First Look at Good-Quality EDGES Data

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Description

These slides present the result of the first look at EDGES data taken between (and including) days 101 and 127. The only day for which there are no data is day 125, due to rain. For the others days, data excision occurred due to rain and RFI, but significant amounts of data remain. The excision happens at the raw frequency resolution. Frequency binning is then applied at the resolution imposed by the calibration file generated from lab measurements, which is $\sim$ 0.78 MHz.

The following plots show the repeatability of the calibrated sky temperature when measuring the same part of the sky, represented by LST, over all the available days. Here, *calibration* refers to impedance matching and receiver effects only. The measurements have not been corrected for beam effects. This will be done when they are made available.

Figures 0 through 23 show the residuals after removing a best-fit power law. These fits were performed with data in the range 110-140 MHz, since at higher frequencies the spectra show significant structure. In these figures, each line corresponds to a 1-hour average coming from a different day. For example, the lines in figure 0 (LST 00) correspond to 1-hour averages between LST 00 and LST 01, for all the days between 101 and 127 for which there are good data. Since there is at least one day missing, the maximum possible number of lines in a figure is 26.

Figure 24 shows the results of the parameter fitting in the range 110-140 MHz for all the days and all LSTs.

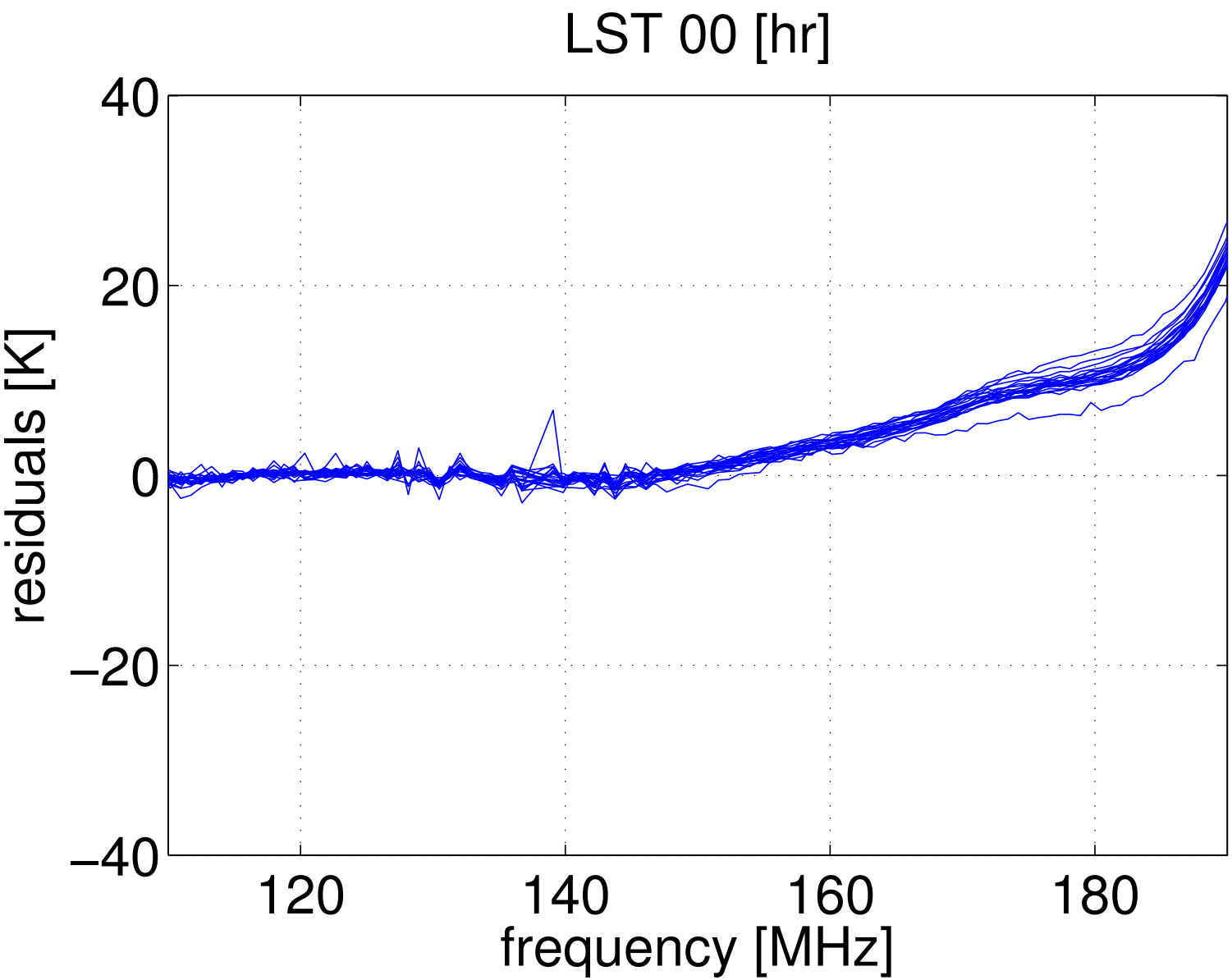
LST 00 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (0)

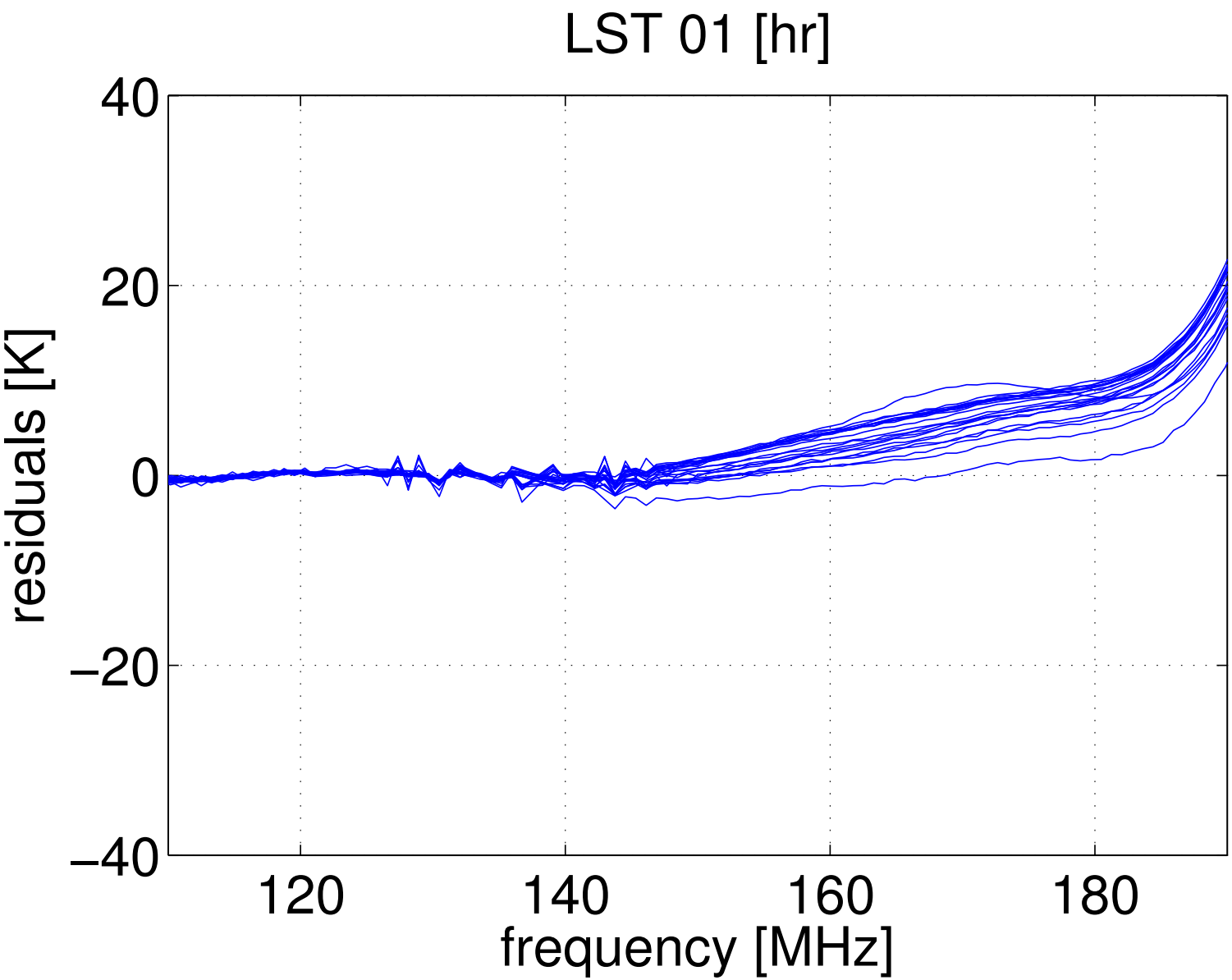
LST 01 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (1)

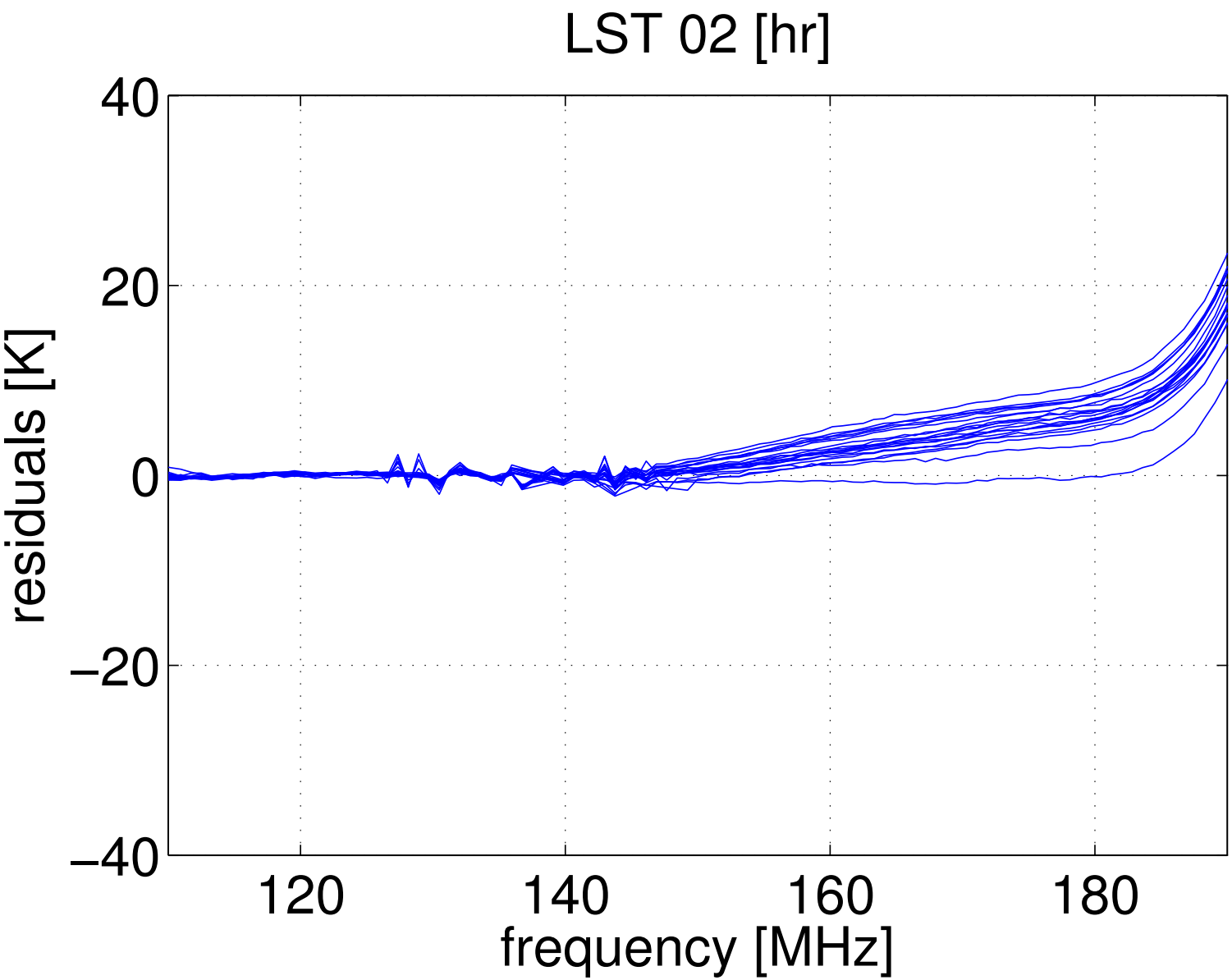
LST 02 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (2)

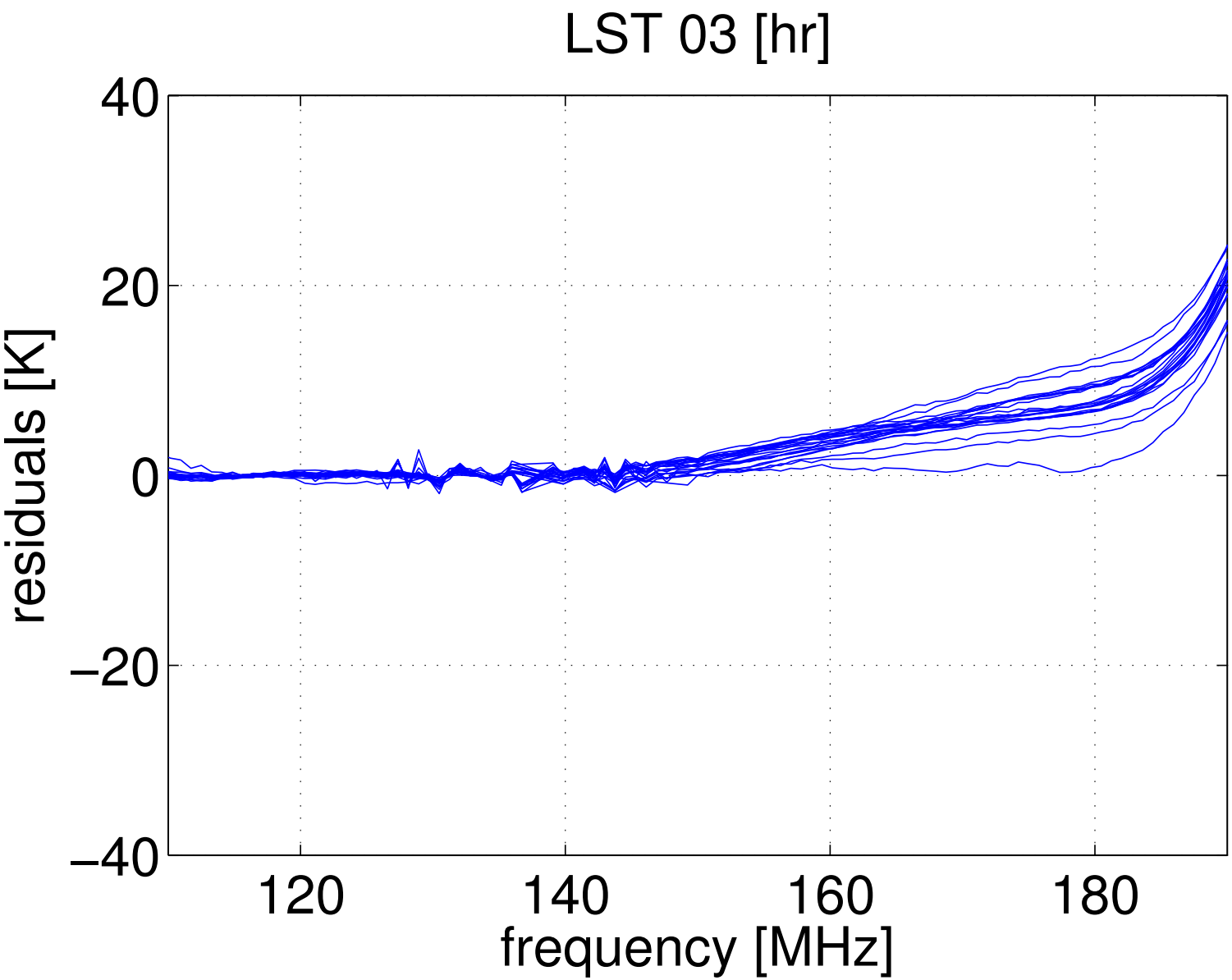
LST 03 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (3)

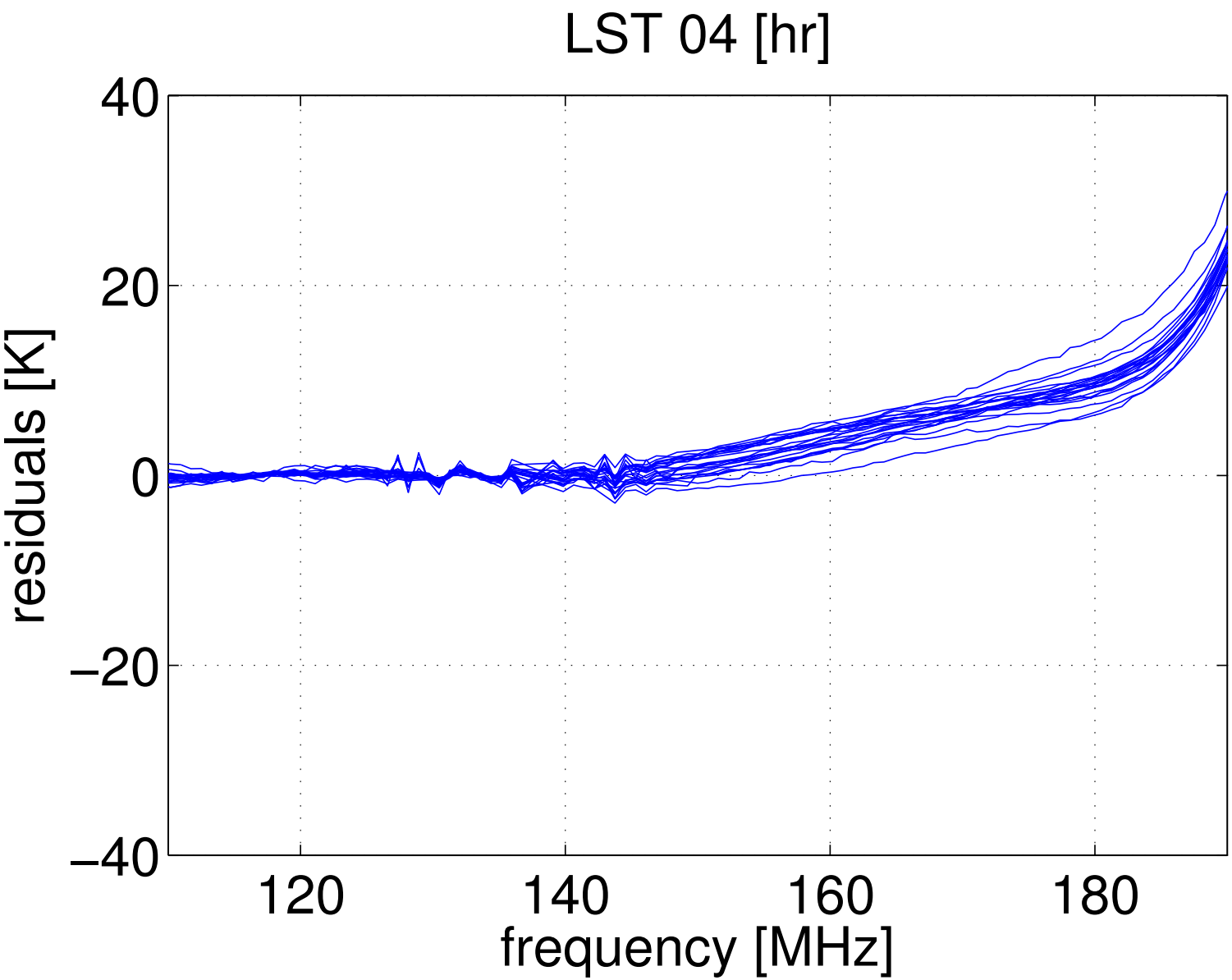
LST 04 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (4)

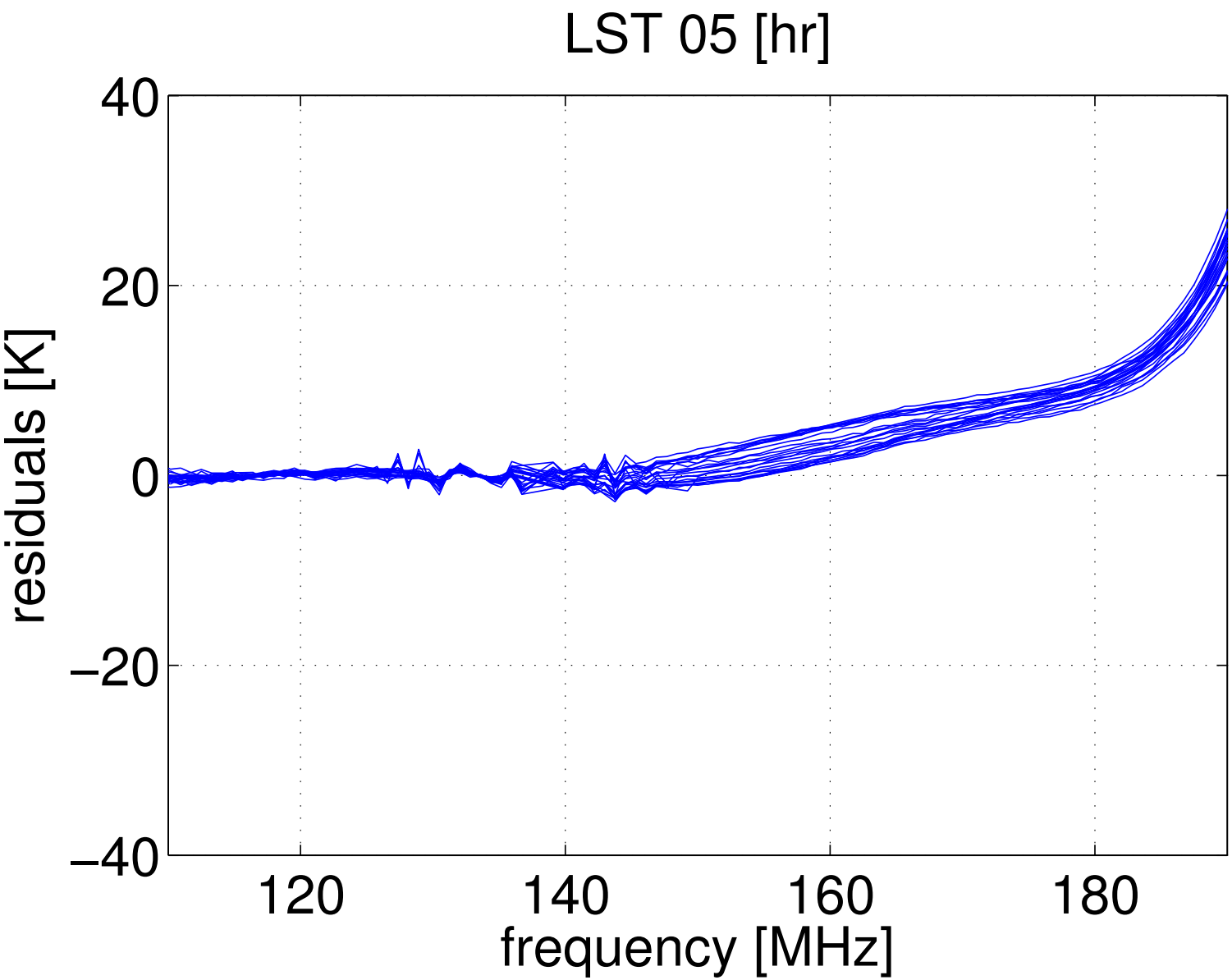
LST 05 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (5)

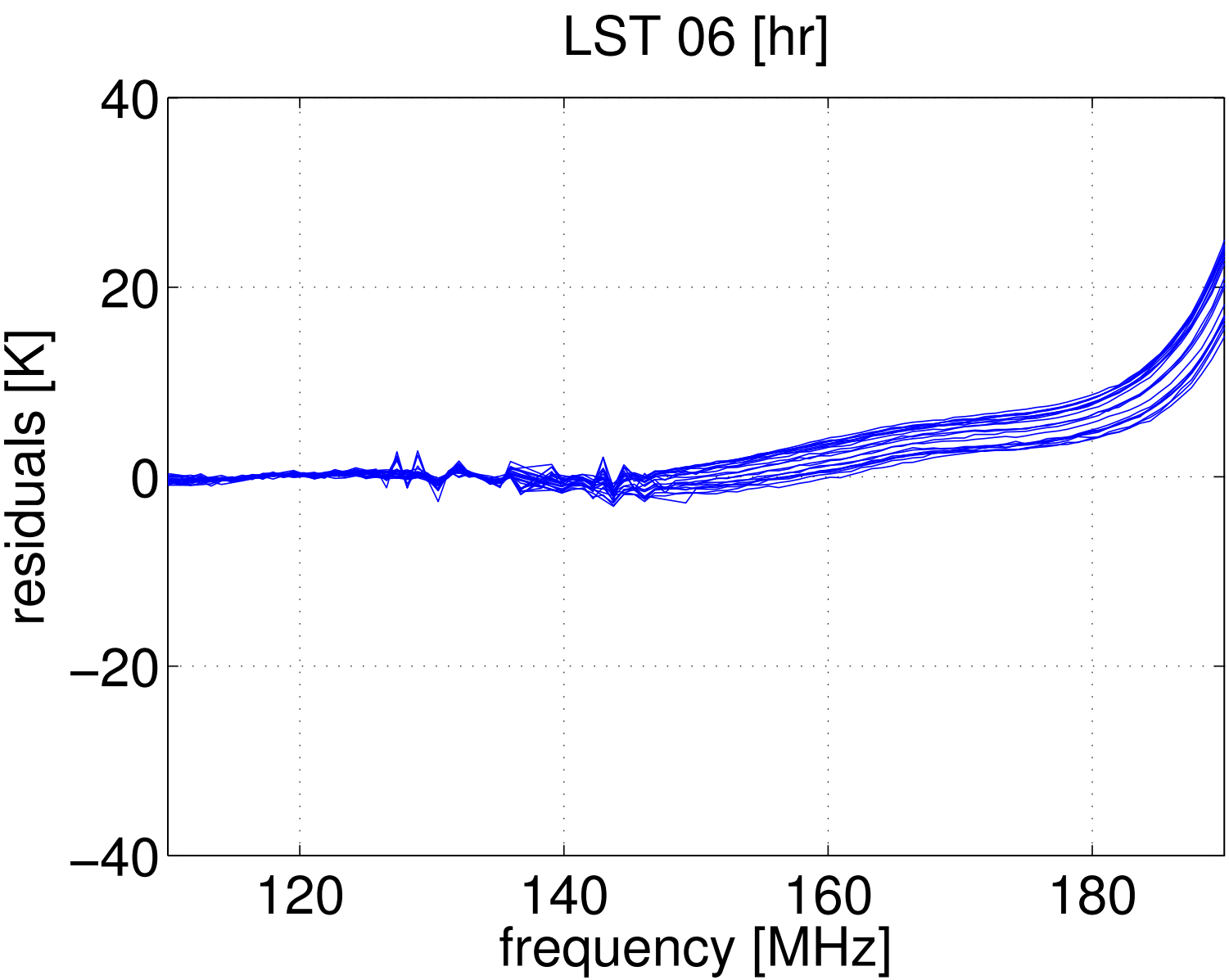
LST 06 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (6)

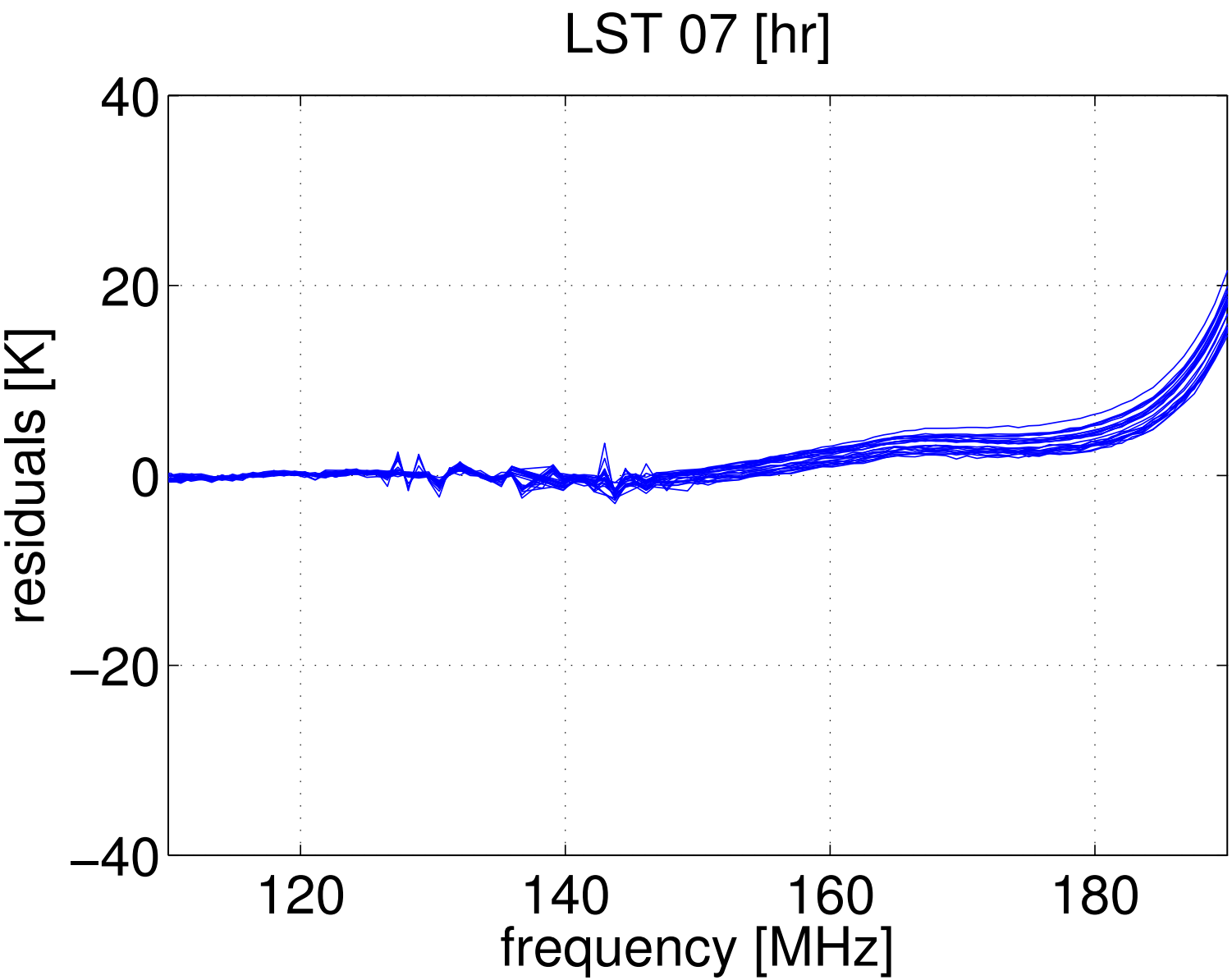
LST 07 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (7)

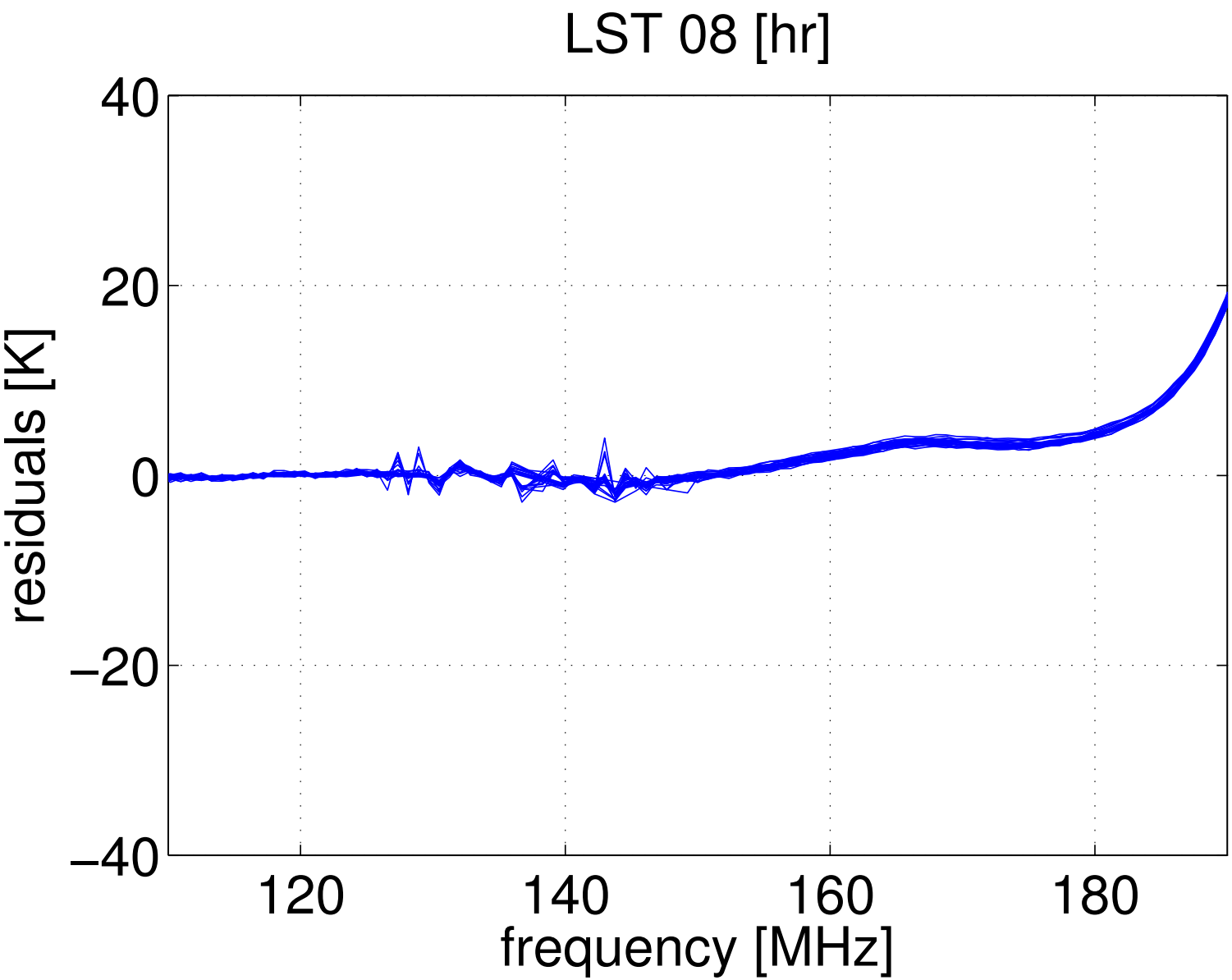
LST 08 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (8)

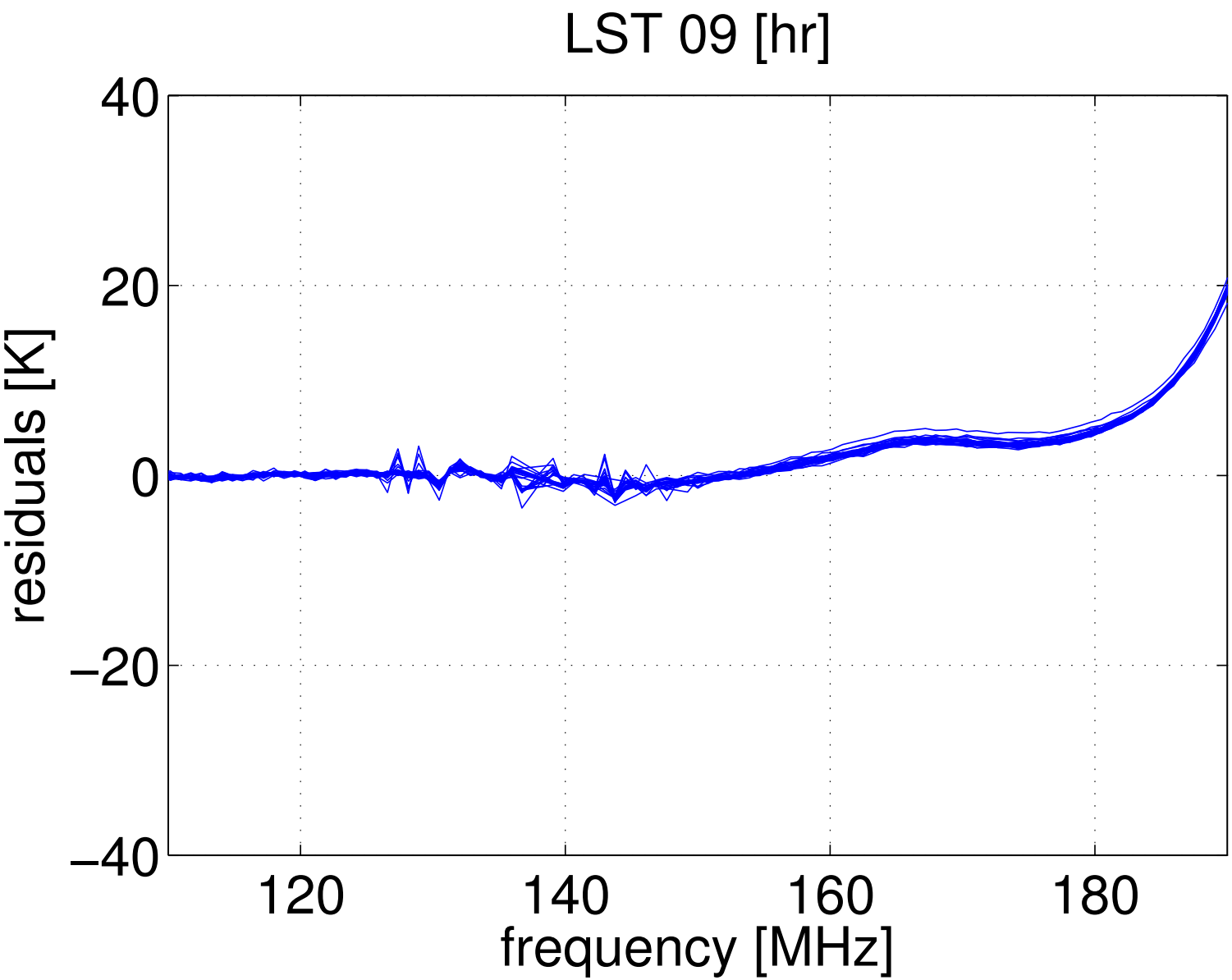
LST 09 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (9)

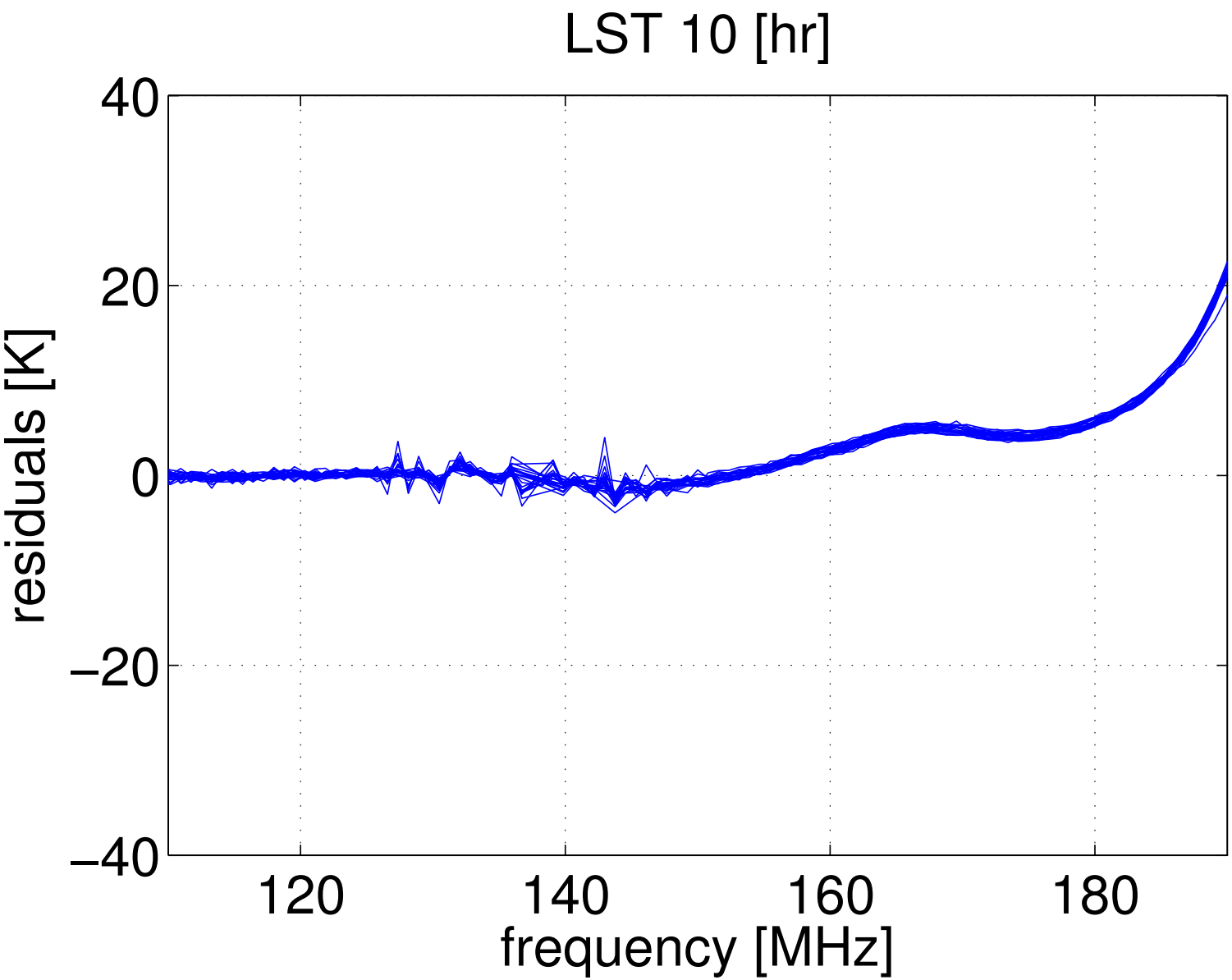
LST 10 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (10)

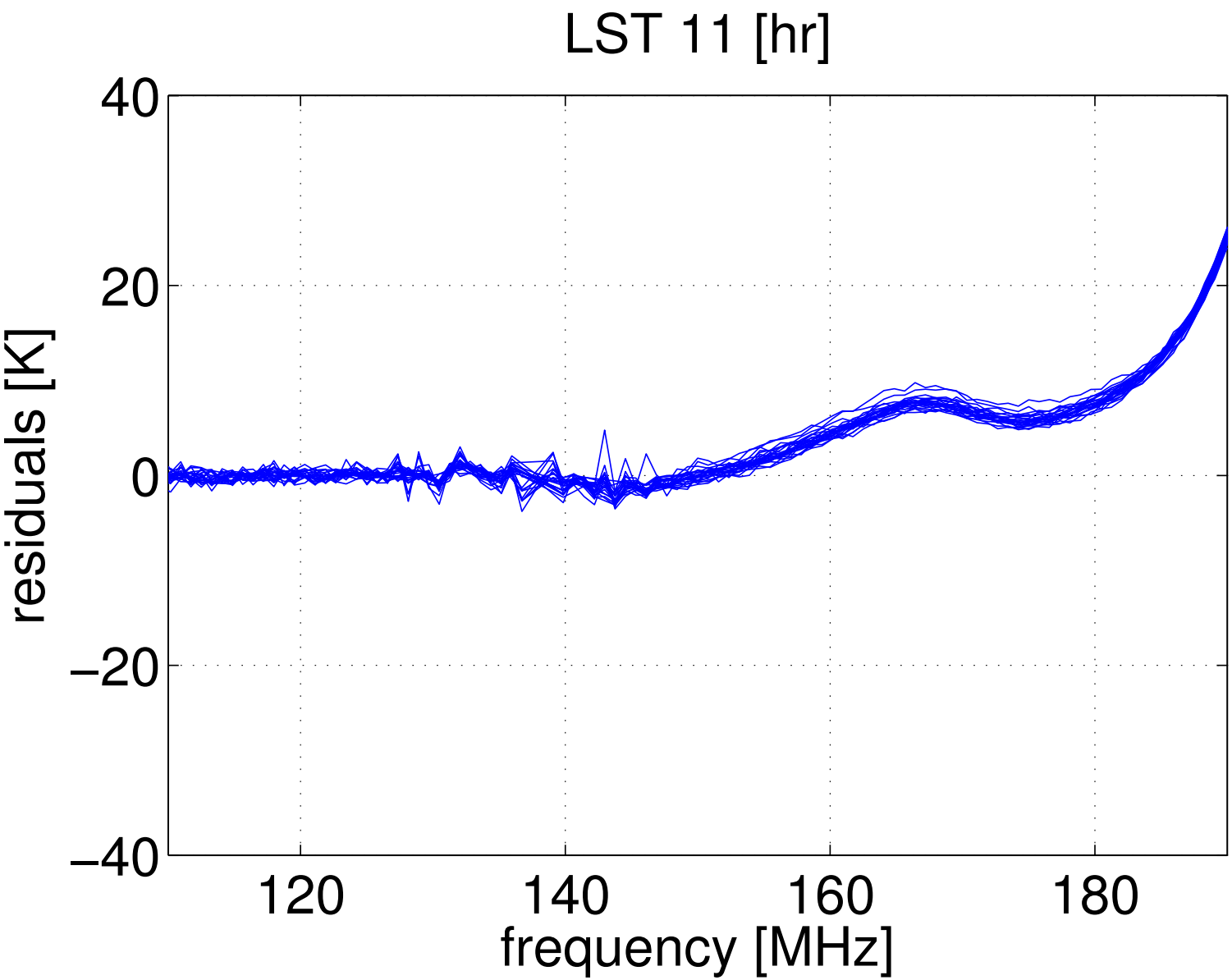
LST 11 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (11)

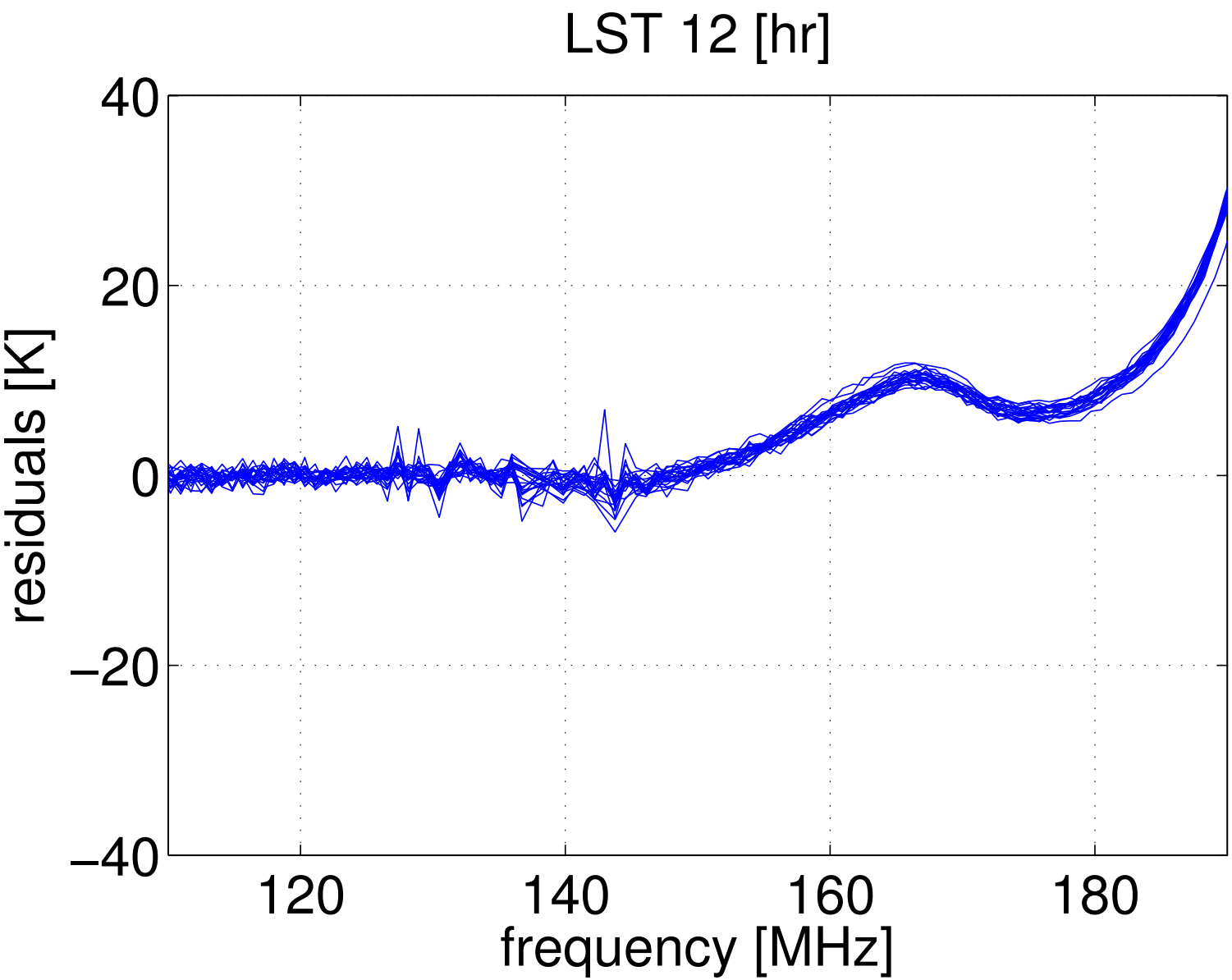
LST 12 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (12)

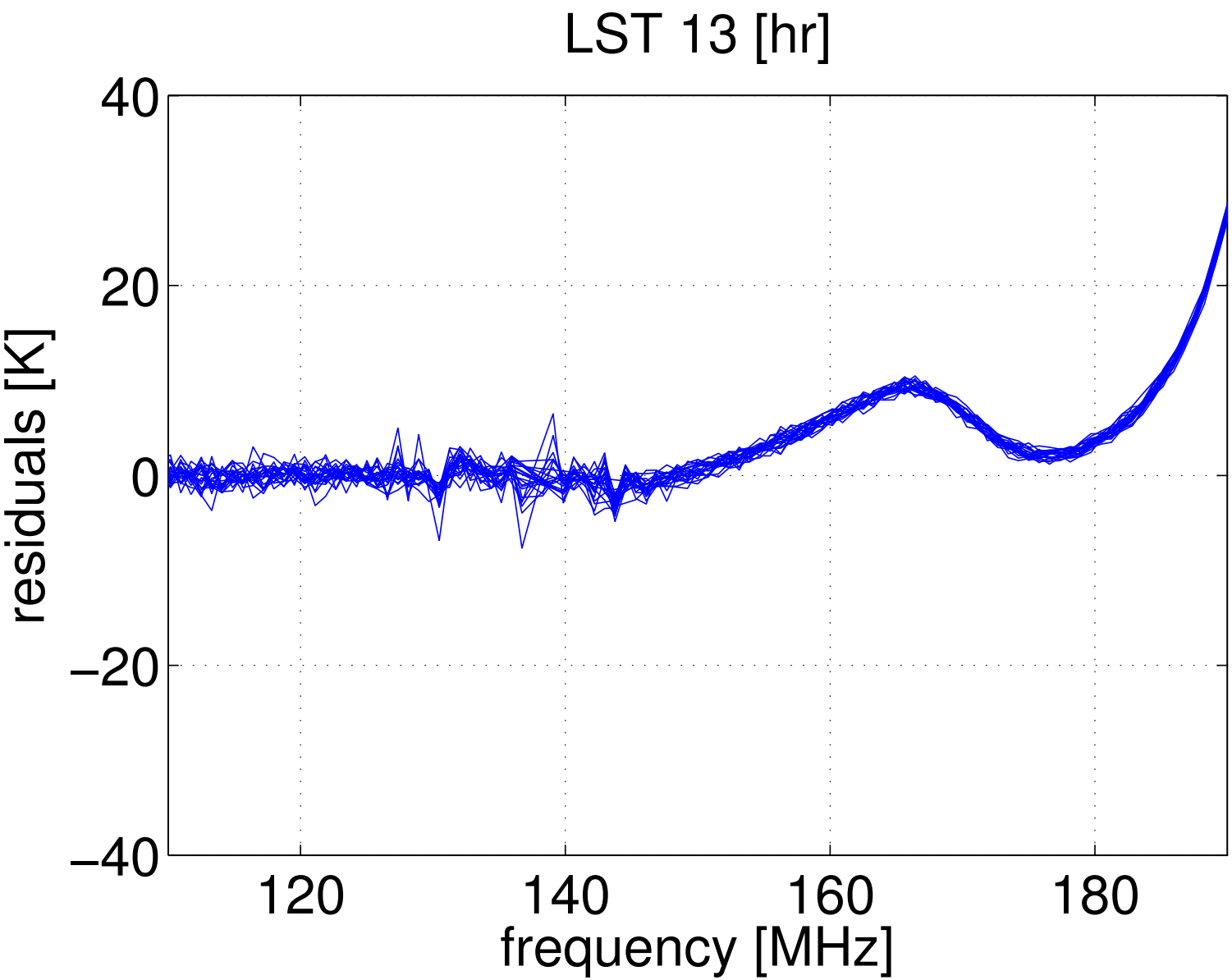
LST 13 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (13)

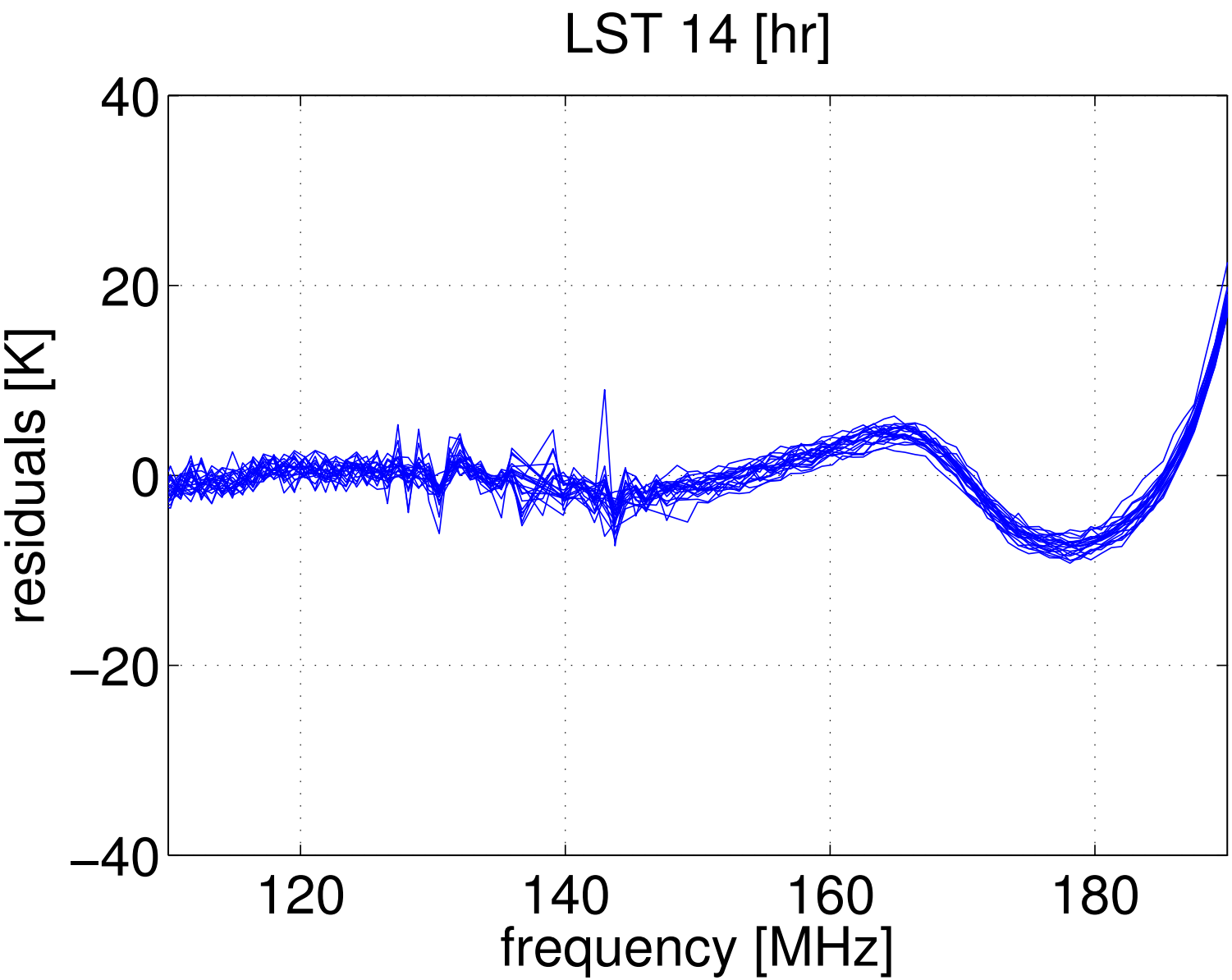
LST 14 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (14)

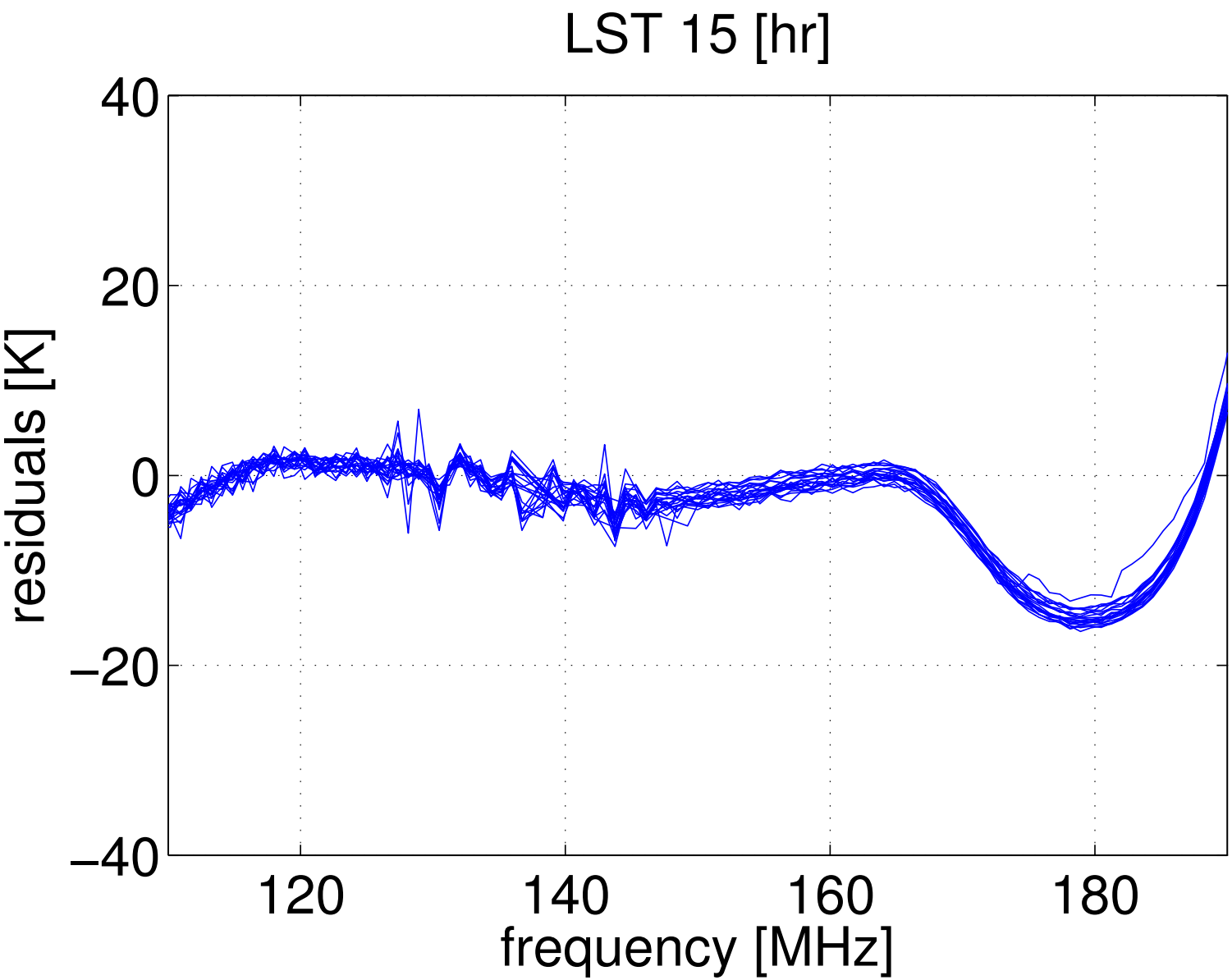
LST 15 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (15)

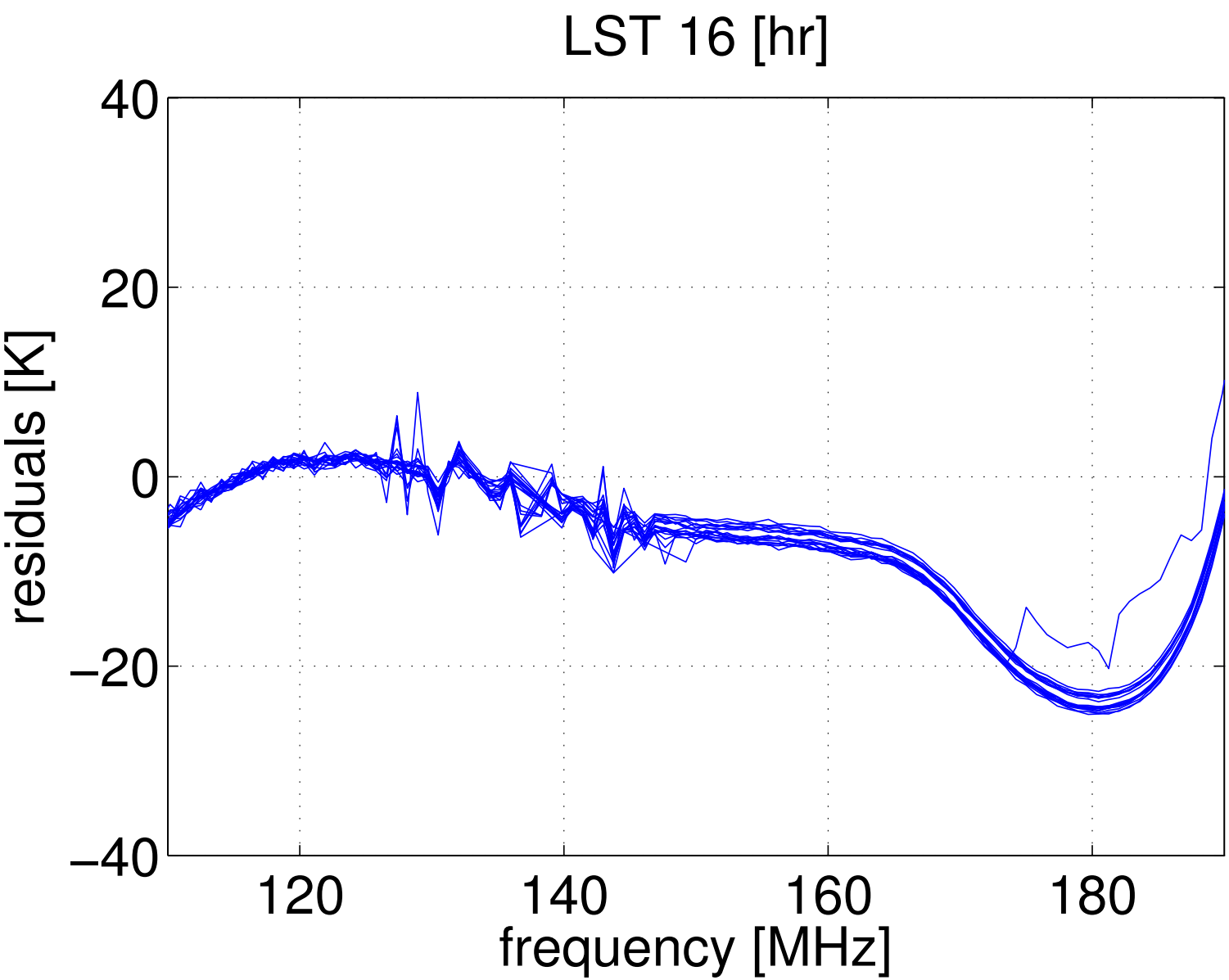
LST 16 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (16)

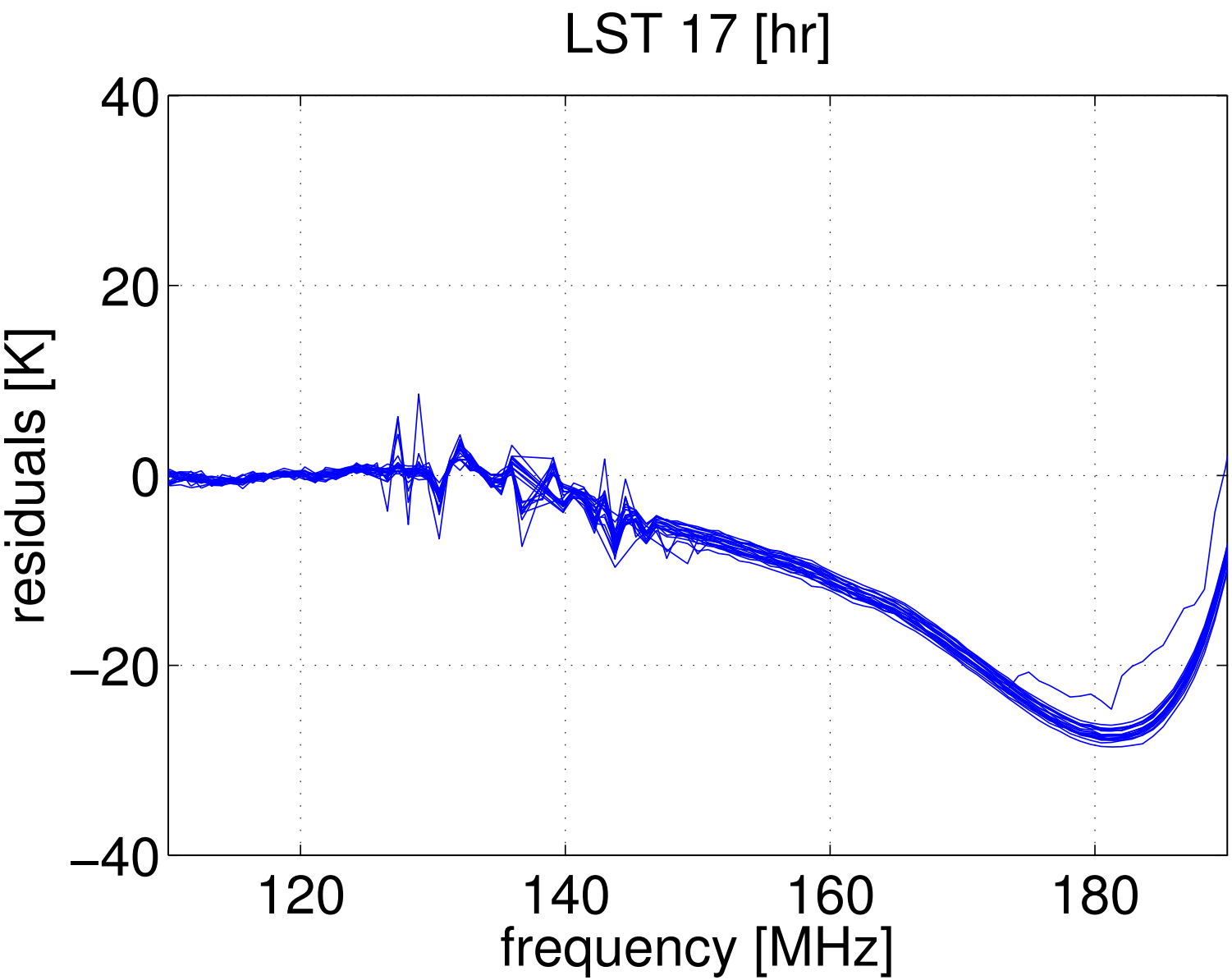
LST 17 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (17)

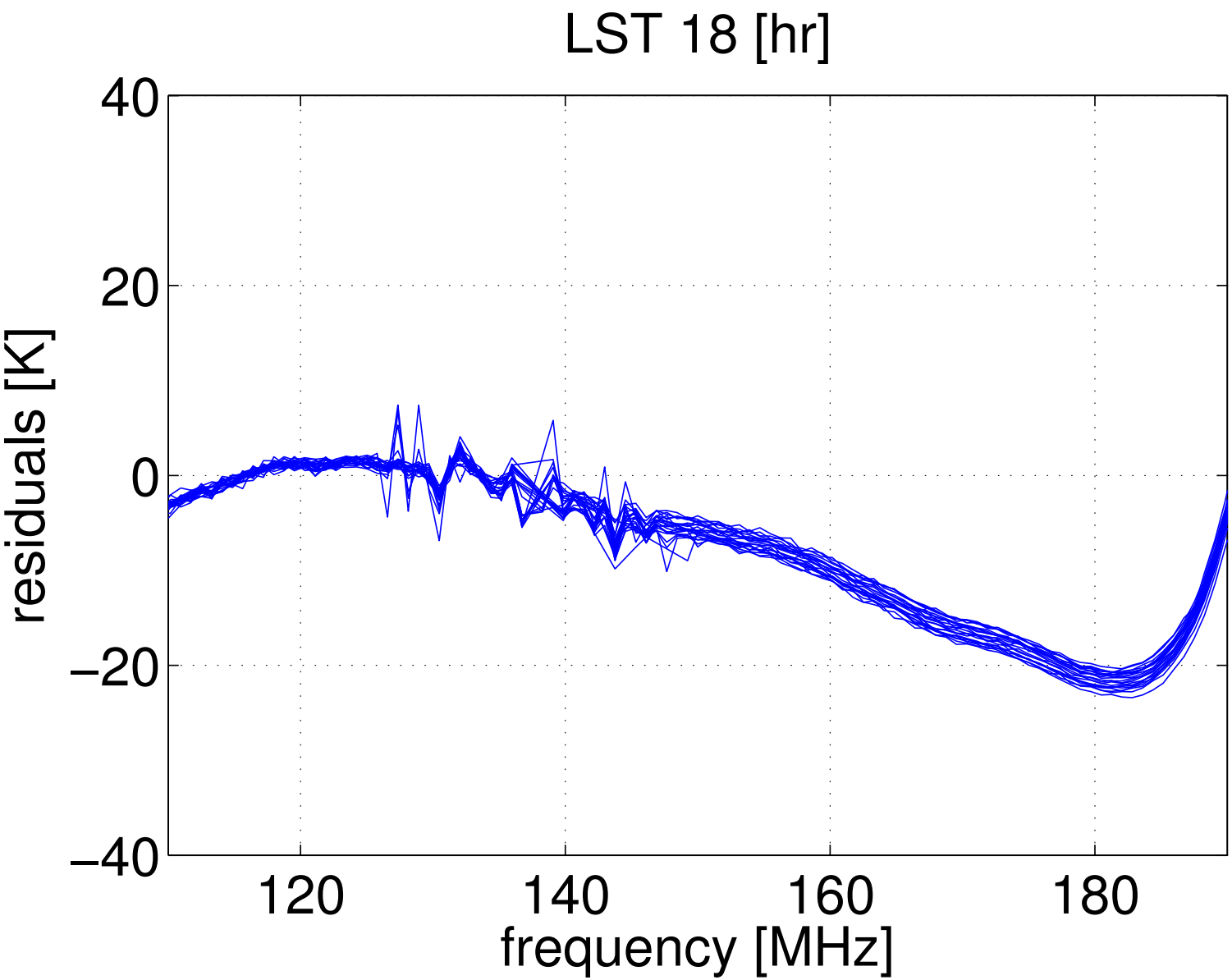
LST 18 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (18)

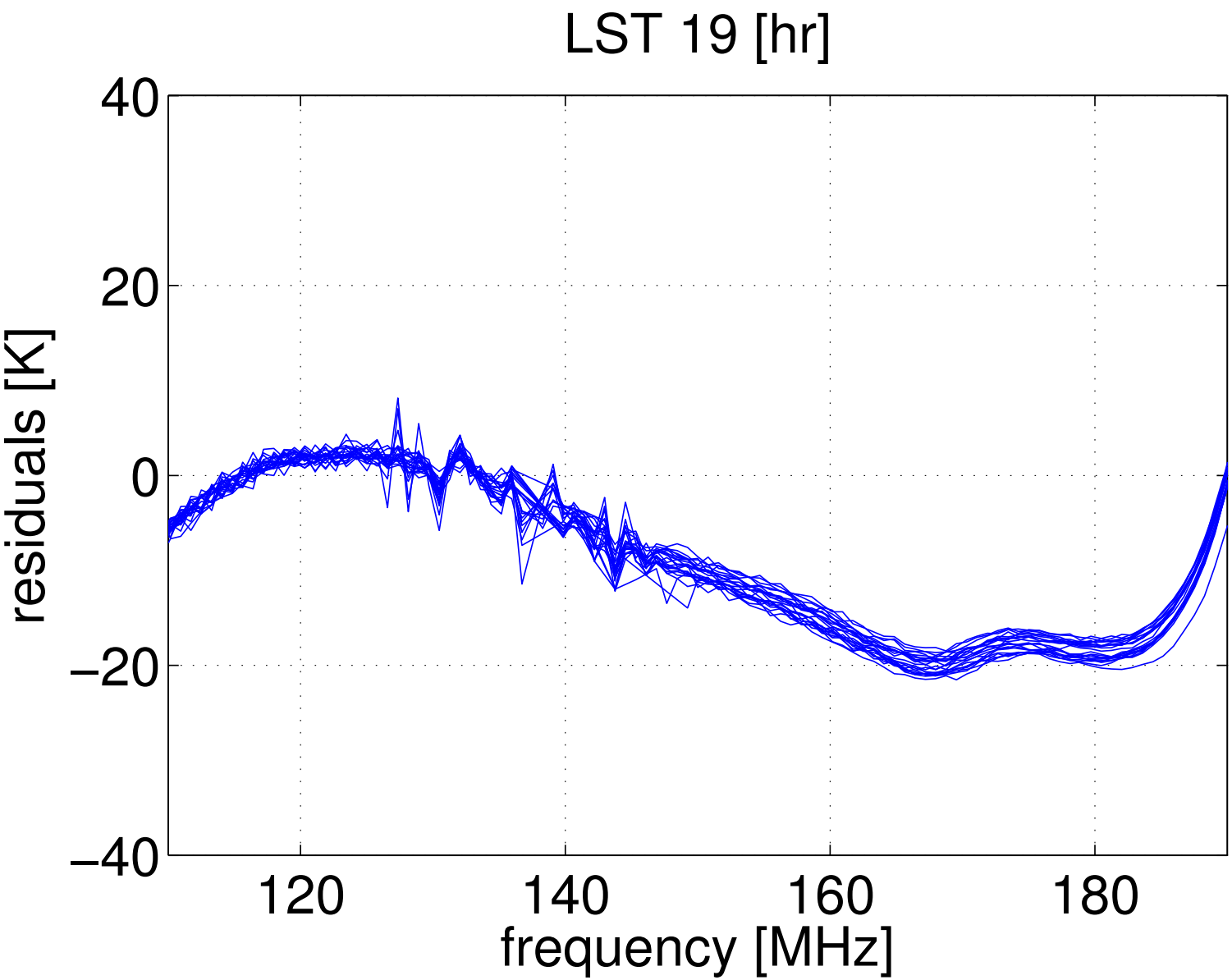
LST 19 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (19)

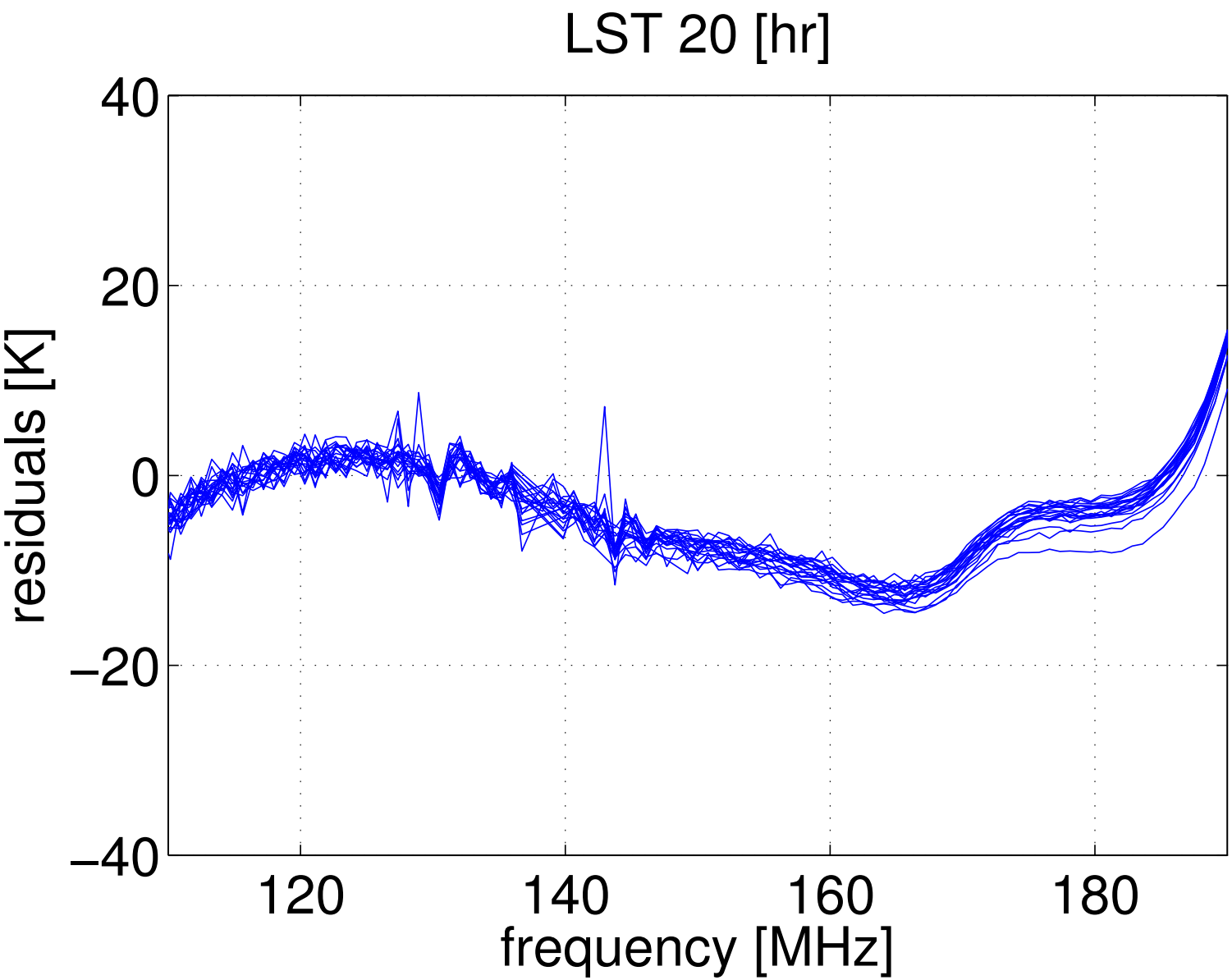
LST 20 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (20)

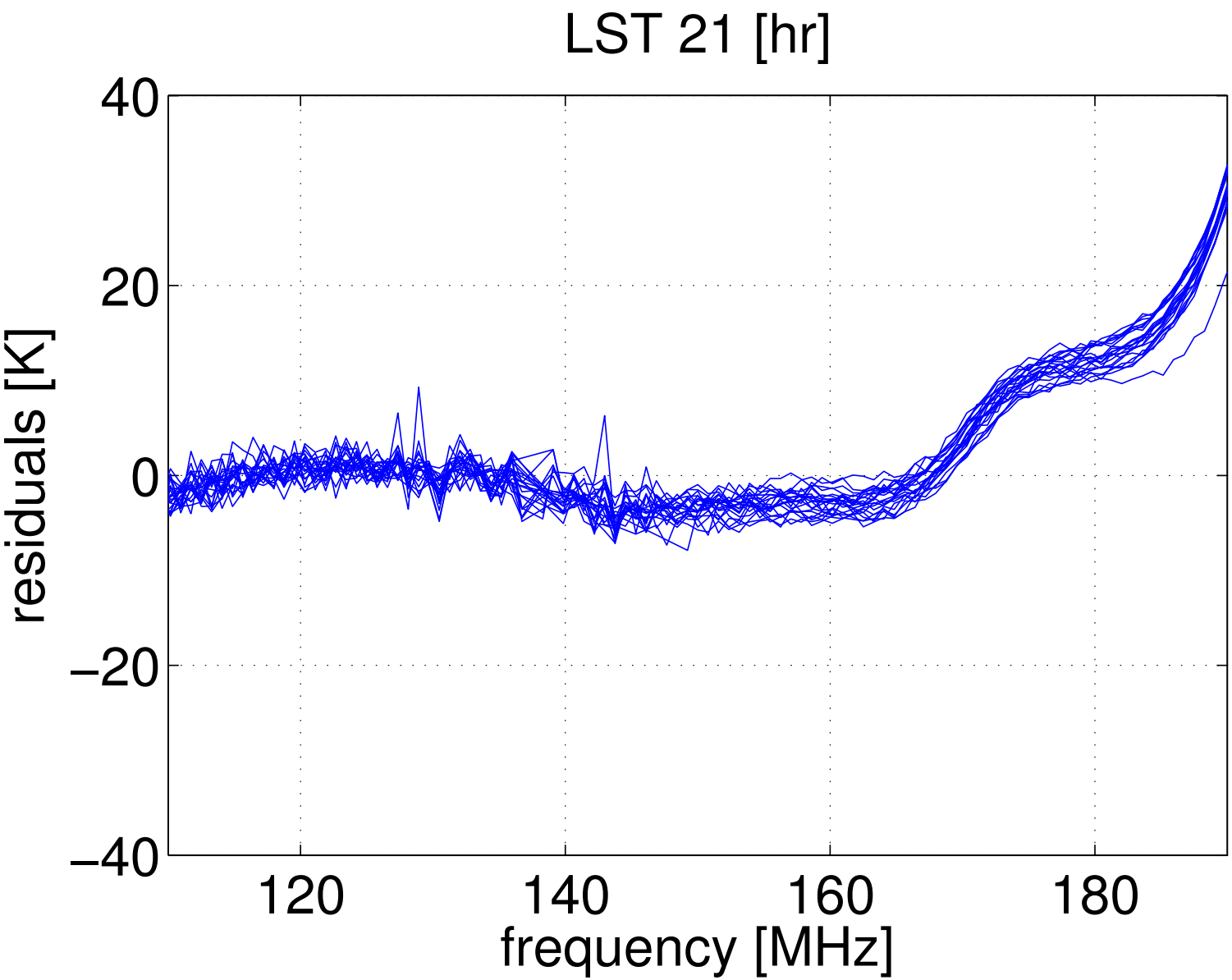
LST 21 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (21)

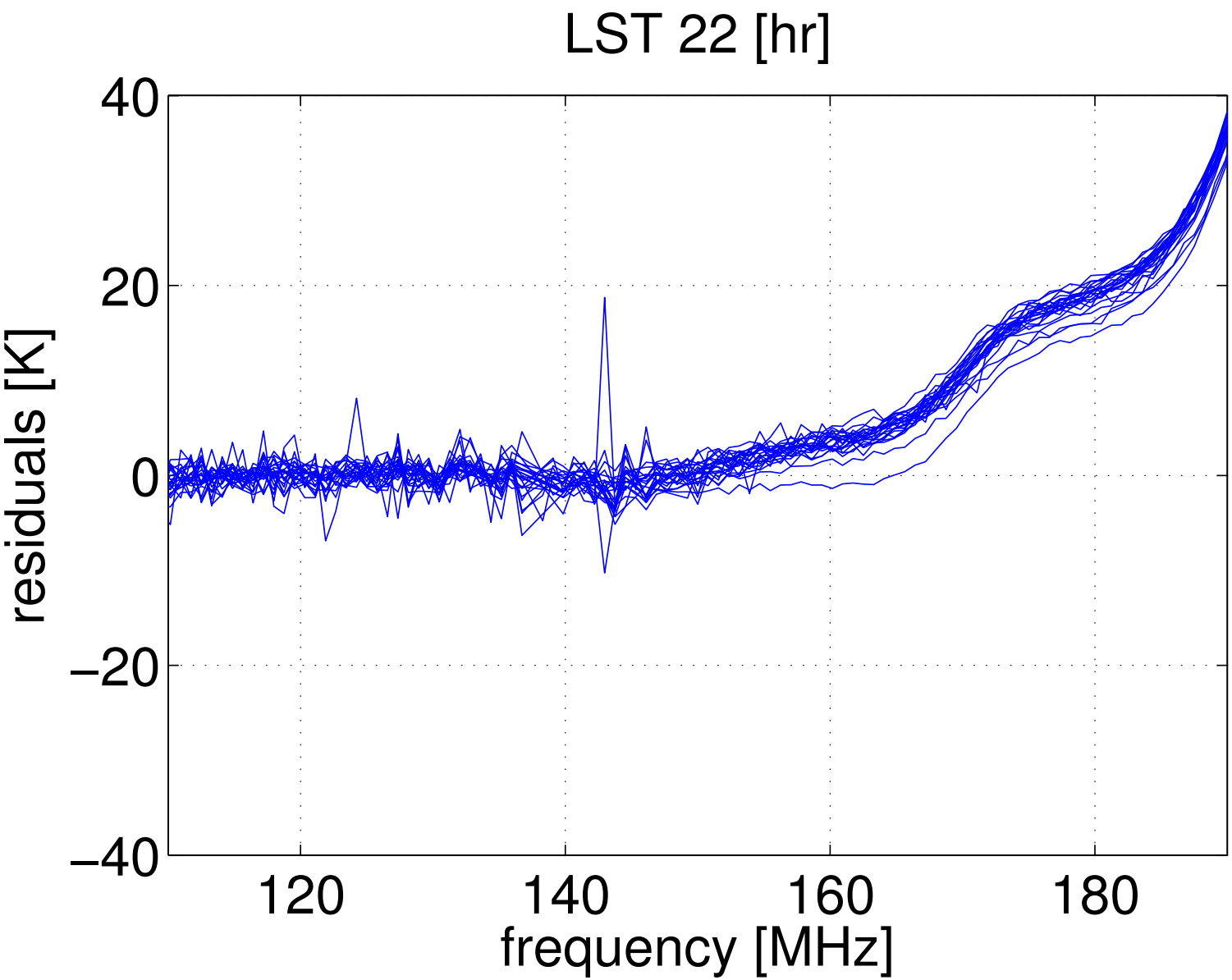
LST 22 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (22)

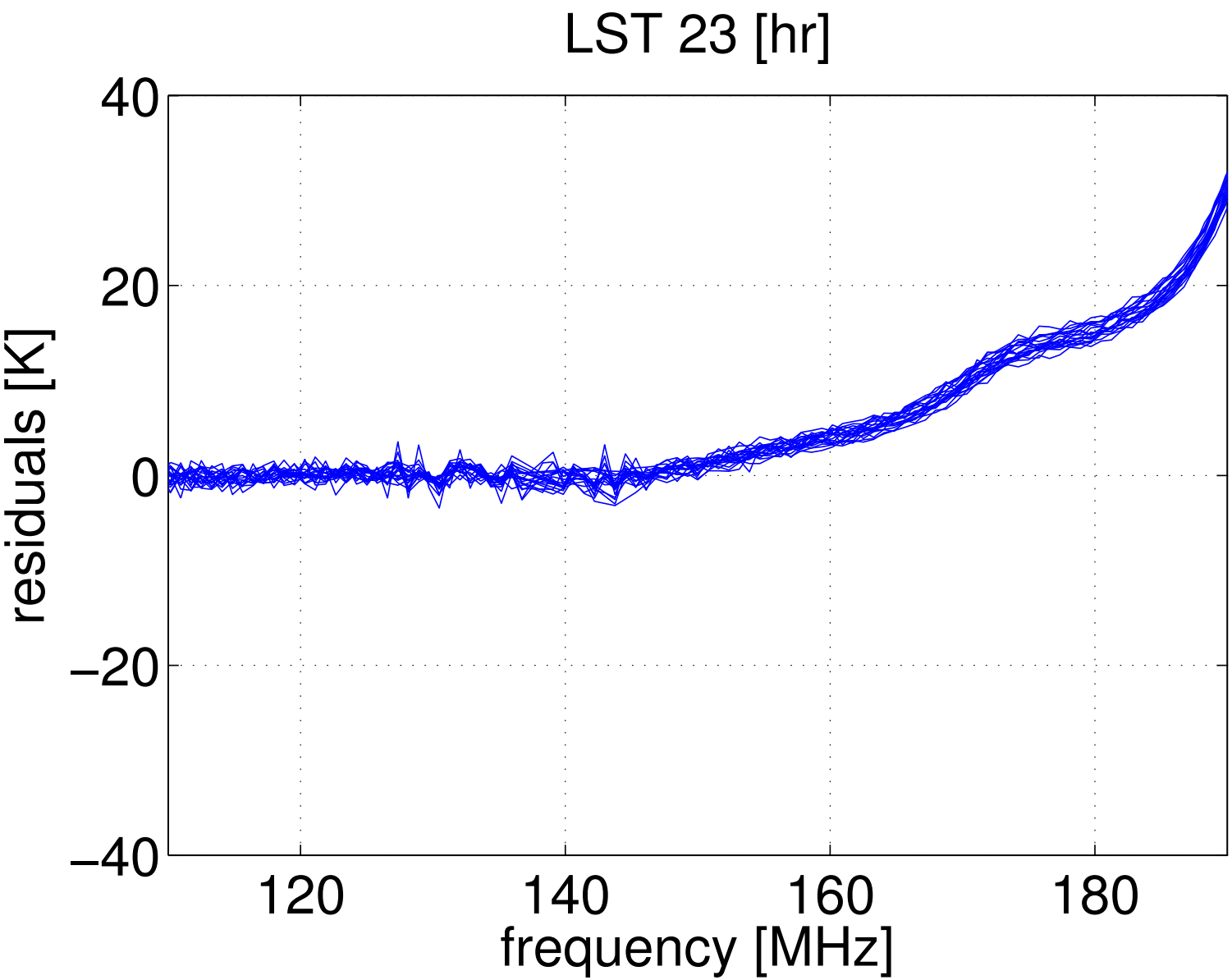
LST 23 [hr]
40
20
0
−20
−40
residuals [K]
120
140
160
180
frequency [MHz]

Figure : (23)

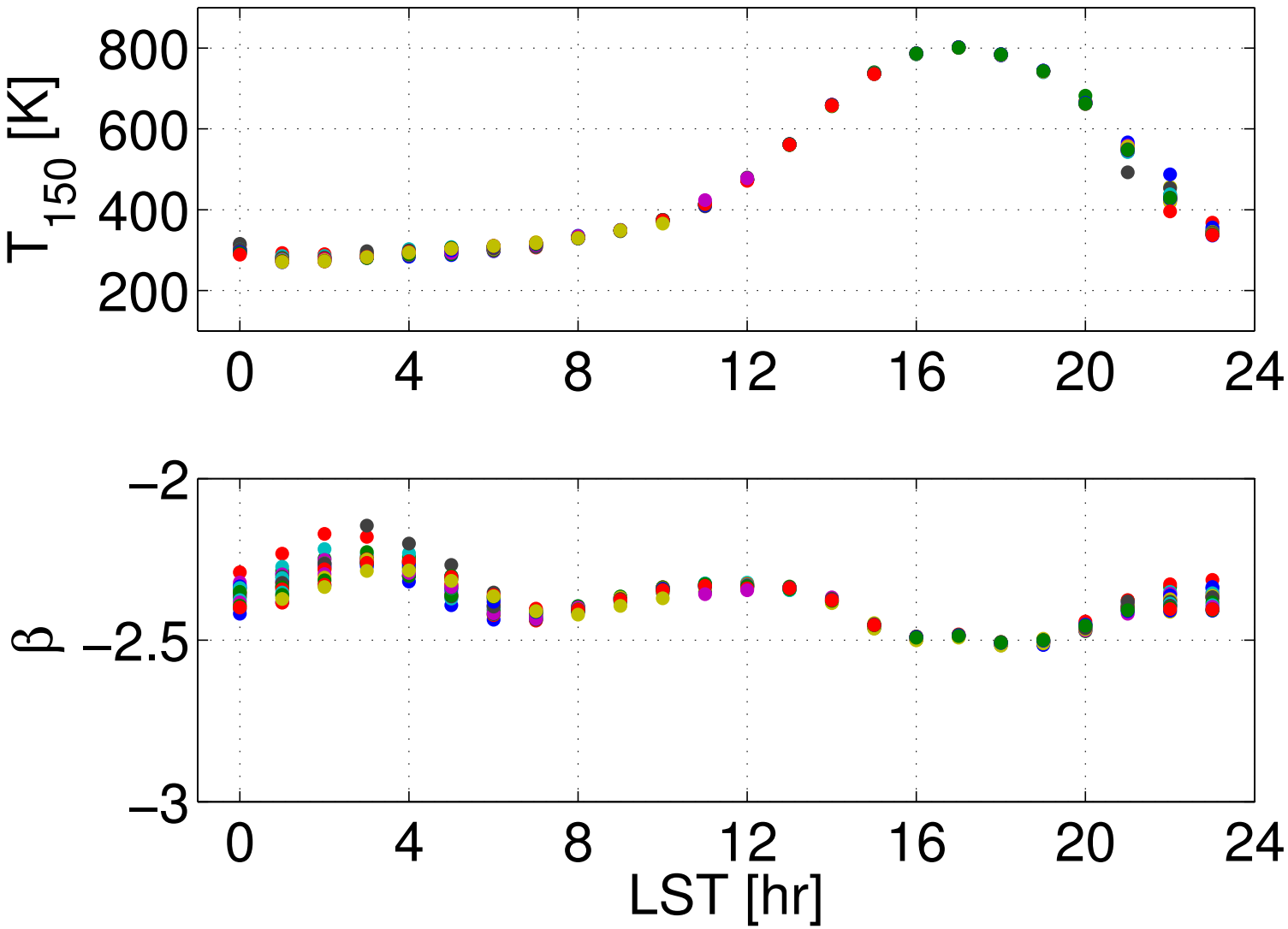

Figure : (24)

Conclusions

As expected due to the way the power-law model was fitted, figures 0 through 23 show low level residuals below 140 MHz. Also, up to $\sim$ 150 MHz there is remaining RFI that was not detected and excised by my current filter, but is noticeable in 1-hour-average traces.

In general, there is repeatable behavior between different days when observing the same part of the sky, which is appreciated mostly above 150 MHz. The shape of the residuals evolve with LST, and is self-consistent in the sense that the shape at 00 LST is the continuation of the trend coming from 23 LST. Above 150 MHz, the residuals have a negative peak when the galactic center is overhead, between 17 and 18 LST, and a positive feature during transit of the anticenter. The transition between a positive and a negative feature involves the development of a *knee* at $\sim$ 165 MHz, clearly identifiable between 7 and 17 LST. A second bump at $\sim$ 175 MHz develops as the galactic center descends from the zenith, between 19 and 23 LST, and the whole feature becomes positive.

Beyond the first-order consistency, the scatter between different days at a given LST has not been fully explored. For example, for hours between 01 and 07 the residuals above 150 MHz have larger scatter than below 150 MHz, while for the other times the scatter is stable across the frequency band. Although this effect is somewhat artificial (since I am forcing the lower frequencies to match the model), the difference in behavior between some hours and others is yet to be explored. For a better analysis it is necessary to remove the remaining RFI, and attempt a power-law modeling in different, maybe broader, frequency ranges.

Figure 24 serves only as a guide on the repeatability of the recovered power-law parameters for data within the 110-140 MHz range. Under these conditions, the spectral index reaches -2.5 only when the galactic center is overhead, and it becomes smaller in absolute value for other times, with an oscillatory pattern. For both, the spectral index and the reference temperature, there is less daily scatter when the galactic center is overhead. In this figure, at a given LST, each dot represents a day.