

**HNRAO Observing Log**  
**40.673181 N – 80.437885 W**  
**EN90sq**



**Date: 21 April 2017**

**Object: Jupiter – Io-A**

**Observer: JB/Unattended**

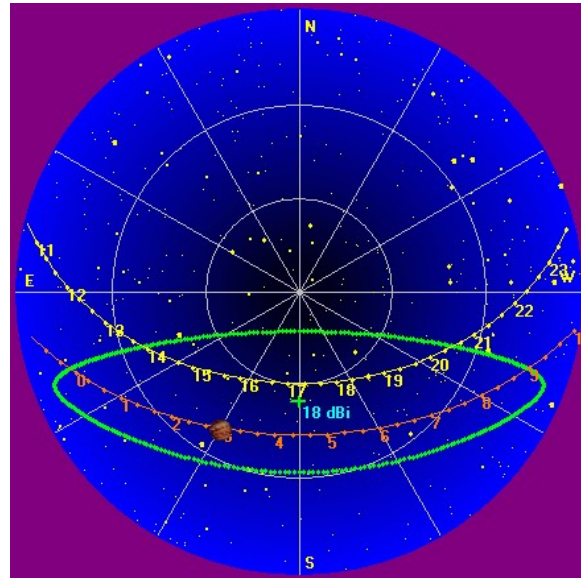
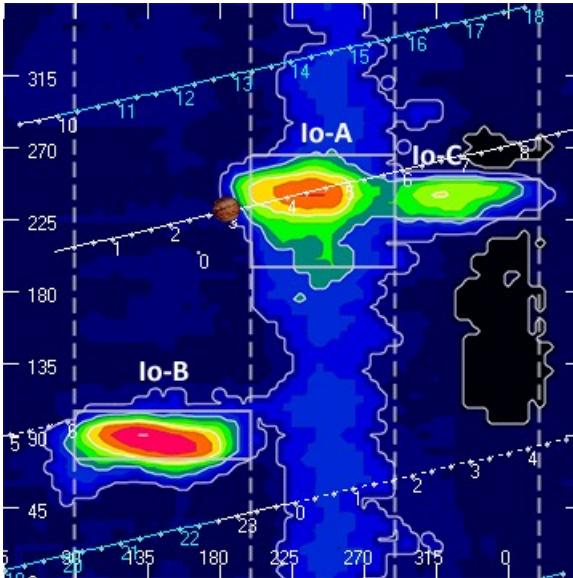
<b>Start of pass:</b>	<b>0259 UT</b>	<b>Planetary K-index:</b>	<b>1</b>
<b>Jupiter Altitude:</b>	<b>40.0 degrees</b>	<b>Jupiter Azimuth:</b>	<b>150.7 degrees</b>
<b>Jupiter CML:</b>	<b>184.79</b>	<b>Jupiter Io Phase:</b>	<b>230.32</b>
<b>Jupiter RA:</b>	<b>13:03</b>	<b>Jupiter Dec:</b>	<b>-05.02</b>
<b>Hour Angle:</b>	<b>-01:28</b>	<b>Polarization</b>	<b>RCP</b>
<b>Sun Altitude:</b>	<b>-29.5 degrees</b>	<b>Sun Azimuth:</b>	<b>321.4 degrees</b>
<b>Sun RA:</b>	<b>01:49</b>	<b>Sun Dec:</b>	<b>11:14</b>

<b>End of pass:</b>	<b>0526 UT</b>		
<b>Jupiter Altitude:</b>	<b>36.8 degrees</b>	<b>Jupiter Azimuth:</b>	<b>218.2 degrees</b>
<b>Jupiter CML:</b>	<b>309.95</b>	<b>Jupiter Io Phase</b>	<b>259.80</b>
<b>Hour Angle:</b>	<b>01:59</b>		
<b>Sun Altitude:</b>	<b>-35.4</b>	<b>Sun Azimuth:</b>	<b>022.0</b>

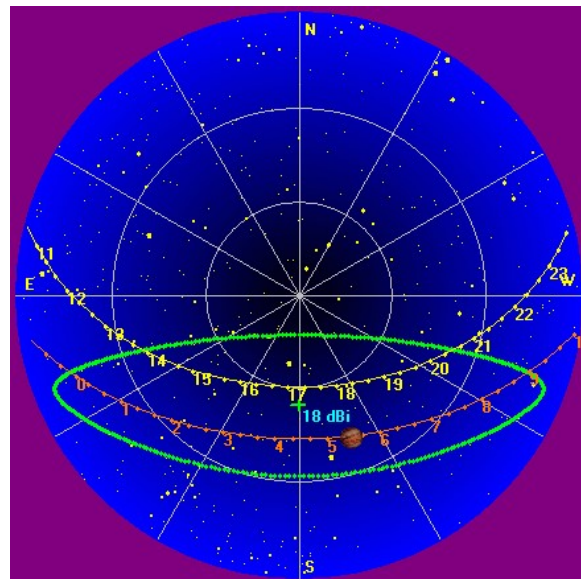
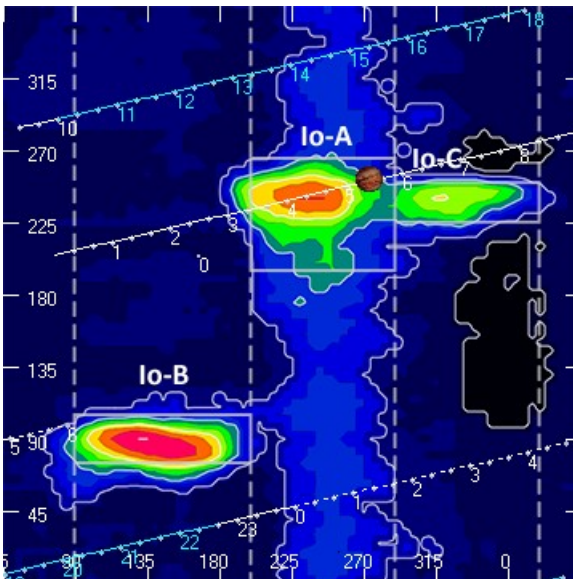
Observations made using:

1. FSX-8S fed by the TFD array
  - a. 7.7 dB loss between TFD and Multicouplers.
  - b. Connect to array through HNRAO Multicoupler #1 and #2, port 2
    - i. HNRAO Multicoupler #1 – TFD/LCP
    - ii. HNRAO Multicoupler #2 – TFD/RCP
      1. Port 1 having 10 dB of gain, all other ports have 3 dB gain.
2. FSX-2 fed by the LWA array directly
  - a. LWA element configuration – 90 degrees
3. JOVE 2 receiver fed by phased JOVE dipoles @ 13'
  - a. 12' 6" phase cable - phased for 2016-17 season
  - b. Calibrated 19 April 2017
  - c. Connected to dipoles through HNRAO Multicoupler #3, port 1.
    - i. 3.165 dB loss between Multicoupler and dipoles.
4. Icom R75 receiver fed by experimental DDRR antenna directly.
  - a. Calibrated 19 April 2017
5. SDRPlay
  - a. RSP1 (2) and RSP2 (1)

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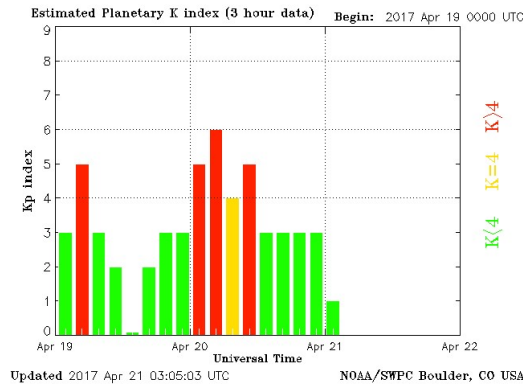


**Beginning of Pass**



**End of Pass**

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MODE	CML RANGE	Io RANGE	MAX F	POLAR	ARC	NOTES
Io-D	0-200	95-130	18	LH	Early	Also called "fourth source"
Io-B	(105 - 185)	(80-110)	39.5	RH	Early	Also called "early source"
non Io-B	80-200	0-360	38	RH	Early	Voyager info
Io-A	(200-270)	(205-260)	38	RH	Late	Also called "main source"
non-Io-A	(230-280)	0-360	38	RH	Late	
Io-C	(300-20)	(225-260)	36	RH&LH	Late	Also called "third source"
non-Io-C	300-360	0-360	32	RH&LH	Late	Voyager info

Lightning and rain during the pass manifested itself thought the observations. Lightning discharges show as bright vertical lines in the spectrograph. Heavy rain between 0515 UT and 0522 UT shows as a very bright wide vertical structure.

A center Io-A pass. The emissions started about 30 minutes earlier than expected for Io-A. All modulation lanes had a negative drift which is characteristic of Io-A. Non-Io-B modulation lanes are characteristically positive drift.

Emissions began with RCP negative drift L-bursts with negative drift modulation lanes. Activity began 0259 UT and ended 0526 UT. There was no following Non-Io-C observed.

Modulation lanes were gently curved and had a higher drift rate the higher in frequency observed. For example, measured drift rates in a 45 second period, from 0320 UT until 0320:45 and measured from 22 MHz to 18 MHz were -101 kHz/sec, -87 kHz/sec, -86 kHz/sec and -77 kHz/sec respectively. Measurements throughout the pass produced similar results. There was some weak activity recorded on SkyPipe with the Radio JOVE receiver/JOVE dipole pair at 20.1 MHz.

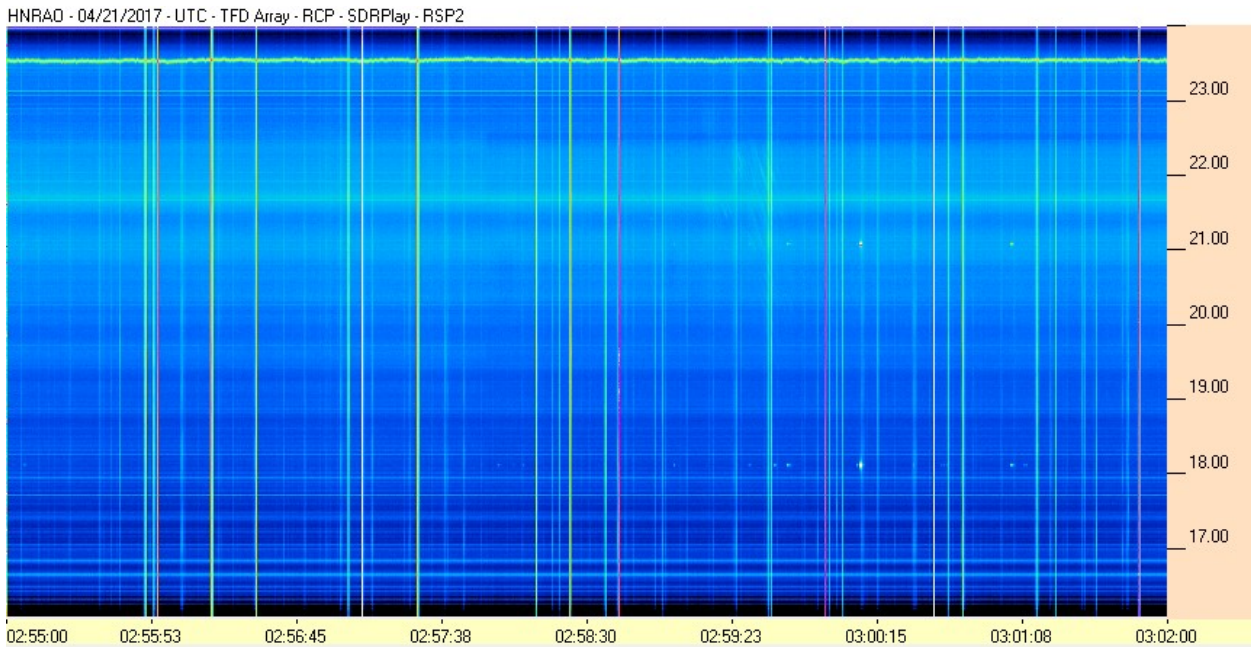
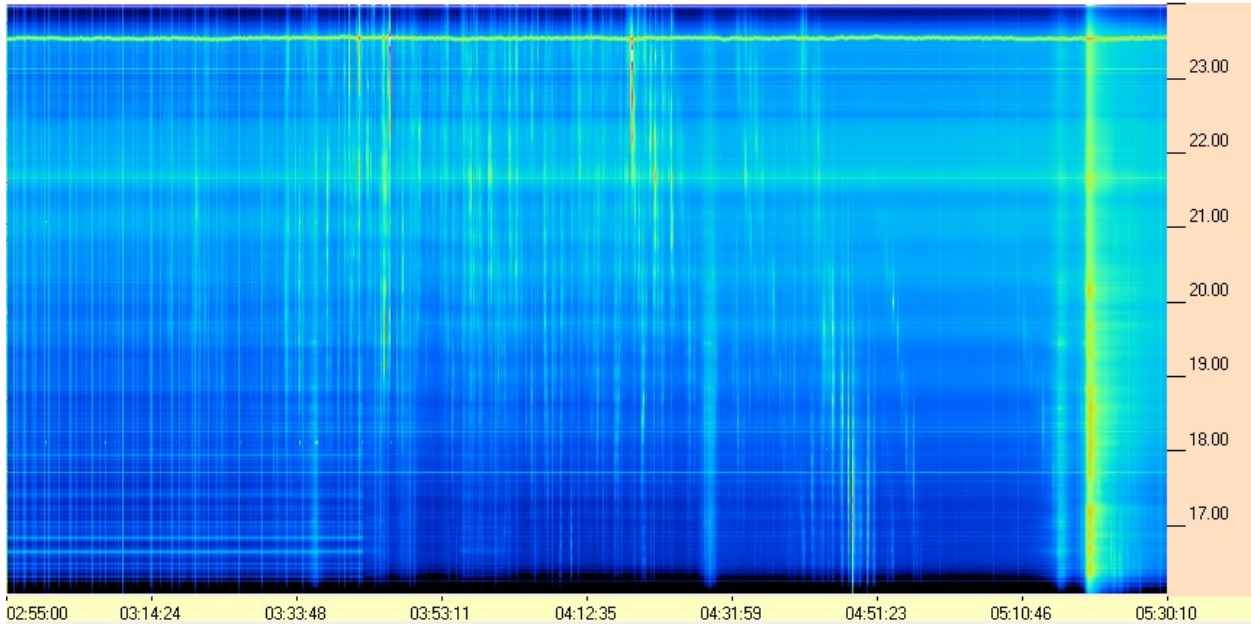
Observation notes are at the end of this report.



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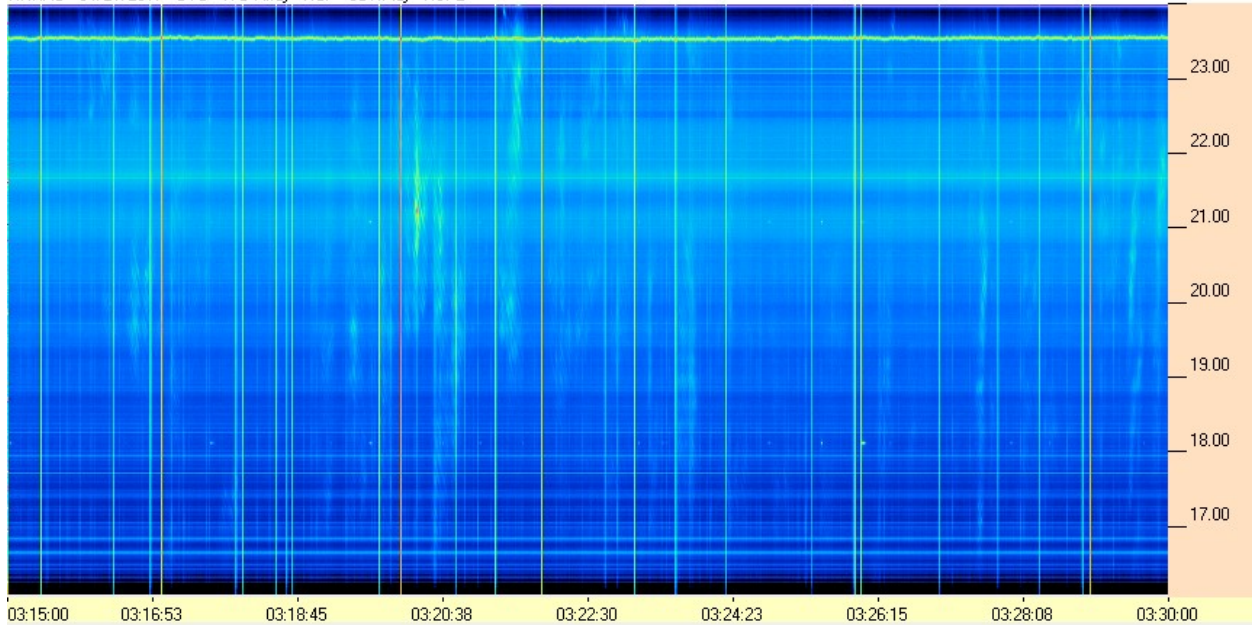
**SDRPlay RSP1/TFD Pair**  
**(header on images says RSP2, but an RSP1 unit was used)**



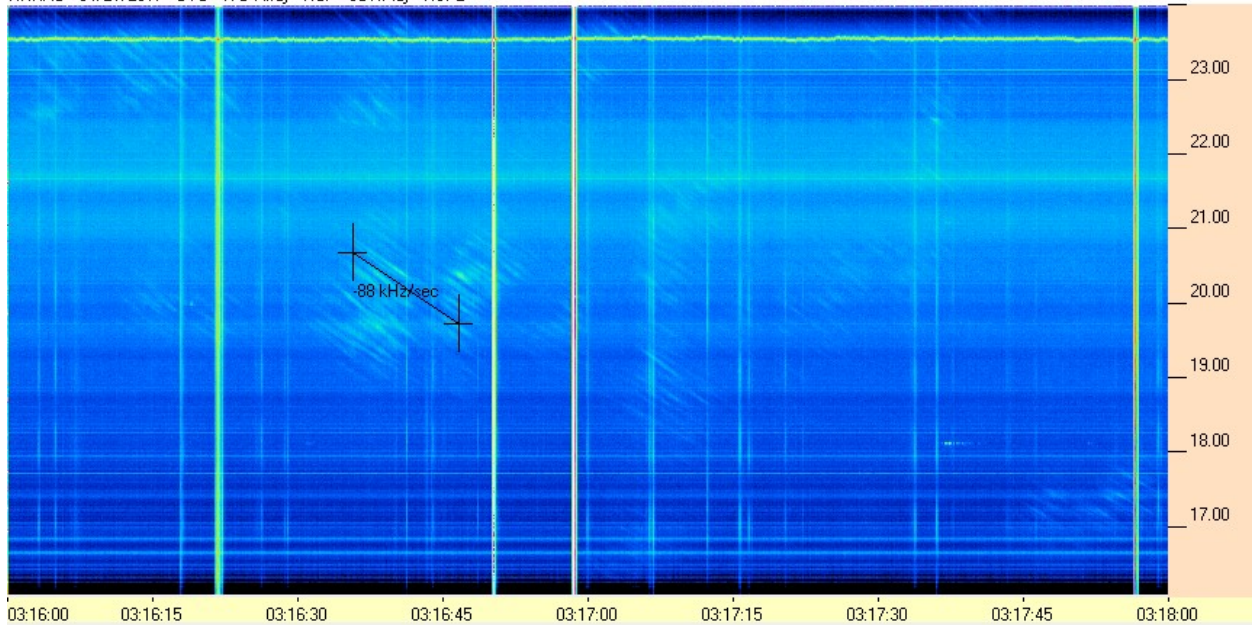
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HNRAO - 04/21/2017 - UTC - TFD Array - RCP - SDRPlay - RSP2



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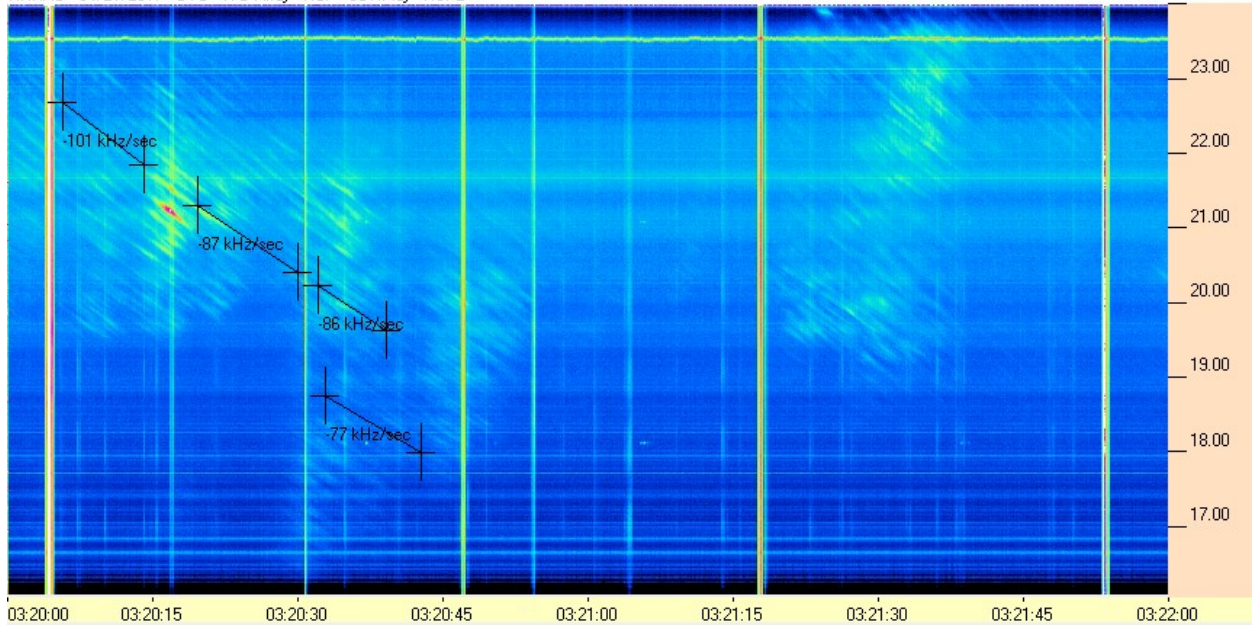




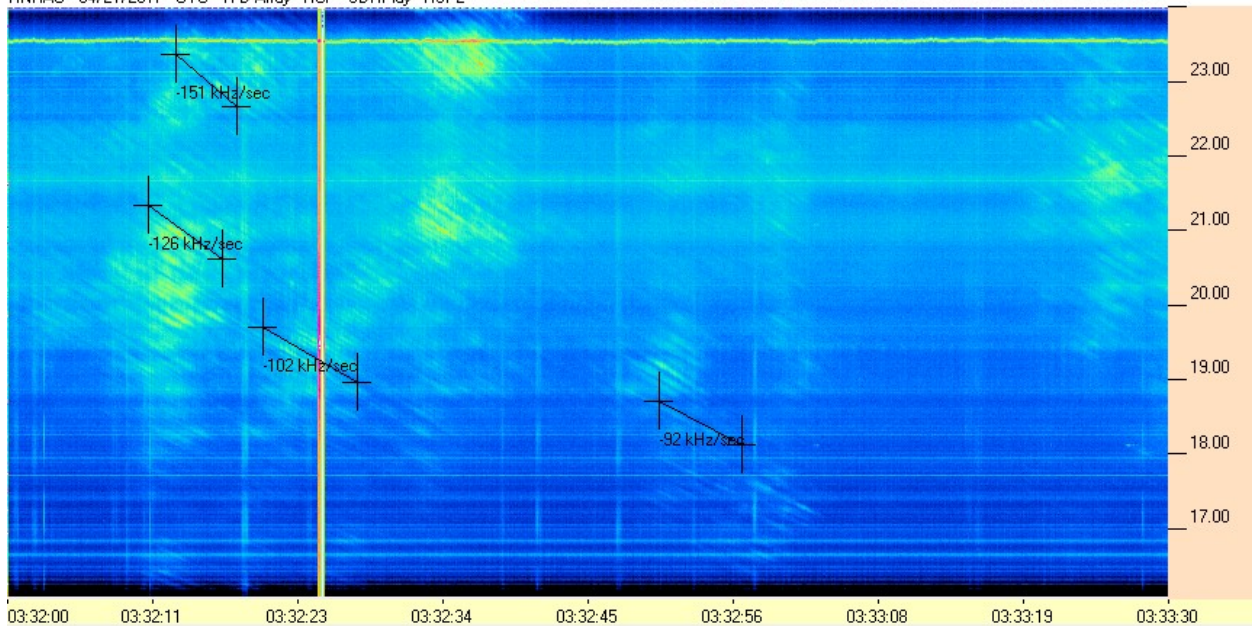
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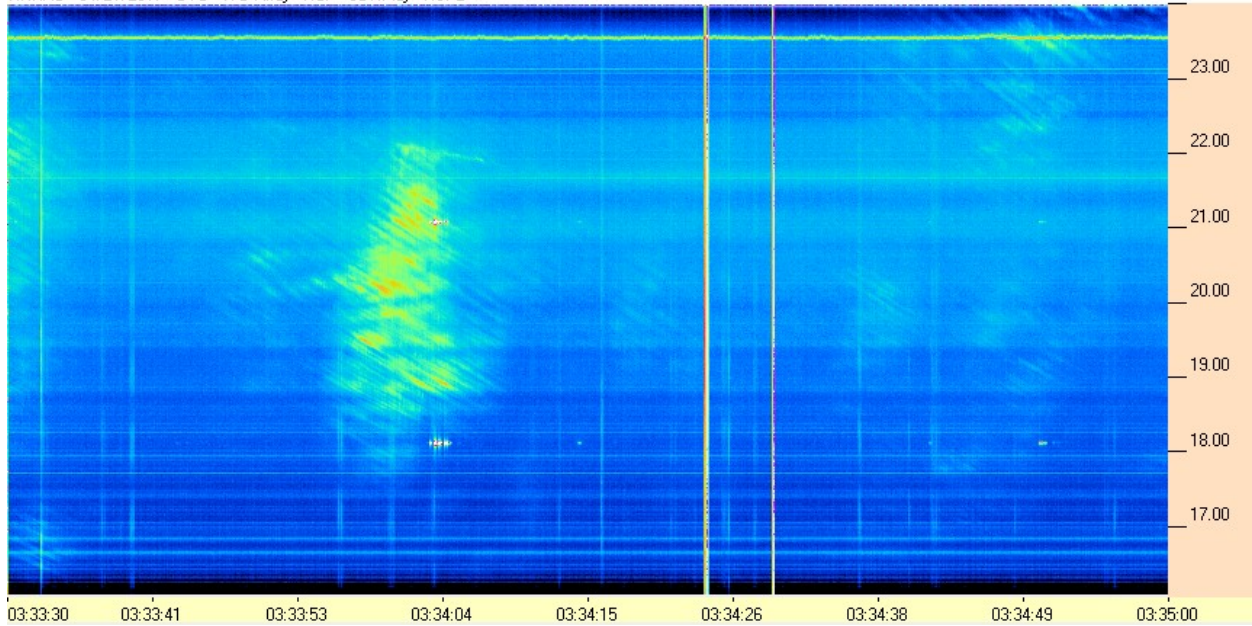




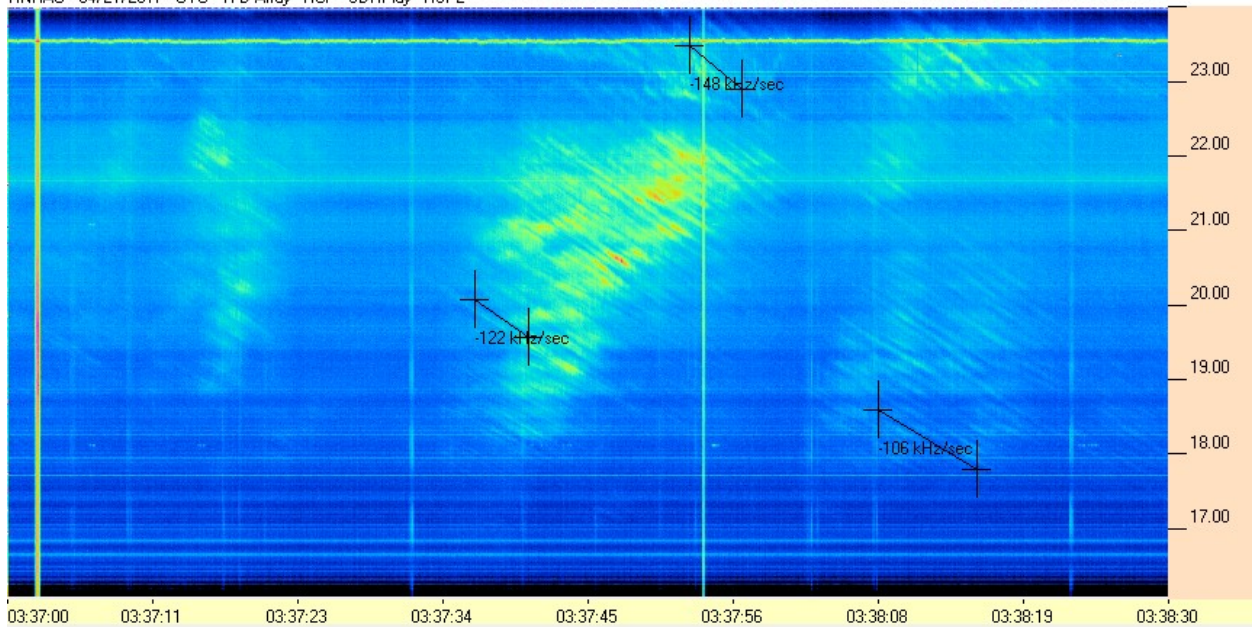
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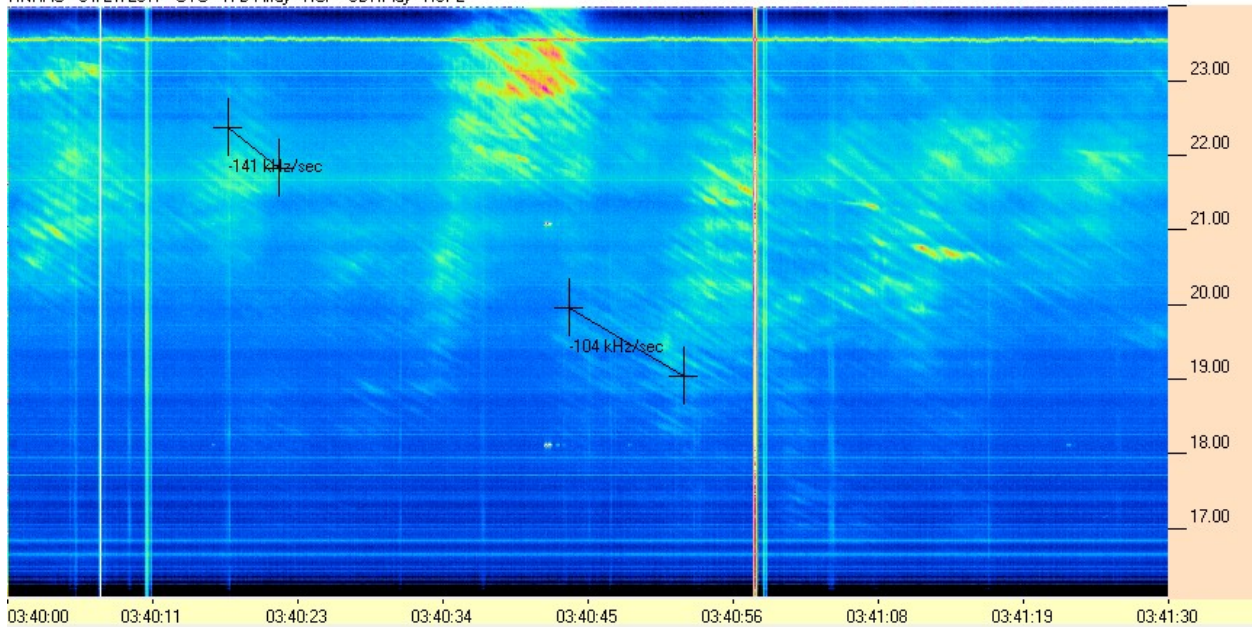




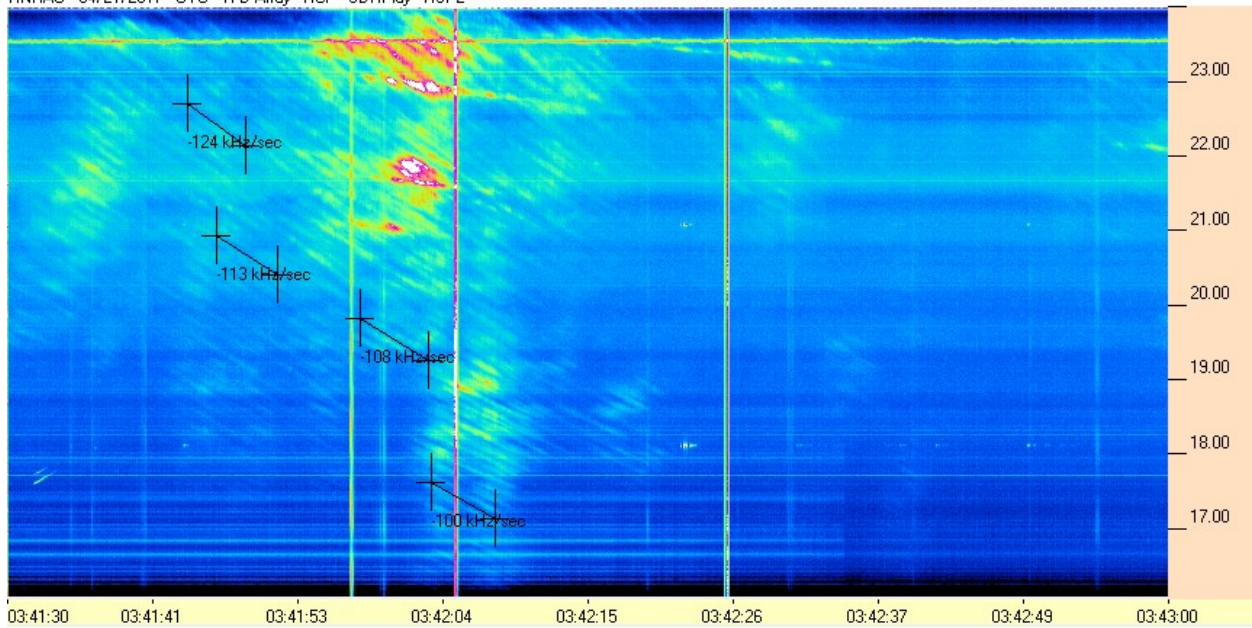
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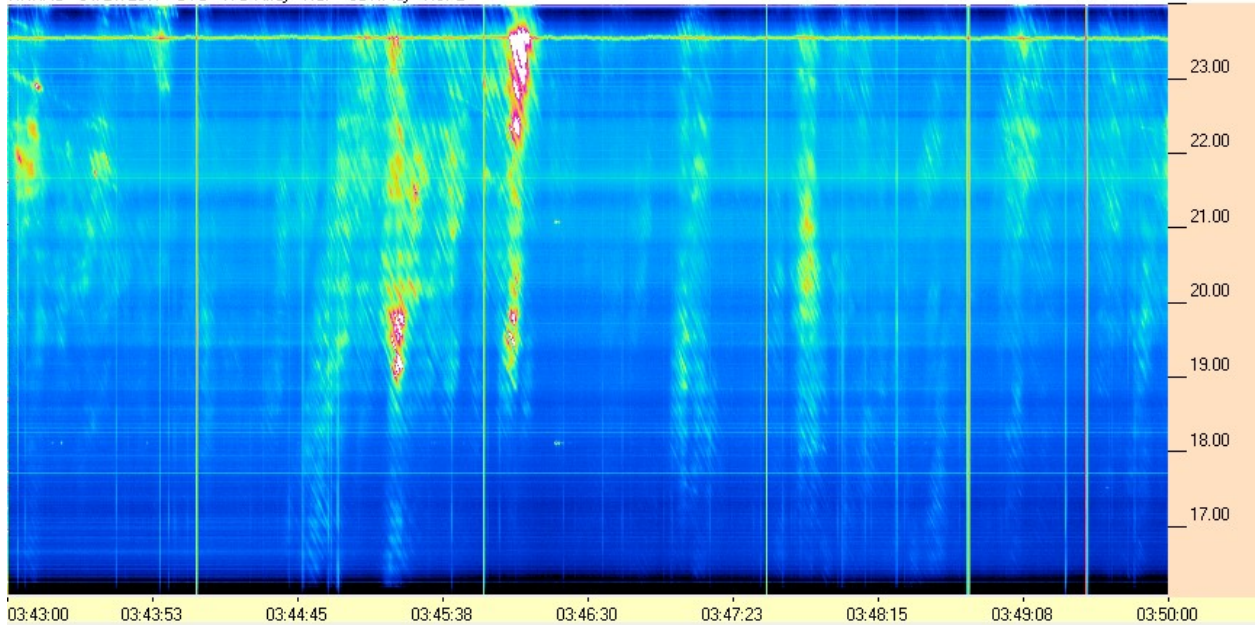




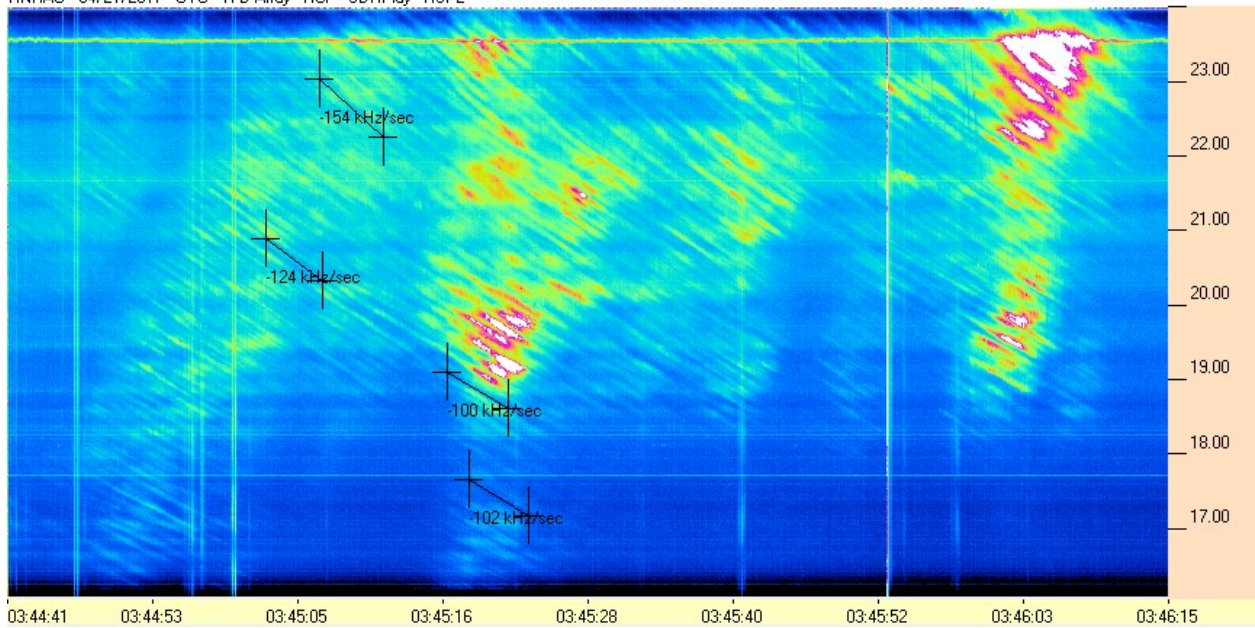
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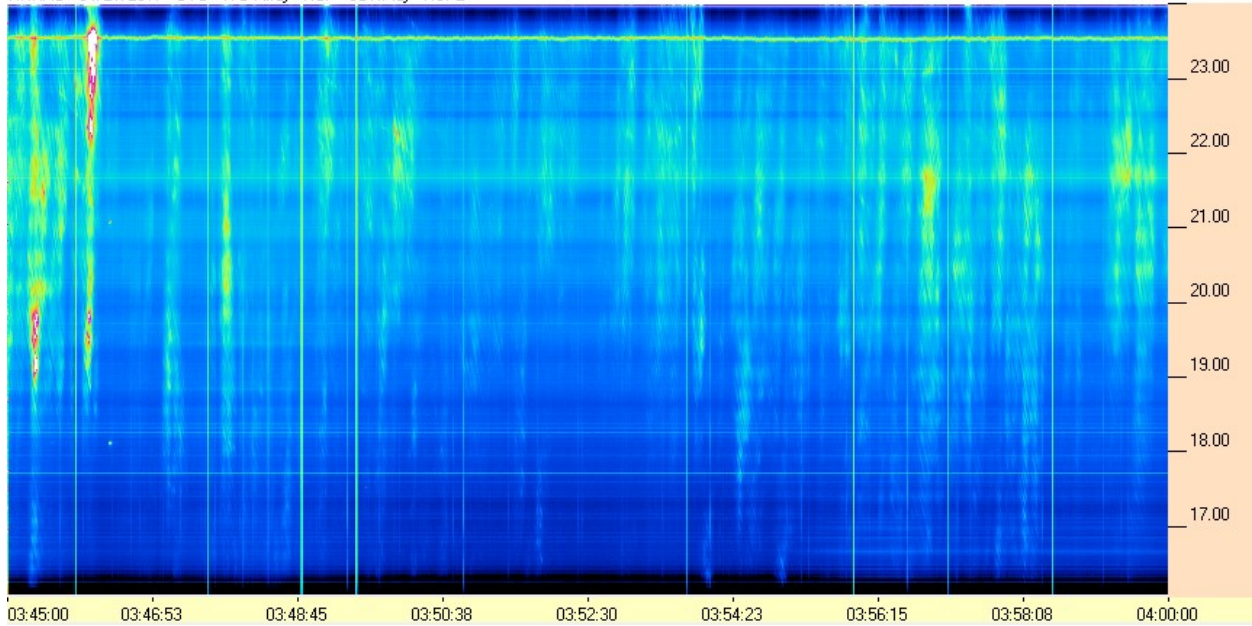




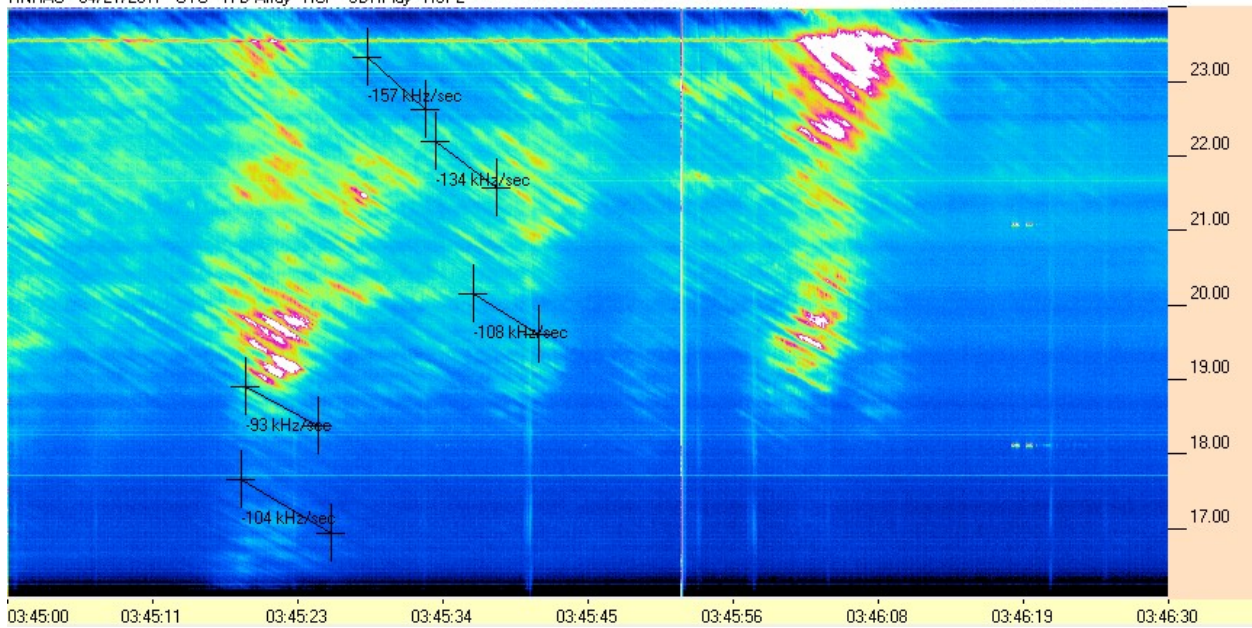
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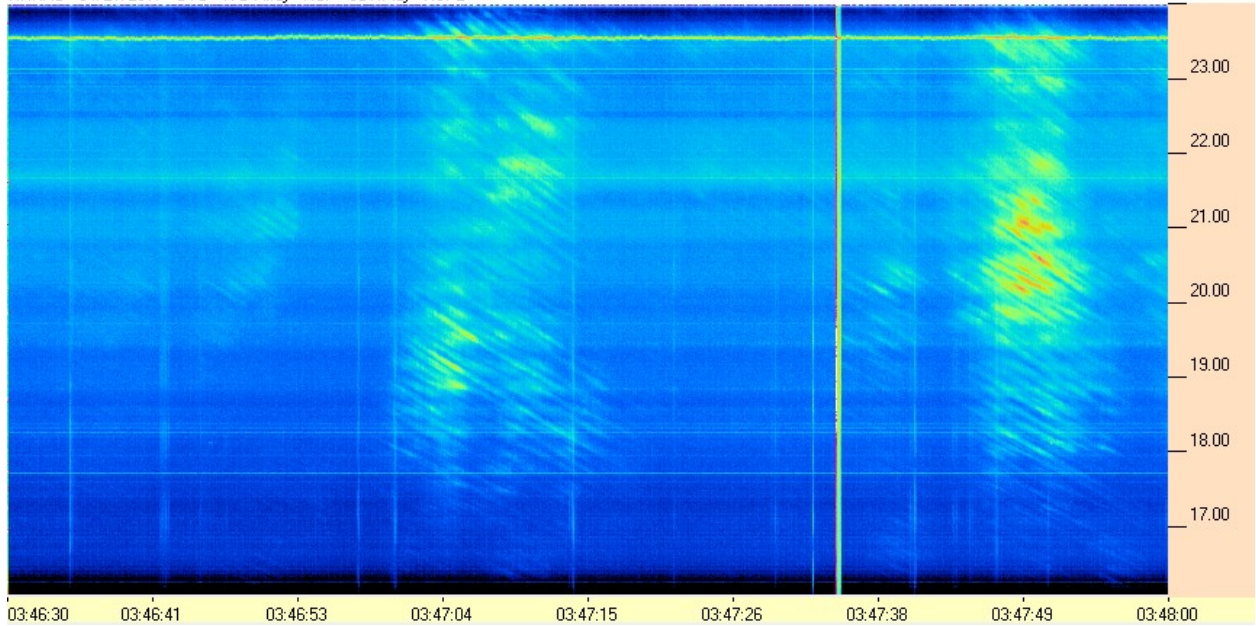




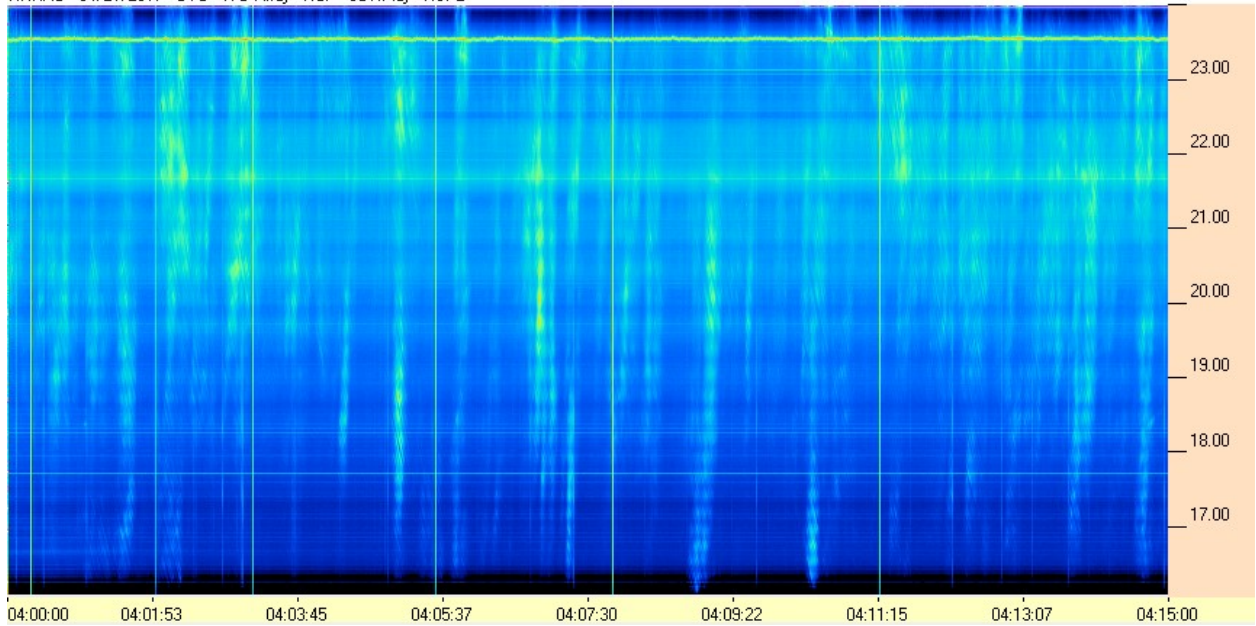
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HNRAO - 04/21/2017 - UTC - TFD Array - RCP - SDRPlay - RSP2



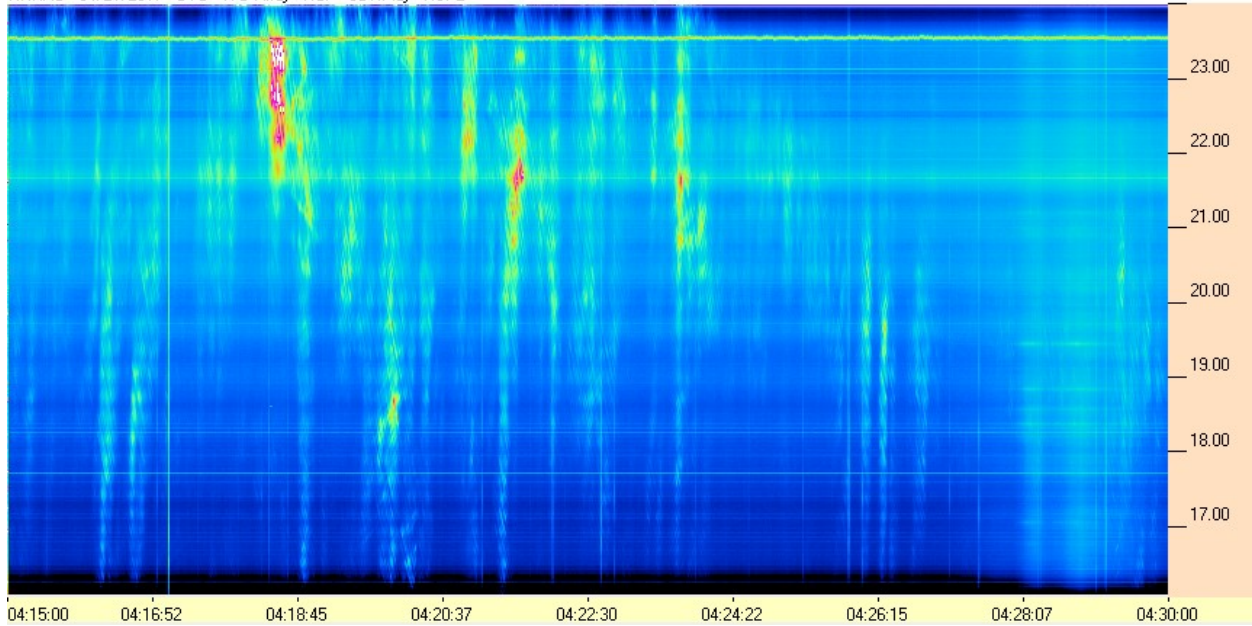
HNRAO - 04/21/2017 - UTC - TFD Array - RCP - SDRPlay - RSP2



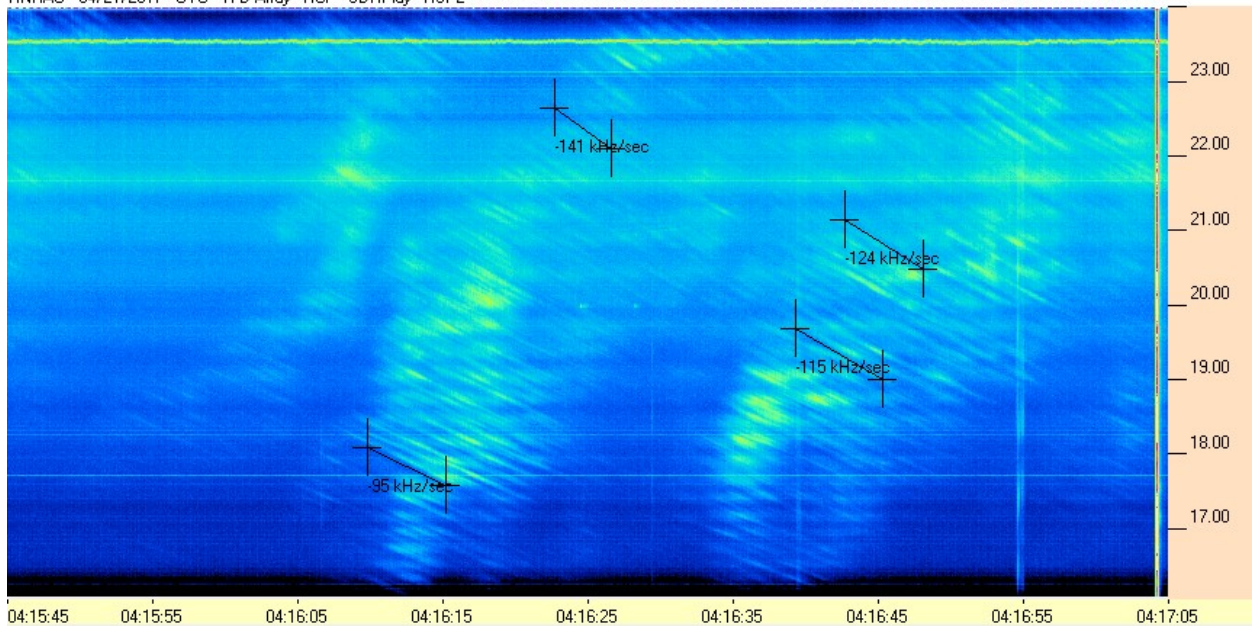
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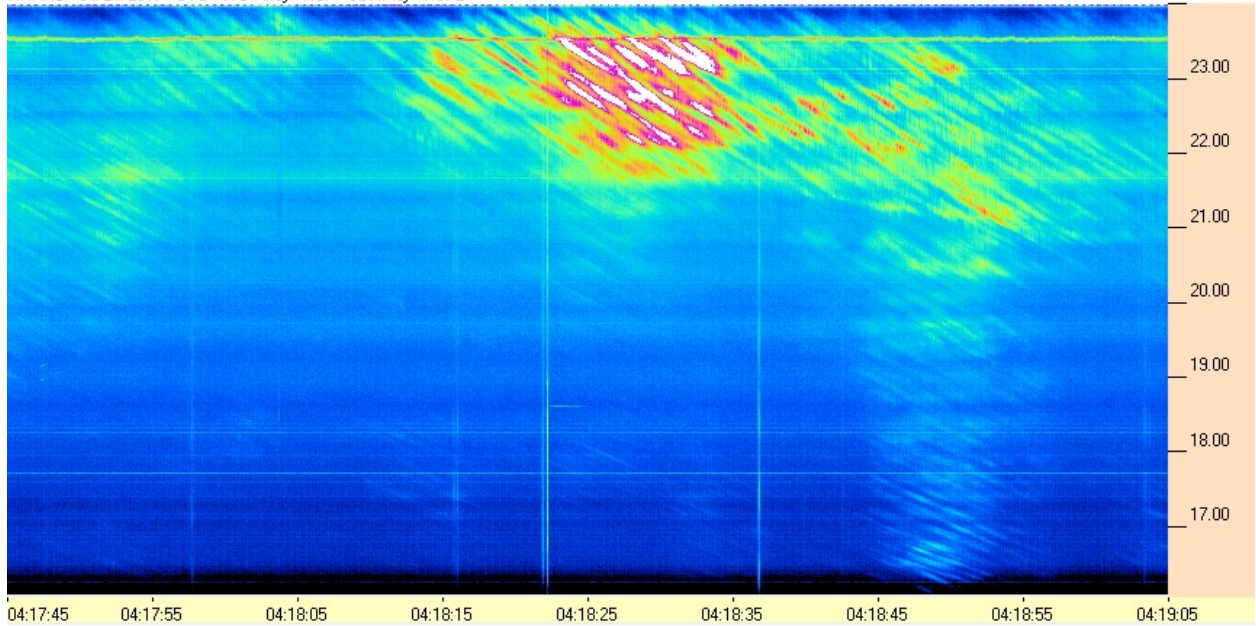




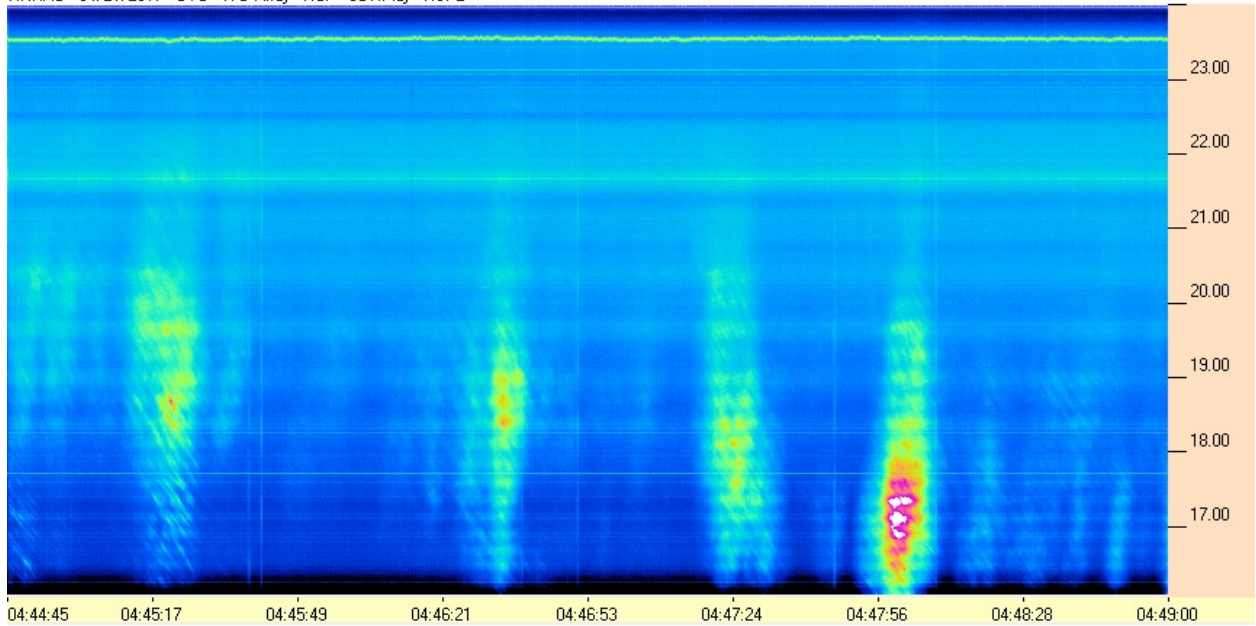
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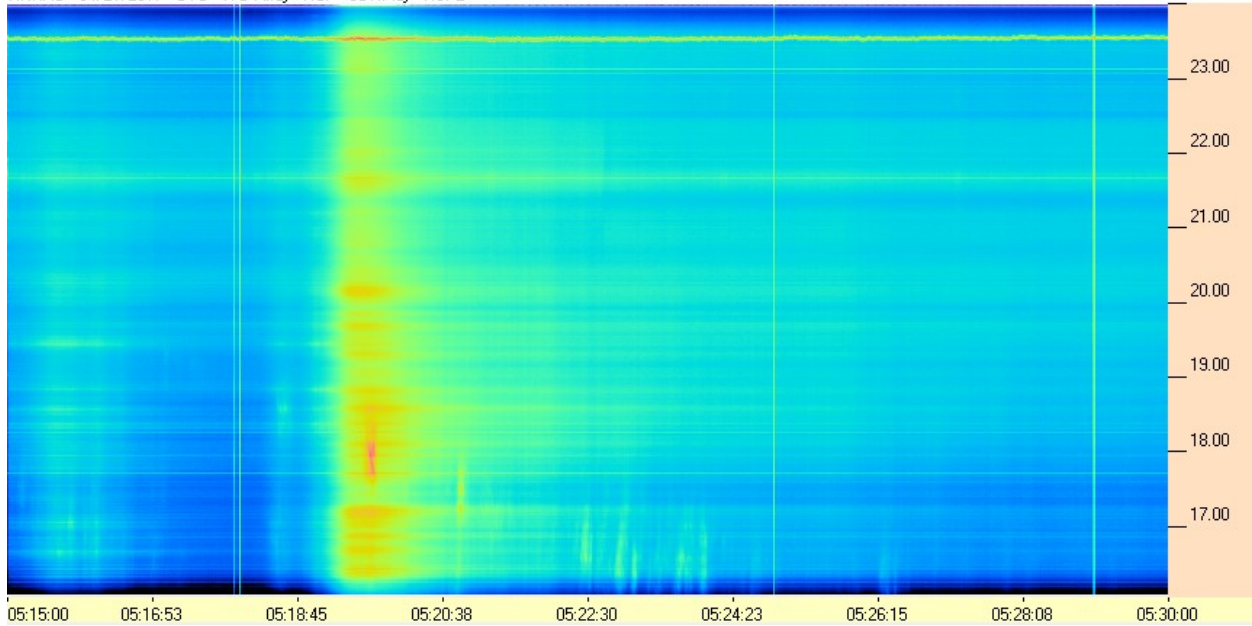
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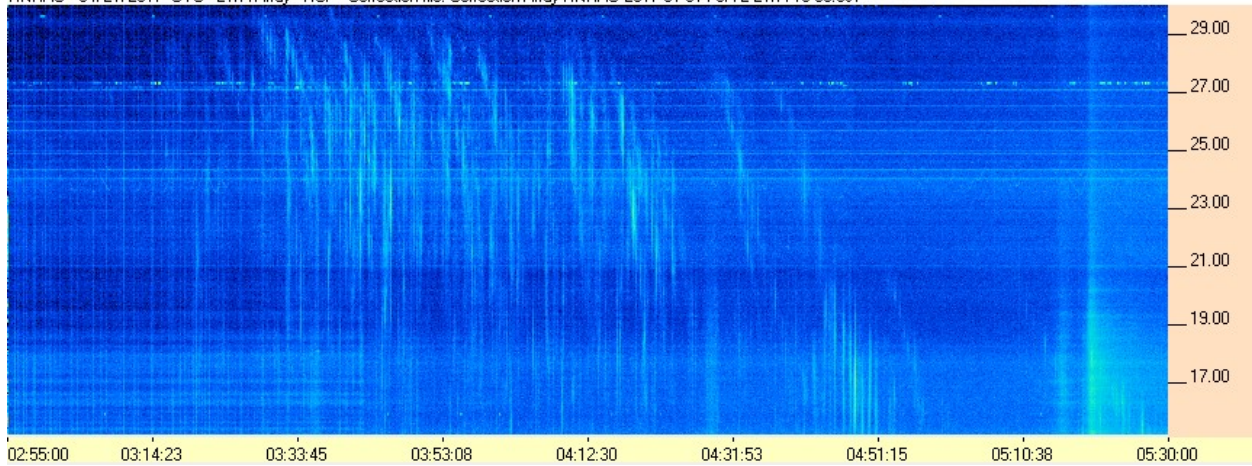


HNRAO - 04/21/2017 - UTC - TFD Array - RCP - SDRPlay - RSP2



**FSX-2/LWA Pair**

HNRAO - 04/21/2017 UTC - LWA Array - RCP - Correction file: Correction Array HNRAO 2017 01 31 FSX-2 LWA 15-30.csv

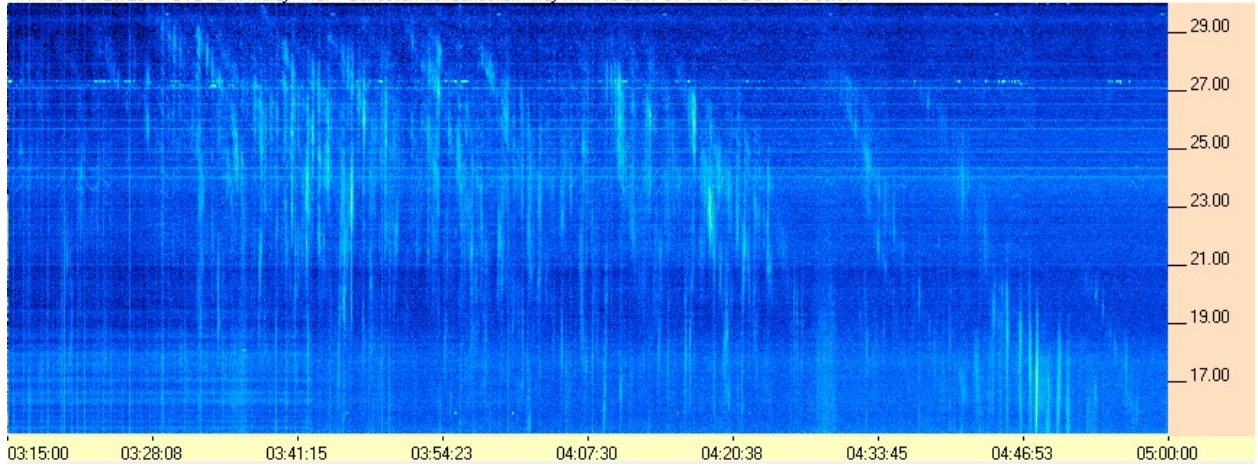




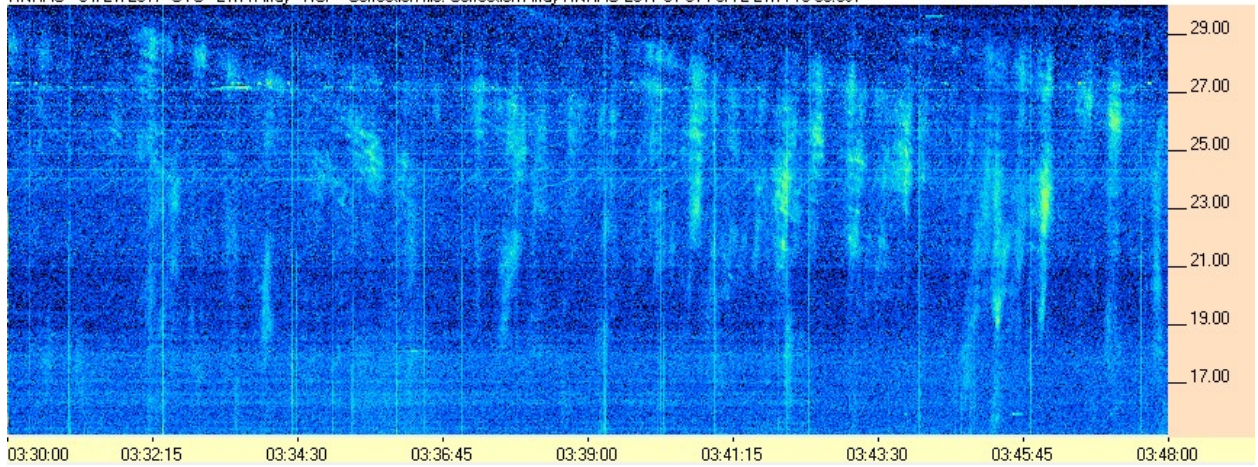
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HNRAO - 04/21/2017 UTC - LWA Array - RCP - Correction file: CorrectionArray HNRAO 2017 01 31 FSX-2 LWA 15-30.csv



HNRAO - 04/21/2017 UTC - LWA Array - RCP - Correction file: CorrectionArray HNRAO 2017 01 31 FSX-2 LWA 15-30.csv



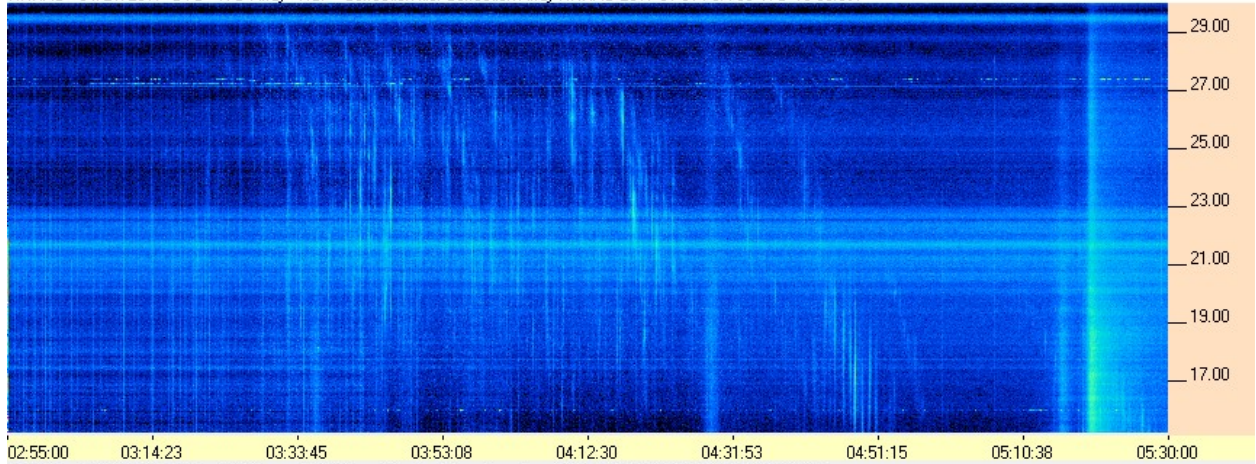


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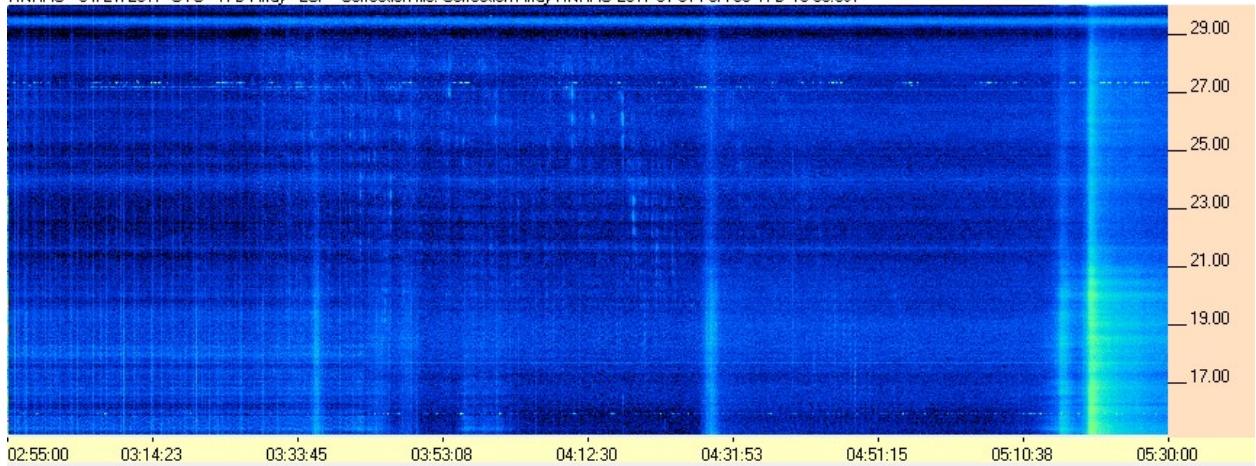


**FSX-8S/TFD Pair**

HNRAO - 04/21/2017 UTC - TFD Array - RCP - Correction file: Correction Array HNRAO 2017 01 31 FSX-8S TFD 15-30.csv



HNRAO - 04/21/2017 UTC - TFD Array - LCP - Correction file: Correction Array HNRAO 2017 01 31 FSX-8S TFD 15-30.csv

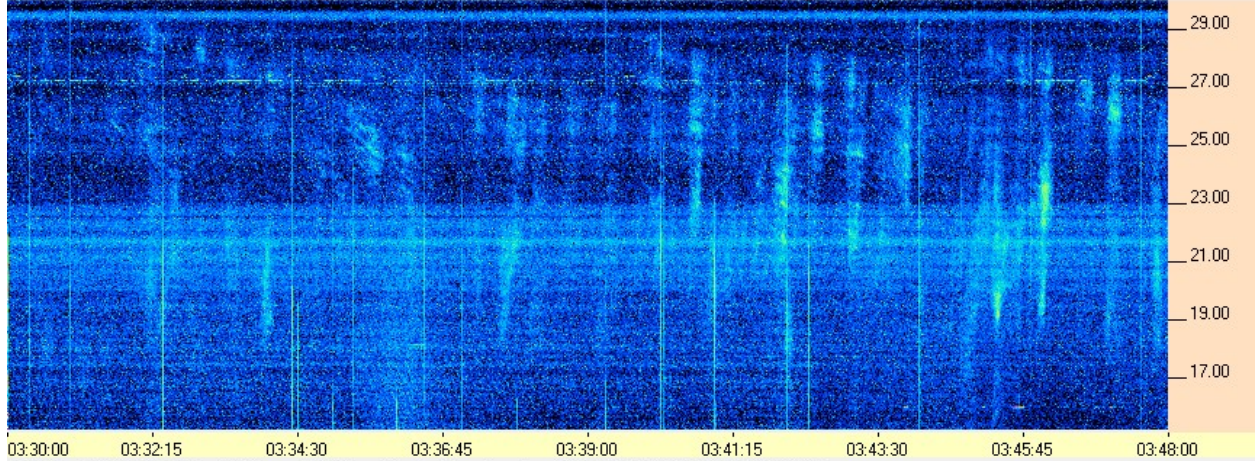




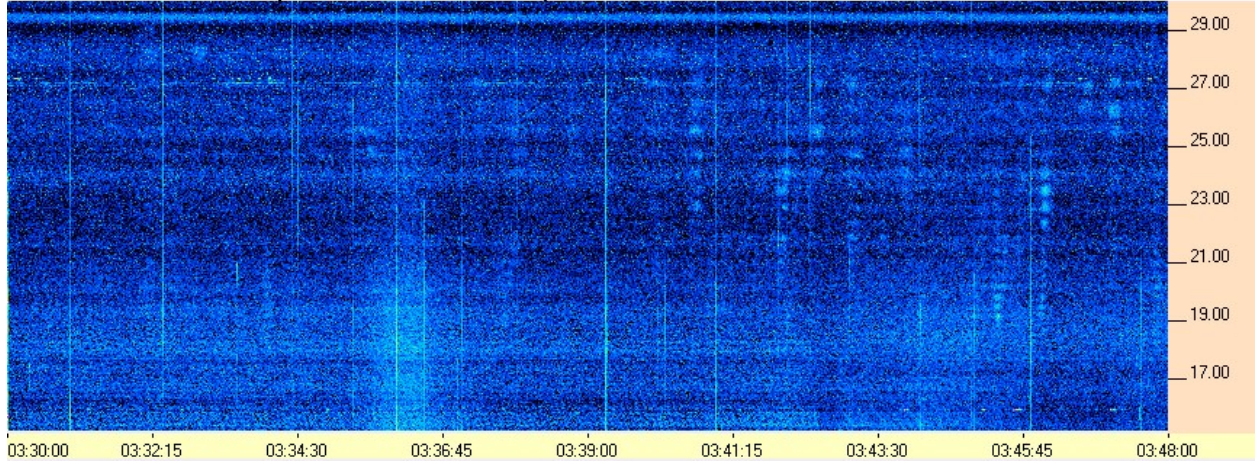
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HNRAO - 04/21/2017 UTC - LWA Array - RCP - Correction file: Correction Array HNRAO 2017 01 31 FSX-2 LWA 15-30.csv



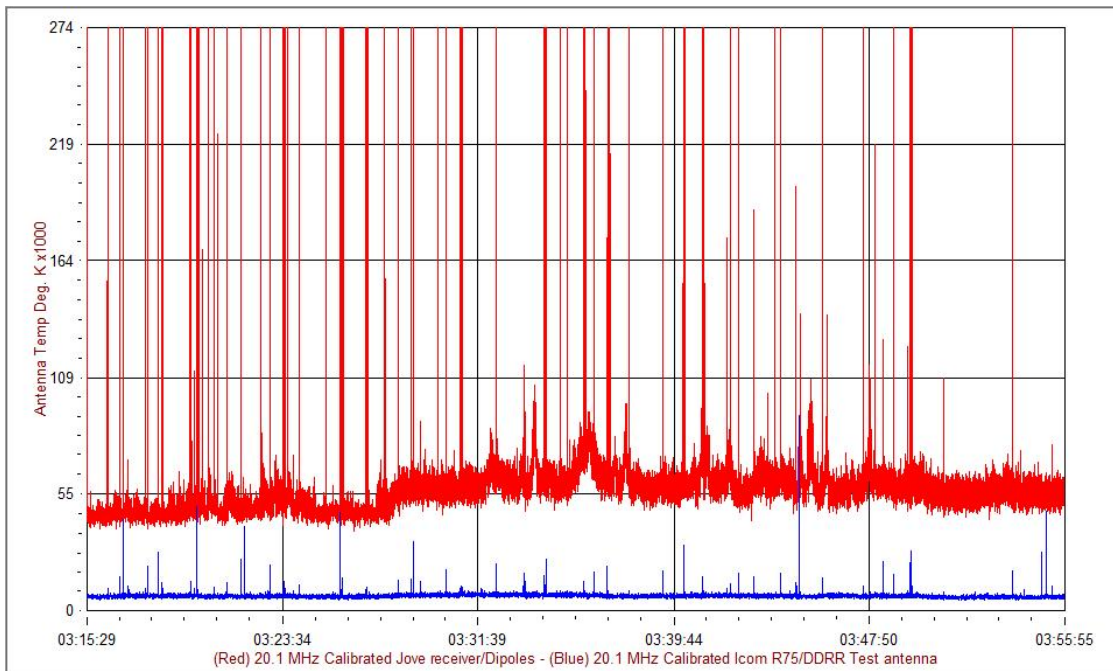
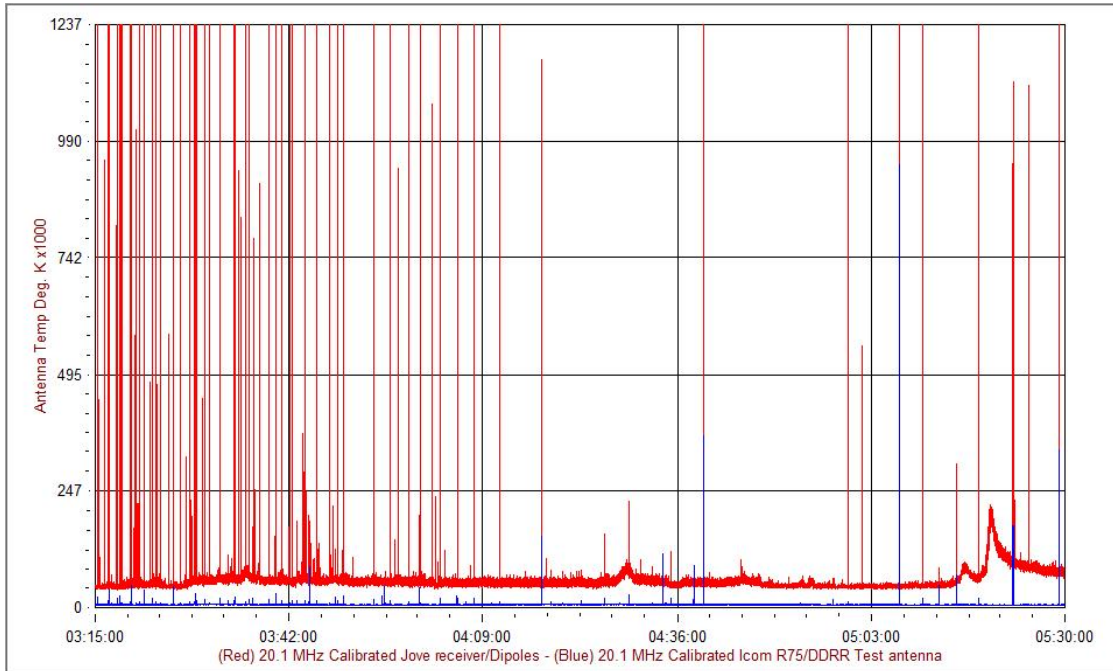
HNRAO - 04/21/2017 UTC - TFD Array - LCP - Correction file: Correction Array HNRAO 2017 01 31 FSX-8S TFD 15-30.csv



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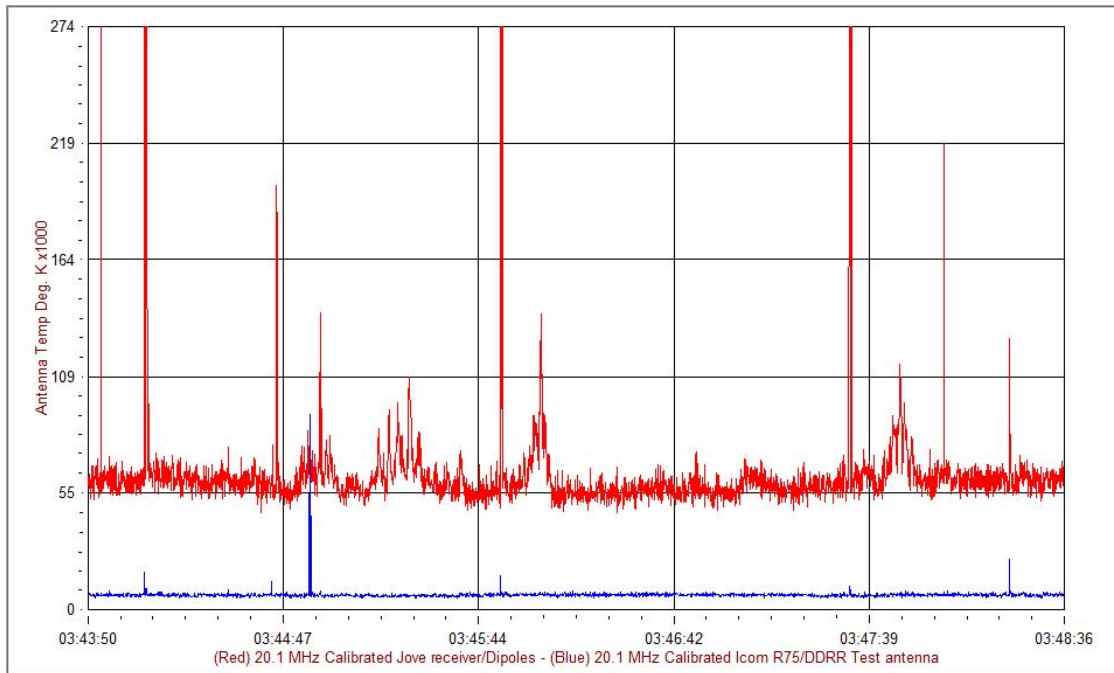


**JOVE II Receiver/JOVE Dipoles Pair**





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**Observation notes:**

Current observing conditions

Outside temperature 67 degrees F

65% humidity

Distant lightning (67 miles via Weather Bug).

A possibility of rain during the next several hours may affect spectrographs

Galactic background via SkyPipe/Radio JOVE is 45 kK

0259:18 UT

First emissions – L-bursts

Negative drift modulation lanes – 21 MHz – 23 MHz

Negative drift L-bursts

0304 UT

Barely above GB modulation lanes

20-13 MHz

0308 UT

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Very weak modulation lanes 21-24 MHz  
0312 UT  
More modulation lanes. Barely above GB.  
Radio Jupiter Pro shows 16% probability  
0316 UT  
Modulation lanes 19-24 MHz  
Weak but strengthening  
0317 UT  
Modulation lanes showing at 16-18 MHz  
0320 UT  
Much stronger emissions. 21 MHz, very strong.  
0327:35 UT  
L-burst on SkyPipe – slight rise.  
0332:10 UT  
L-burst SkyPipe 80 kK  
0334 UT  
L-burst 105 kK – SkyPipe  
0335:12 UT  
N-event at 23.5 MHz  
Emissions also being seen on both FSX spectrographs.  
0337 UT  
Strong emissions 18-22 MHz  
SkyPipe 91 kK  
0340 UT  
Very hot burst at 23 MHz  
0341 UT  
Very hot burst 21-24 MHz  
0345 UT  
L-burst grouping on SkyPipe 143 kK  
Very strong emission at 23 MHz  
0347:47 UT  
L-burst on SkyPipe 123 kK  
0351 UT  
Series of “holes” or blank areas breaking up modulation lanes.  
0353 UT  
GB 54 kK  
0356:50 UT  
Strong emissions 21-22 MHz  
0410 UT  
Cross hatched modulation lanes 16-17 MHz  
0413 UT



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Approaching transit  
RJP 73% probability  
0430 UT  
Unattended