EDGES MEMO #472

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886

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Telephone: 617-715-5533

To: EDGES group

From: Alan E.E. Rogers

Subject: Study of emission received when the sun is more than 30 degrees below the horizon

The analysis of EDGES-3 data for the measurement of the global 21-cm absorption has been limited to data when the sun is more than 30 degrees below the horizon in order to avoid the effects of solar emissions. This was found be necessary when a peak at about 65 MHz thought to be from the sun was still seen in figure 1 of memo 452 when the sun is about 17 degrees below the horizon.

Recently some emission in the form of a peak at 65 MHz has been seen in the data from the EDGES-3 in WA even when the sun is more than 30 degrees below the horizon. The most recent occurrence on days 50 and 52 of 2025 have been examined in more detail in order to determine the source of this emission and if the emission is from the sun determine how the emissions travel around the globe to the EDGES antenna.

Figures 1 and 3 show the presence of the additional emission while figure 2 shows the residuals for a typical day which is similar to all the other days from the EDGES-3 deployment at the WA from about the middle of 2024 as summarized in memos 456, 466 and 467. The appearance of the added peak at 65 MHz with the sun more than 30 degrees below the horizon was first noticed on day 50 and then seen to disappear on day 51 and then reappear over a different time range on day 52. The time range for which the sun is more than 30 degrees below the horizon at the WA is from 13 to 19 UT (21 – 03) LT.

In order to study the emission feature in more detail figures 4 and 5 which show that the emission seen when the sun is more than 30 degrees below the horizon is stronger and more variable than the emission seen in figures 5 of memos 453 and 454.

A search through all the EDGES-3 data from day 140 of 2024 to day 52 of 2025 has a few brief emissions with the sun below 30 degrees elevation but nothing on the scale of the emissions in days 50 and 52 of 2025. Tests of the effects of the FM threshold, ADC saturation, and other filtering have no effect so that it is unlikely that the peak at 65 MHz is the result of emissions from satellites. The large variation in amplitude seen on a short integration may make it possible to still get global 21-cm data by excluding the peaks at 65 MHz using a rms acceptance threshold on short blocks of data. The plots in the figures 1 to 5 are all processed with the files listed in Table 1 and use a 5 term loglog polynomial to remove the large frequency scale of the ionosphere absorption and emission along with the spectral index and curvature of the radio sky noise.

file	name
beam	azelq_box_perf_48_2e-2.txt
calibration	specals_210opt.txt
antenna s11	s11ant286.csv

Table 1. Files used in processing

In summary the width of the peaks at about 65 MHz are about 7 MHz and have a strength of about 10 K averaged over 1 hour have variations that peak to about 100 K on the scale of about 36 seconds. The origin of the emissions are unknown but are most likely emissions from sun propagated to the EDGES antenna via “ducting” in the ionosphere. Sporadic VHF propagation over very large distances has been reported for many decades and “ducting” between E and F layers, which has been suggested as the mechanism for the long range propagation of VHF radio transmitters, is poorly understood. The propagation of solar emissions over large distances around the globe has not been reported in the literature probably because the peak strength seen on day 50 is only about 100 K so it is not strong enough to be detected by communication systems.

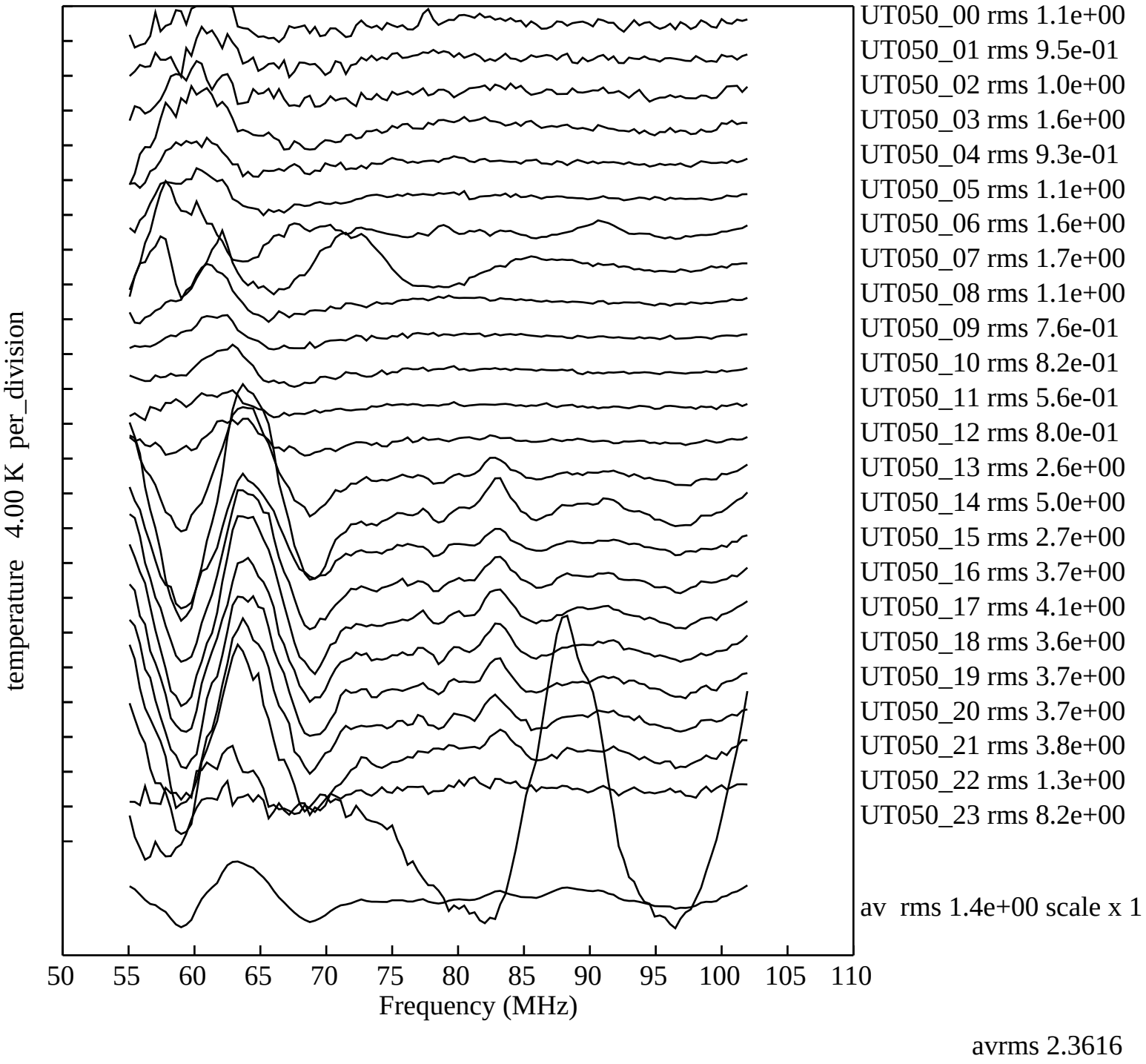

Figure 1. Residuals with 5-terms removed for 24 one hour UT blocks of 2025 day 50

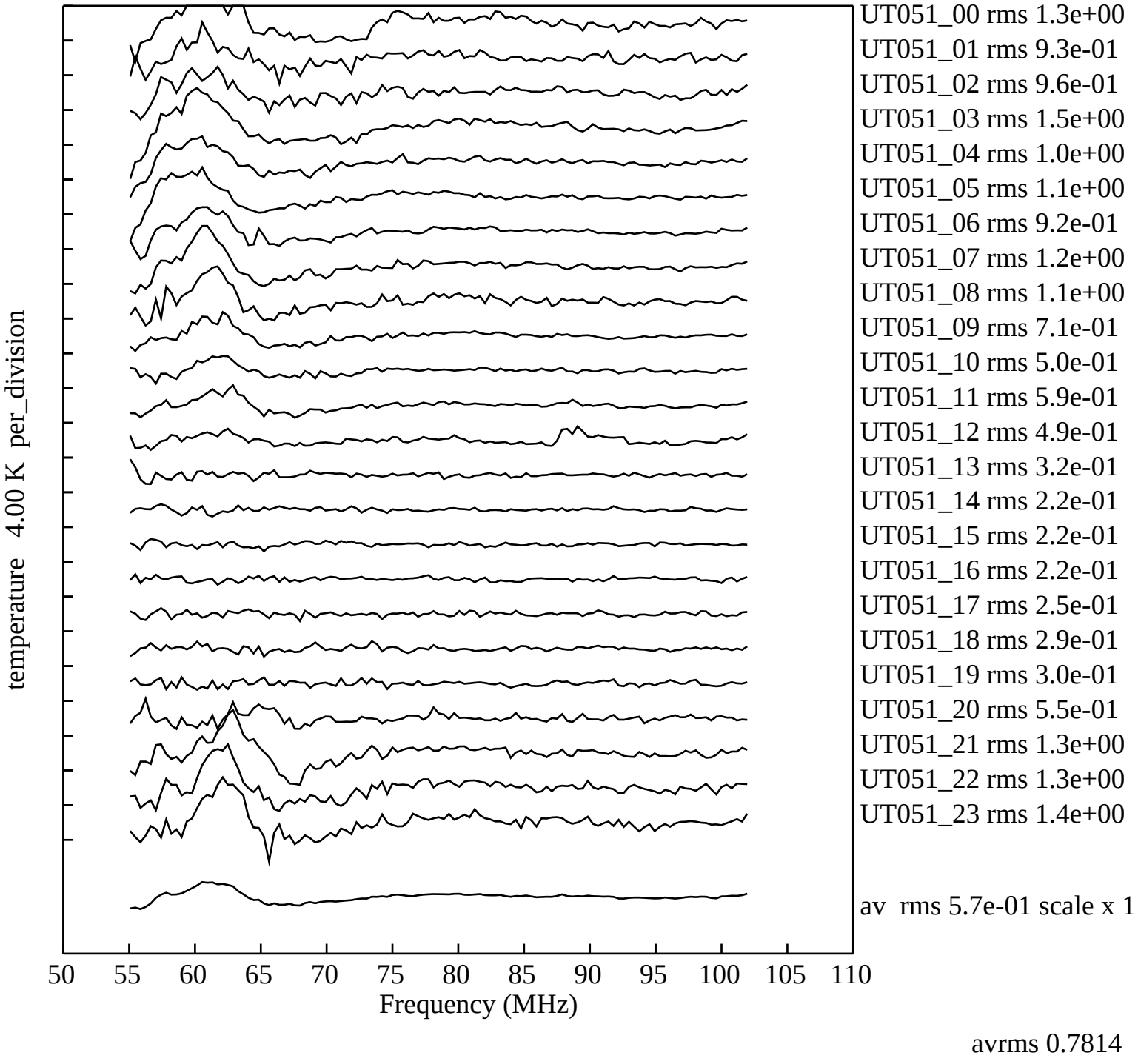

Figure 2. Residuals with 5-terms removed for 24 one hour UT blocks of 2025 day 51

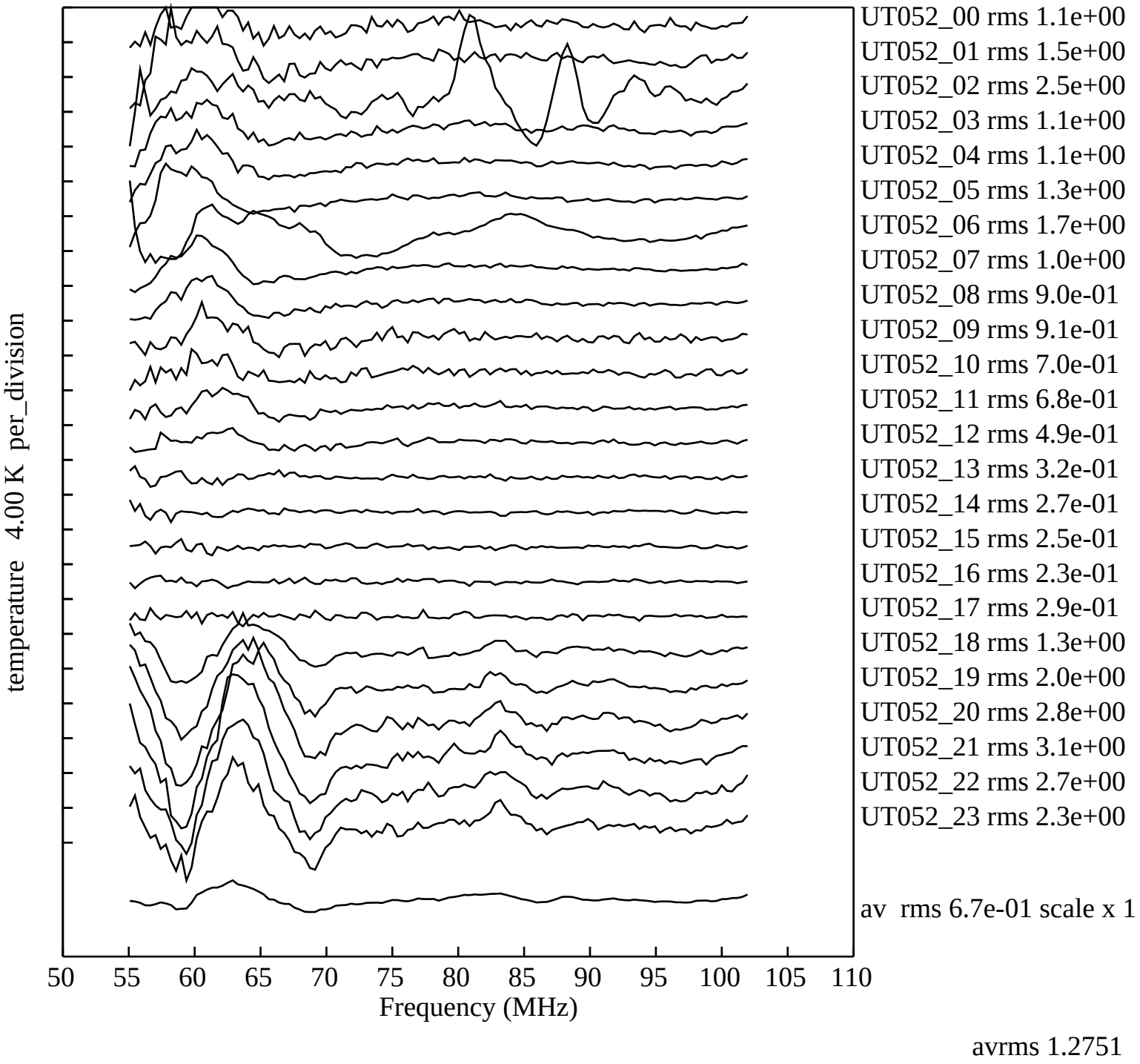

Figure 3. Residuals with 5-terms removed for 24 one hour UT blocks of 2025 day 52

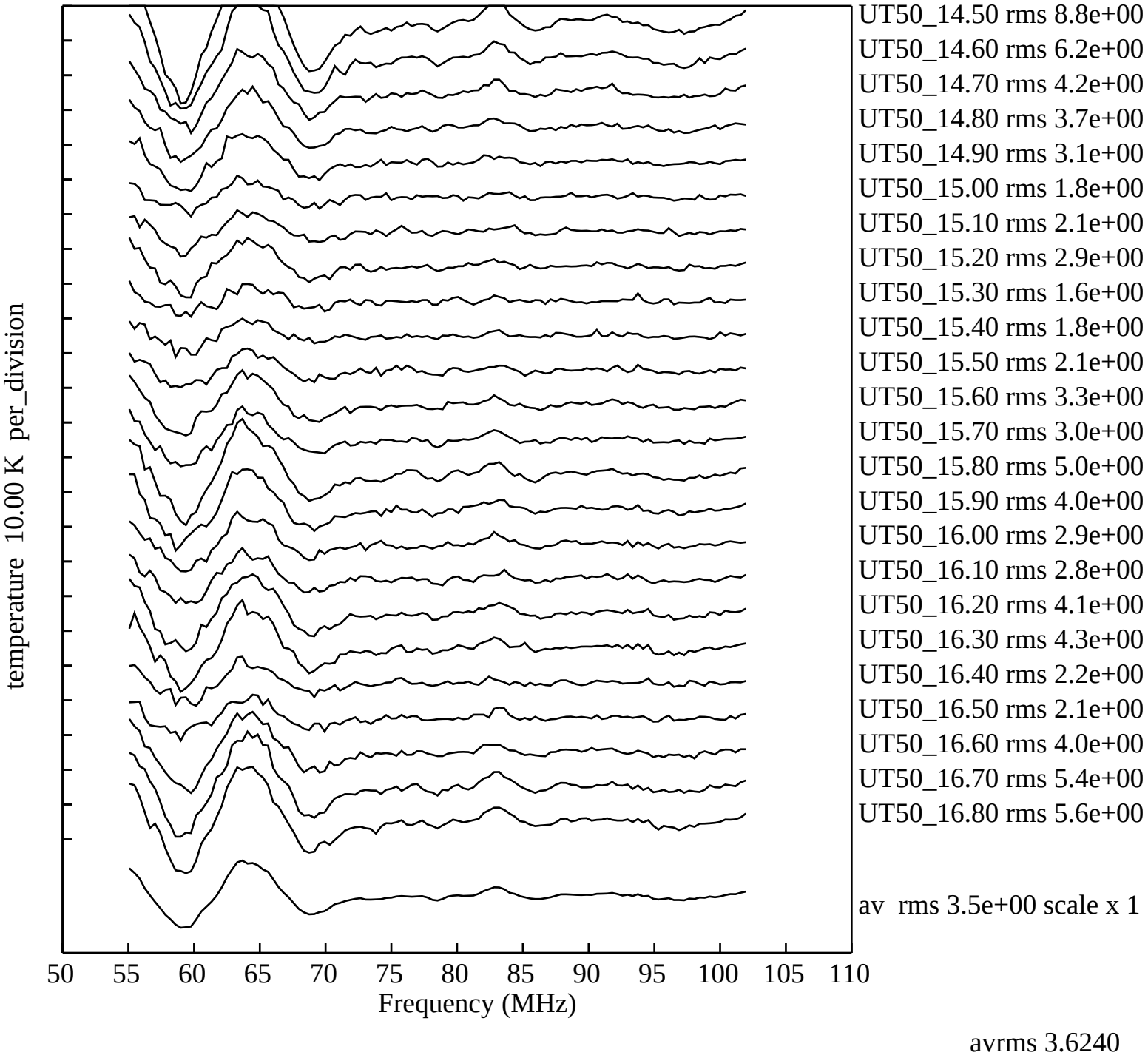

Figure 4. Residuals with 5-terms removed for 24 6 minute UT blocks of 2025 day 50

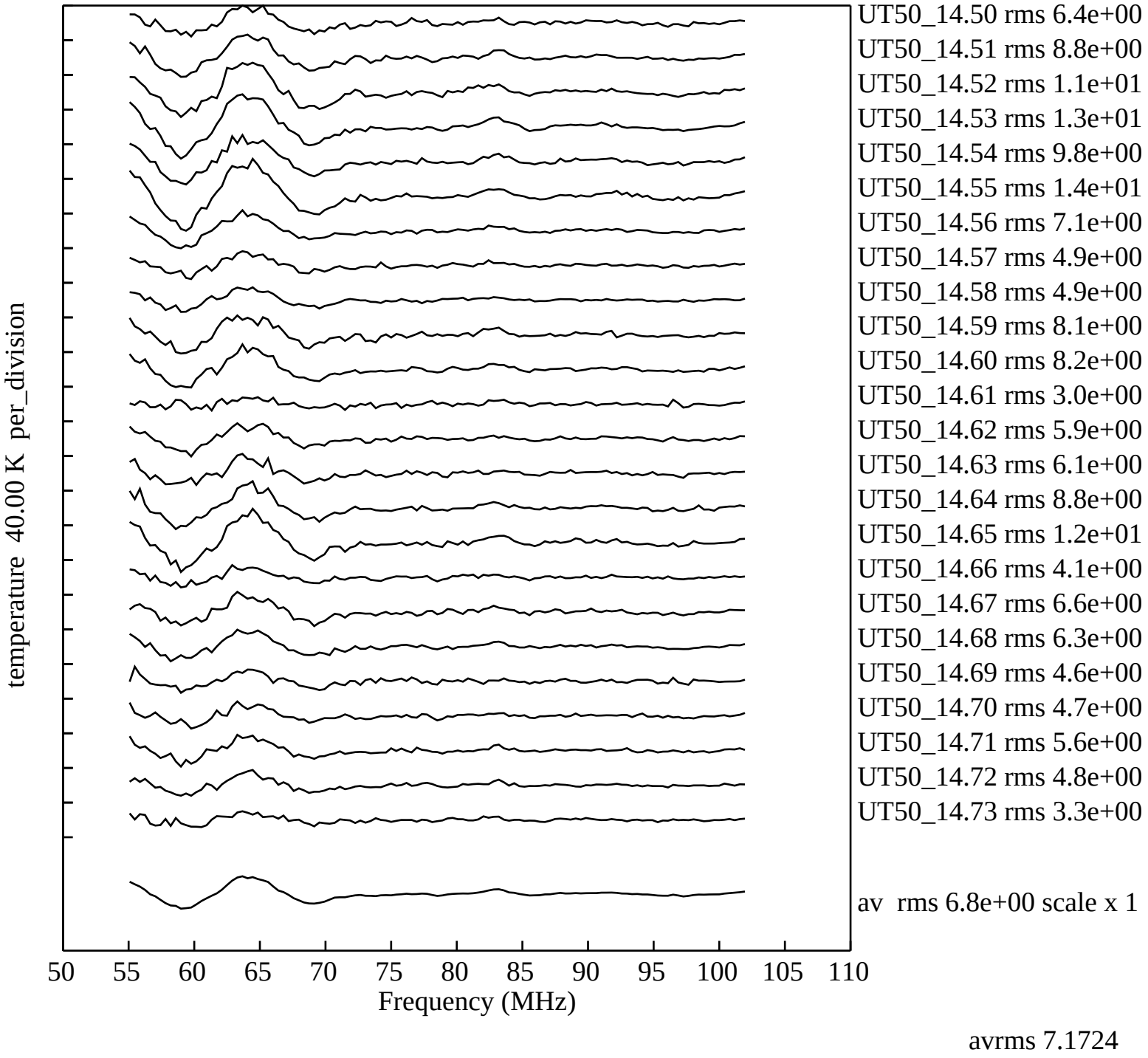

Figure 5. Residuals with 5-terms removed for 24 36 second UT blocks of 2025 day 50