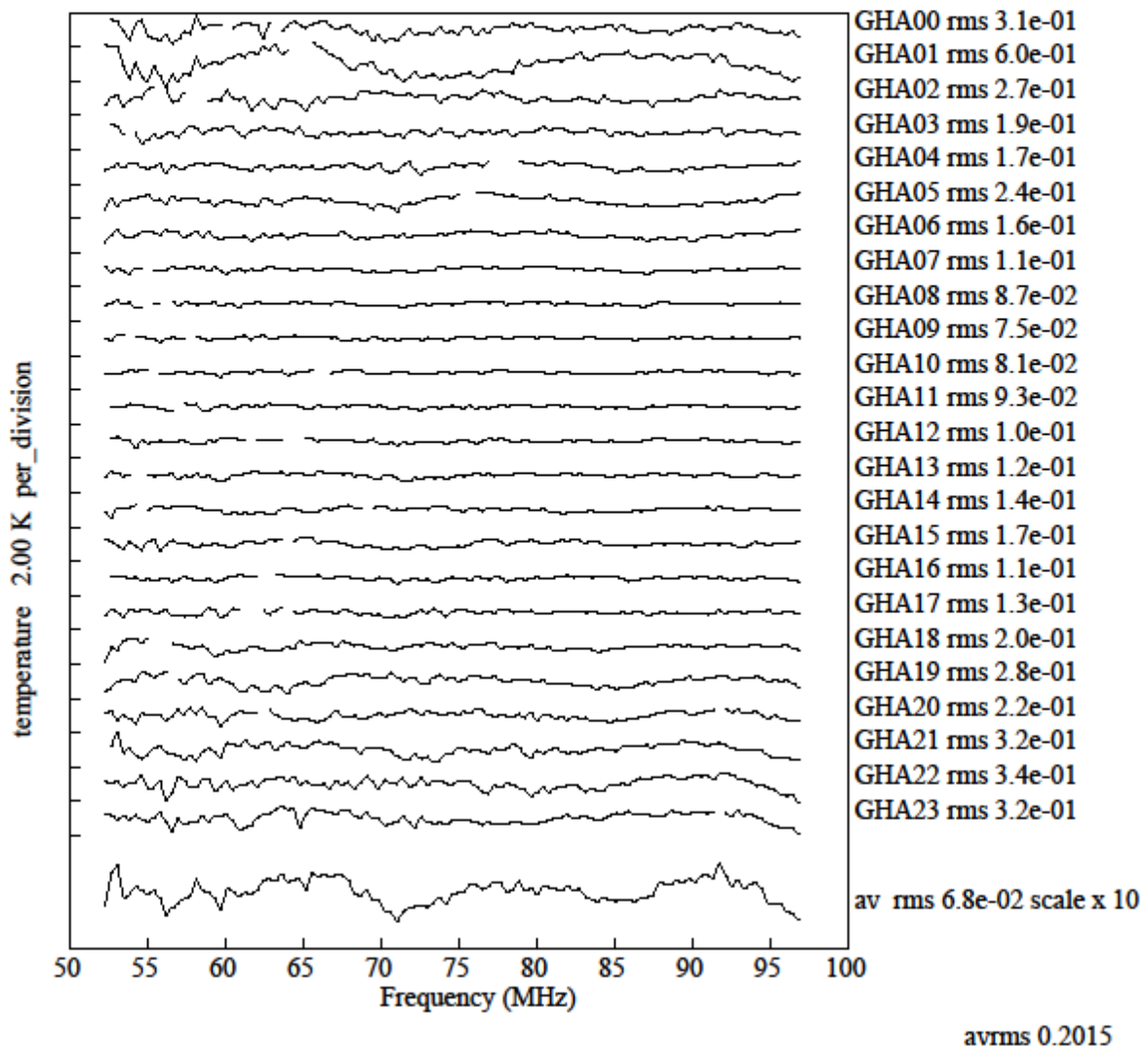


Figure 1. Low band spectra from 2016_258 to 2016_274 with 5 physical terms removed.

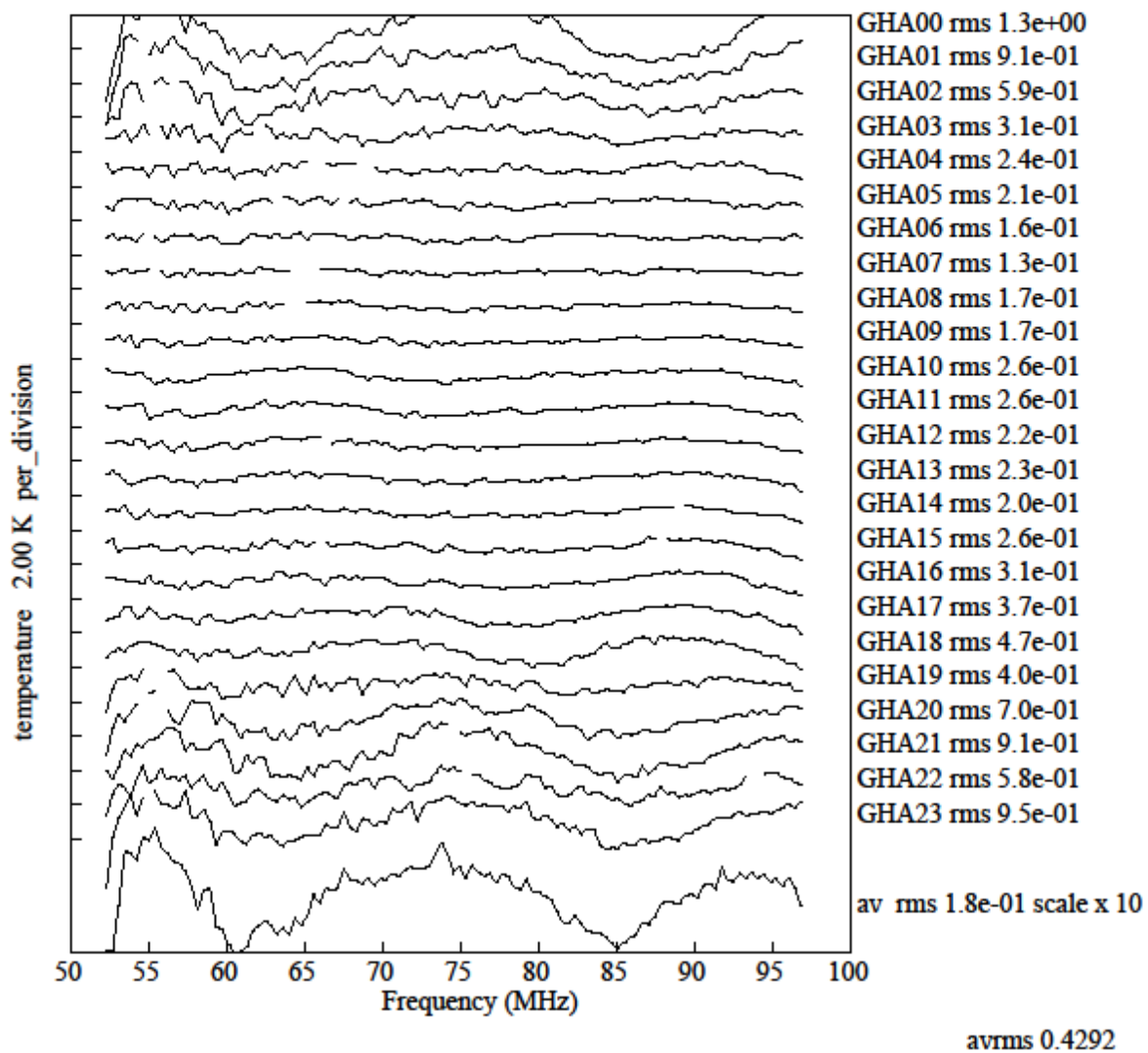


Figure 2. Spectra from 2015_290 to 2015_298.

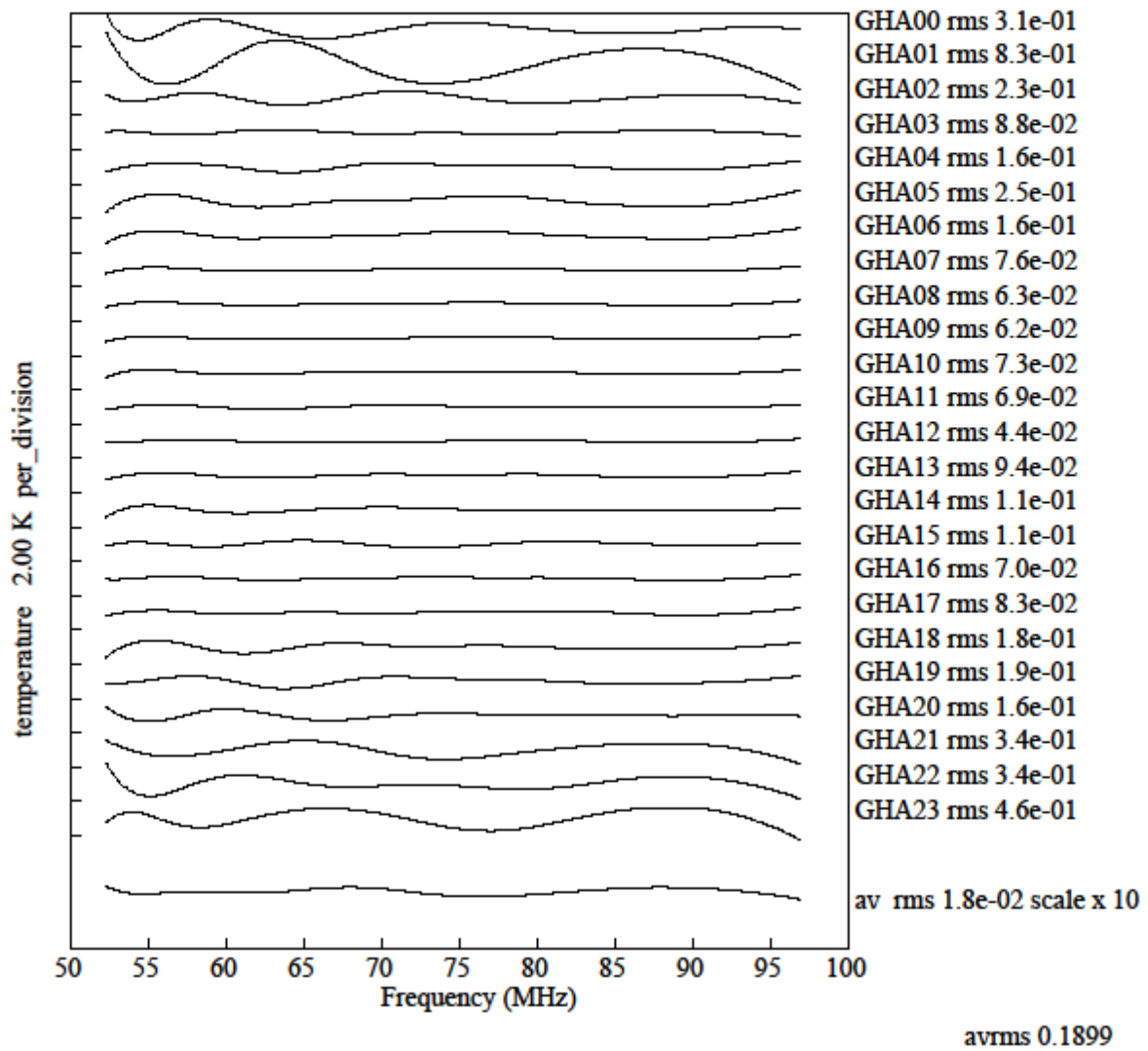


Figure 3. Simulated spectra with 5-terms removed for extended ground plane. Dielectric 3.5 and conductivity $2e-2$.

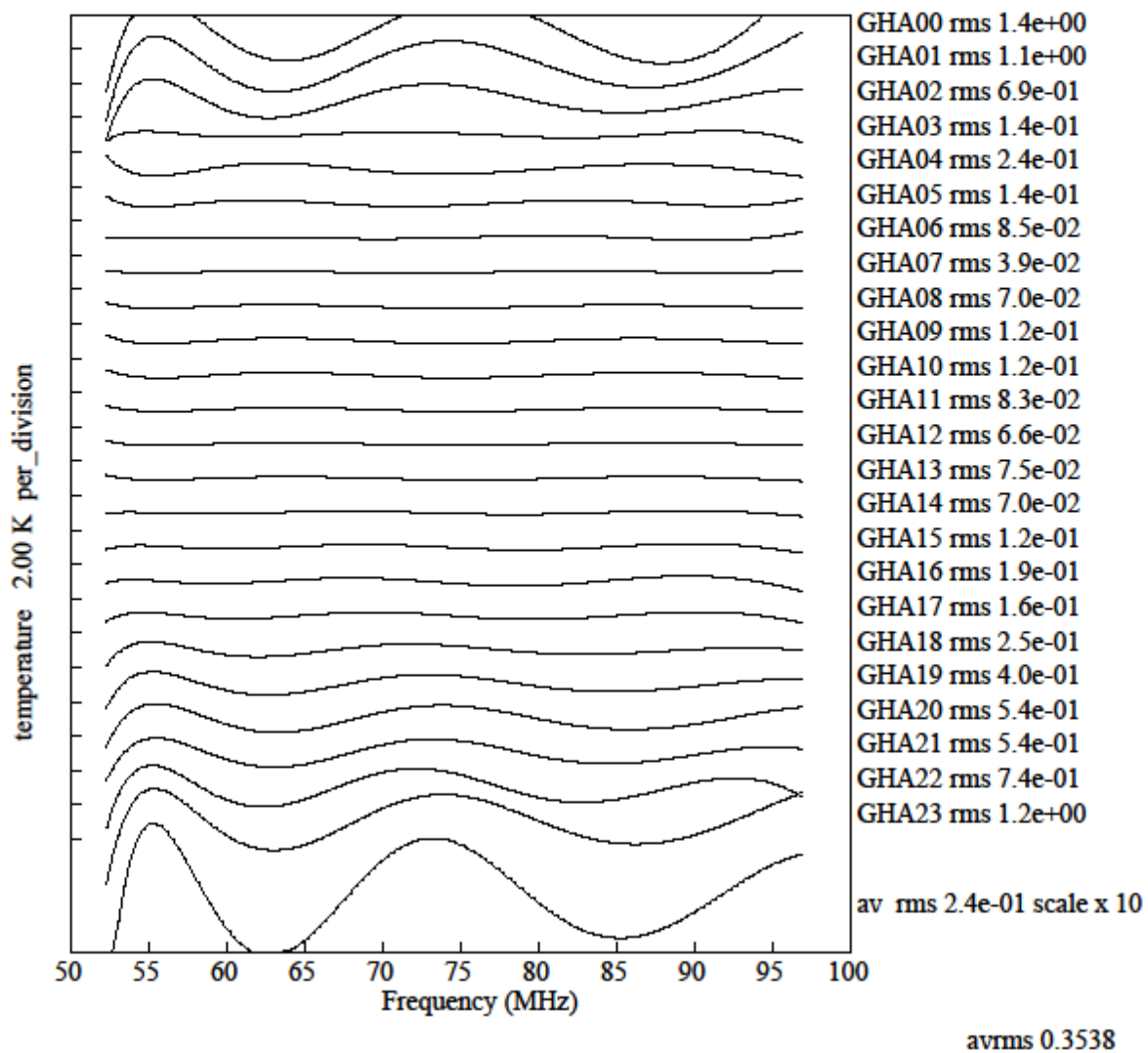


Figure 4. Simulated spectra for original ground plane.

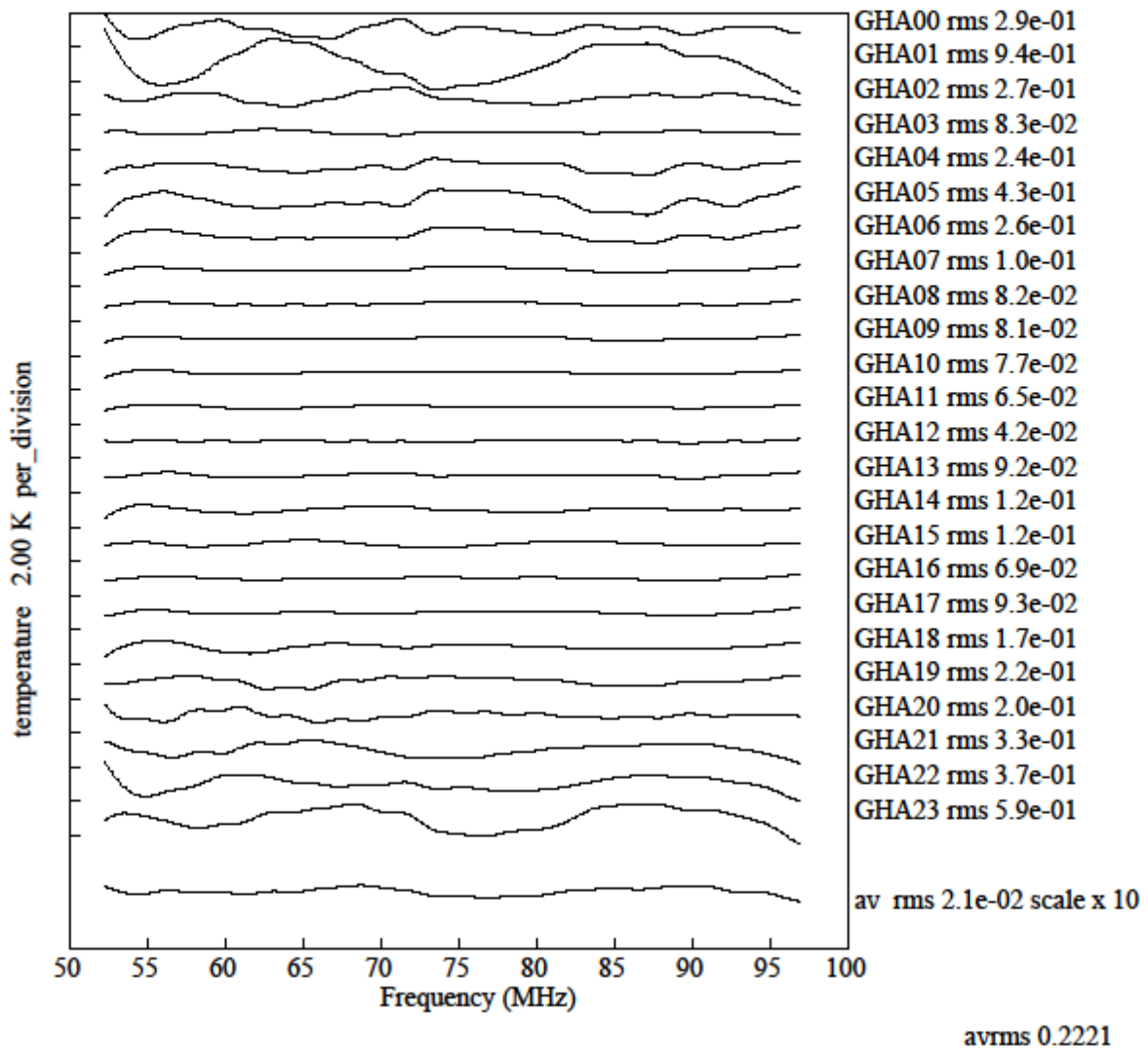


Figure 5. Simulated spectra for extended ground plane with electronics hut included.

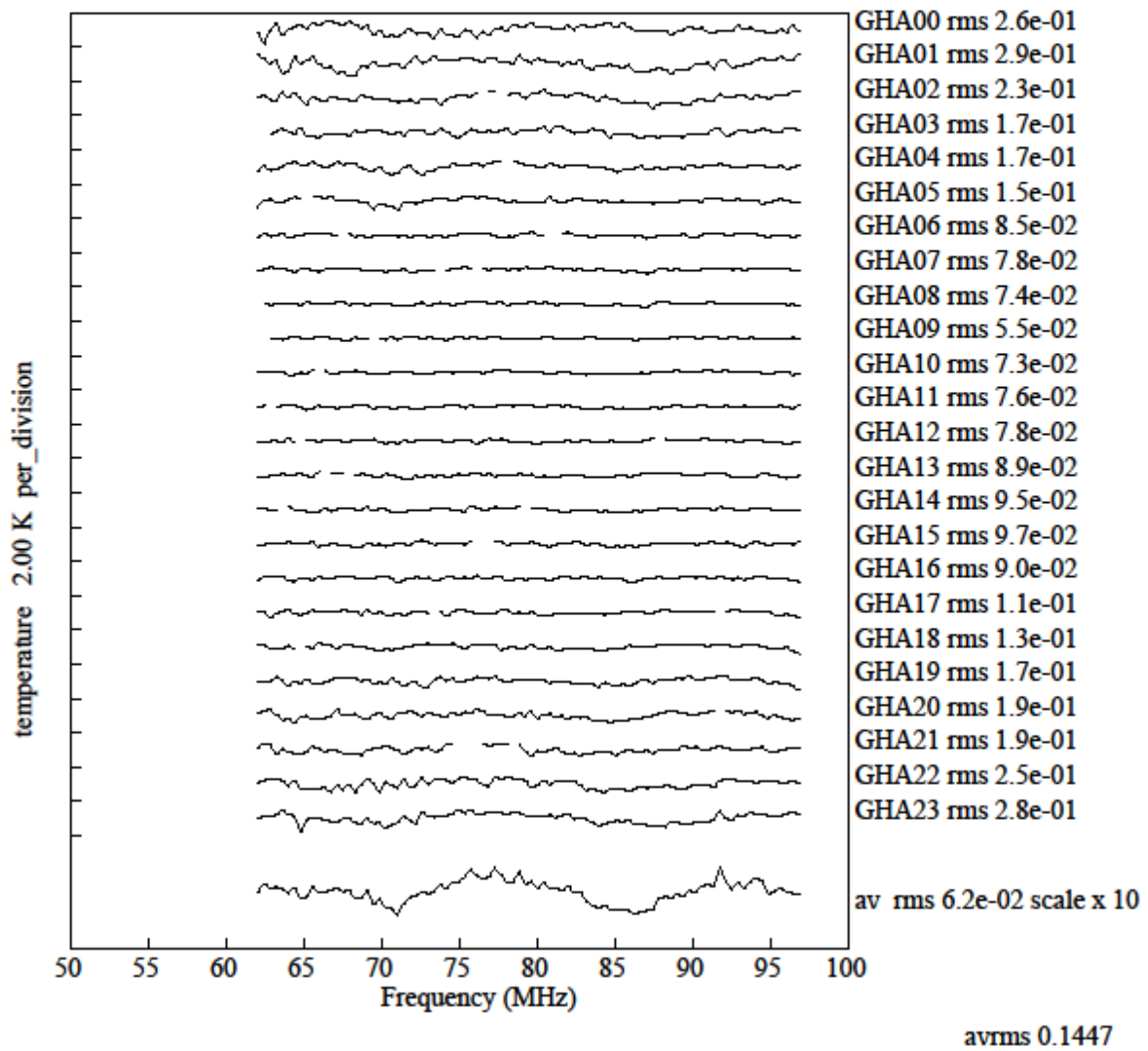


Figure 6. Beam corrected spectra with 4 physical terms removed with beam correction.