HNRAO Observing Log
40.673181 N – 80.437885 W
EN90sq

Date: 07 Jan 2018

Object: Jupiter – Io-B

Observer: Unattended

Start of pass:	**1016 UT**	**Planetary K-index:**	
Jupiter Altitude (deg):	**19.7**	**Jupiter Azimuth (deg):**	**134.0**
Jupiter CML:	**100.45**	**Jupiter Io Phase:**	**090.00**
Jupiter RA (hr/min):	**15.01**	**Jupiter Dec (hr/min):**	**-16.02**
Hour Angle (hr/min):	**-02:59**	**Polarization**	**RCP**
Sun Altitude (deg):	**-26.3**	**Sun Azimuth (deg):**	**098.1**
Sun RA (hr/min):	**19.06**	**Sun Dec (hr/min):**	**-22.35**

End of pass:	**1217 UT**		
Jupiter Altitude (deg):	**31.7**	**Jupiter Azimuth (deg):**	**163.6**
Jupiter CML:	**173.59**	**Jupiter Io Phase**	**107.05**
Hour Angle (hr/min):	**-00:58**		
Sun Altitude (deg):	**-04.4**	**Sun Azimuth (deg):**	**116.2**

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 1 Jan 2018
    c. Connected to dipoles through HNRAO Multicoupler #3, port 1.
        i. -3.19 dB loss between Multicoupler and dipoles.
4. JOVE 1 receiver fed by TFD/RCP. JOVE 1 receiver fed by TFD/LCP
    a. Calibrated 1 Jan 2018
    b. Connected to TFD through HNRAO Multicouplers #1 & #2, port 1.
5. SDRPlay
    a. RSP1 (TFD/LCP) and RSP2 (TFD/RCP)

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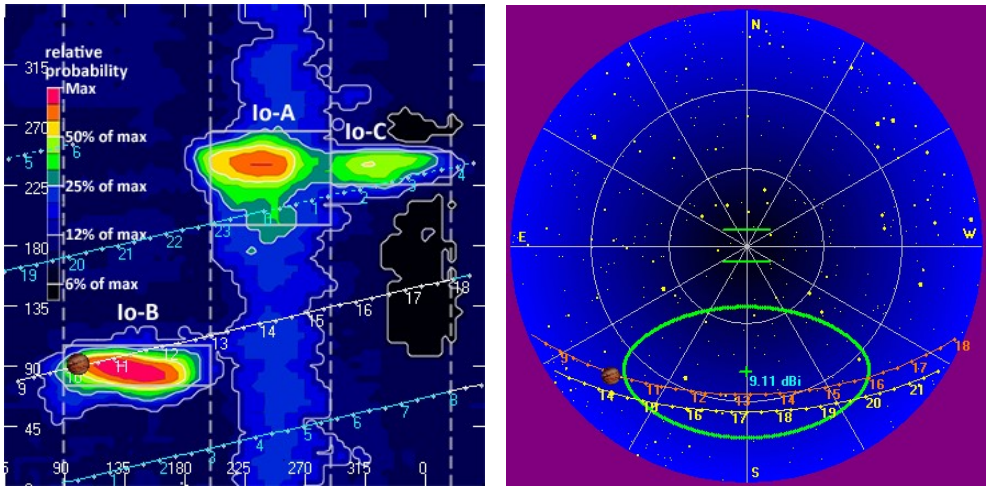
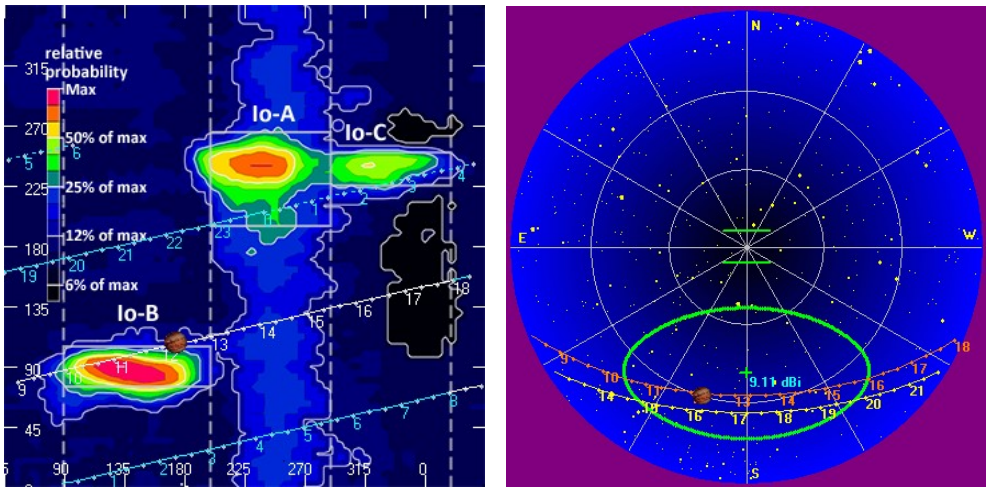


Beginning of Pass



End of Pass

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

https://www.radiosky.com/jupmodes.html

Modulation Lanes Designations*	
L - Burst	S-Burst
L1 – No lanes	S1 – No lanes
L2 - Positive slope	S2 – Positive slope
L3 - Cross hatched	S3 – Cross hatched
L4 – Negative slope	S4 – Negative slope
*Modulation Lanes in the Dynamic Spectra of Jovian L-bursts, J.J. Riihimaa, Astron. & Astrophys. 4, 1970	

An Io-B storm from 15 MHz to 27 MHz, observed with the FSX-2/LWA (RCP), FSX-8S/TFD (RCP), SDRPLay RSP2 (RCP) as well as the Radio JOVE receiver/dipoles (linear). Emissions were dominated by RCP L-burst emissions. It is possible that there were S-bursts as well, but positive identification was not apparent. There were L2, positive modulation lanes and L3, cross hatched lanes. Measurements from beginning to end of storm showed an overall trend (see trend line in slope plot at end of report) indicates the slope in kHz/sec decreased as the CML III increased for positive slope modulation lanes. Calibrated Radio JOVE/SkyPipe chart showed peak emissions at 1120 UT to be 300 kK equivalent antenna temperature at 20.1 MHz.

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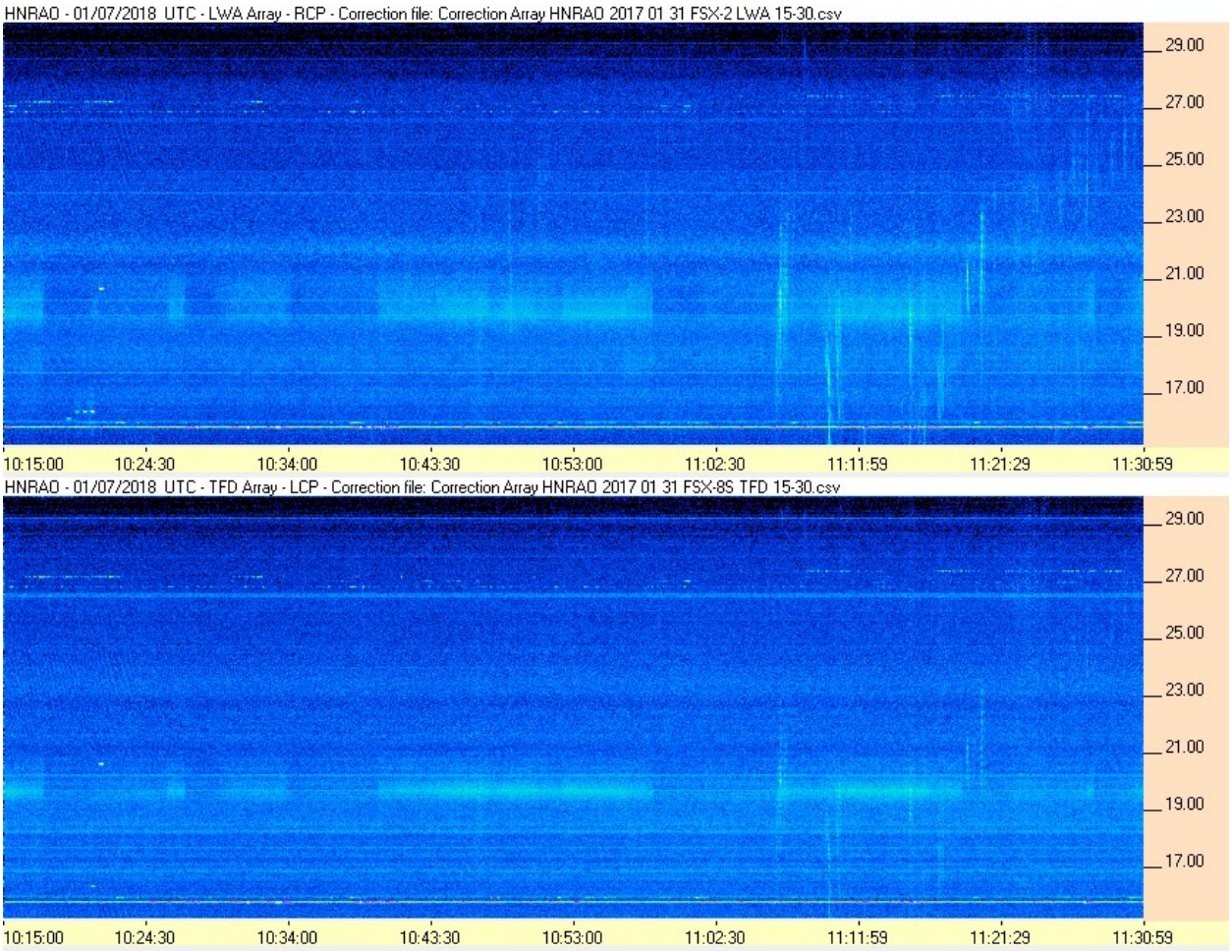
FSX-8S/TFD Pair



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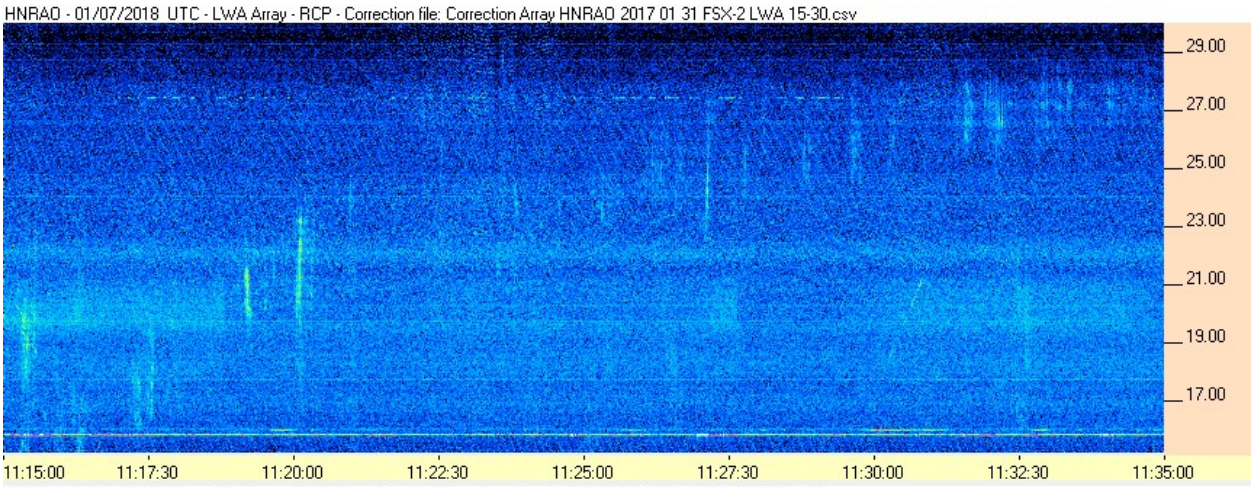

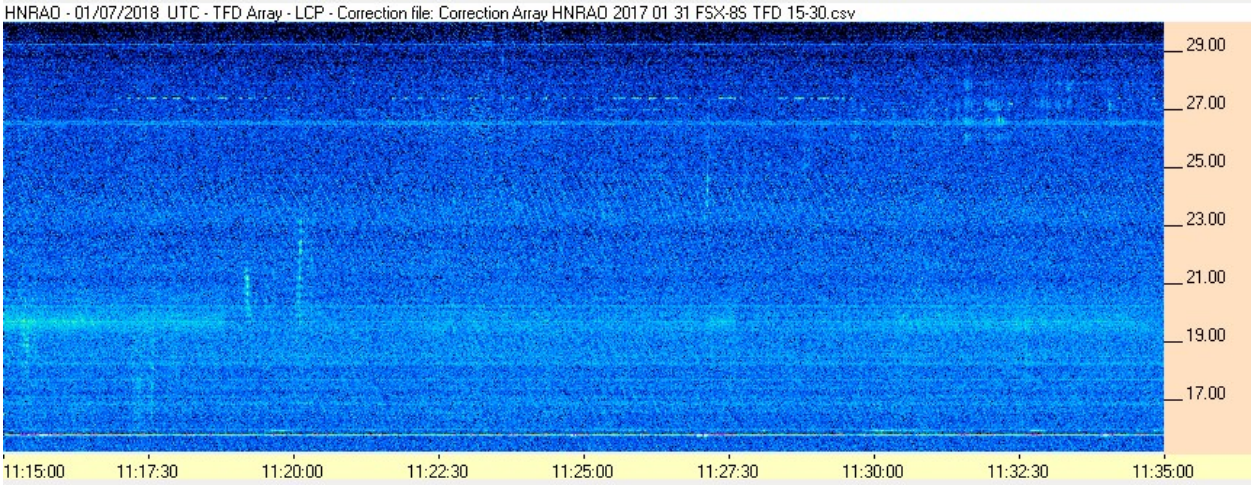

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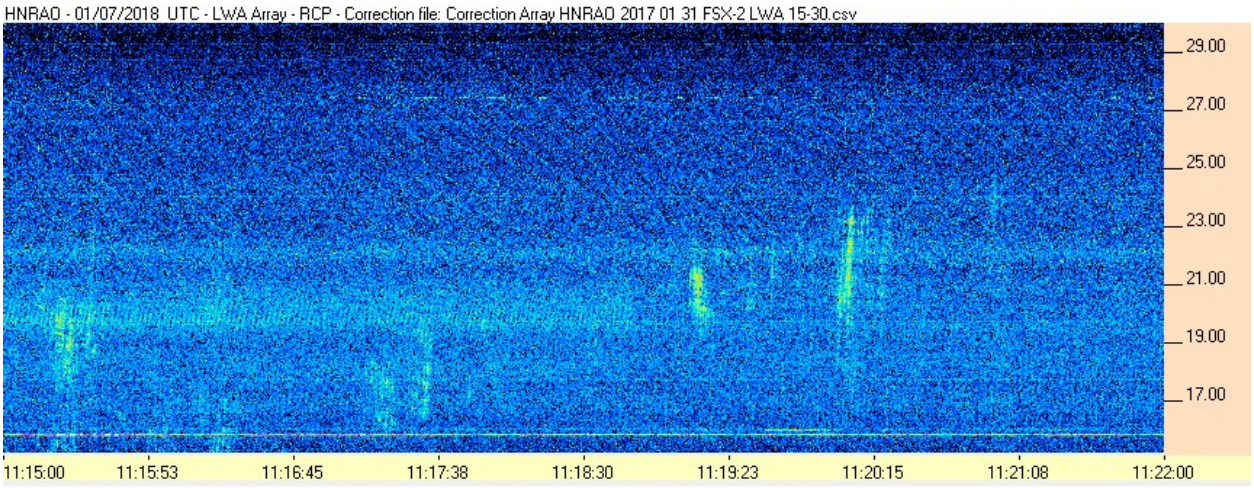

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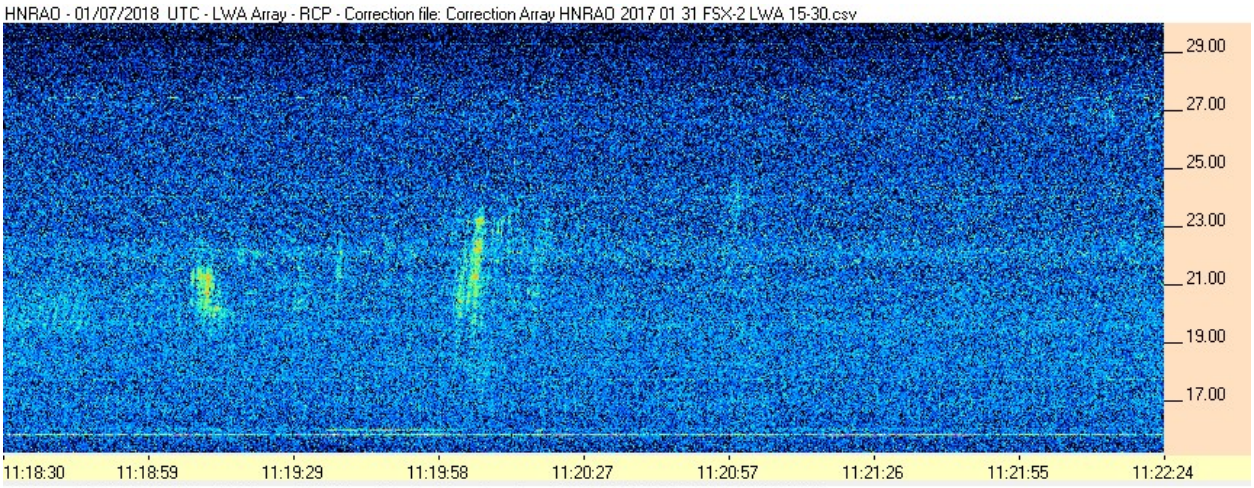

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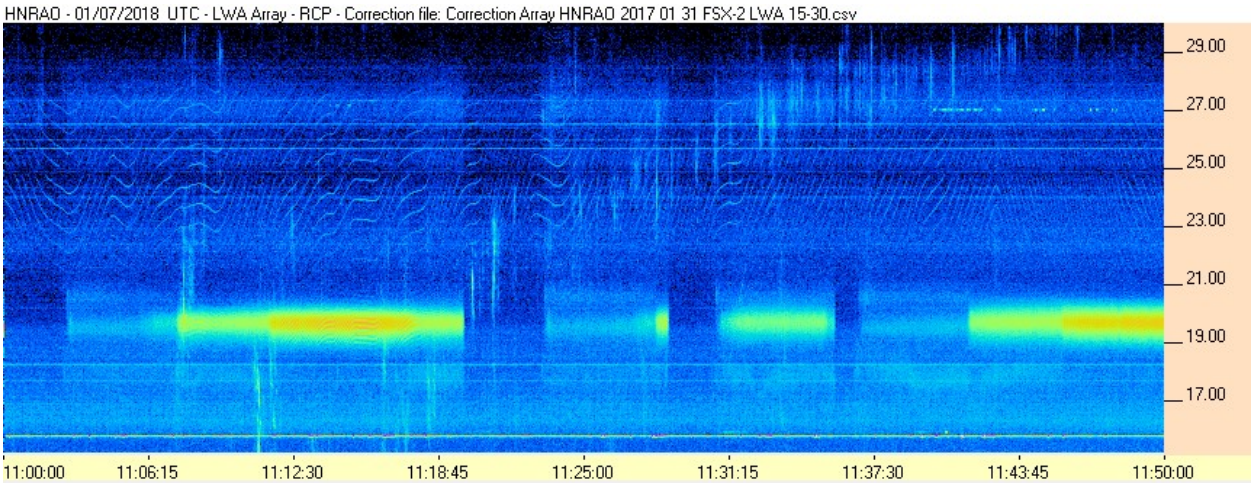
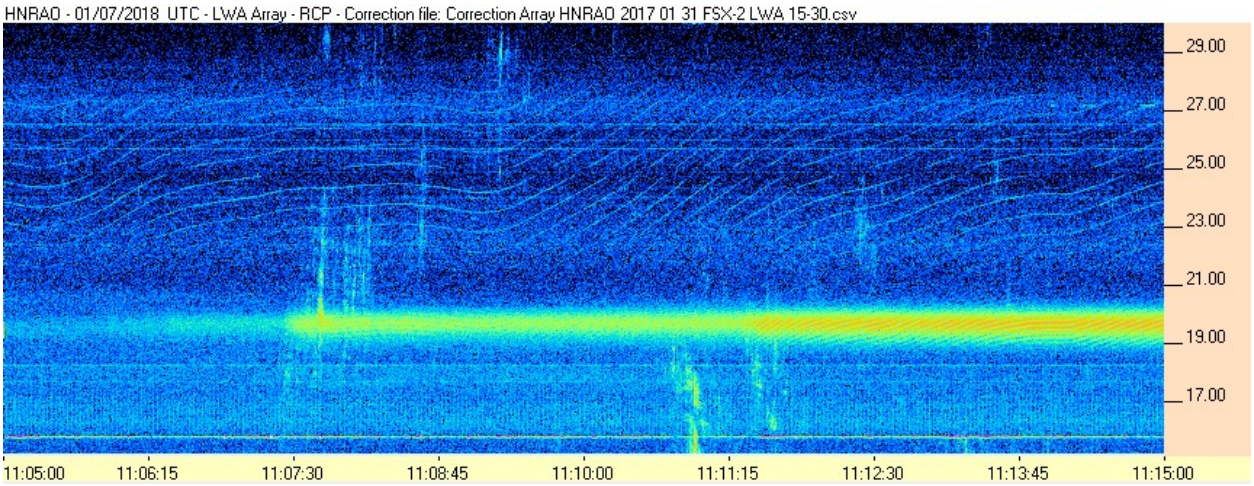
FSX-2/LWA Pair





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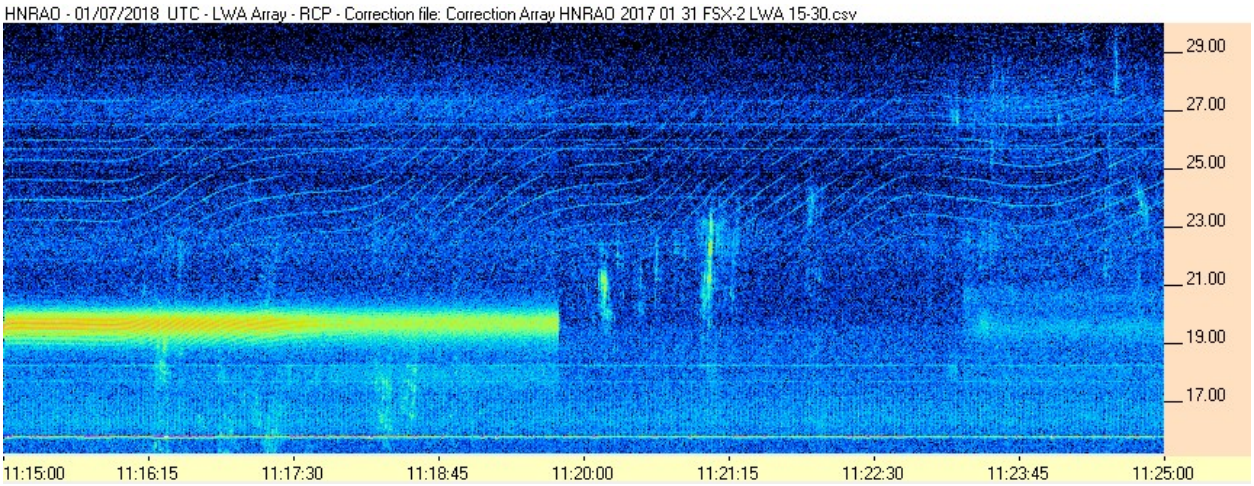

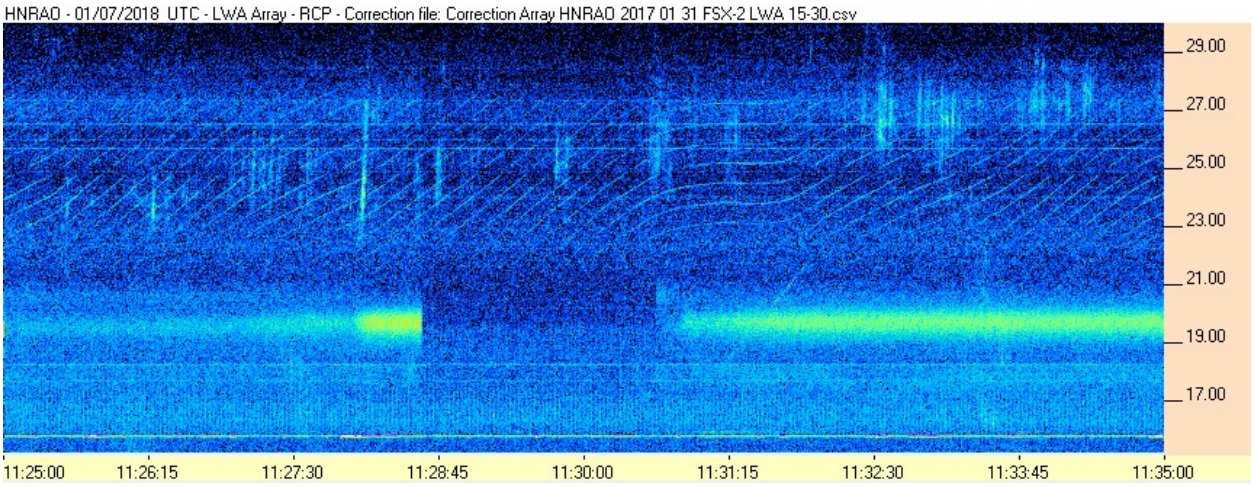

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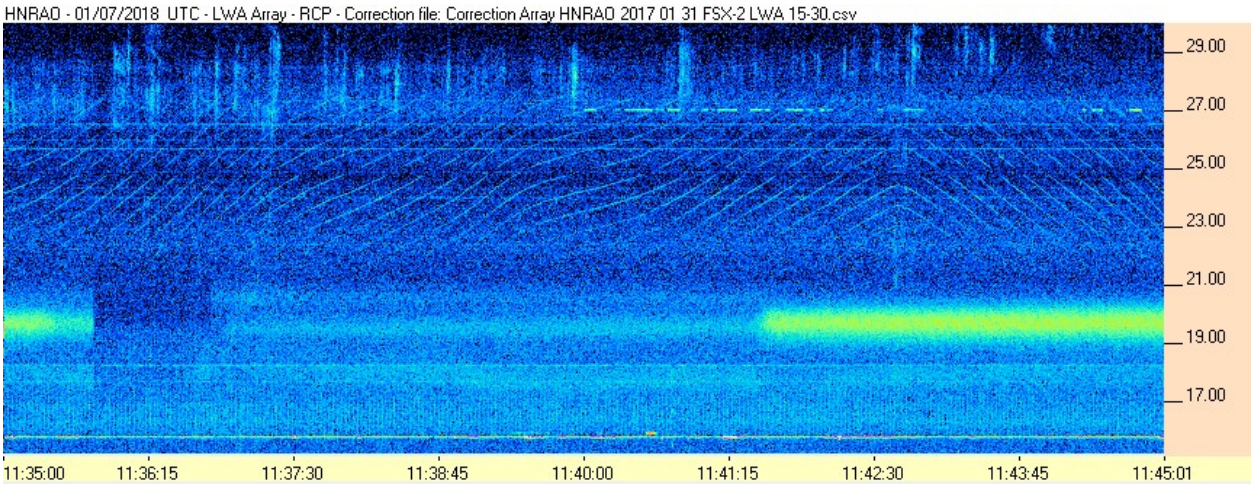
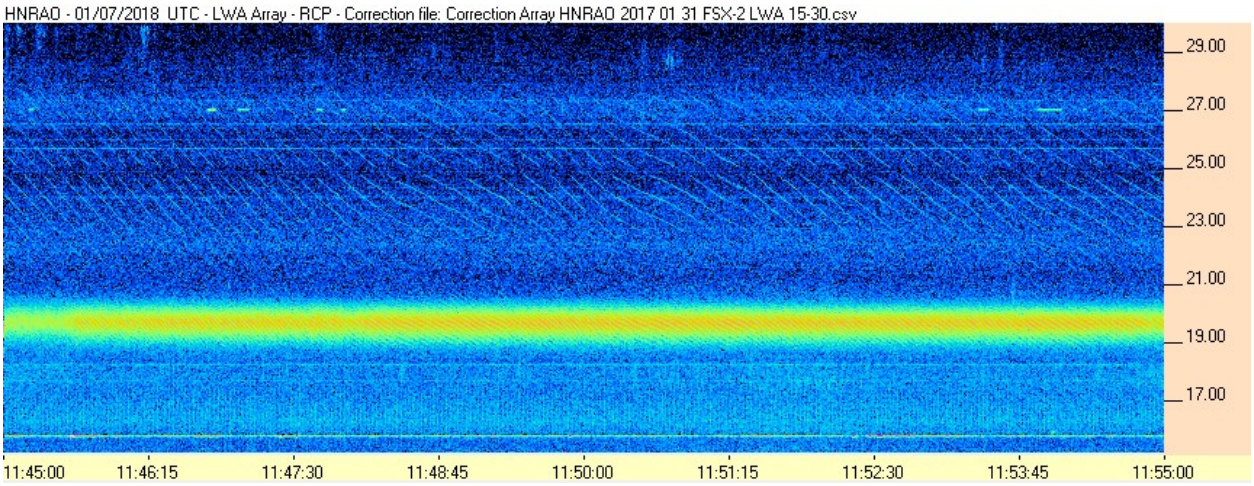
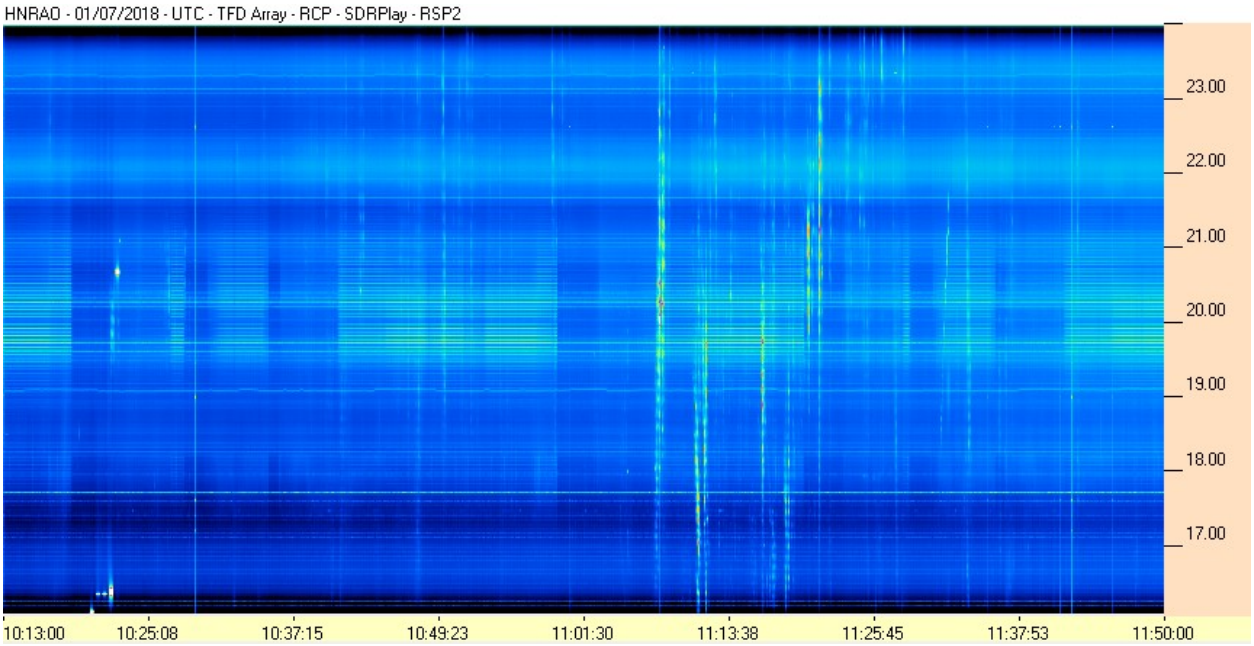
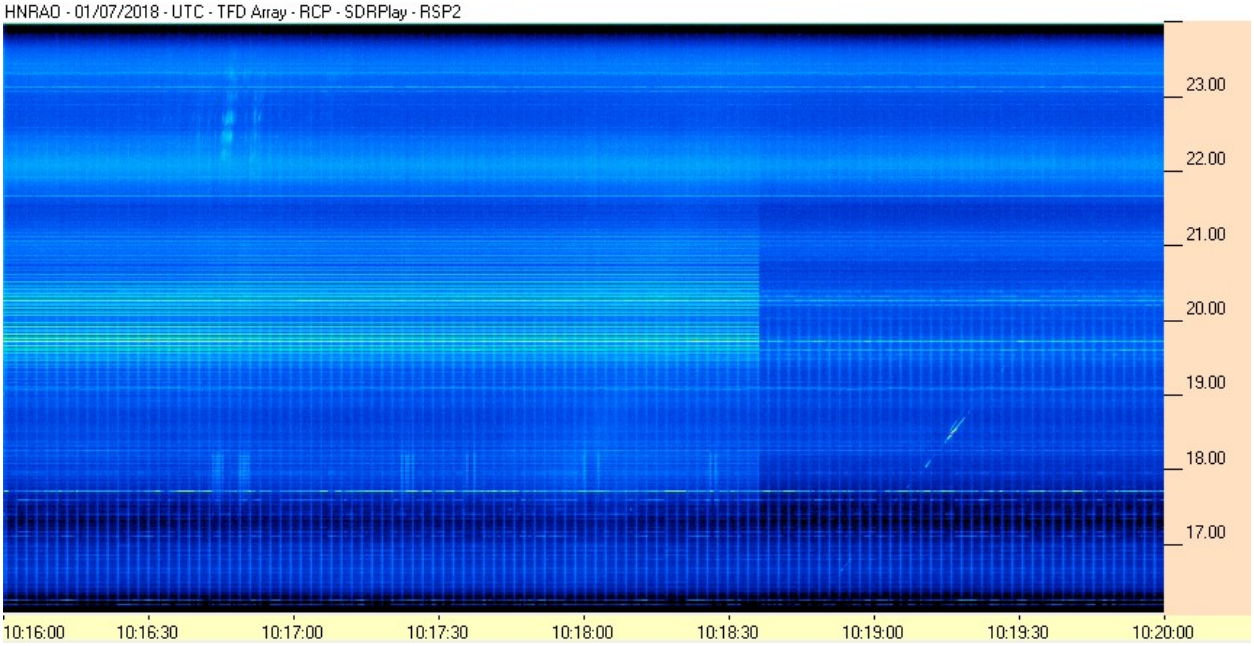




SDRPlay RSP1/TFD RCP Pair





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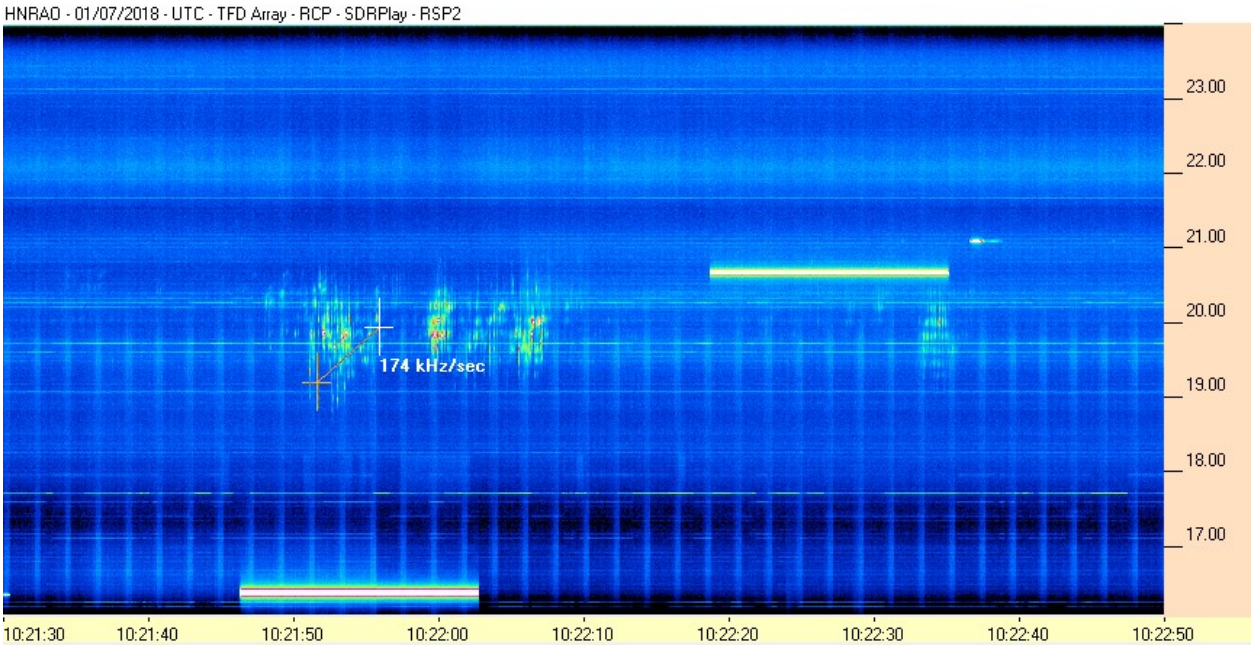
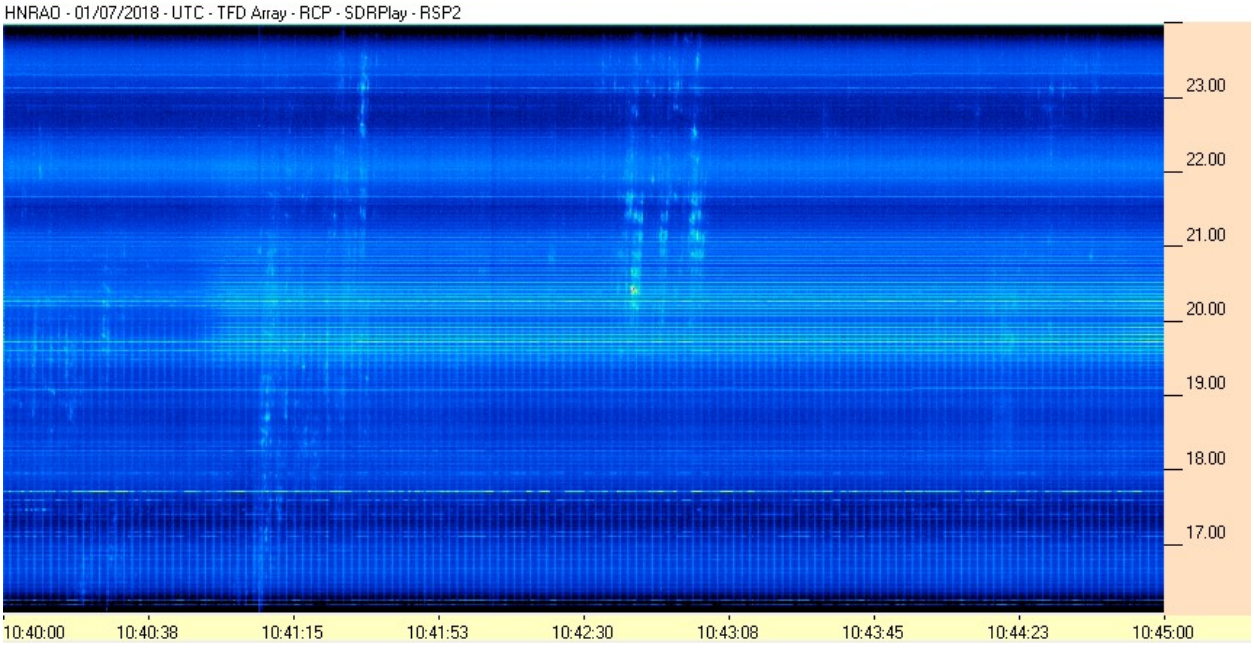
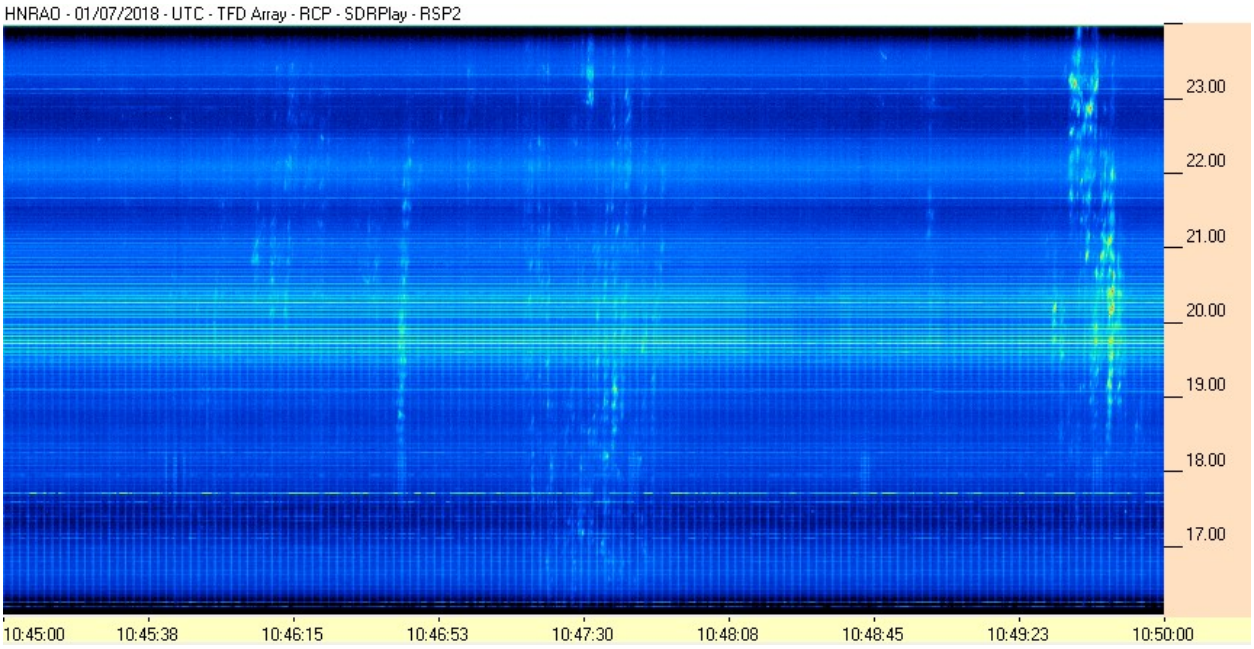
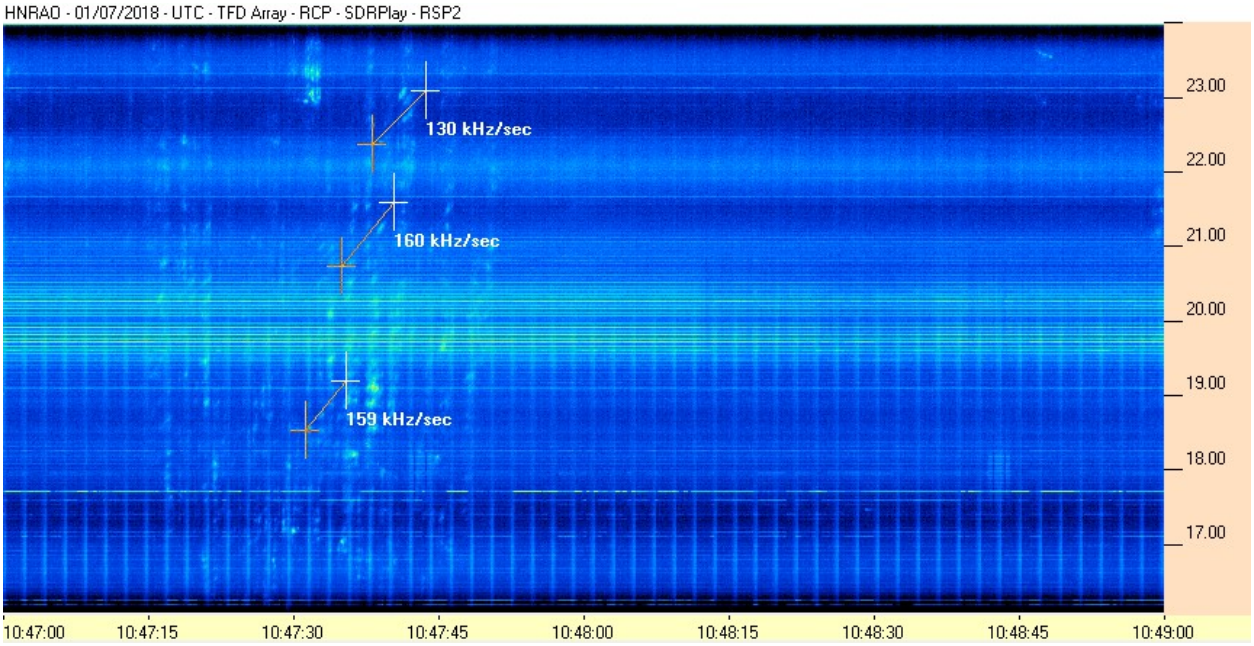





HNRAO - 01/07/2018 - UTC - TFD Array - RCP - SDRPlay - RSP2
23.00
22.00
21.00
20.00
19.00
18.00
17.00
10:45:00
10:45:38
10:46:15
10:46:53
10:47:30
10:48:08
10:48:45
10:49:23
10:50:00


HNRAO - 01/07/2018 - UTC - TFD Array - RCP - SDRPlay - RSP2
130 kHz/sec
160 kHz/sec
159 kHz/sec
23.00
22.00
21.00
20.00
19.00
18.00
17.00
10:47:00
10:47:15
10:47:30
10:47:45
10:48:00
10:48:15
10:48:30
10:48:45
10:49:00

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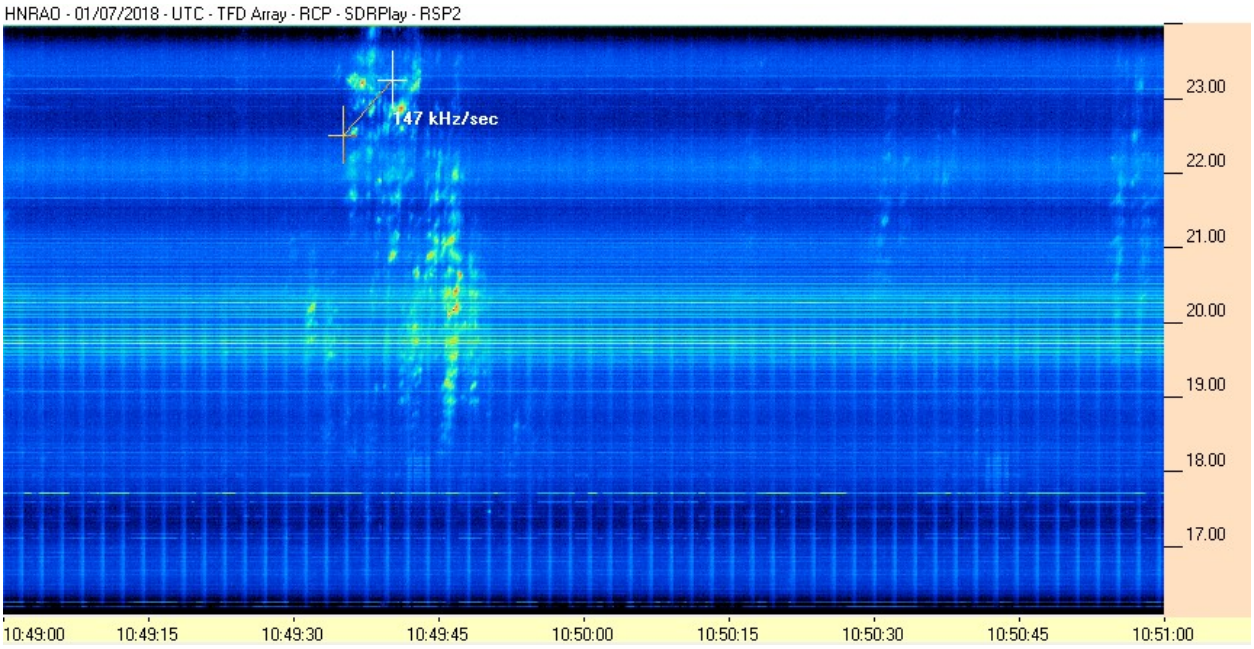

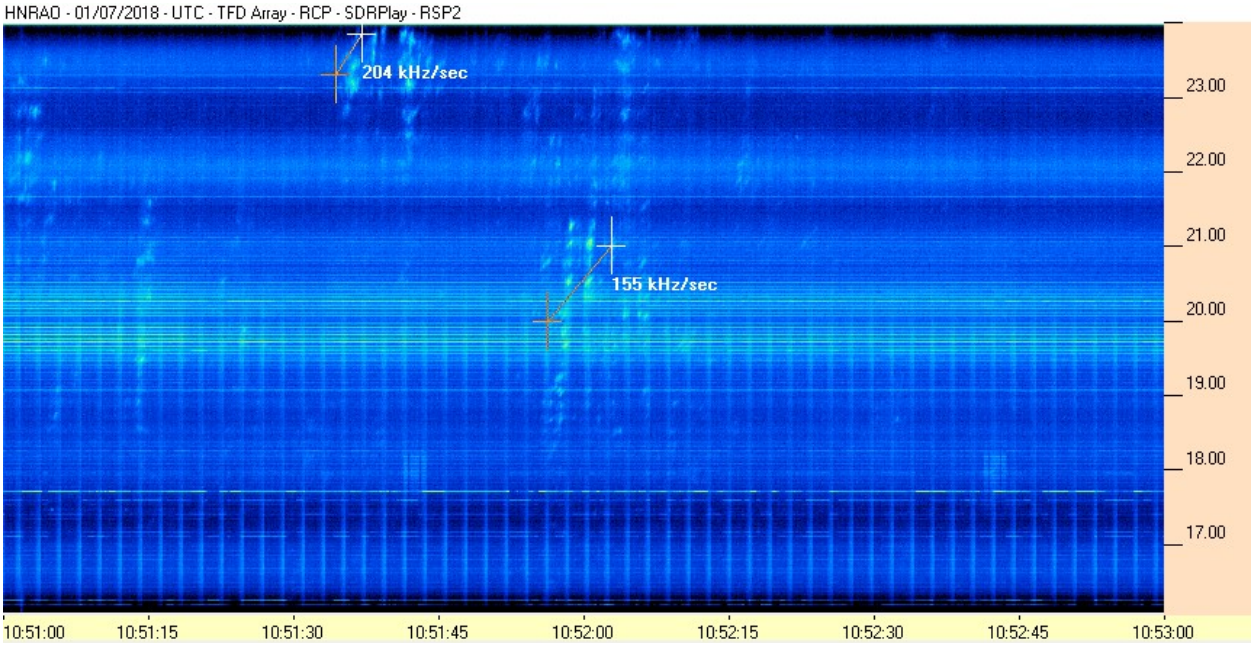

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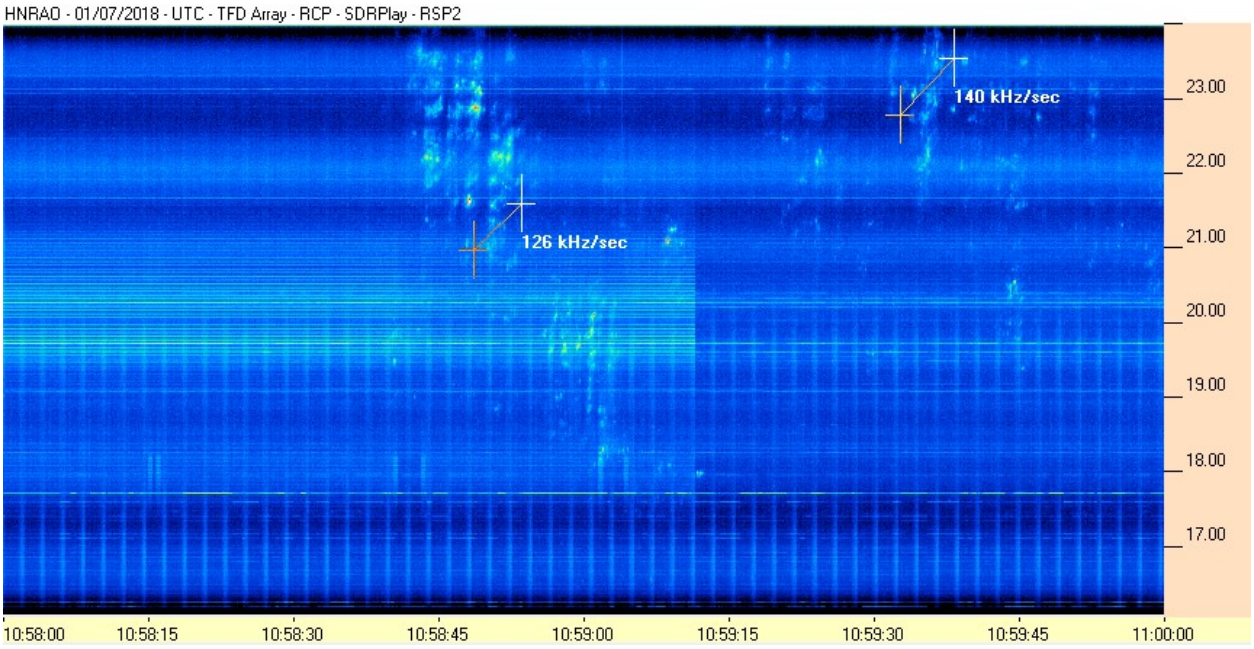

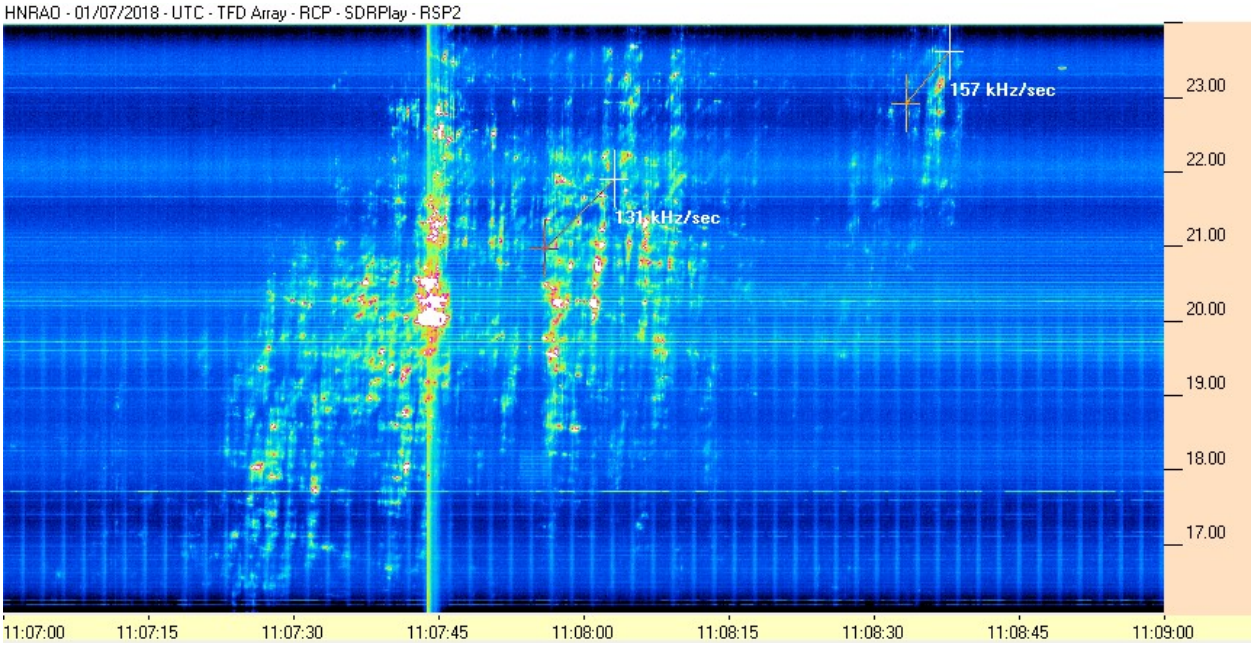

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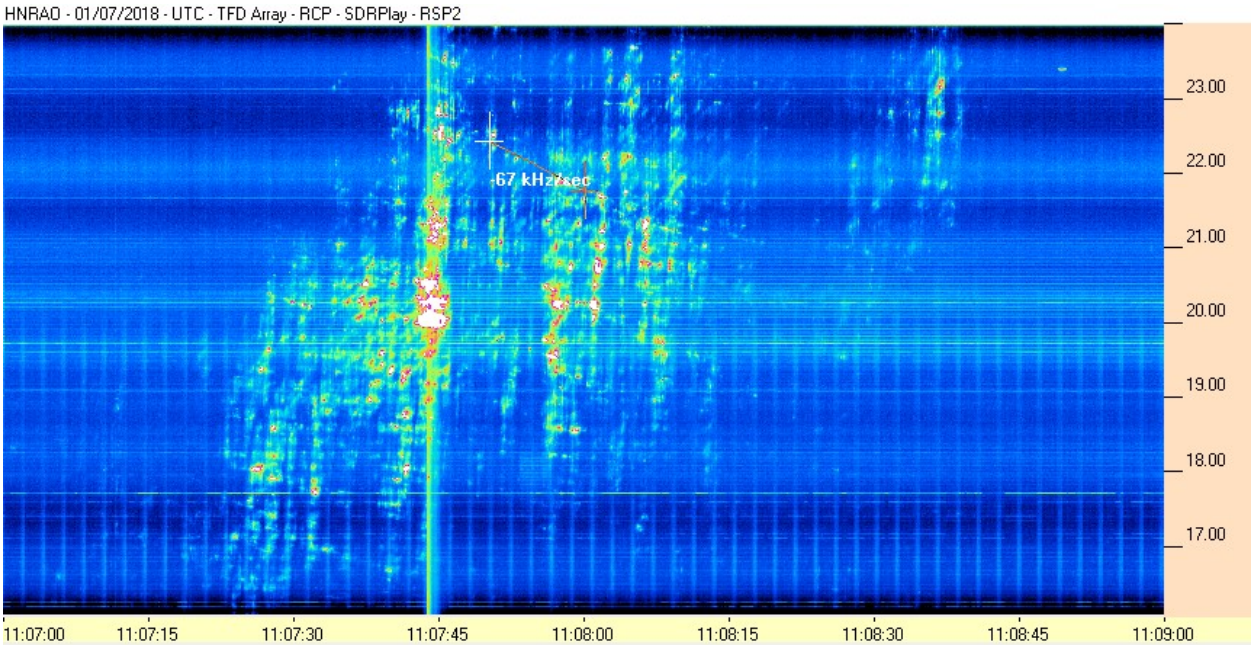

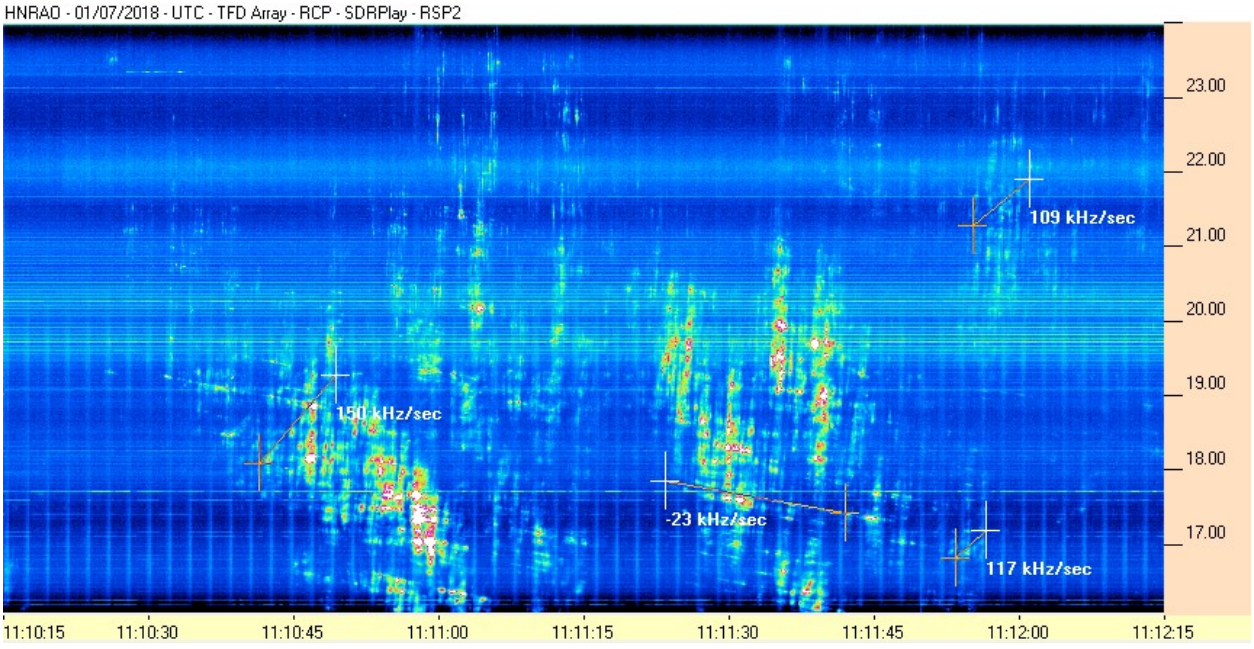

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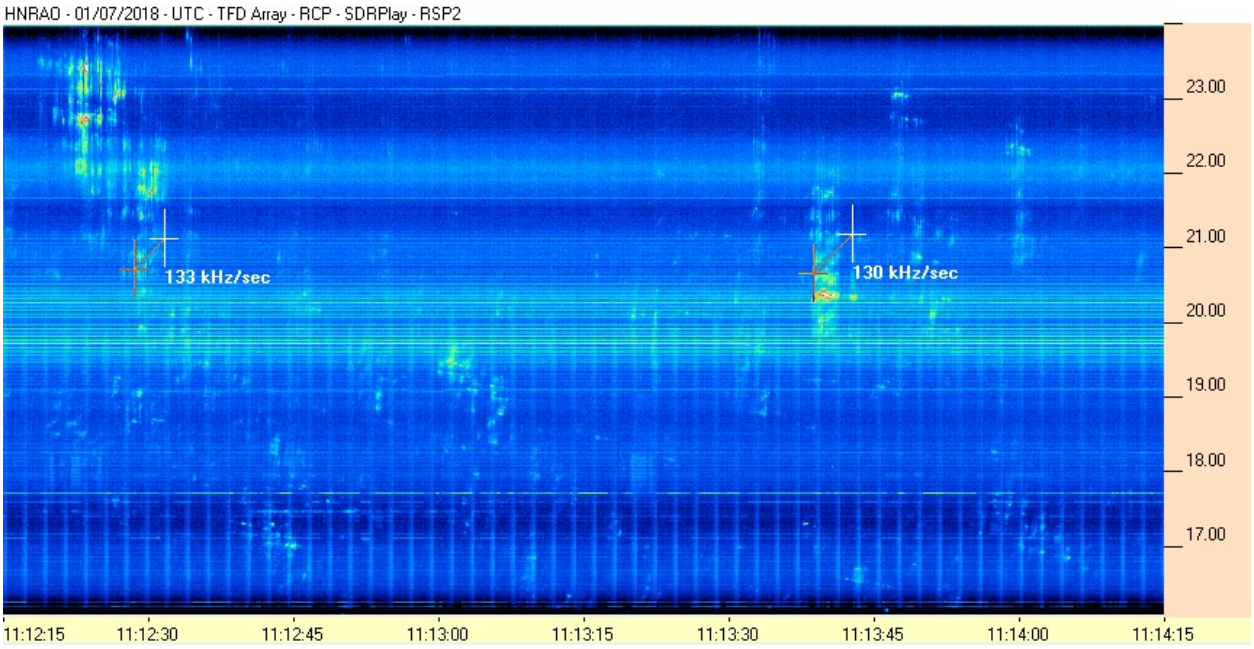

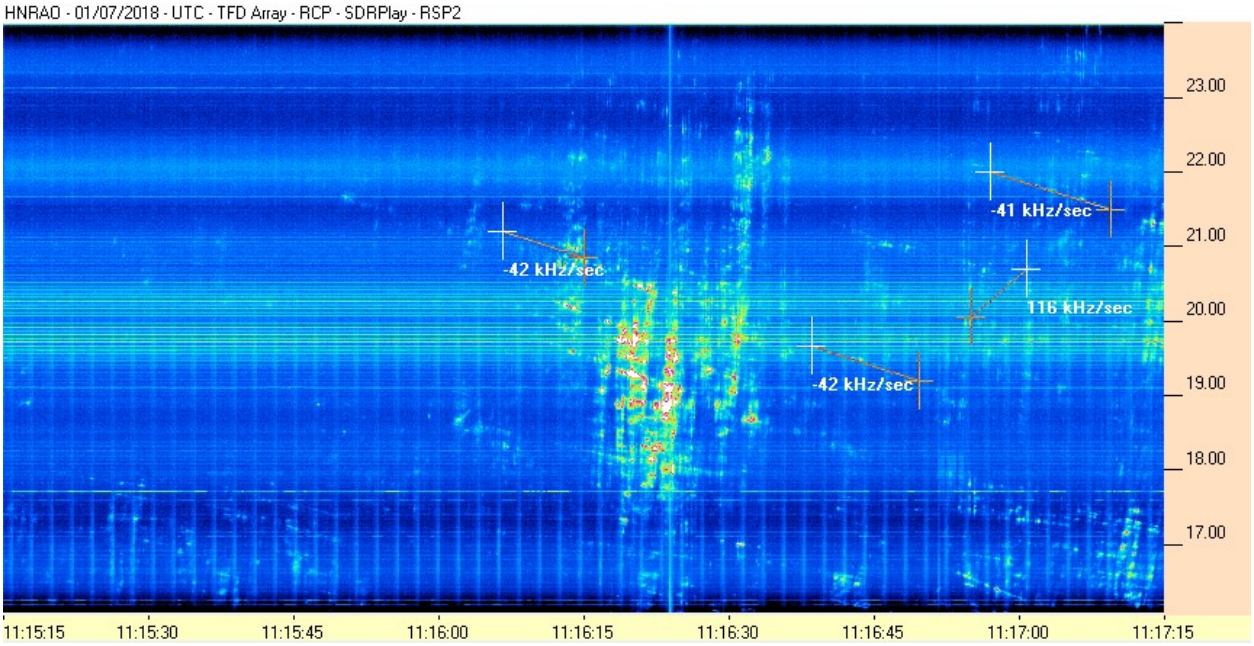

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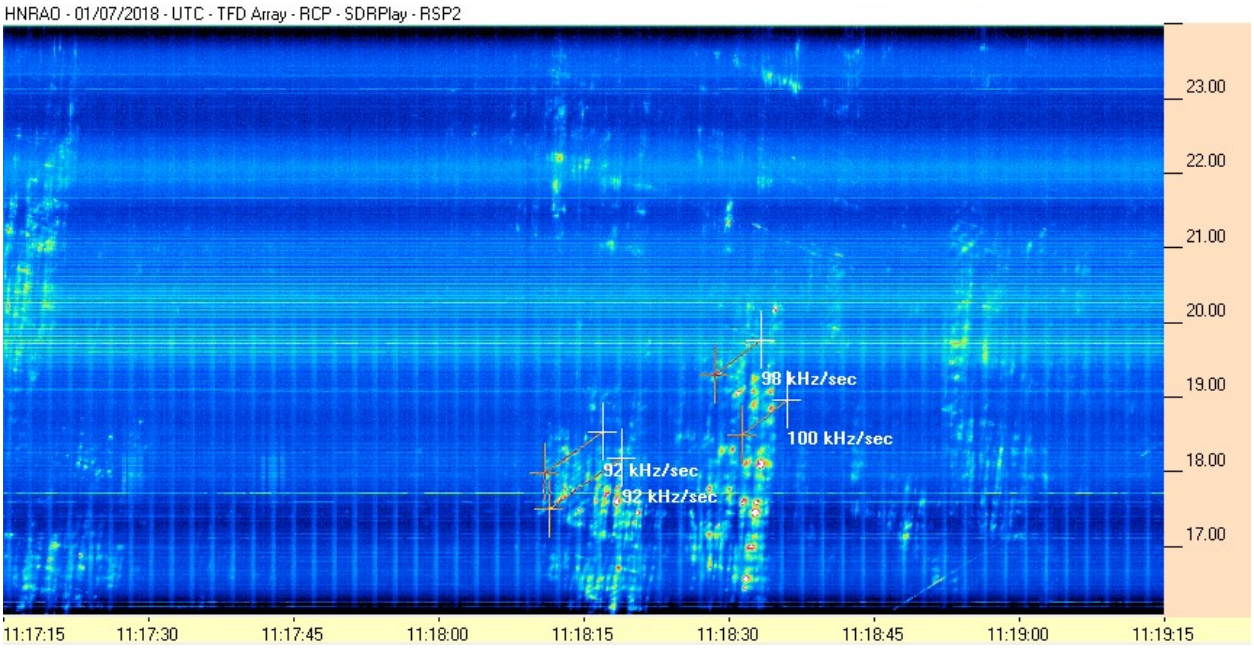
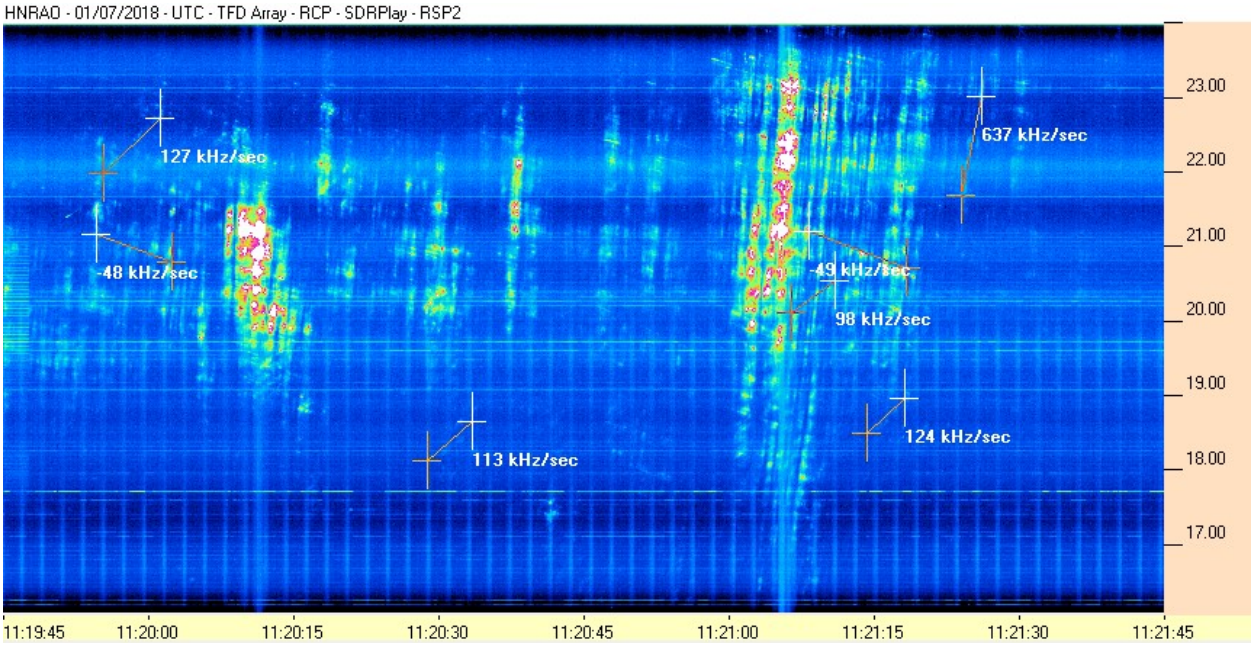
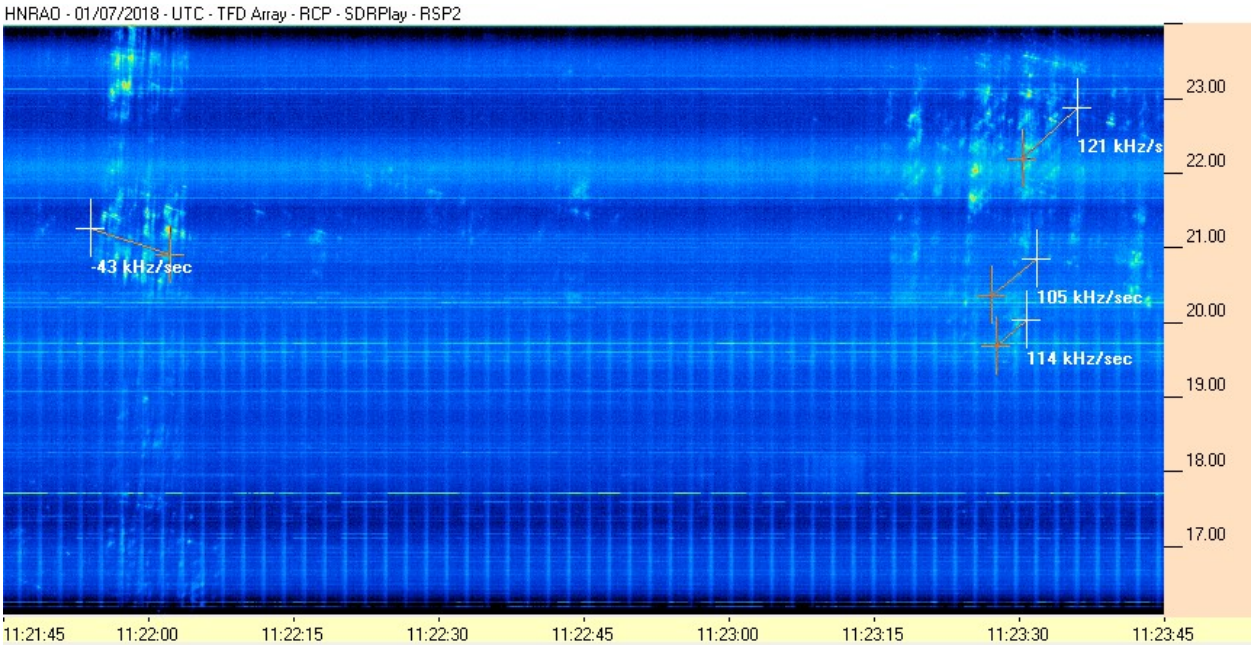
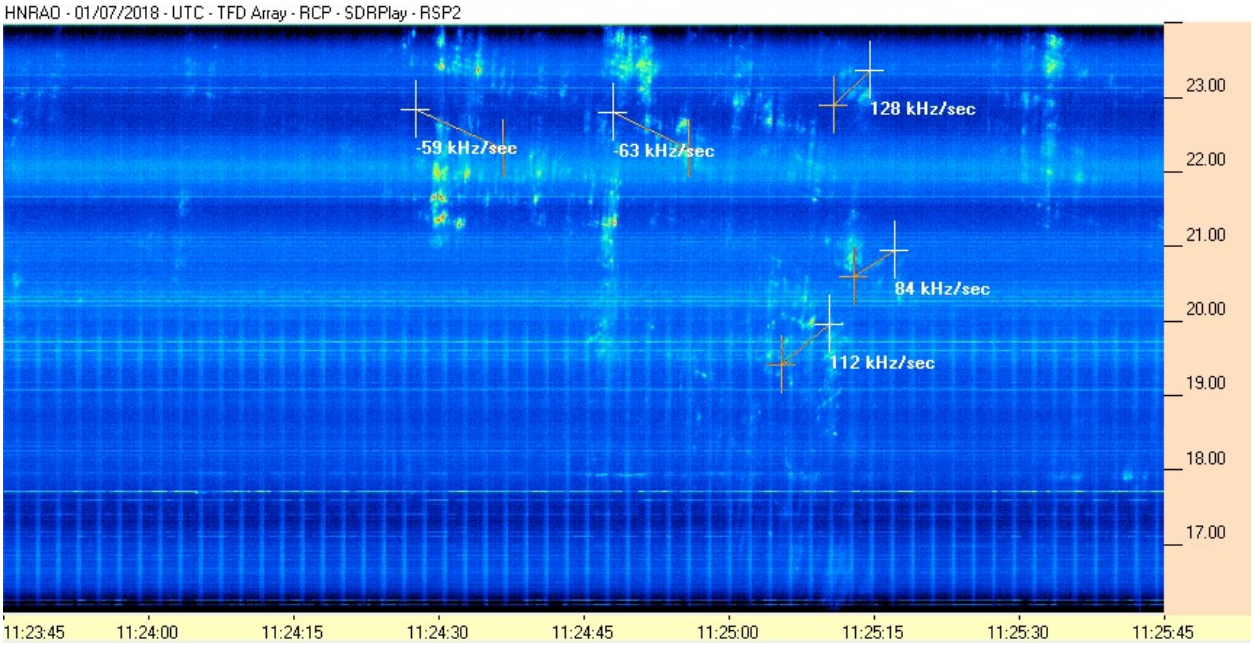





HNRAO - 01/07/2018 - UTC - TFD Array - RCP - SDRPlay - RSP2
-43 kHz/sec
121 kHz/s
105 kHz/sec
114 kHz/sec
23.00
22.00
21.00
20.00
19.00
18.00
17.00
11:21:45
11:22:00
11:22:15
11:22:30
11:22:45
11:23:00
11:23:15
11:23:30
11:23:45


HNRAO - 01/07/2018 - UTC - TFD Array - RCP - SDRPlay - RSP2
-59 kHz/sec
-63 kHz/sec
128 kHz/sec
84 kHz/sec
112 kHz/sec
23.00
22.00
21.00
20.00
19.00
18.00
17.00
11:23:45
11:24:00
11:24:15
11:24:30
11:24:45
11:25:00
11:25:15
11:25:30
11:25:45

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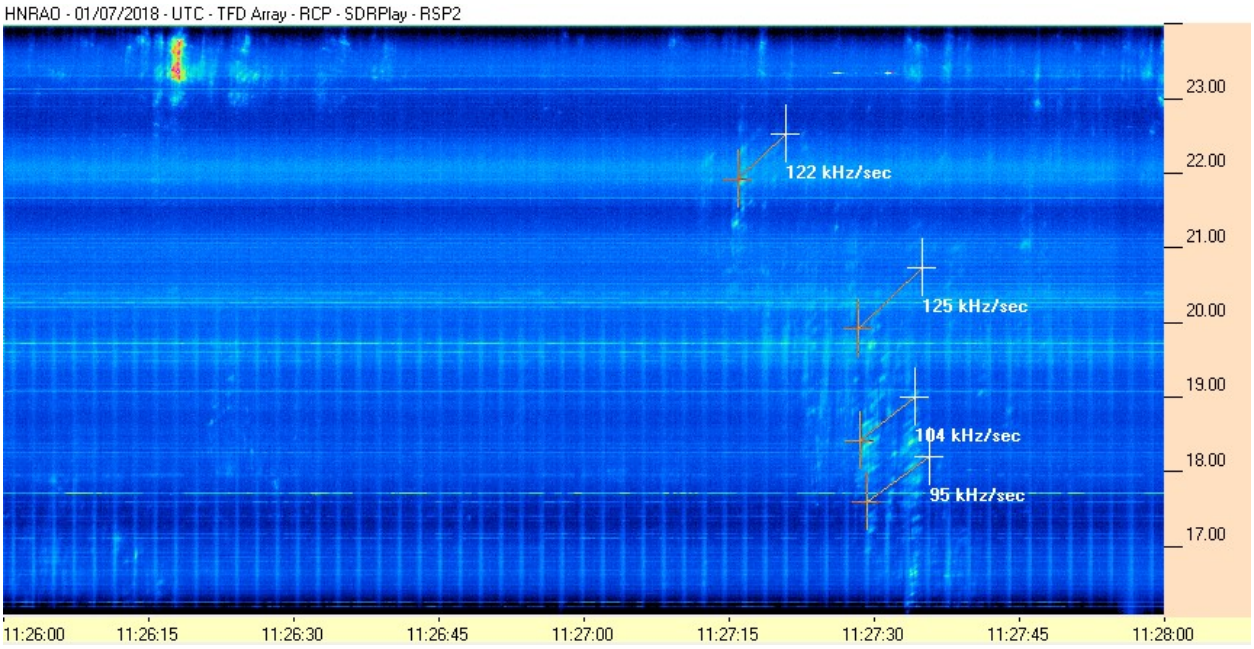

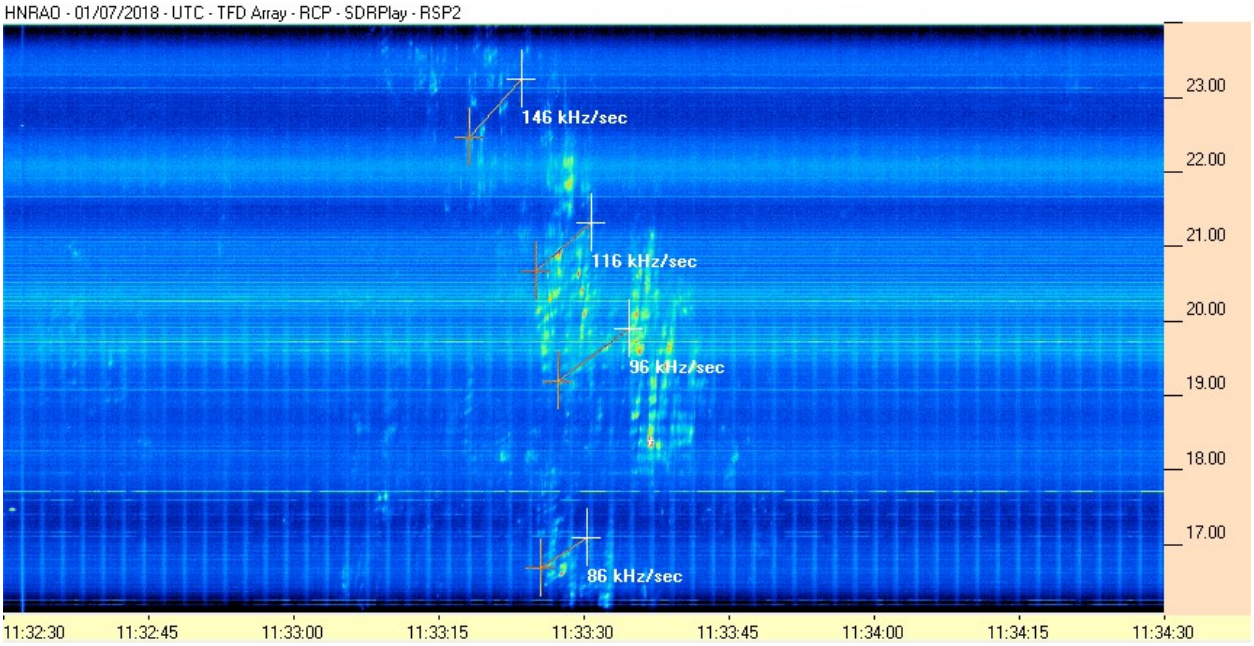

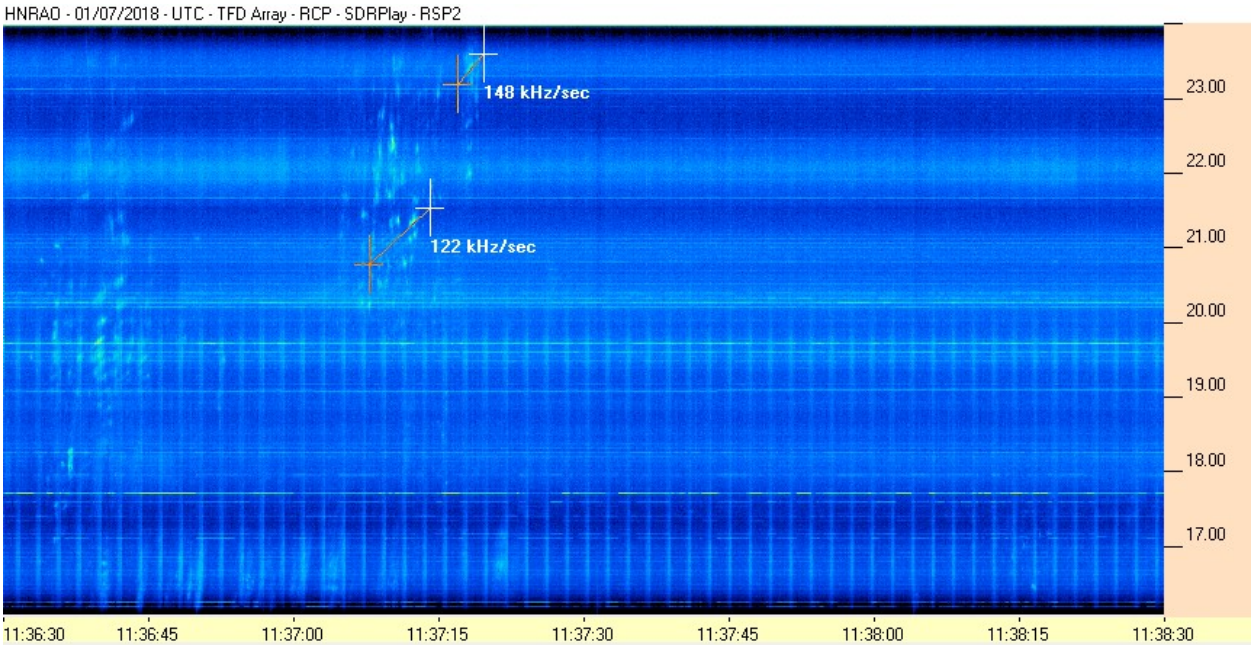
HNRAO - 01/07/2018 - UTC - TFD Array - RCP - SDRPlay - RSP2
148 kHz/sec
122 kHz/sec
23.00
22.00
21.00
20.00
19.00
18.00
17.00
11:36:30
11:36:45
11:37:00
11:37:15
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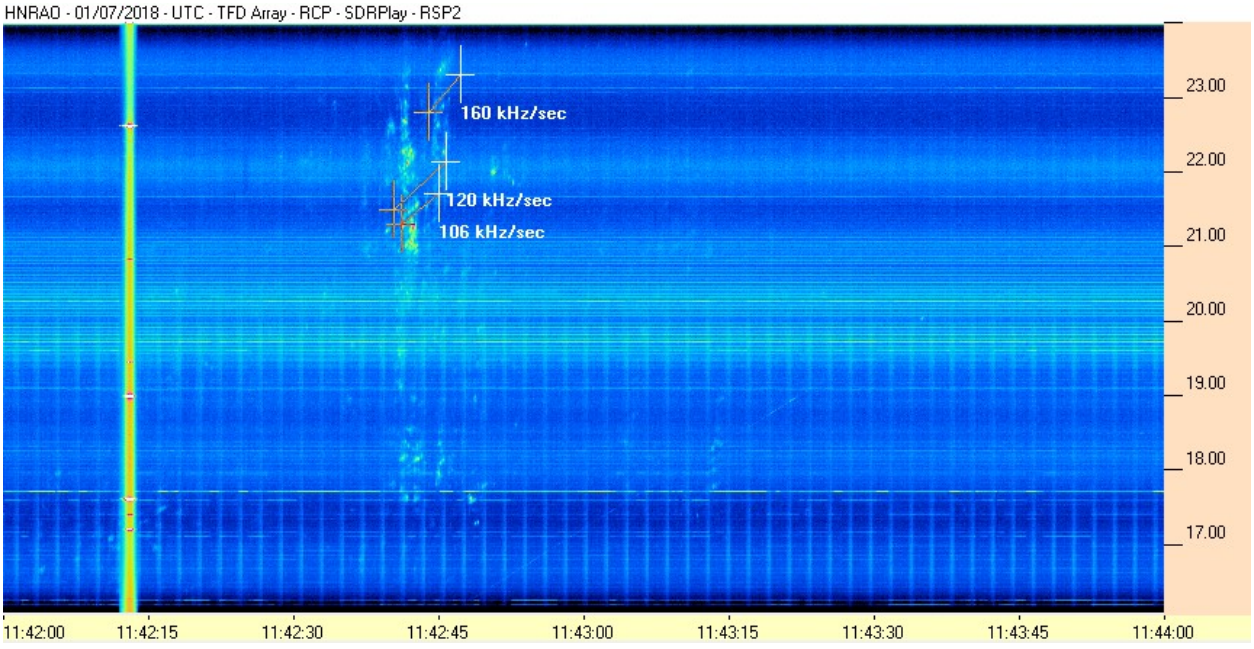
11:37:45
11:38:00
11:38:15
11:38:30


HNRAO - 01/07/2018 - UTC - TFD Array - RCP - SDRPlay - RSP2
160 kHz/sec
120 kHz/sec
106 kHz/sec
23.00
22.00
21.00
20.00
19.00
18.00
17.00
11:42:00
11:42:15
11:42:30
11:42:45
11:43:00
11:43:15
11:43:30
11:43:45
11:44:00

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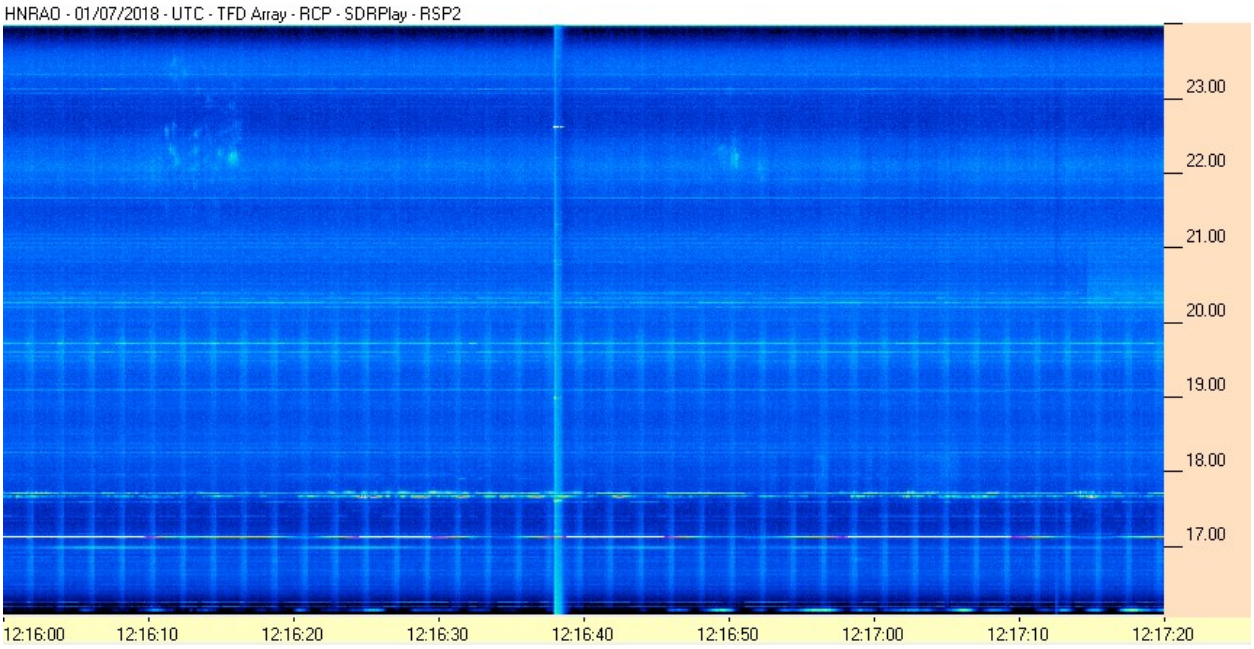

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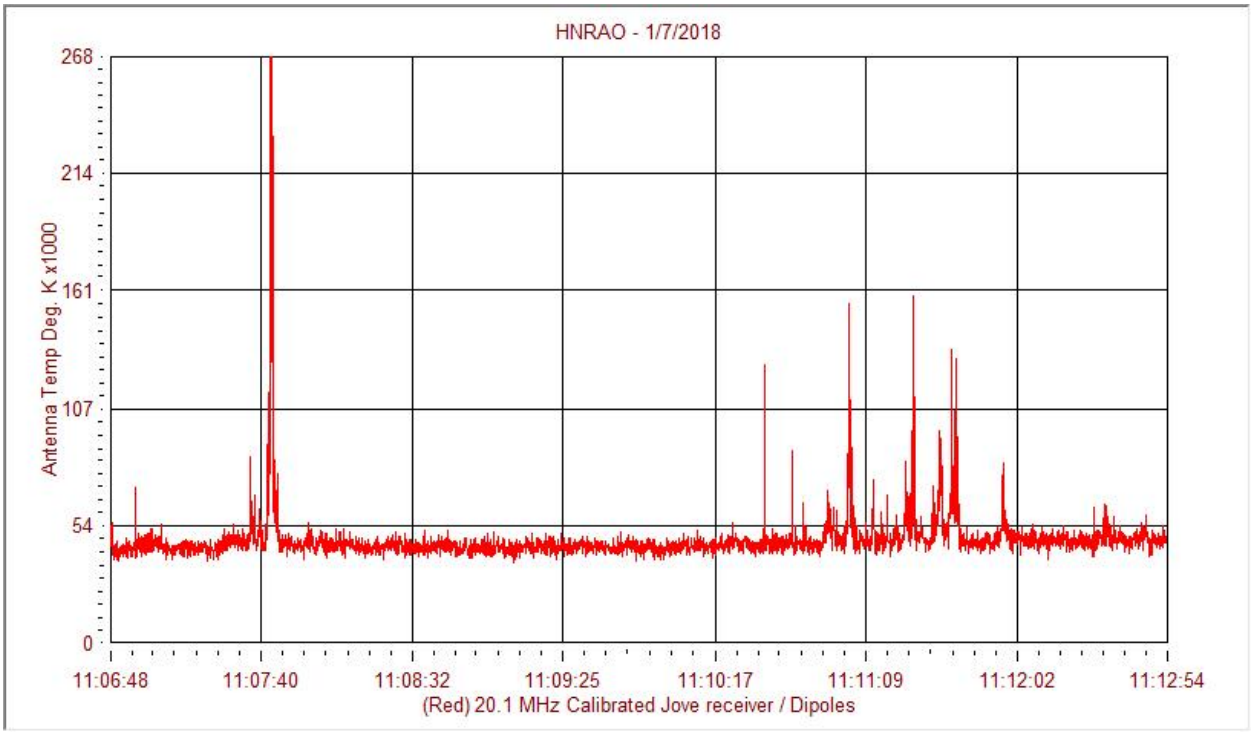
RadioJOVE/Dipole Pair



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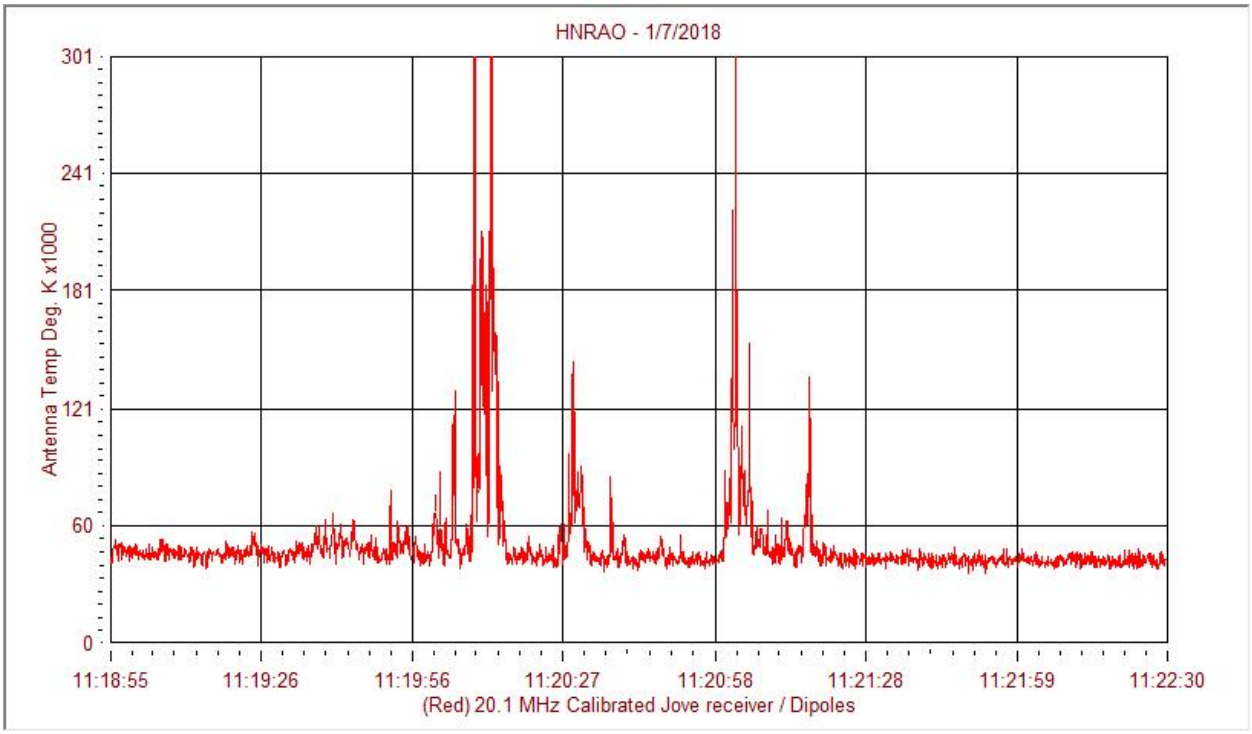

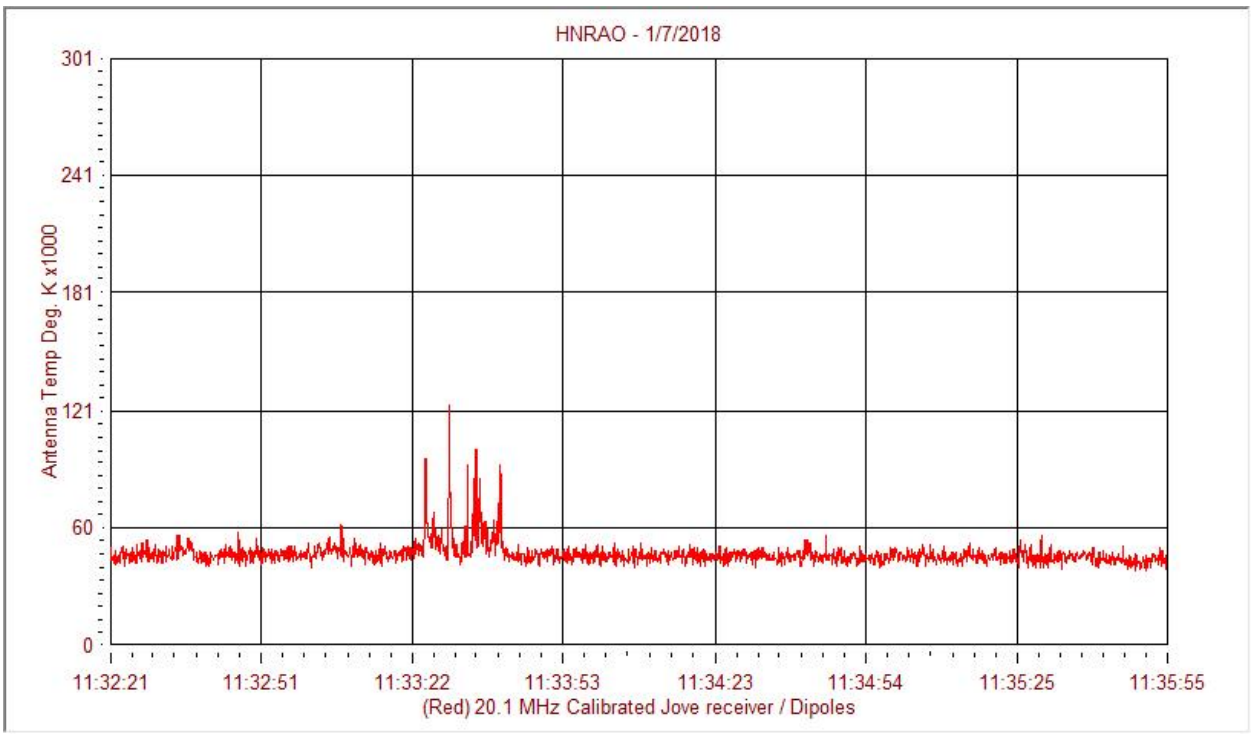

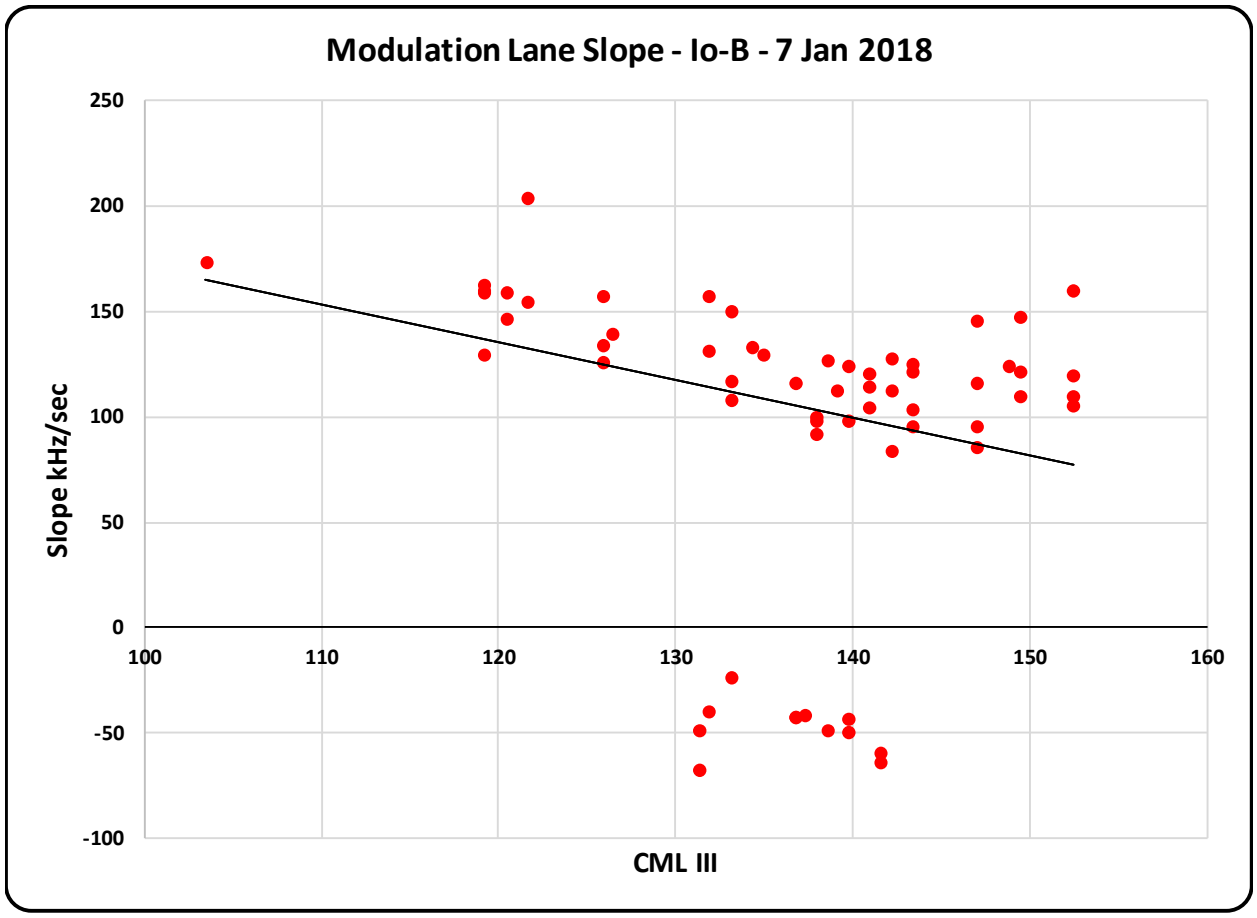
Modulation Lane Slope - Io-B - 7 Jan 2018
Slope kHz/sec
250
200
150
100
50
0
-50
-100
100
110
120
130
140
150
160
CML III