EDGES MEMO #404

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January 3, 2023

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To: EDGES Group
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Subject: Short duration RFI bursts observed with EDGES-3 at the MRO

Short duration RFI bursts have been observed in Western Australia at Boolardy in 2010 and reported in memos 55 and 58. Meteor scatter is discussed in memo 54 . RFI conditions in Oregon are discussed in memo 52. Very strong bursts of RFI from transmitters in the 50 – 120 MHz range have been observed in EDGES data on several occasions with duration shorter than the 23 second cycle time of the 3-position switch through all 3-states of 7.6 seconds. The origin of these bursts are unknown. They do not contain strong continuum so they are probably not due to lightning or the sun. They are probably too short to be due to a meteor. They are most likely due to a large micrometeorite or some particular type of "Sporadic E" cloud concentration of a compact region in the ionosphere.

Examples of these events are those with large residuals of a 3-term fit in figure 3 of memo 403 at

UTC=320_05 - UTC=320_09 16 Nov 1 to 5 pm Local Time at the MRO

I find that the large residuals seen in figure 3 at 320_06,07,08 and 09 are the result of are produced by strong short duration bursts, typically of only a single 3-position switch cycle. These events are filtered out and should not be a problem for the 21-cm signal detection. Figure 1 shows the uncalibrated spectrum of a strong burst at 2022:349:13:36:02 which is at night in the MRO data.

In addition to strong FM this burst also lights up the band with signals at 50.04 and 50.45 in the 6m ham band and a signal at 70.2 MHz which could be amateur radio propagation beacons. Without RFI excision or down weighting the very strong FM signals produce the change in shape of the residuals in order to accommodate the strong FM. The origin of these very strong reflections of radio transmissions within 2000 km is not clear but might be from short duration sporadic E producing clouds in ionosphere. Typical estimates of the ionosphere absorption at 75 MHz from 4-term fits for lowband data at the MRO from 2017_082 to 2017_119 run at about 1% compared with about 2 to 5% for the EDGES-3 data.

Figure 2 shows the spectrum of a similar burst observed by the EDGES-3 prototype in Oregon at 2019:258:23:05:02 and is also seen in waterfall plot in Figure 7 of memo 310. Looking through lowband data from 2016:330:00:00:2 I found a strong short burst shown in Figure 3 but I found no strong bursts from the first few days of 2017 so this suggests that the occurrence is probably from seasonal large meteorites or particular conditions in the ionosphere which depend on season.

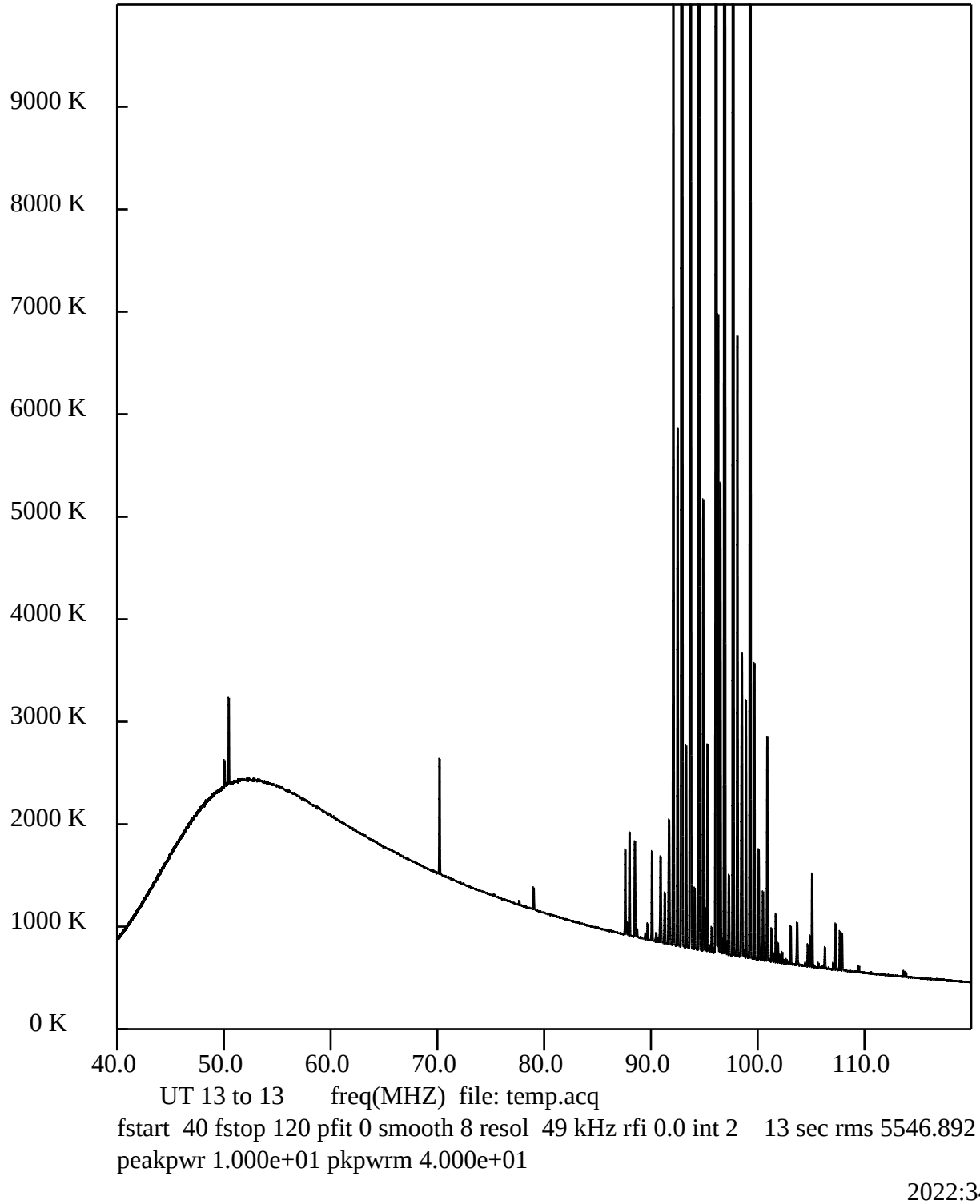

Figure 1. Uncalibrated spectrum of a strong burst at 2022:349:13:36:02 in the MRO data.

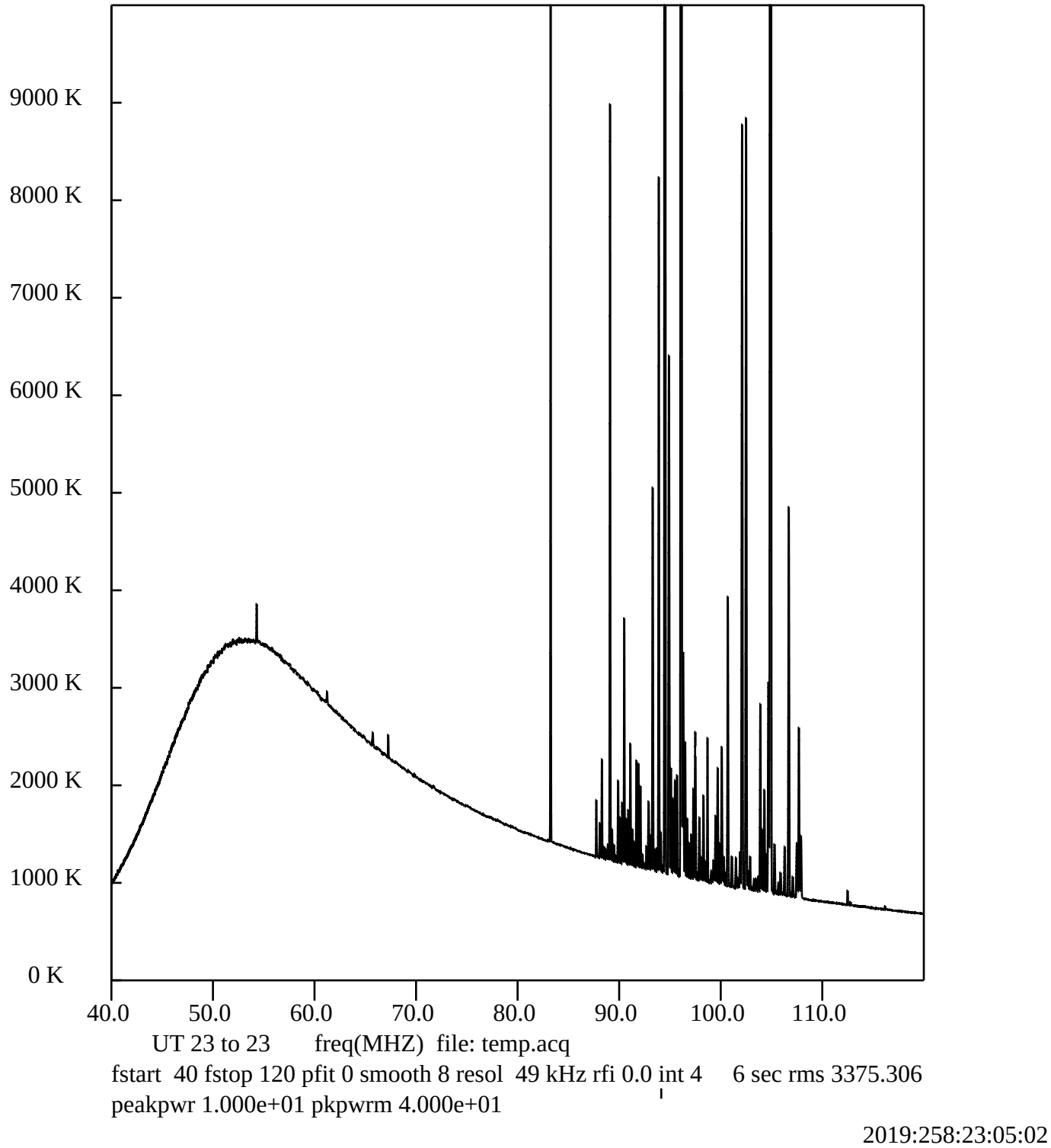

Figure 2. Uncalibrated spectrum of a strong burst at 2019:258:23:05:02 in EDGES-3 in Oregon.

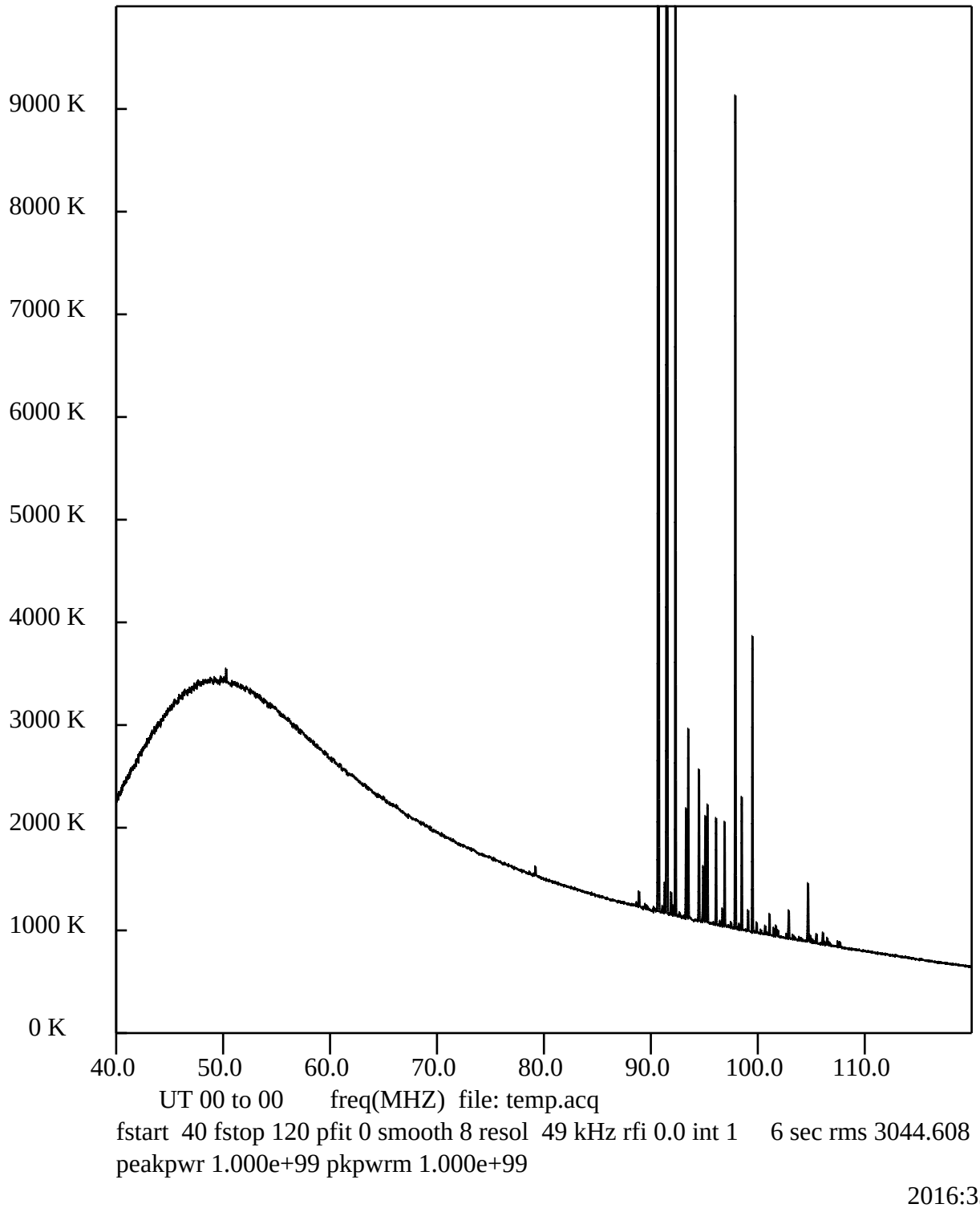

Figure 3. Uncalibrated spectrum of a strong burst at 2016:330:00:00:2 in EDGES-2 lowband at the MRO.