

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

January 23, 2023

Telephone: 617-715-5533

To: EDGES Group
From: Alan E.E. Rogers
Subject: Simulation of the effect of a resonant slot on the base plate at the MRO

The possibility that there is a slot resonance effecting the EDGES-3 data from the MRO is discussed in Memo 407. Figure 8 of memo 407 shows a simulation of a slot within 1m from the center. A more specific possibility is that there is a gap between the base plate and the frame shown in Figure 7 of memo 407. A simulation of a gap in the contact with the frame between bolts on the south-east corner of base plate (see ASU memo 162 for the detail of the design) has been made with a simple FEKO model.

The FEKO model is made using a simplified geometry which consists of a 0.8x0.8m metal plate with a 15cm long slot loaded at it's center with 58 pf capacitance in series with 14 ohms resistance. The center of the metal plate with slot is offset 1.7m south-east of center of the antenna to match a potential location on the edge of the base plate. The capacitance and resistance have been adjusted to resonance with center and width close to that seen in Figure 1 which shows the residuals to a 5-physical term fit to the 1-hour GHA blocks of EDGE-3 data from 2022:320 to 2023:006. Beam correction of the data was made assuming a 48x48m ground plane with antenna oriented at 70 degrees azimuth with soil dielectric 3.5 and conductivity $2e-2$ S/m.

Several test simulations were made for slot locations at the outer edge of the 2.4x2.4m base plate and the result for the location at the south-east corner of the base plate is shown in Figure 2. In this case the residuals using 5-physical terms beam corrected with the same FEKO model of a slot with zero capacitance loading have some similarity to the residuals in the data shown in Figure 1.

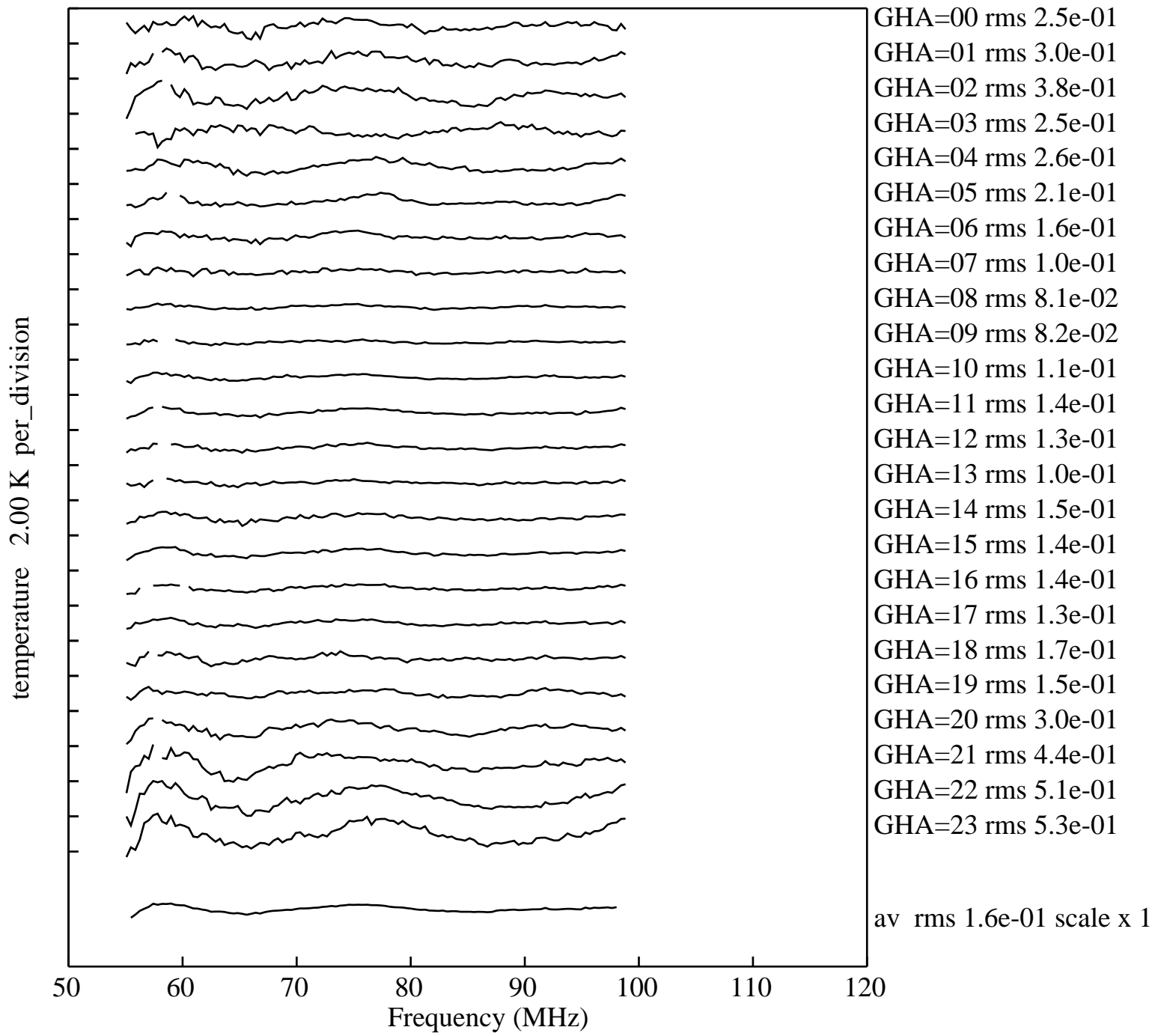
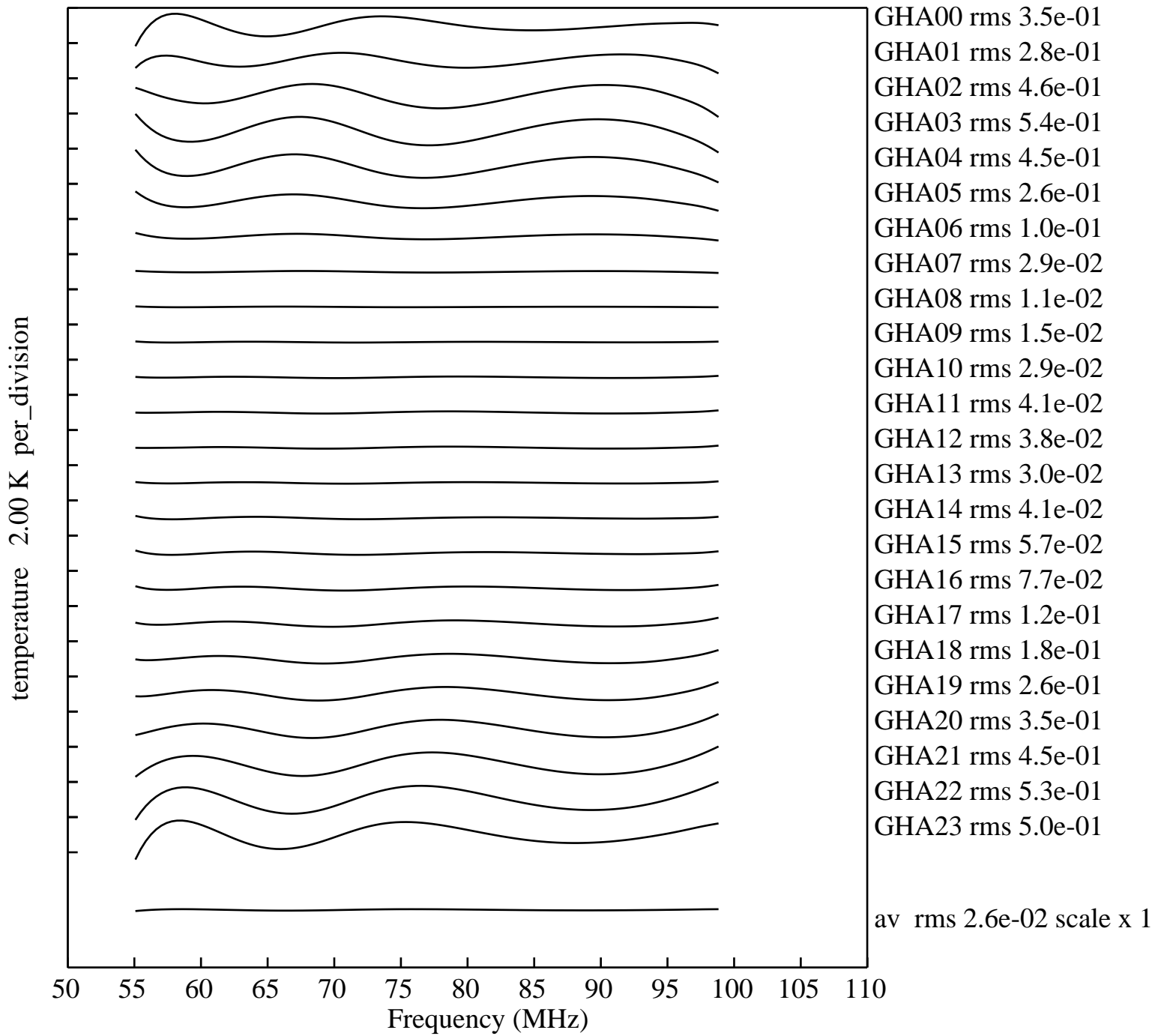


Figure 1. Residuals to a 5-physical term fit to the 1-hour GHA blocks of EDGE-3 data from 2022:320 to 2023:006.



avrms 0.2166

Figure 2. FEKO simulation of the effect of a slot resonance located on the south-east corner of the base plate.