EDGES MEMO #381

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To: EDGES Group

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Subject: Tests and checks of low2-45 2020_058 to 2021_195 GHA 5 to 7 hrs

Lowband2 data from GHA 5 to 7 hrs has some fine structure at about 65 MHz noticed by Raul Monsalve in a study of 2 hour blocks of GHA processed from 53-110 MHz with 5 linlog terms in low2-45 data from 2020_058 to 2021_195. A plot of the data without beam correction from the ASU pipeline of Raul's is shown in Figure 1 and the processing of the Haystack pipeline in Figure 2 using the calibration from Receiver02_2019_12_10_040_to_200_25C and antenna s11 from 2020_080_23_03_01.csv Balun correction is applied. Ground loss is not applied as it is expected to be small for the 30x30m ground plane. The results shown in Figures 1 and 2 are close to each other providing confidence that the two pipelines give close to the same results for the data.

The data from the Haystack processing is beam corrected using

azelq_blade9perf7low_45_fmesh_tilnegtr1.txt

and the result is shown in Figure 3 using 5 linlog terms from 53-110 MHz. Table 1 shows the results of a grid search for the absorption feature using different beam files, frequency range and number of terms:

frequency	beam used for beam correction	# of terms	SNR	center	amp	width	rms1	rms2
60-100	30x30m -1 deg tilt -1deg roll	4 physical	22	77.0	0.45	16.8	95	39
60-100	pec -1 deg tilt -1 deg roll	4 physical	22	77.0	0.49	17.6	95	39
60-100	pec no tilt or roll	4 physical	14	77.0	0.37	18.0	78	46
52-110	30x30m -1 deg tilt -1 deg roll	5 physical	19	80.5	0.57	20.1	134	72

Table 1. Results of feature search for GHA = 5-7 hrs using a fixed tau = 7. rms1 and rms2 are the rms residuals before and after fitting the feature in mK.

The source of the structure in the 2 hour block centered at GHA = 6 could be from rocks, brush pile or tree stumps as in the simulations in memo 341. Figure 6 shows a simulation of the effect of an object 20m from the antenna at an azimuth of 112 degrees which produces a ripple with a period close to those seen in the residuals in Figures 4 and 5. It is hard to find an object distribution to match the data as there could be many objects with different size, location, dielectric and conductivity involved. As seen in the google map in Figure 1 of 341 there are many objects in a range of about 20m from the antenna.

It is noted in memo 353 that tilt and roll have an effect and for correction for a ground plane tilt, which slopes down from east to west and down from south to north, requires negative values of tilt and roll as discussed in memo 336. This test emphasizes the need for a large flat horizontal ground plane without nearby objects which can produce significant scatter as discussed in memos 337, 353 and 379.

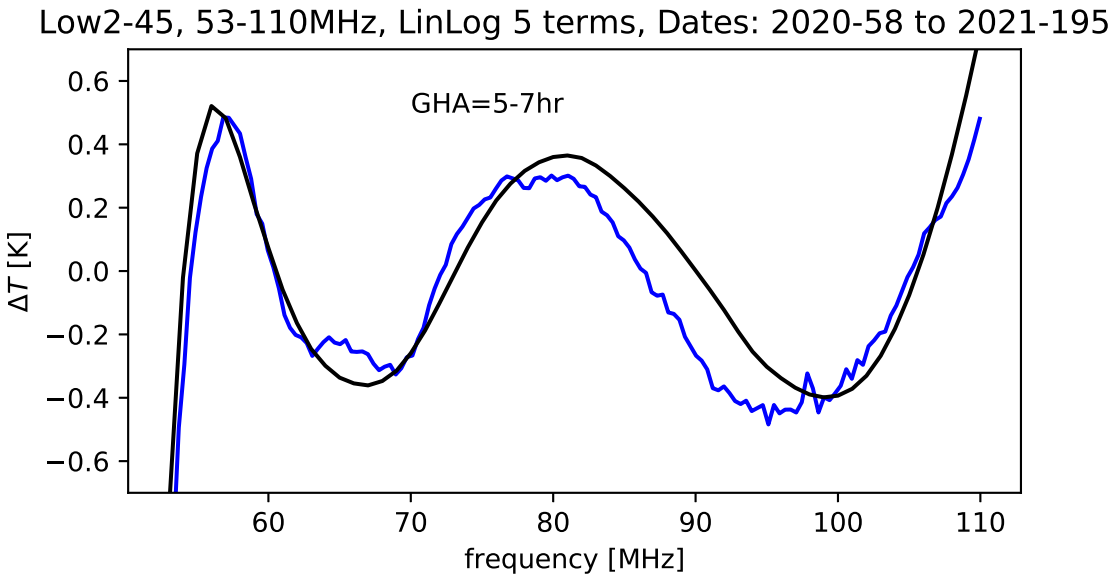

Figure 1. low-45 53-110 MHz, LinLog 5 terms 2020_58 to 2021_195 from ASU pipeline.

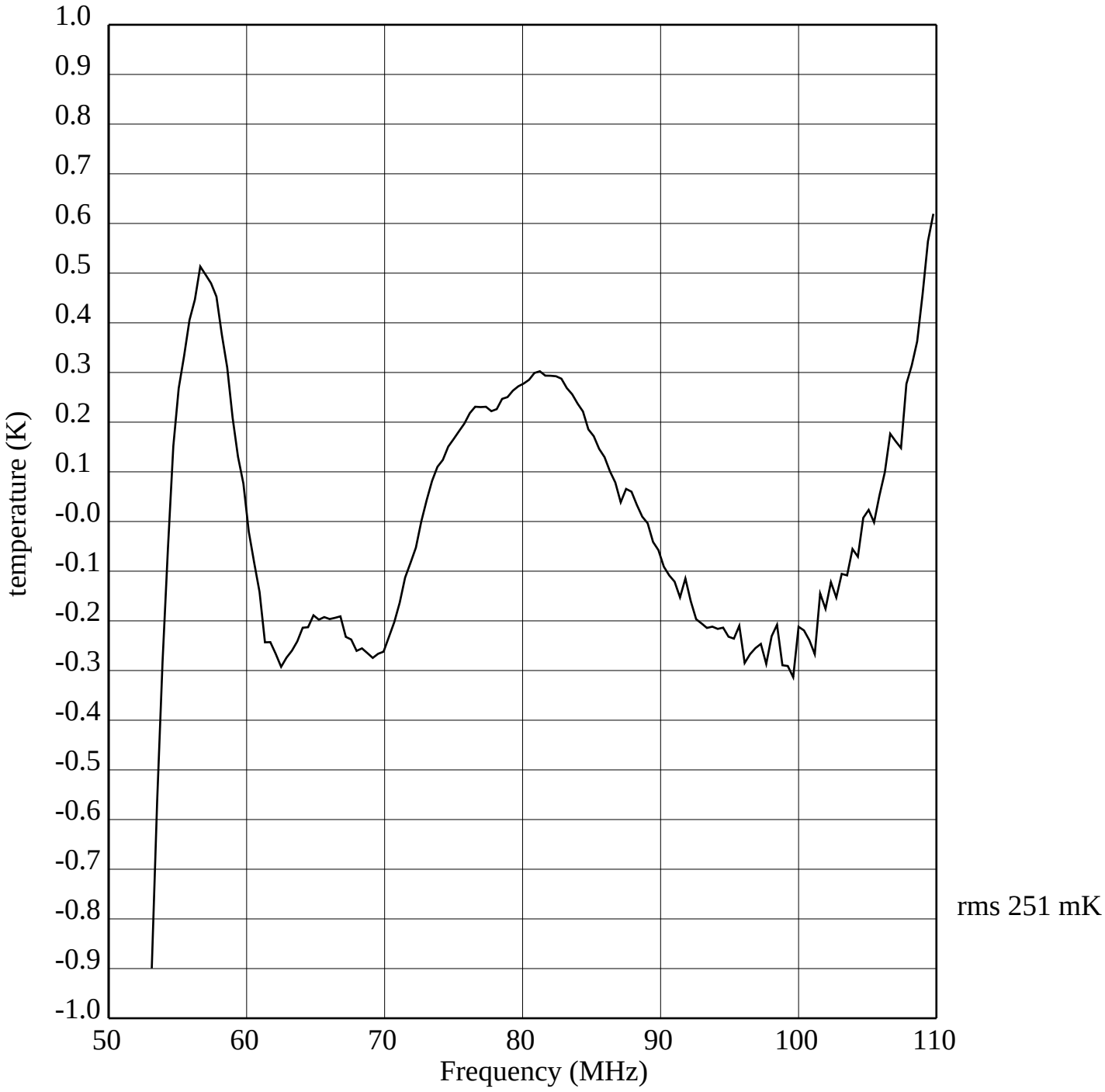

Figure 2. low-45 53-110 MHz, LinLog 5 terms 2020_58 to 2021_195 from Haystack pipeline

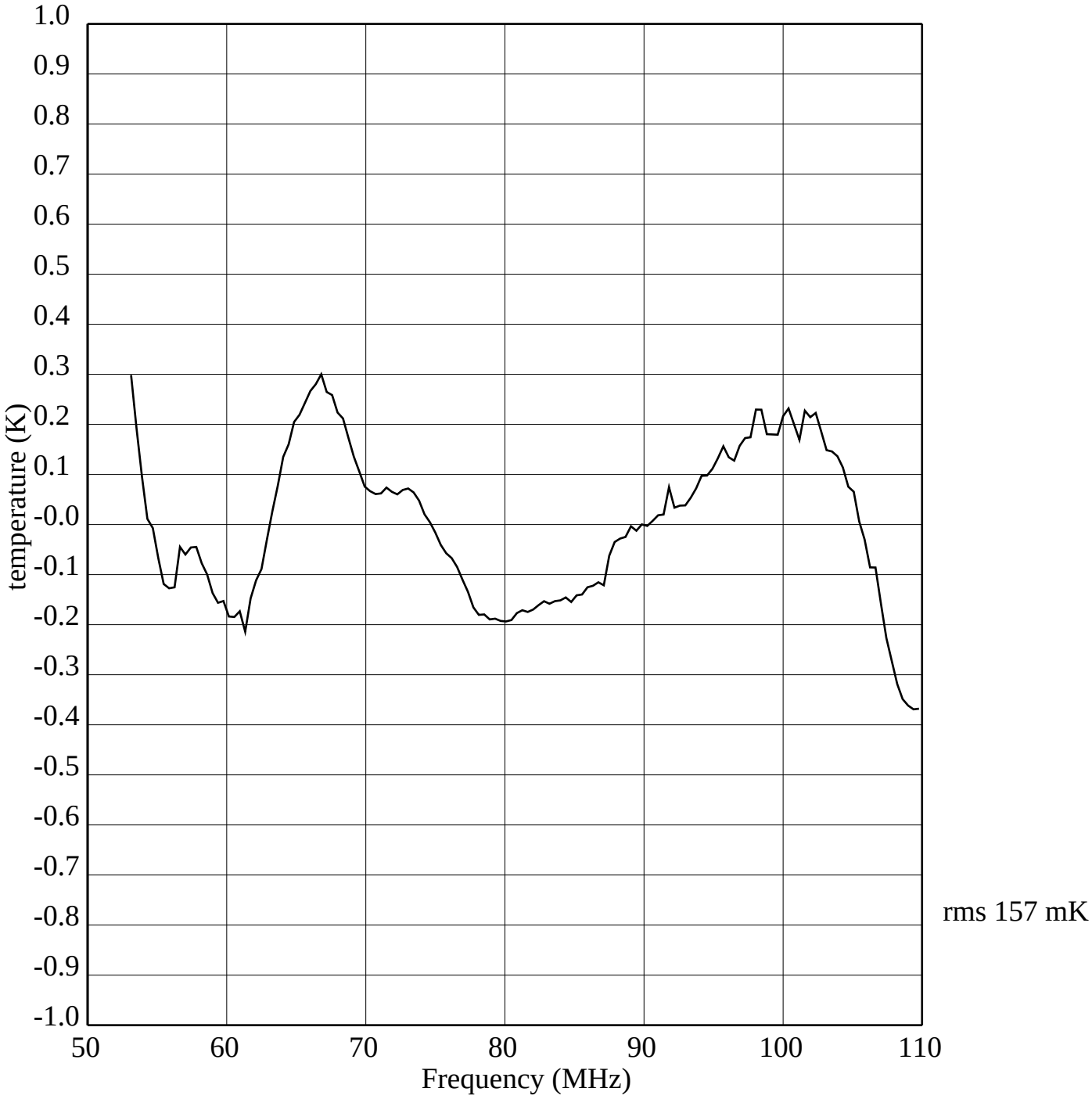

Figure 3. Same as Figure 2 but with 30x30m -1 deg tilt +1 deg roll beam correction

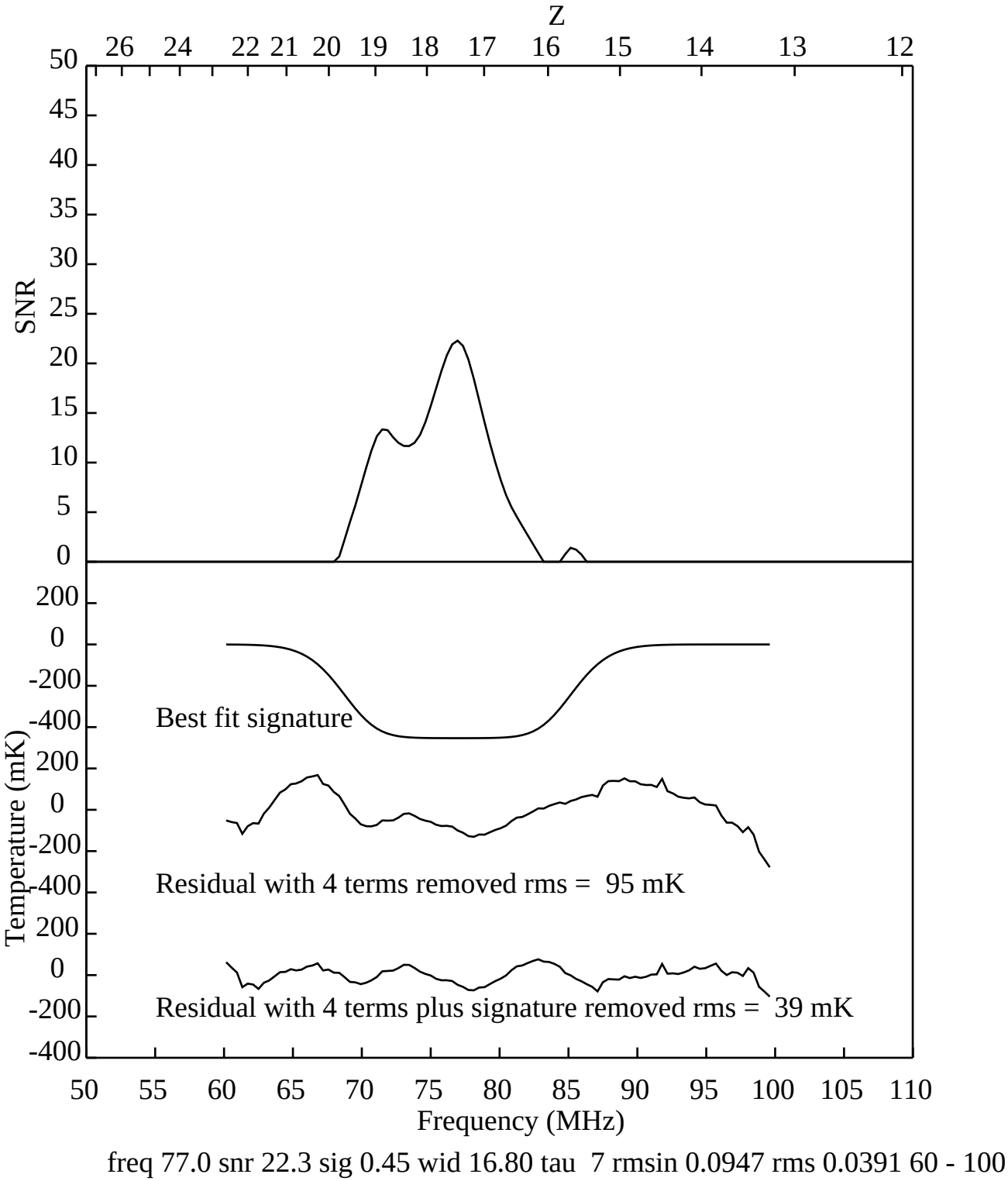

Figure 4. Feature search for first case in table 1 using 4 physical terms

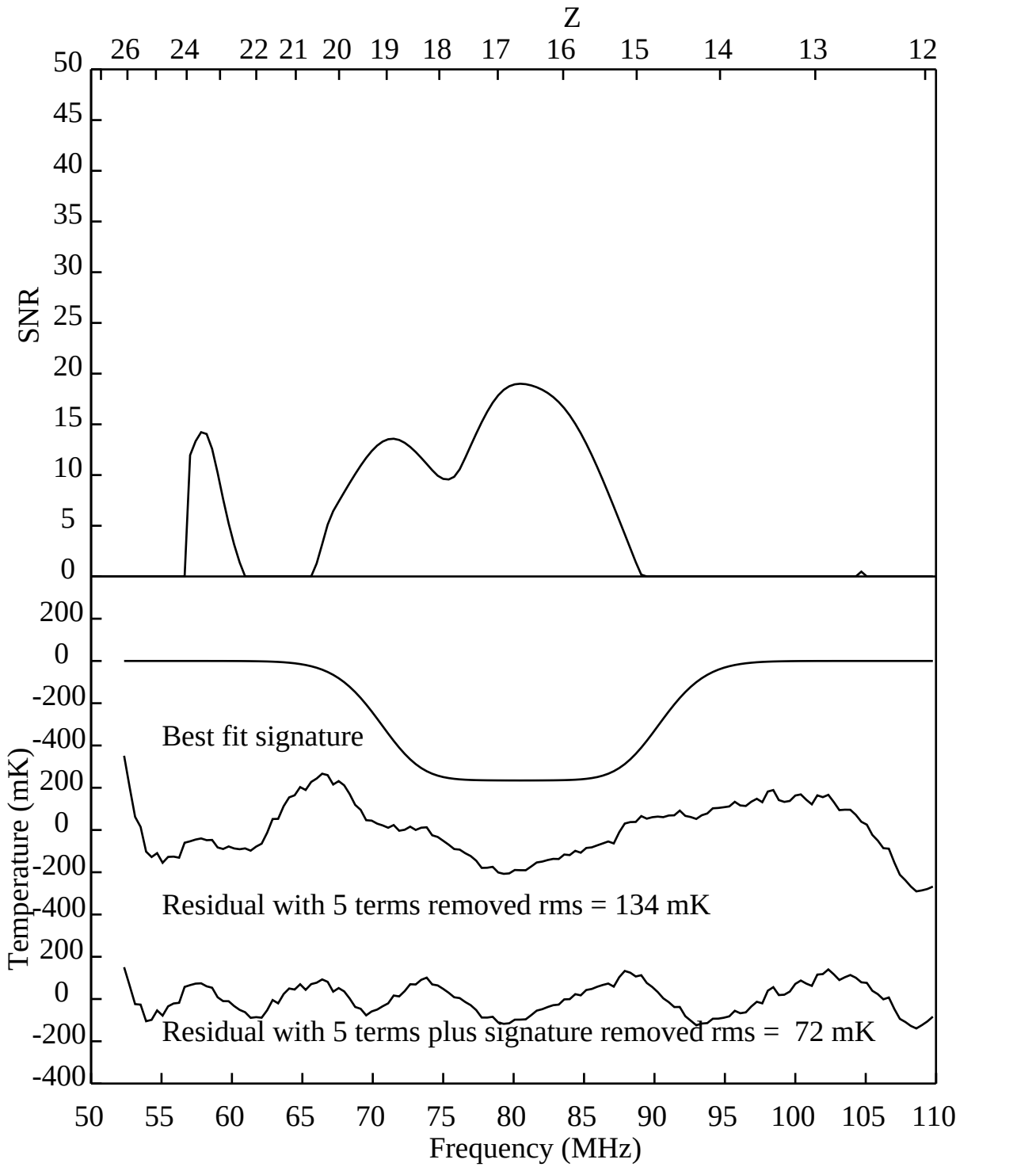

Figure 5. Feature search for last case in table 1 using 5 physical terms

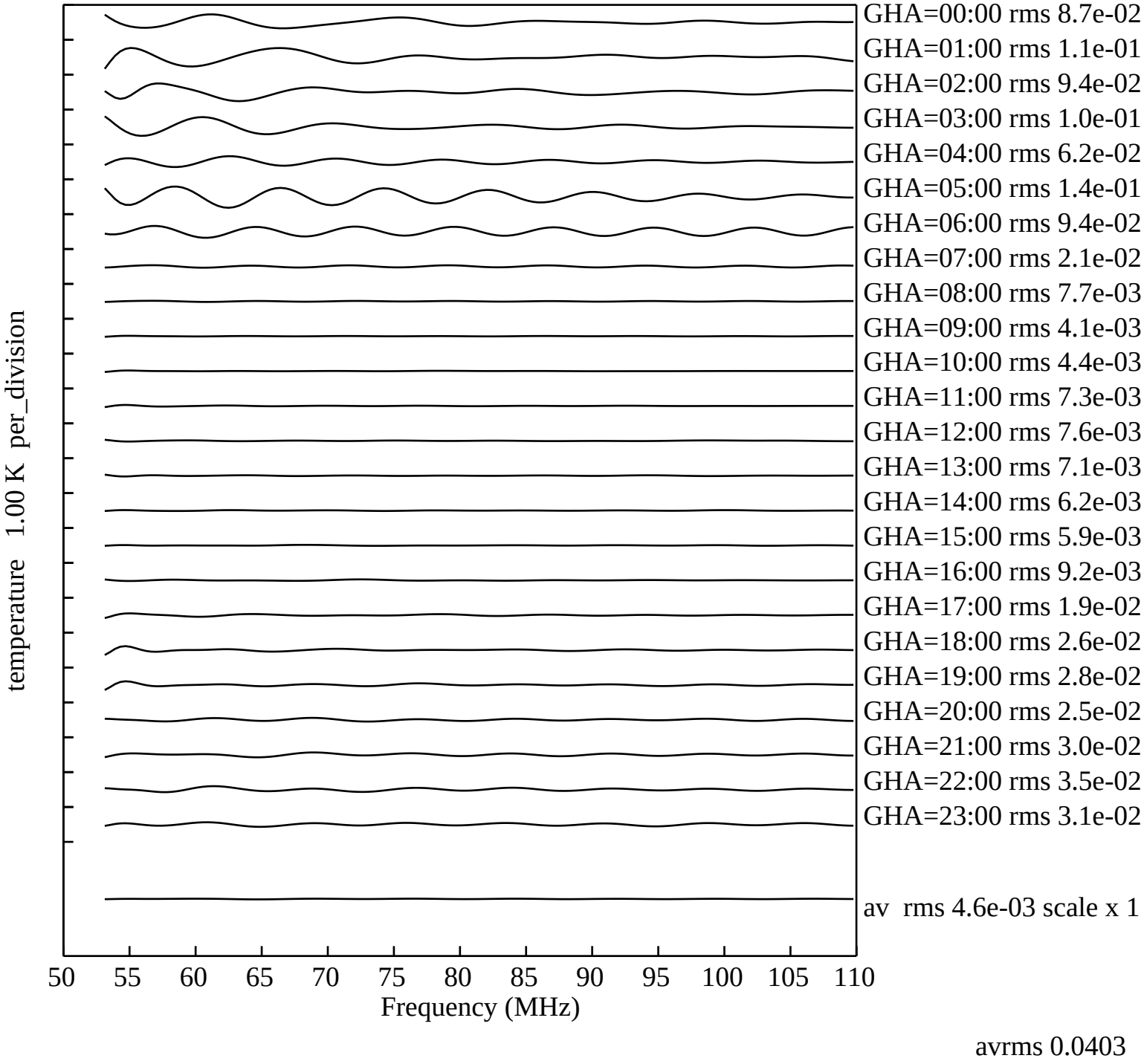

Figure 6. Simulation of beam chromaticity for an object 2m in height 50 cm in diameter 20m from antenna at an azimuth of 112 degrees for low2-45 pointed an azimuth 42 degrees. The plots are for 5-terms and the chromaticity is relative to that without the object and the simulation is for the antenna on a PEC ground plane.