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To: EDGES group

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Subject: Test of using EDGES-3 to observe recombination line spectra below 50 MHz

A study of recombination lines has been made by Vydula et al. using EDGES-2 low and midband. A test of using EDGES-3 to observe recombination lines below 50 MHz is made by calibrating EDGES-3 from 40 to 100 MHz to check the recombination line spectrum made using low band to cover the carbon alpha lines shown in Figure 4 of memo 261 which covers 64 to 66 MHz. The scale of the carbon line absorptions in Figure 1 agree fairly well with Figure 4 of memo 261.

A test of going below 50 MHz is then made of the carbon alpha lines from 44 to 46 MHz and 42 to 44 MHz using EDGES-3 data from day 54 to 365 in 2023 for GHA from -6 to +6 which are shown in figures 2 and 3.

The tests in Figures 1, 2 and 3 were made using only data with the sun more than 20 degrees below the horizon. Figure 4 is a repeat of the frequency range 42 to 44 MHz without restricting the data to that taken with the sun more than 20 degrees below the horizon. Figures 5 and 6 are for a frequency range of 40 to 42 MHz which is the lowest range possible using the 40 – 100 MHz calibration. Going below 40 MHz is limited the antenna S11 of only -0.5 dB at 40 MHz.

ref:

Vydula, A.K., Bowman, J.D., Lewis, D., Crawford, K., Kolopanis, M., Rogers, A.E., Murray, S.G., Mahesh, N., Monsalve, R.A., Sims, P. and Samson, T., 2023. Low-Frequency Radio Recombination Lines Away From the Inner Galactic Plane. *The Astronomical Journal*, 167(1), p.2.

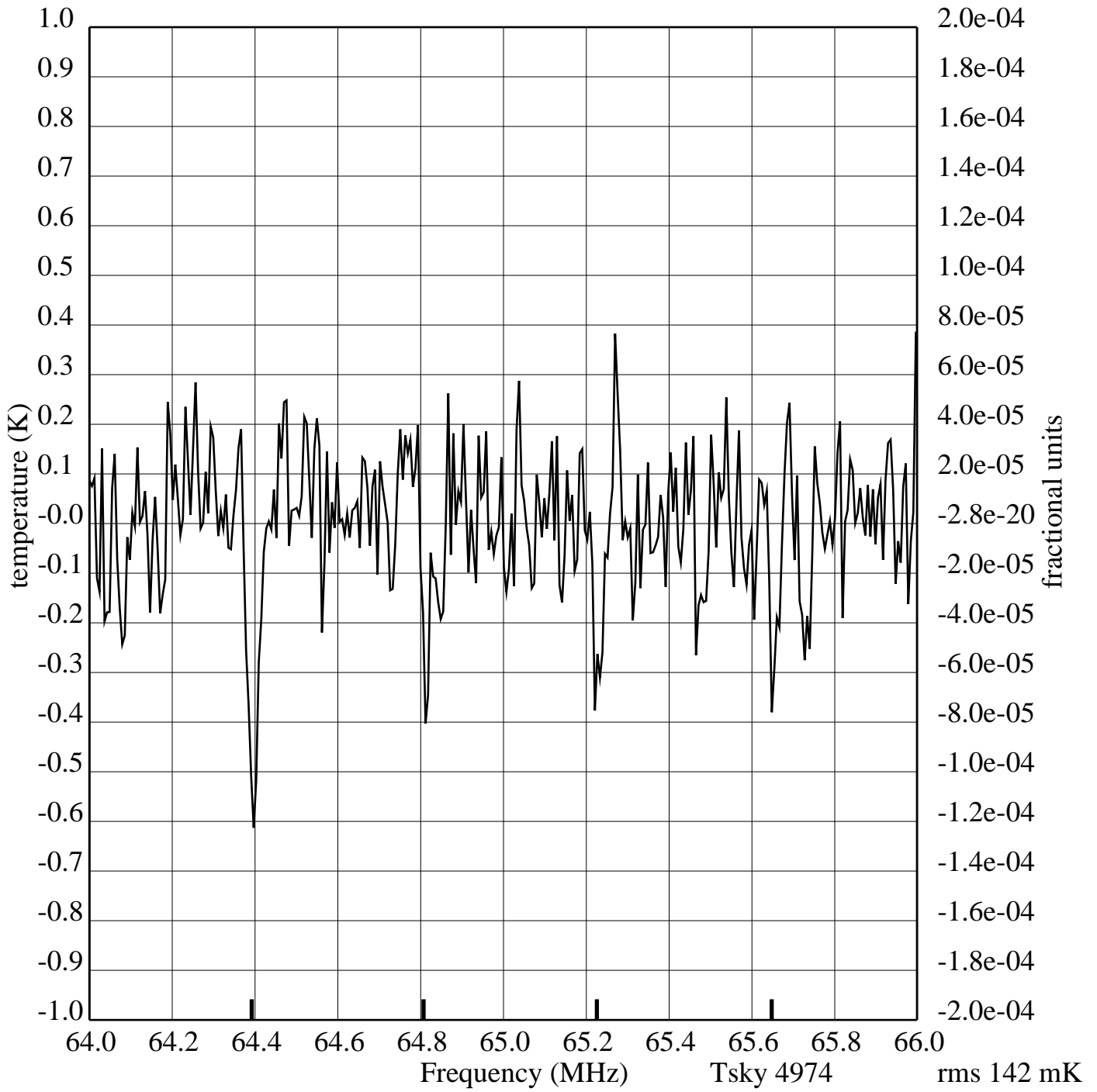


Figure 1 Spectrum from GHA = -6 to +6 hours showing carbon alpha for N= 467,466,465,464.

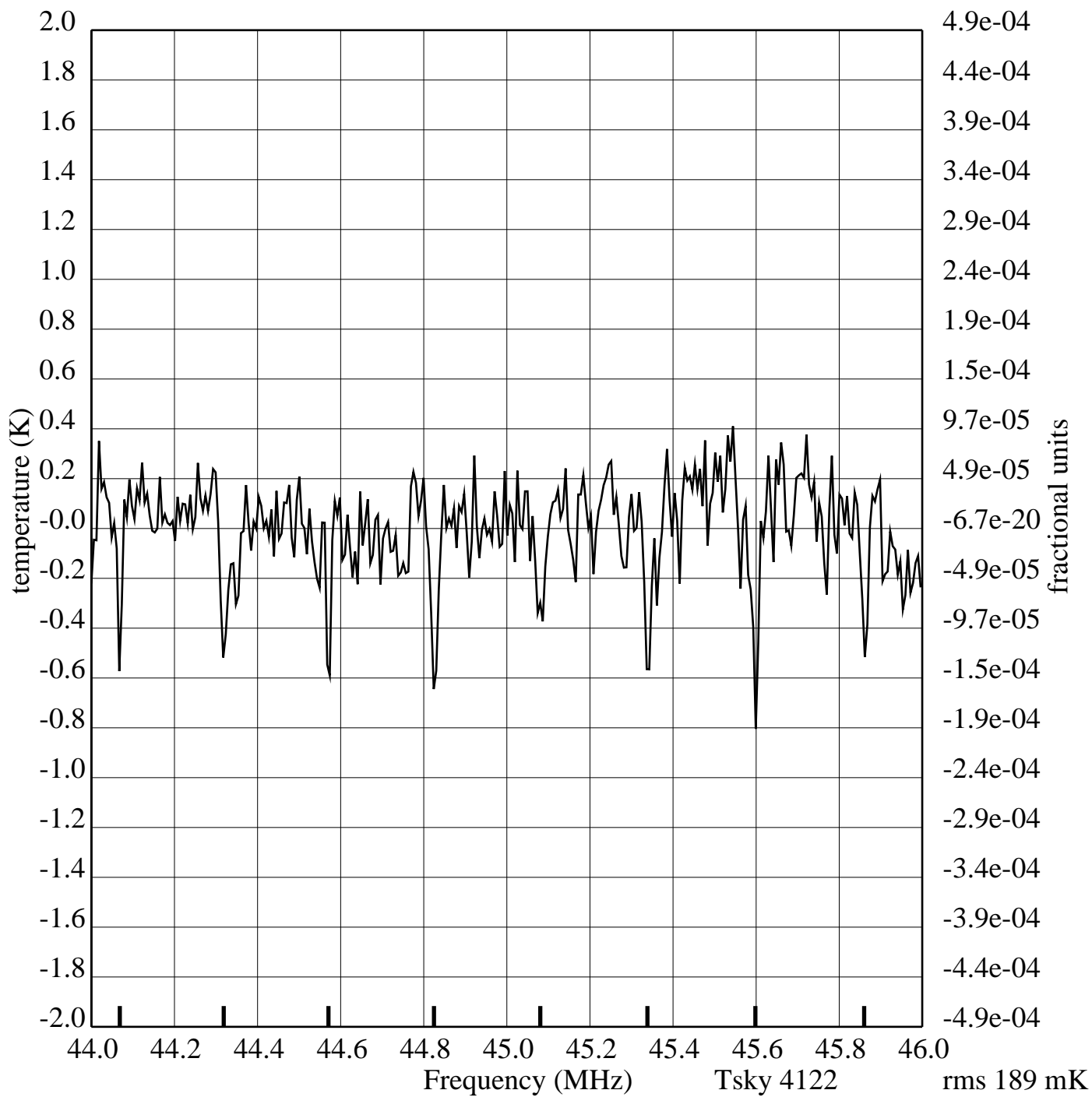


Figure 2 Spectrum from GHA = -6 to +6 hours showing carbon alpha for N= 523 to 530

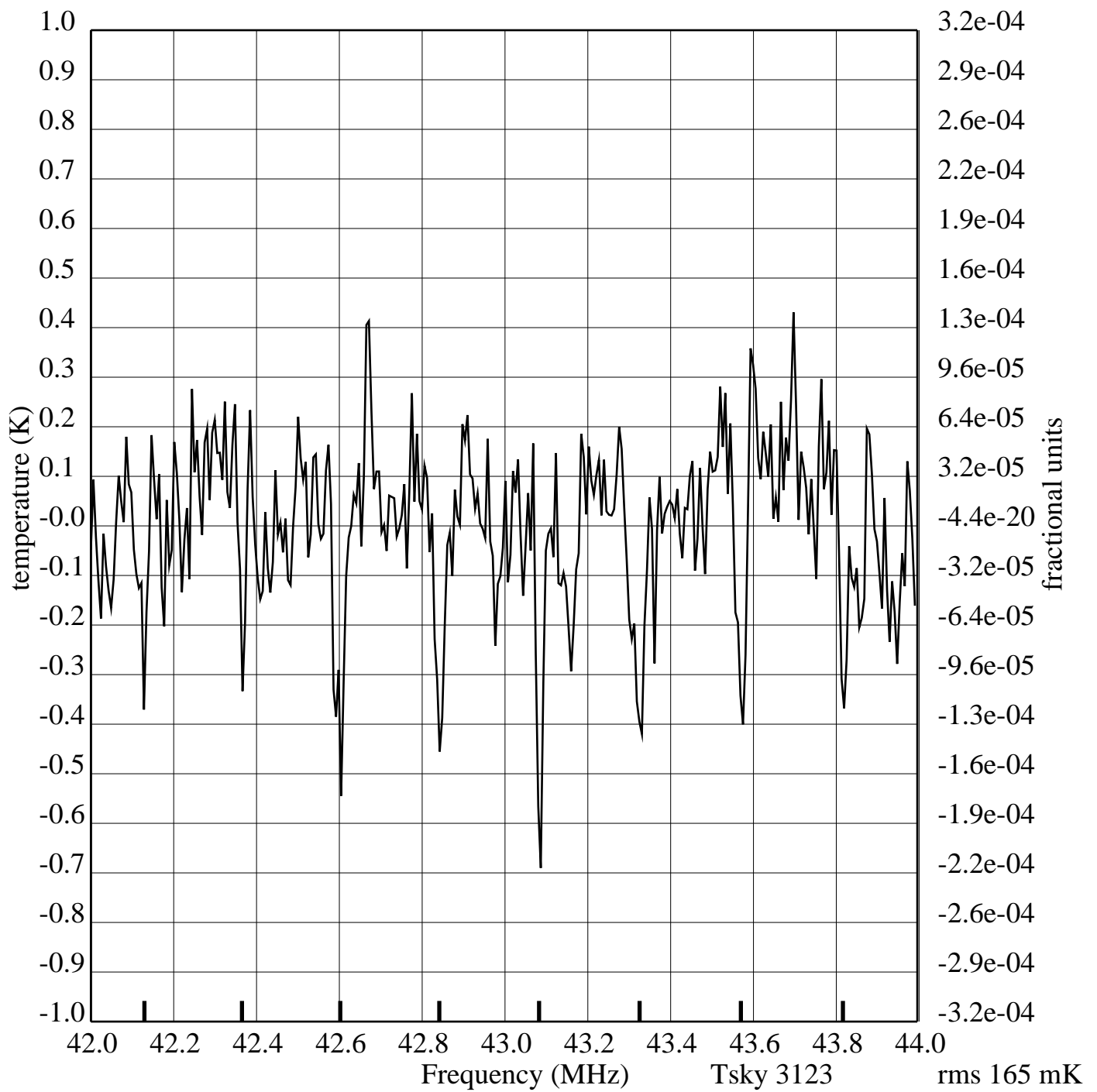


Figure 3 Spectrum from GHA = -6 to +6 hours showing carbon alpha for N= 538 to 531

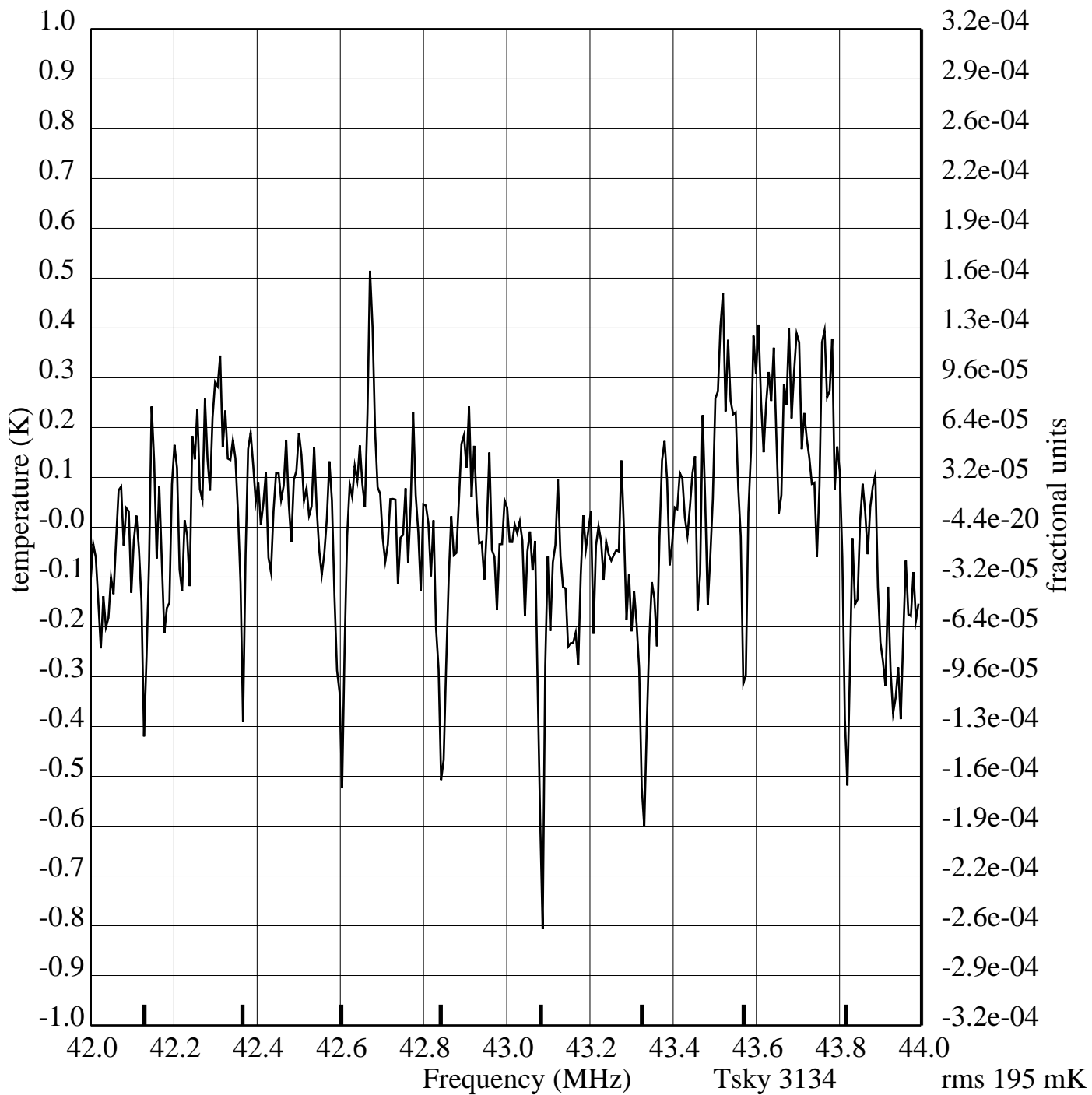


Figure 4 Spectrum from GHA = -6 to +6 hours showing carbon alpha for N= 538 to 531 without restricting the data to that taken with the sun more than 20 degrees below the horizon

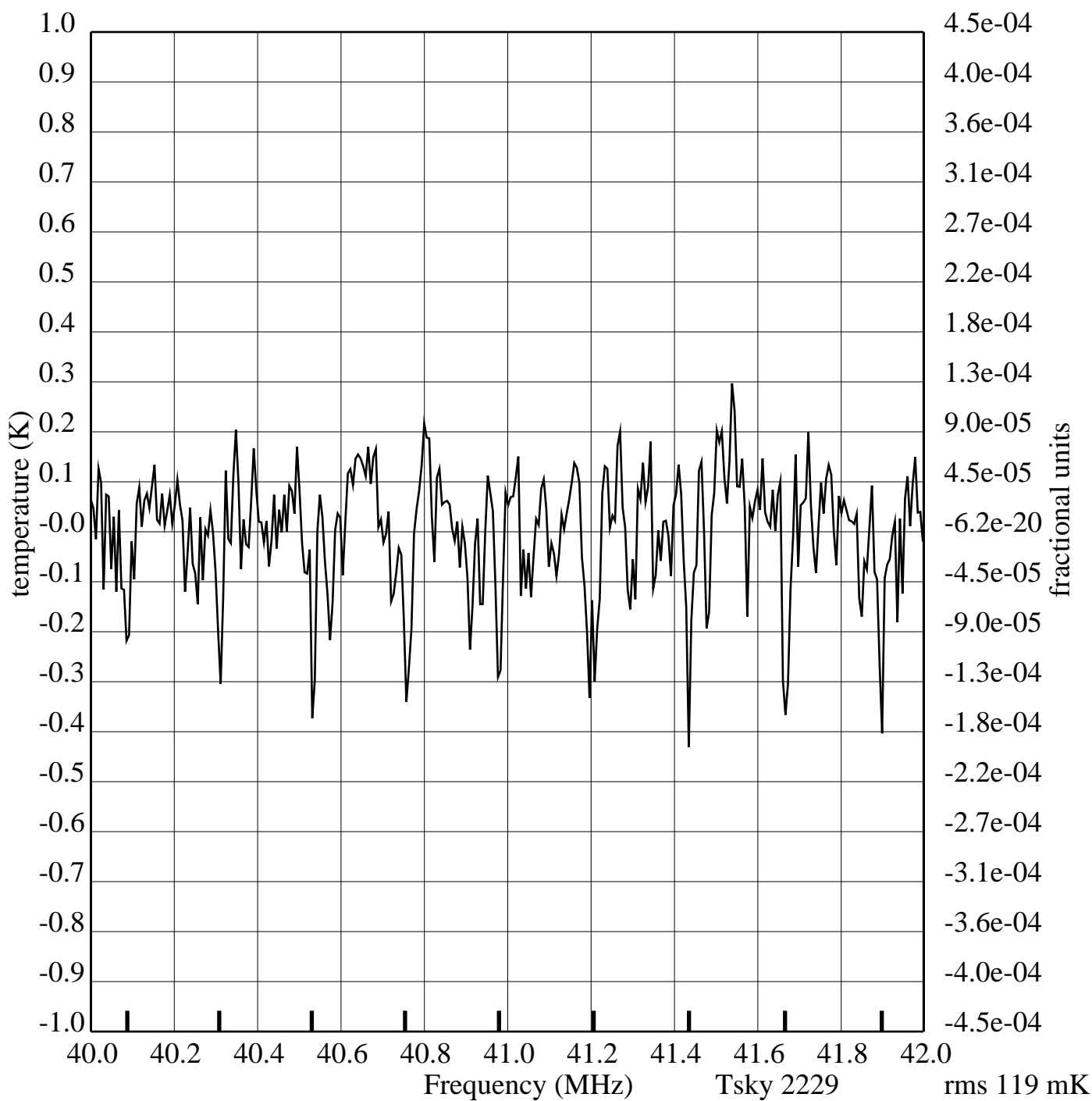


Figure 5 Spectrum from GHA = -6 to +6 hours showing carbon alpha for N= 547 to 539

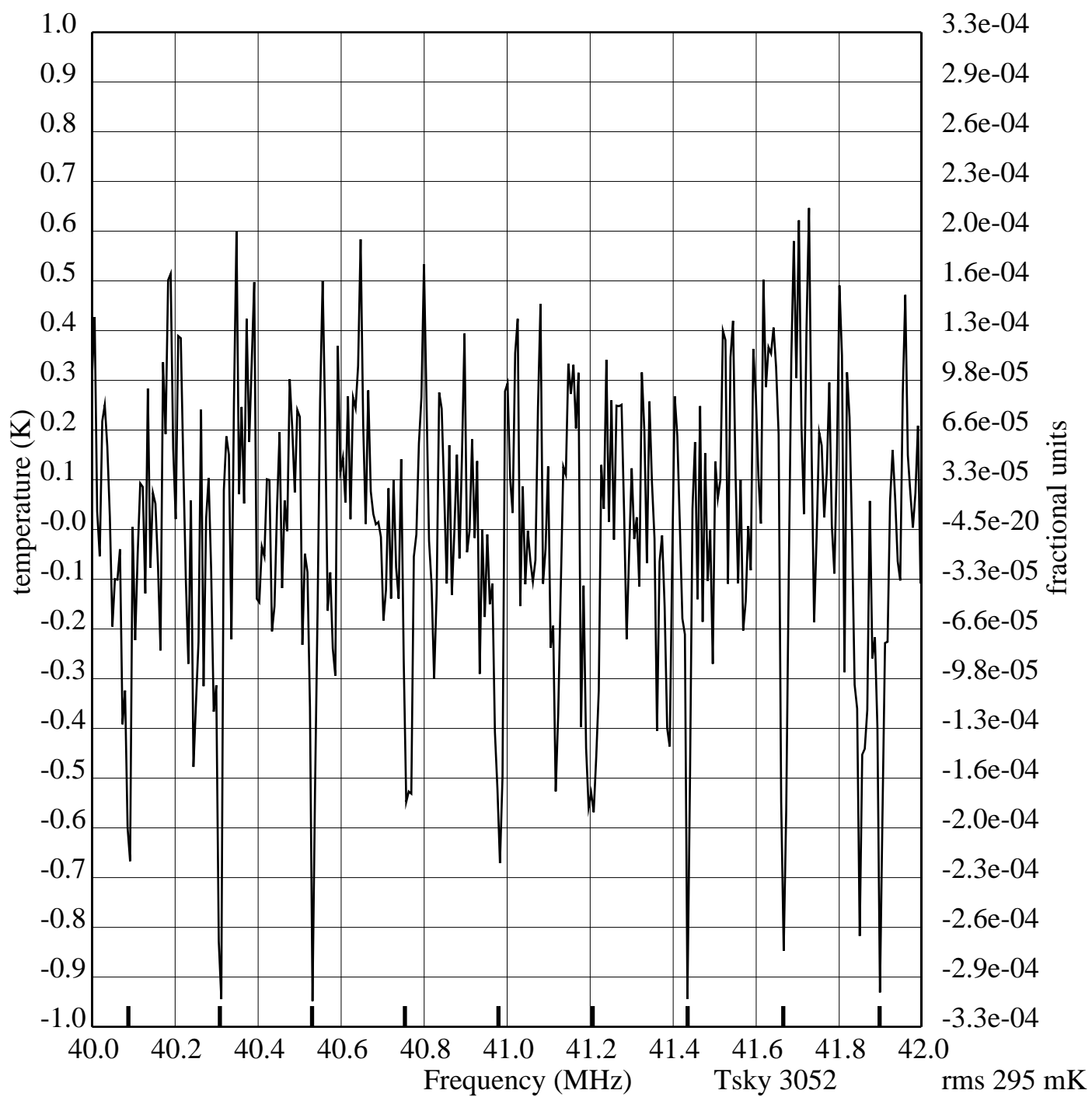


Figure 6 Spectrum from GHA = -0.5 to +0.5 hours showing carbon alpha for N= 547 to 539