

# **ATA 2022 RFI Survey**

## **Data Analysis**

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# 2022-03-10: Updates

- All 28 observing sessions complete!
  - Trying the “track\_az\_el()” call multiple times fixed the issues at 6am, but the issue was strangely repeatable
    - Always the 8800 MHz tuning
    - Every day at 6am
    - Failed the first time and worked the second
    - Is there a mechanical movement associated with the >8800 MHz central frequency?

	<b>Sun</b>	<b>Mon</b>	<b>Tue</b>	<b>Wed</b>	<b>Thu</b>	<b>Fri</b>	<b>Sat</b>
12am							
6am							
12pm							
6pm							

- 28 sessions x 16 slews (v's) per session = 448 individual files
- Slightly fewer because we lost 1a and 1f for some of the weekend sessions

# 2022-03-10: Updates

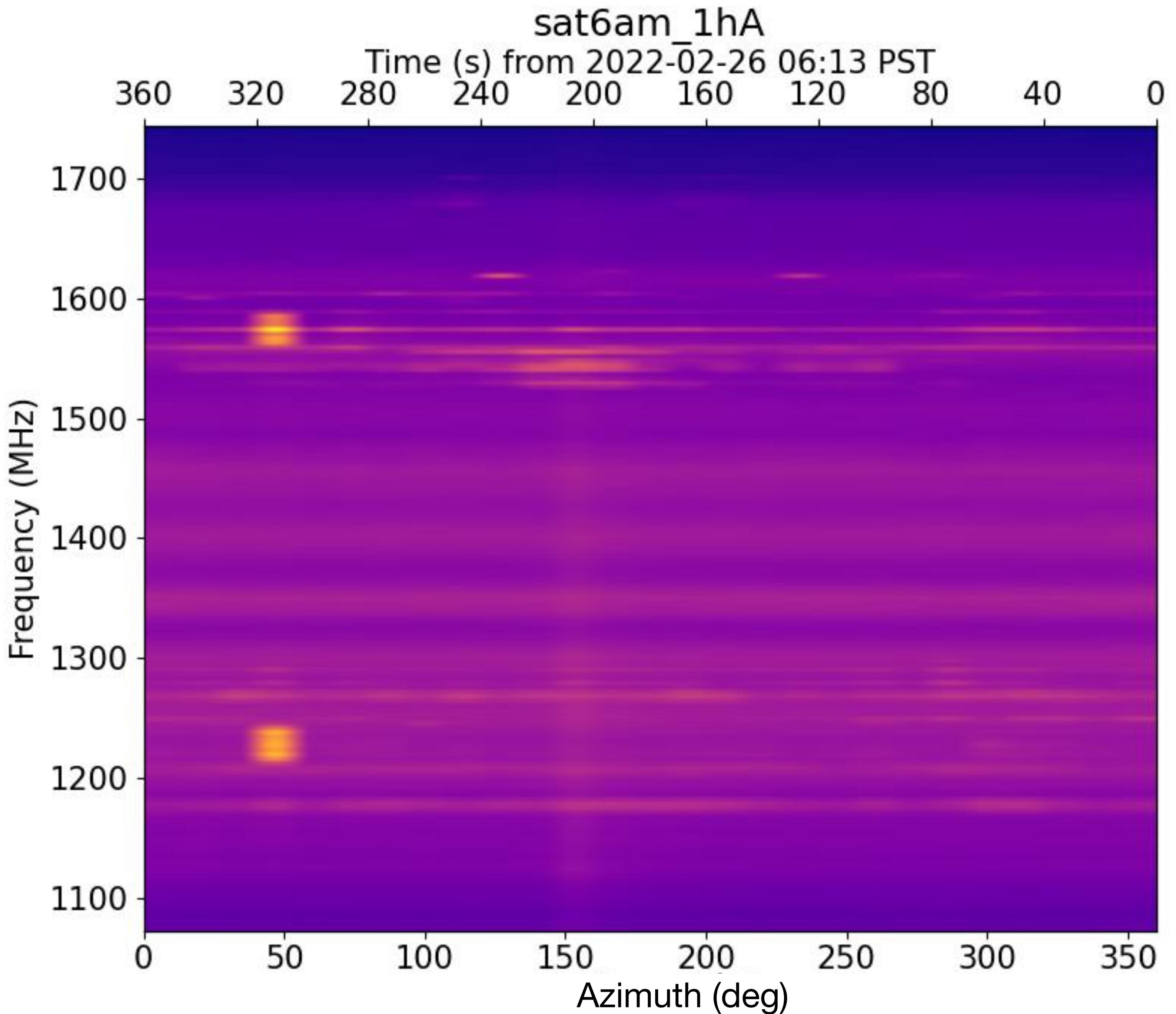
- Data quality checks complete
  - Most files are exactly the expected size
  - Thurs. 6am and Fri. 6am have data recording inconsistencies in a single slew each (2/448)
    - Recording started <1 second AFTER the slewing began
    - Lost <1 degree of data in each of the 2 slews
    - Different v's, different delay time: seems like a fluke
    - Minor issue, forged ahead

# 2022-03-10: Updates

- Made 16-grid (all slews/frequencies for a given session) plots for each session to qualitatively assess azimuthal features and data quality
- Checked each of the ~168 plots (28 sessions x 6 antennas) for azimuthal features - doubled as rough data quality assessment
- Flagged 163 azimuthal events
  - Which are transients and which are directional?
  - Seems like ~80% are attributable to directional azimuthal features, in 9 groups
  - 11 of them are “dark” - power dropouts?

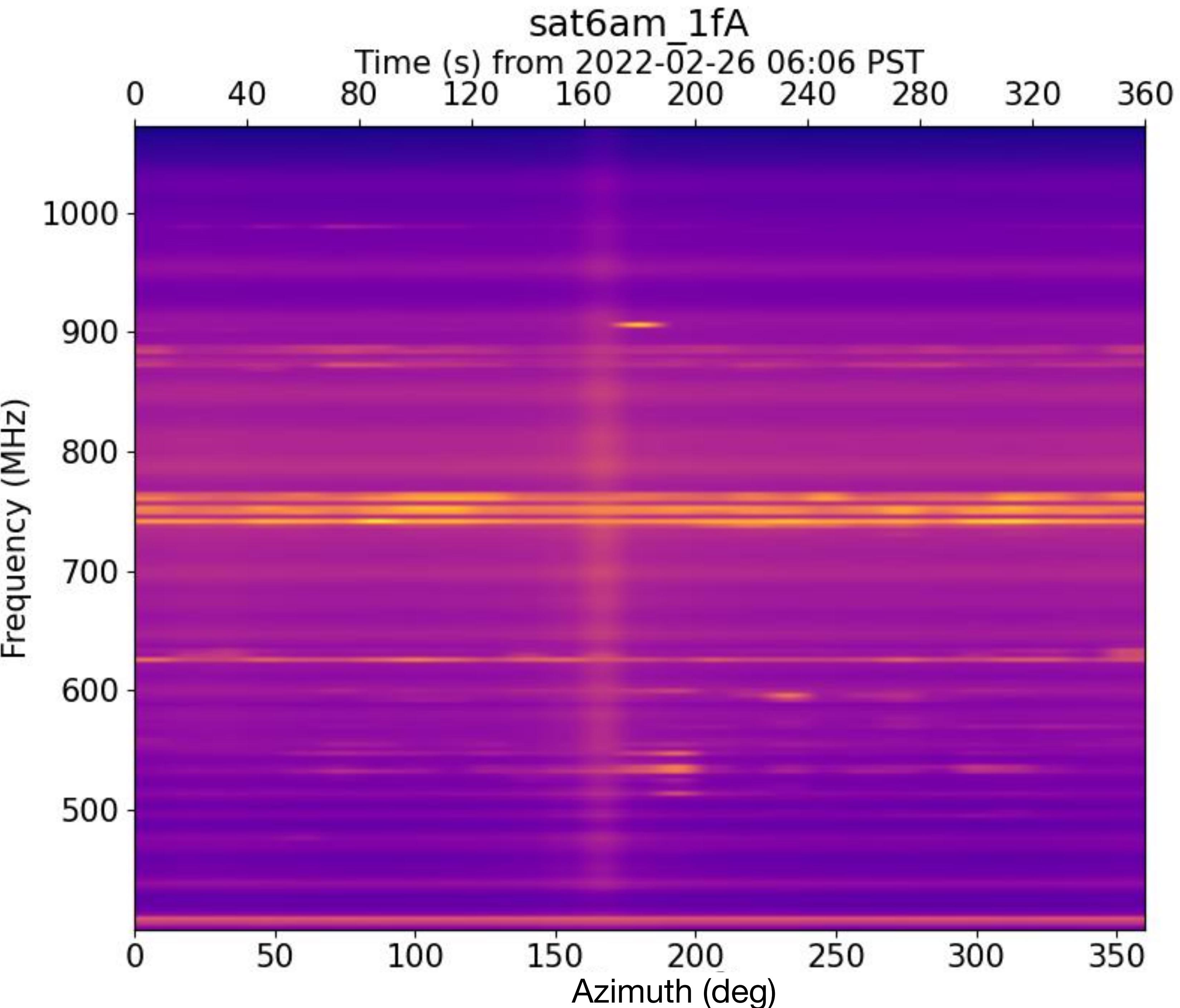
**Azimuthal Group 1: 1h, 3d, and 4j** saw a faint feature at 150 degrees azimuth at 6am on the weekend, spanning the entire 1.1-1.7 GHz range

**Source:** Map comparison doesn't recover any nearby culprits - probably a distant source?



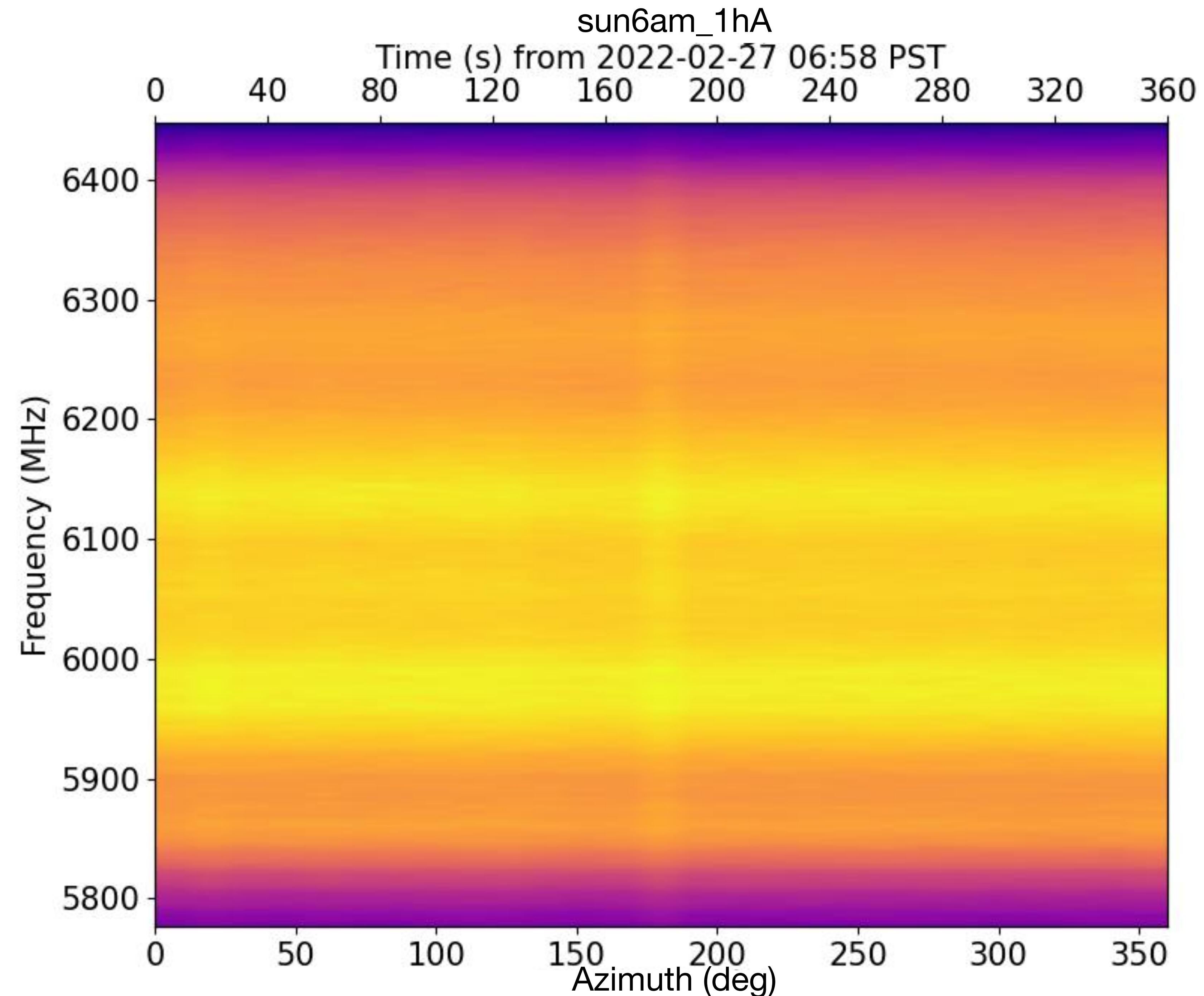
**Azimuthal Group 2: All 6 antennas see an intensity-variable feature at 160 degrees azimuth, spanning the entire 0.4-1.1 GHz range, every day of the week, generally (but not always) in the 6am scan**

**Source:** Map comparison  
doesn't recover any  
nearby culprits - probably  
a distant source?



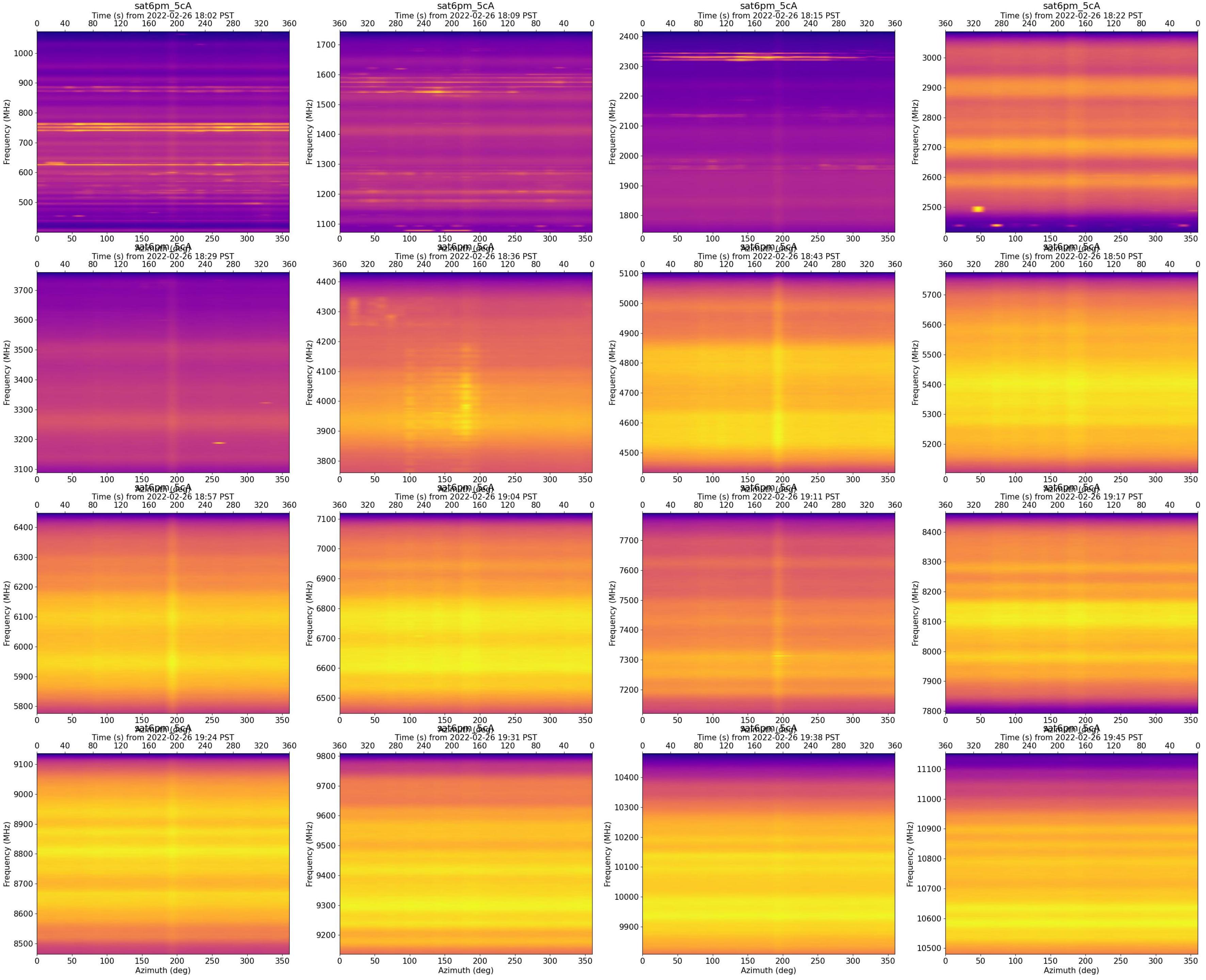
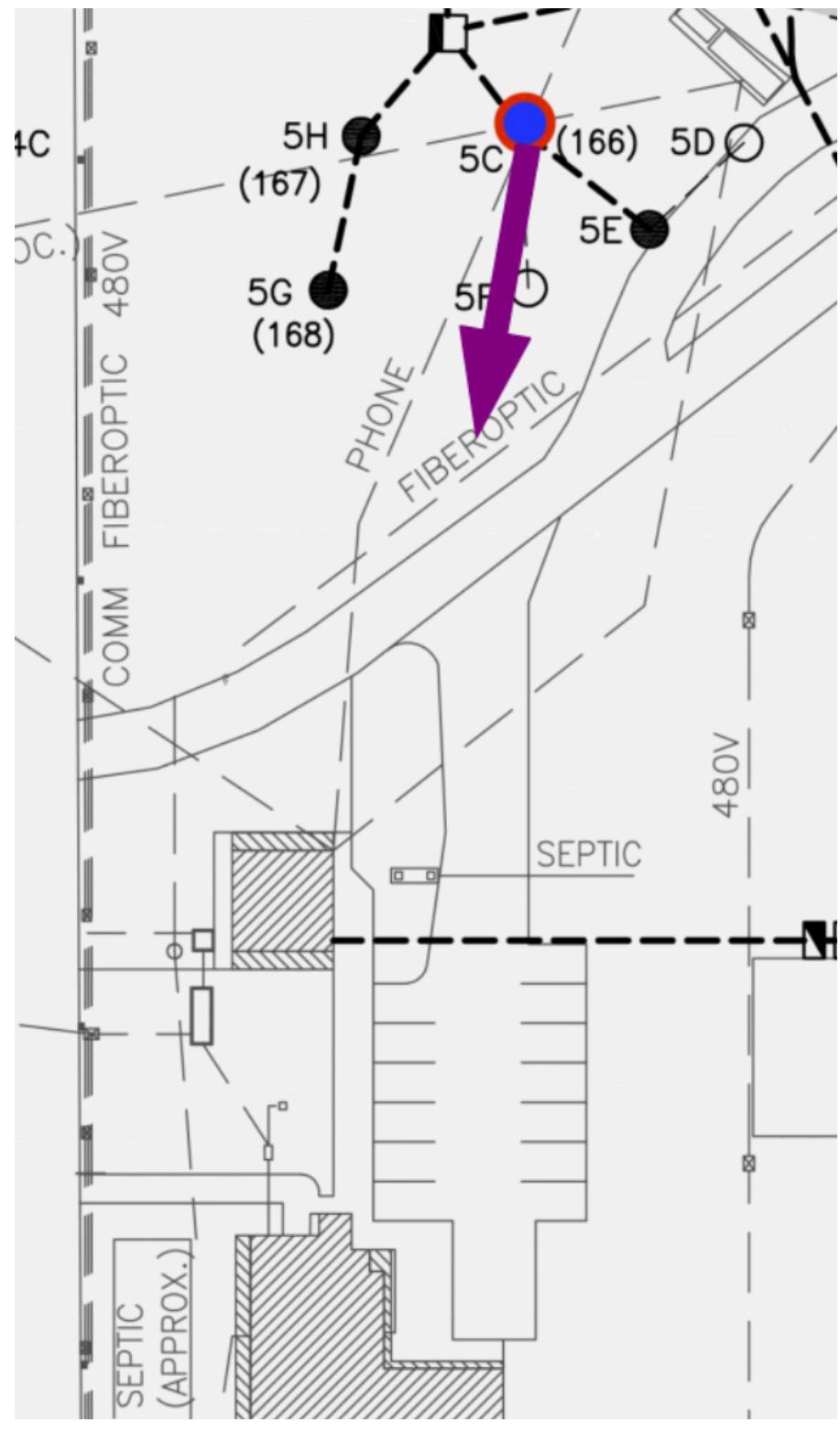
**Azimuthal Group 3: 1h, 4j, and 1f** see a faint feature at 180 degrees azimuth at 6am. On the weekend, it is at 5.8-6.4 GHz, but it may also appear on Wednesday from 4.5-5.1 GHz additionally in 3d and 1a.

**Source:** Map comparison doesn't recover any nearby culprits - probably a distant source?



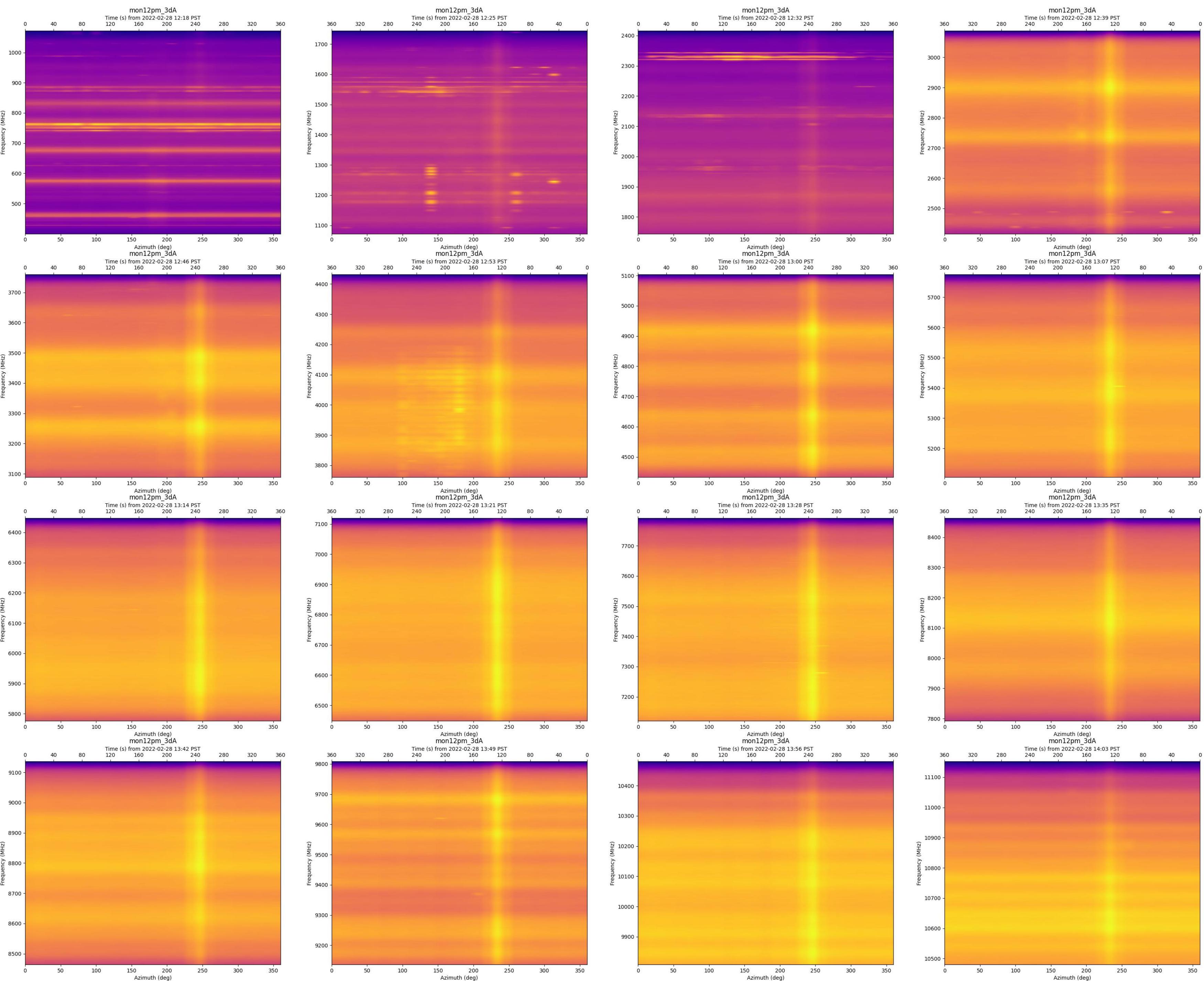
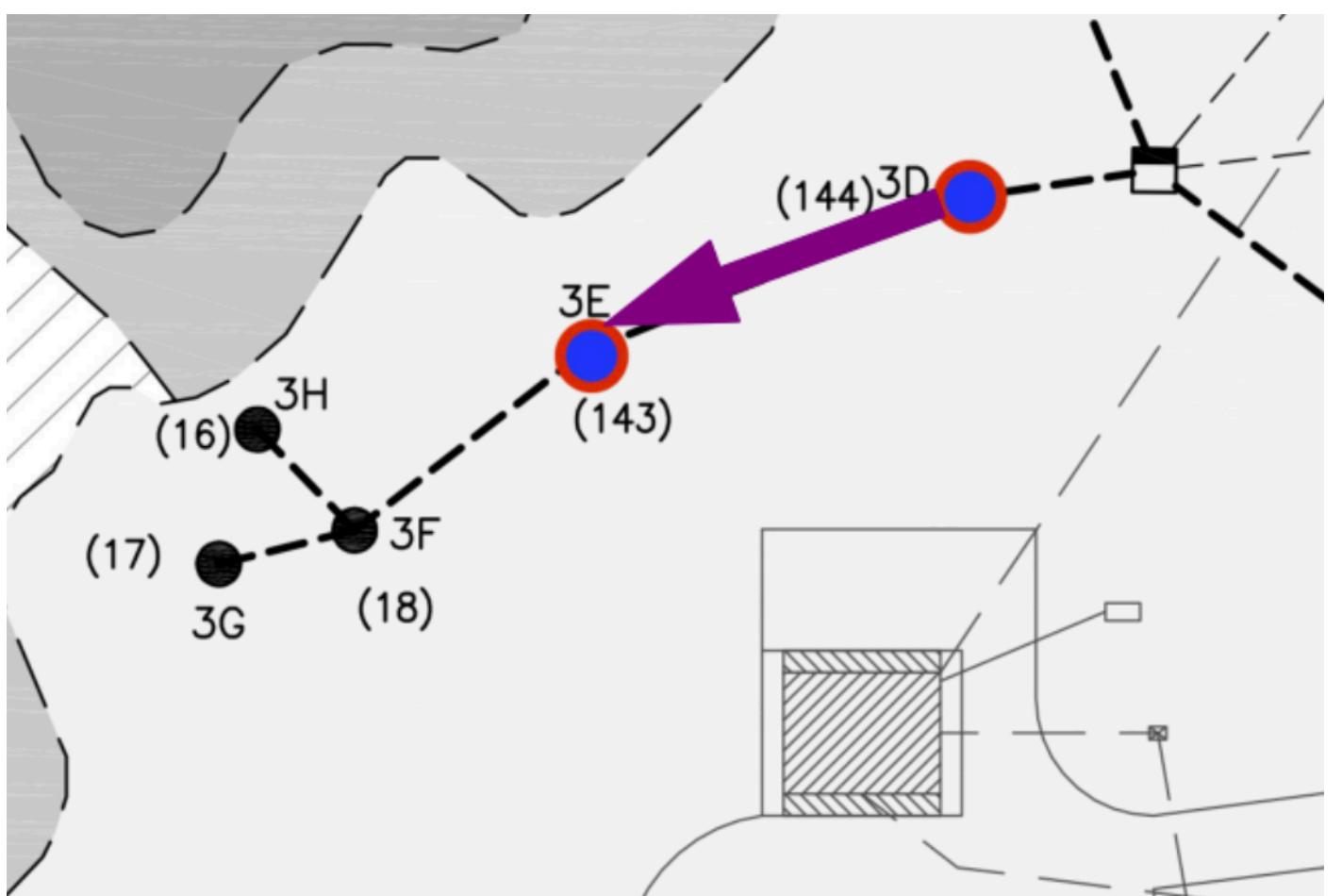
**Azimuthal Group 4: 5c**  
 always sees an azimuthal  
 feature at ~190, across  
 nearly the entire band,  
 with variable intensity

**Source: Main Lab**



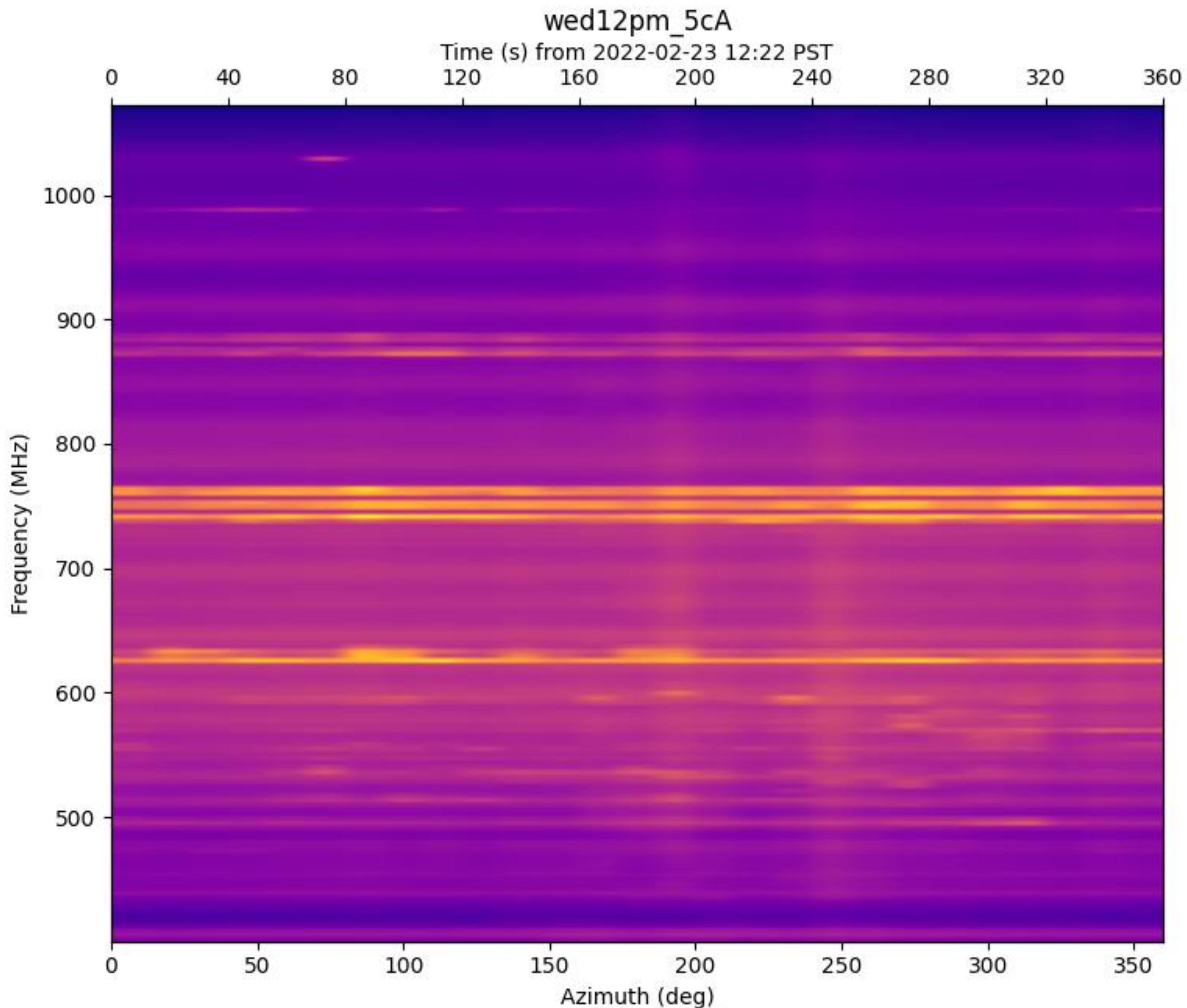
**Azimuthal Group 5: 3d**  
 always sees an extremely  
 bright azimuthal feature  
 slightly below 250  
 azimuth, across the entire  
 band, with some  
 azimuthal structure  
 (almost sidelobe-like).

**Source:** Antenna 3e



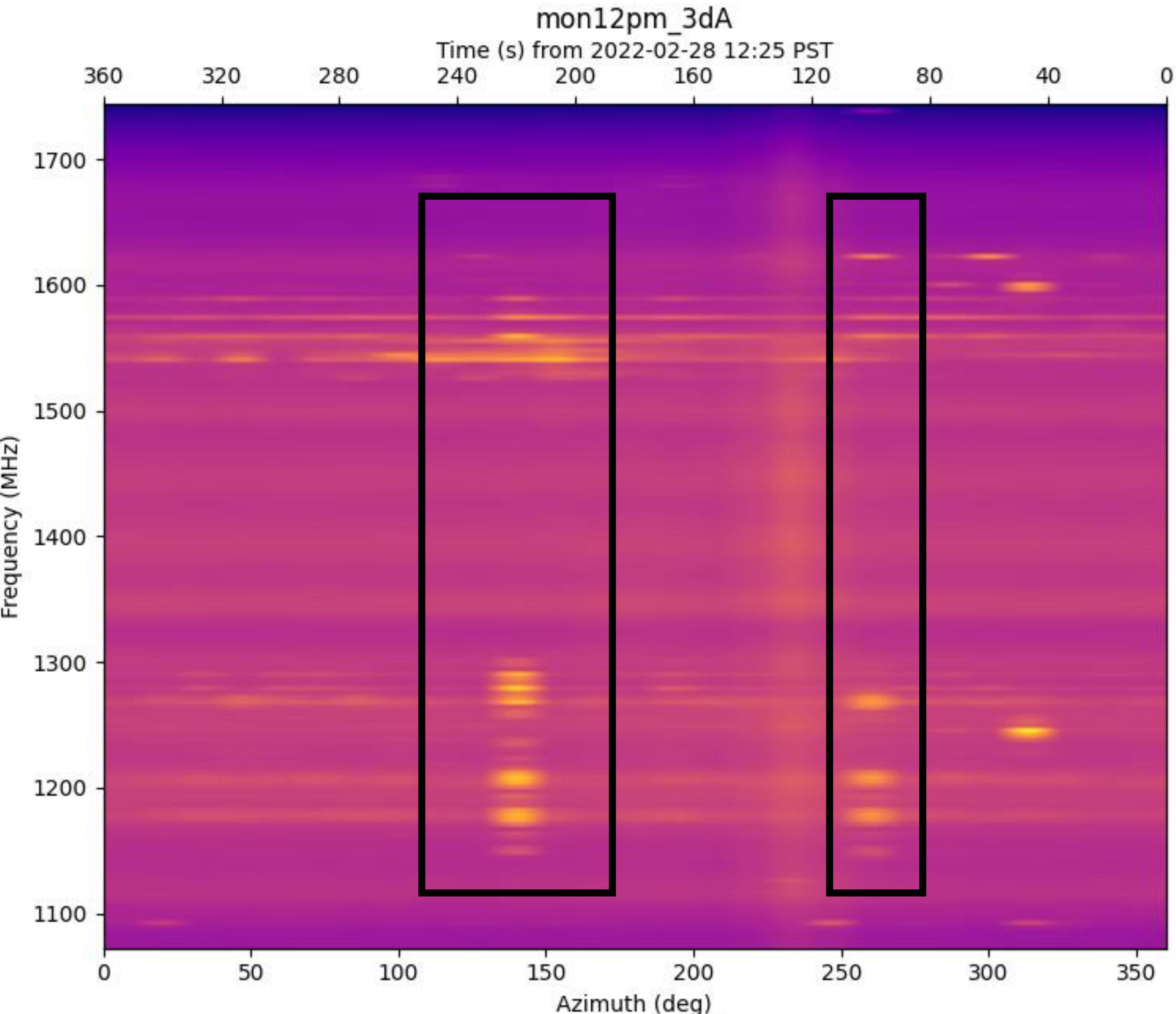
**Azimuthal Group 6:** All antennas see a moderately faint azimuthal feature slightly below 250 at noon (weekends and weekdays) from 0.4-1.1 GHz. It appears to line up with AG5.

**Source:** Map comparison doesn't recover any nearby culprits - probably a distant source?



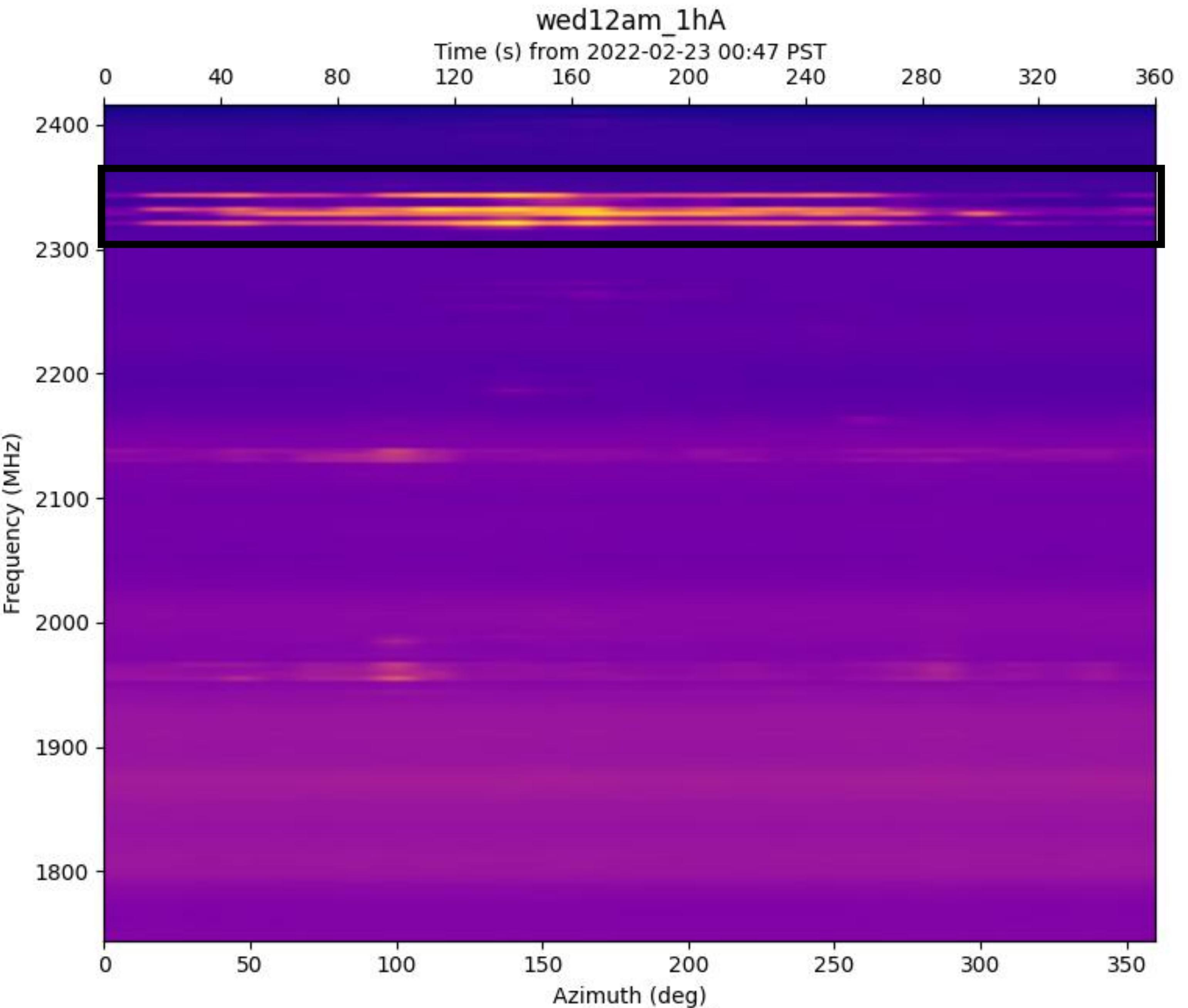
**Azimuthal Group 7:** All antennas always see a bright comb-like feature with variable azimuth in the 1.1-1.6 GHz range - likely transient / periodic and not fixed in azimuth.

**Source:** ???



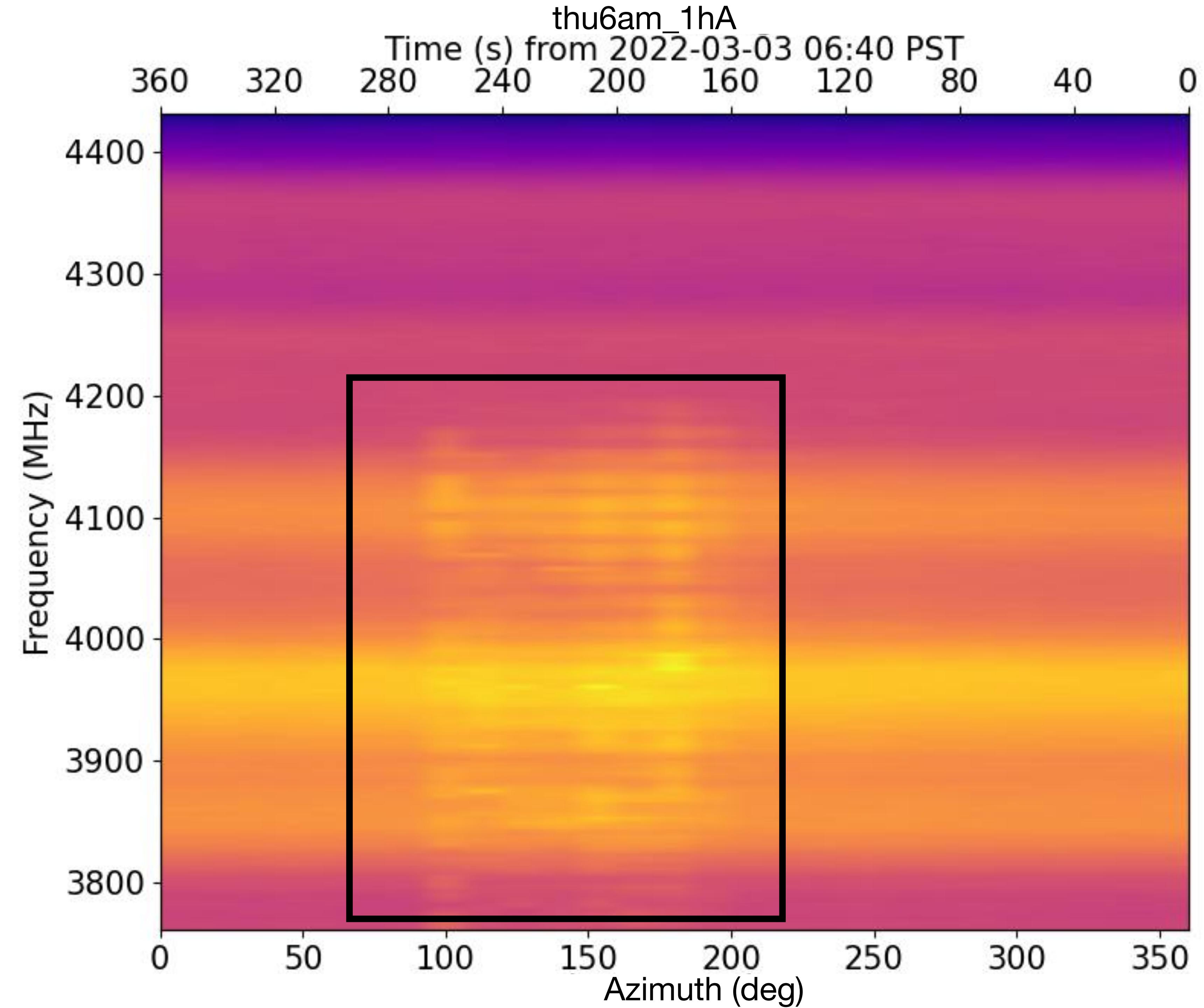
**Azimuthal Group 8:** All antennas always see an all-azimuth interferer from 2.30-2.35 GHz

**Source:** Satellite radio  
(Sirius XM) -  
geostationary



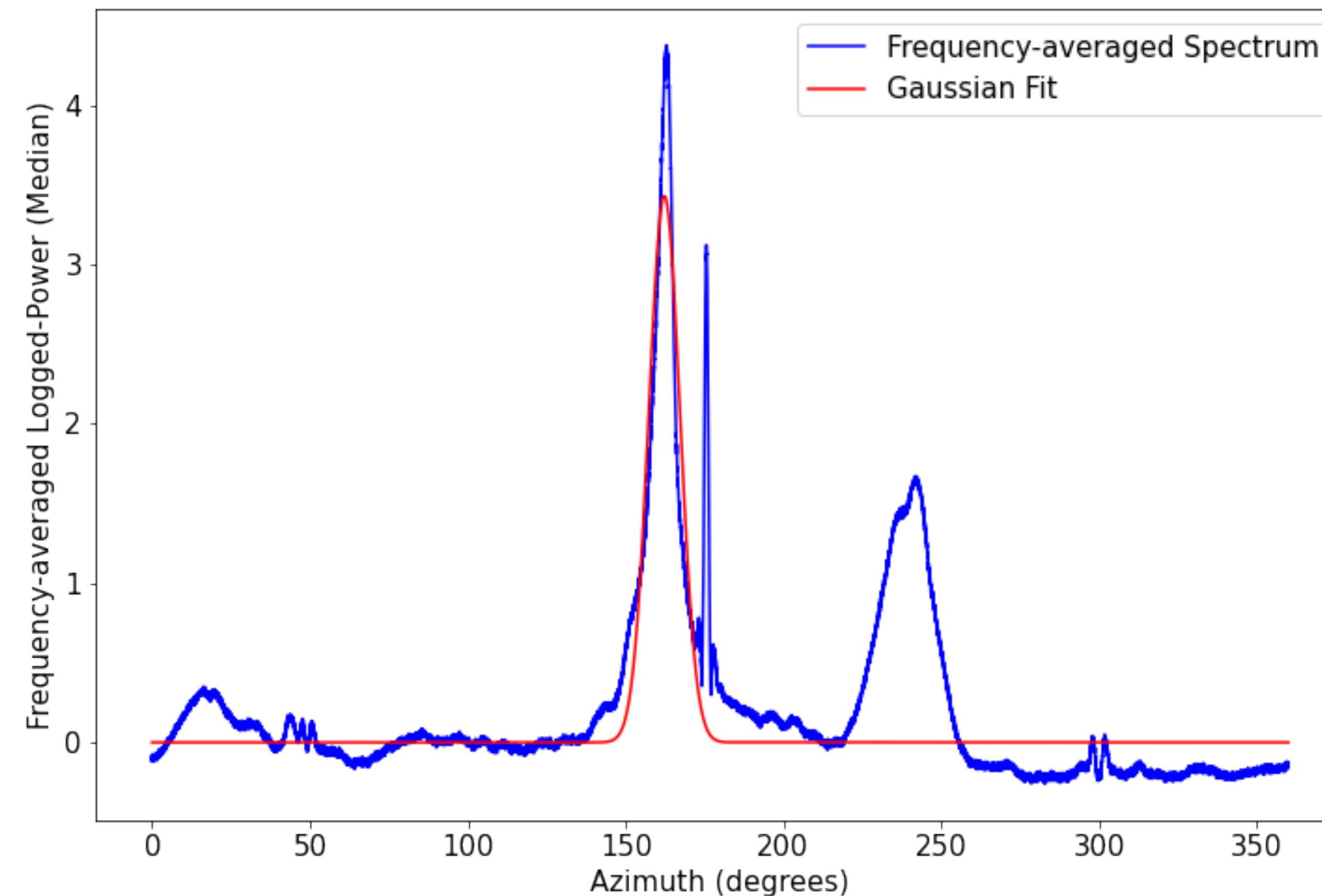
**Azimuthal Group 9:** All antennas always see a bright, comb-like interferer between 100-200 from 3.7-4.2 GHz

**Source:** C-band satellite downlinks in the geostationary arc



# 2022-03-10: Updates

- Measured azimuthal position and width of the 6 features with a “Gaussian-like” constant azimuth



	<b>Explained?</b>	<b>Gaussian Fittable?</b>	<b>Mean (deg)</b>	<b>Standard Deviation (deg)</b>
<b>AG1</b>	No	Yes	162.32	4.94
<b>AG2</b>	No	Yes	159.58	7.77
<b>AG3</b>	No	Yes	174.79	0.38
<b>AG4</b>	Lab	Yes	91.19	3.29
<b>AG5</b>	3e	Yes	239.71	10
<b>AG6</b>	No	Yes	245.05	6.74
<b>AG7</b>	No	No	-	-
<b>AG8</b>	XM	No	-	-
<b>AG9</b>	Geo	No	-	-

# Results so far: 2 local features, 2 satellite bands

- Do not...
  - Point 5c at ~190 degrees azimuth at <20 degrees elevation (main lab)
  - Point 3d at ~245 degrees azimuth at <20 degrees elevation (3e)
  - Observe between 2.3-2.35 GHz (SiriusXM)
  - Observe between 3.7-4.2 GHz at 100-200 degrees azimuth (geostationary)

# 2022-03-10: Next Steps

- Try to figure out sources of the 5 remaining Azimuthal RFI Groups
  - What is in the distance at azimuth: 155, 160, 180, 250?
  - What transmits intermittently between 1.1-1.7 GHz, for ~15 sec at a time?
- Update memo with current status
- Use AOFLAGGER and rfifind to assess narrowband interferers and their spectral occupancy
  - Consider future observations (higher altitude slews? weekly scans) and how to automate them

# Automatic RFI Identification

## AOFLAGGER

- Successfully got AOFLAGGER working with the data on obs-node1... sort of...
  - Cannot actually run the aoflagger terminal command b/c of installation weirdness
  - Need to install AOFLAGGER in my own conda environment
  - Working with Wael to debug

