HNRAO Observing Log
40.673181 N – 80.437885 W
EN90sq

Date: March 8, 2020

Object: Jupiter – Io-C

Observer: Unattended

Start - Time UT:	**1349:30**	**Planetary K-index:**	
Jupiter Altitude (deg):	**27.4**	**Jupiter Azimuth (deg):**	**180.8**
Jupiter CML:	**291.15**	**Jupiter Io Phase:**	**253.42**
Jupiter RA (hr/min):	**19:28**	**Jupiter Dec (hr/min):**	**-21:56**
Hour Angle (hr/min):	**0003**	**Polarization**	**LCP**
Sun Altitude (deg):	**22.3**	**Sun Azimuth (deg):**	**119.6**
Sun RA (hr/min):	**23:07**	**Sun Dec (hr/min):**	**-05:42**

End – Time UT:	**1438:20**		
Jupiter Altitude (deg):	**26.2**	**Jupiter Azimuth (deg):**	**193.5**
Jupiter CML:	**320.67**	**Jupiter Io Phase**	**260.26**
Hour Angle (hr/min):	**0052**	**Duration (min):**	**49**
Sun Altitude (deg):	**29.9**	**Sun Azimuth (deg):**	**130.1**
Max Frequency MHz	**19**	**Min Frequency MHz**	**16**
J/S Angular Separation	**054.8**	**De:**	**-1.6**

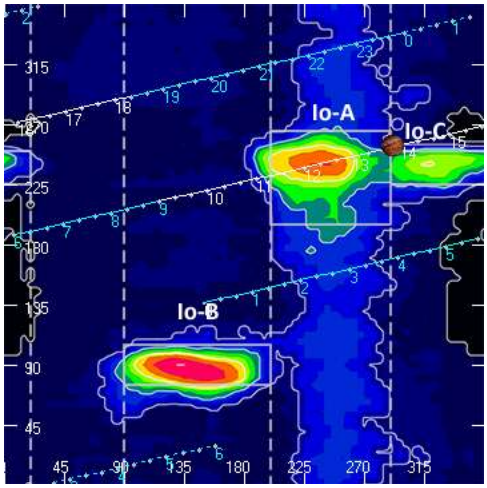
Observatory Configuration

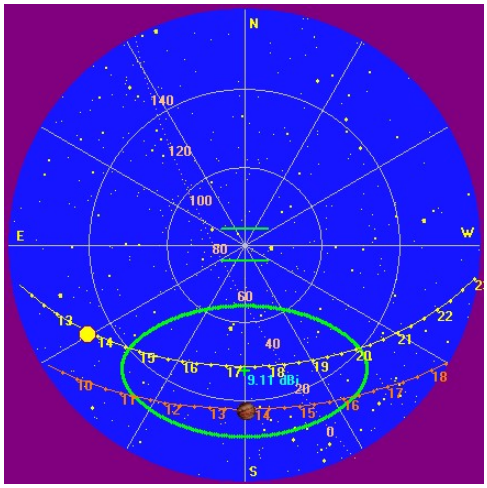
Spectrograph Receiver	Antenna	Polarization	System Loss	Multicoupler	Multicoupler port	Calibrated
FSX-8S	TFD	RCP LCP	-8.35 dB -7.59 dB	#2 RCP #1 LCP	Port 1 +10dB Port 1 +10dB	Twice daily Twice daily
FSX-2	LWA	RCP/LCP manual select		N/A	N/A	N/A
SDRPlay RSP2 #1	TFD	RCP	-8.35 dB	#2 RCP	Port 2 +3dB	Twice daily
SDRPlay RSP2 #2	TFD	LCP	-7.59 dB	#1 LCP	Port 2 +3dB	Twice daily
JOVE II HNRAO #2	Jove dipoles	Linear	-3.66 dB	#3 Linear	Port 4 +3 dB	9/21/2019

Radio JOVE dipoles phased @ 32 degrees for 2020-2021 season
Typinski AN-TFD-24-4 array phased @ 35 degrees for 2020-2021 season
Four LWA antenna array phased @ 35 degrees and orientation for observation: 45 degrees
Radio Sky Spectrograph software version 2.9.30
Radio-SkyPipe software version 2.7.33 Radio-Jupiter Pro software version 3.8.2
Network Time Server GpsNtp-Pi, Reeve Engineering

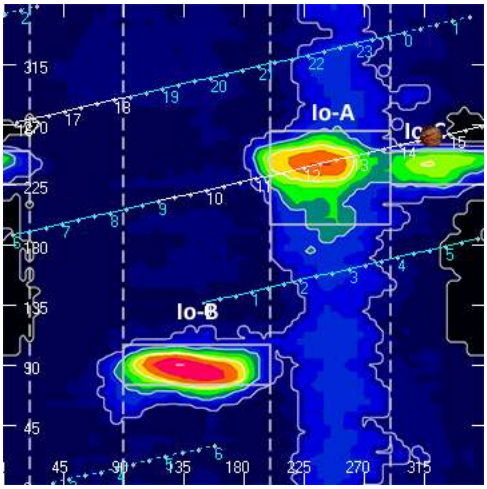
All times are synced with a local GPS locked NTP server.

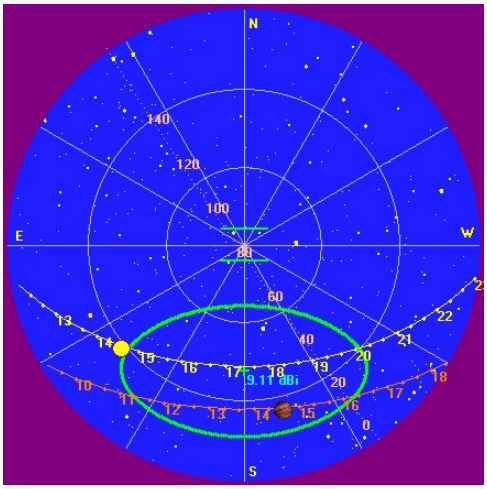
HNRAO Observing Log
40.673181 N – 80.437885 W
EN90sq





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	

Weather at observatory:

Sunny. High of 61 deg F. low of 28 deg F.

Status of observatory equipment:

All telescopes functioning normally. Software issues (RSS 2.9.30) resulted in no data being saved with both the dual polarization FSX-8S and SDRPlay RSP2/RCP spectrographs. The FSX-2 and SDRPlay RSP2/LCP spectrographs were functioning normally. Because of the LCP emissions observed in this storm, there would have been no useable data from the FSX-2 spectrograph or the SDRPlay RSP2/RCP. There would have been no data from the Radio JOVE system as it never reached above 19 MHz.

RFI:

Bright wide bandwidth RFI from unknown source. The Radio JOVE receiver was offline due to an unknown RFI source. Foreign broadcast stations are easily identified in the spectrograms. Foreign broadcast stations and ionospheric conditions made identification of some of the weaker S-bursts challenging.

This was a high pass, skirting the edge of the Io-C probability area. Observed emissions were LCP S-bursts. This storm began at 1439:30 UT and ended about 1350:00 UT dominated by faint S-burst emissions around 17 MHz. Most of the bursts were 1-3 dB above GB.

As observed here, emissions were confined between 16 MHz and 19 MHz. Since data was not taken below 16 MHz, it can be assumed that emissions were below that frequency.

Between 1352:50 UT and 1353:35 UT the emissions became, perhaps, +/- 3 dB above GB stronger with an S-burst N-event centered around 16.5 MHz.

There were long periods of no observed emissions.

Between 1414:00 UT and 1414:40 UT there was a very strong S-burst grouping between 17.5 MHz and 18.5 MHz. This emission group were, possibly +/- 6 dB above GB.

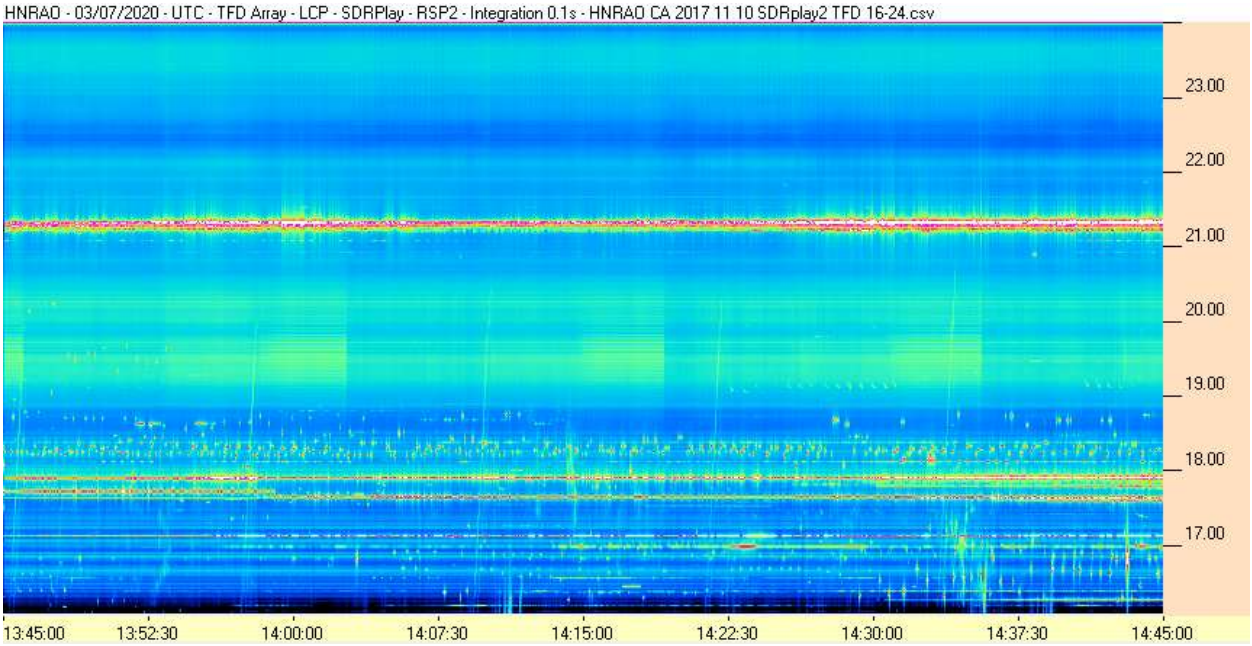
The strongest emissions were observed at the very end of the storm between 16 MHz and 18 MHz from 1433:35 UT to 1436:15 UT, again, +/- 6 dB above GB.

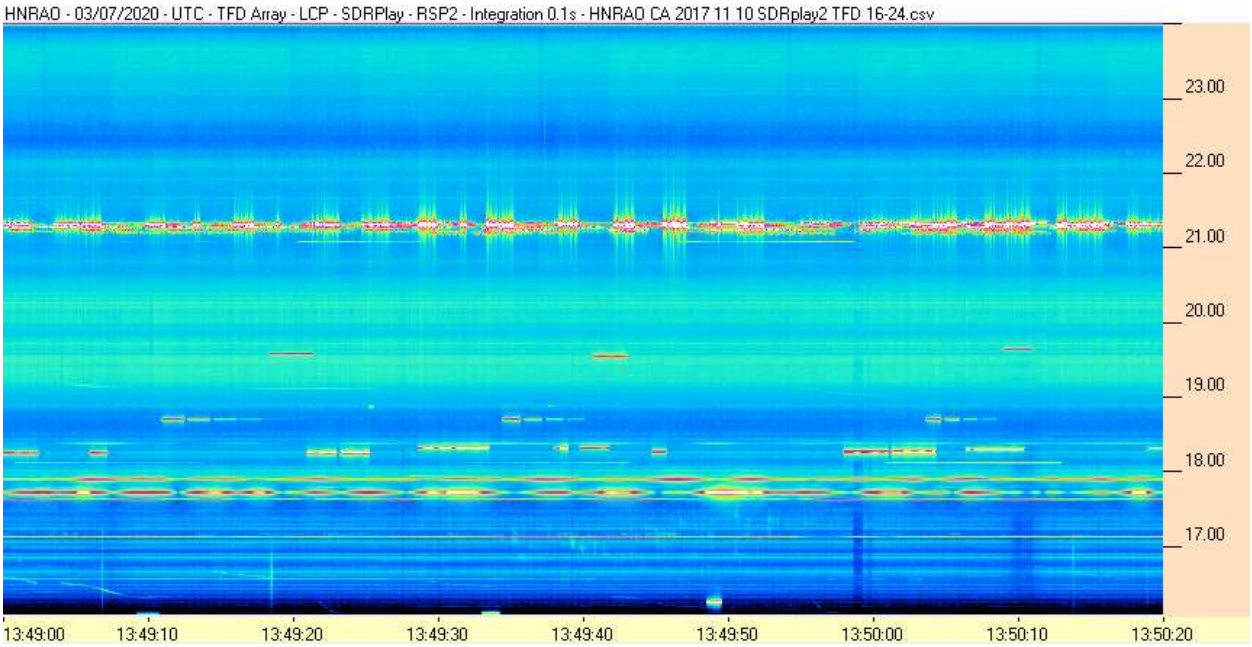
Overall, the storm can be summarized as having weak S-burst emissions of between approx. 1 dB to several dB above GB. There were several notable strong periods of emissions, the most dynamic at the very end of the storm. Emissions were observed between 16 MHz and 19 MHz with observatory spectrographs; however, the record strongly suggests emissions were also present below 16 MHz.

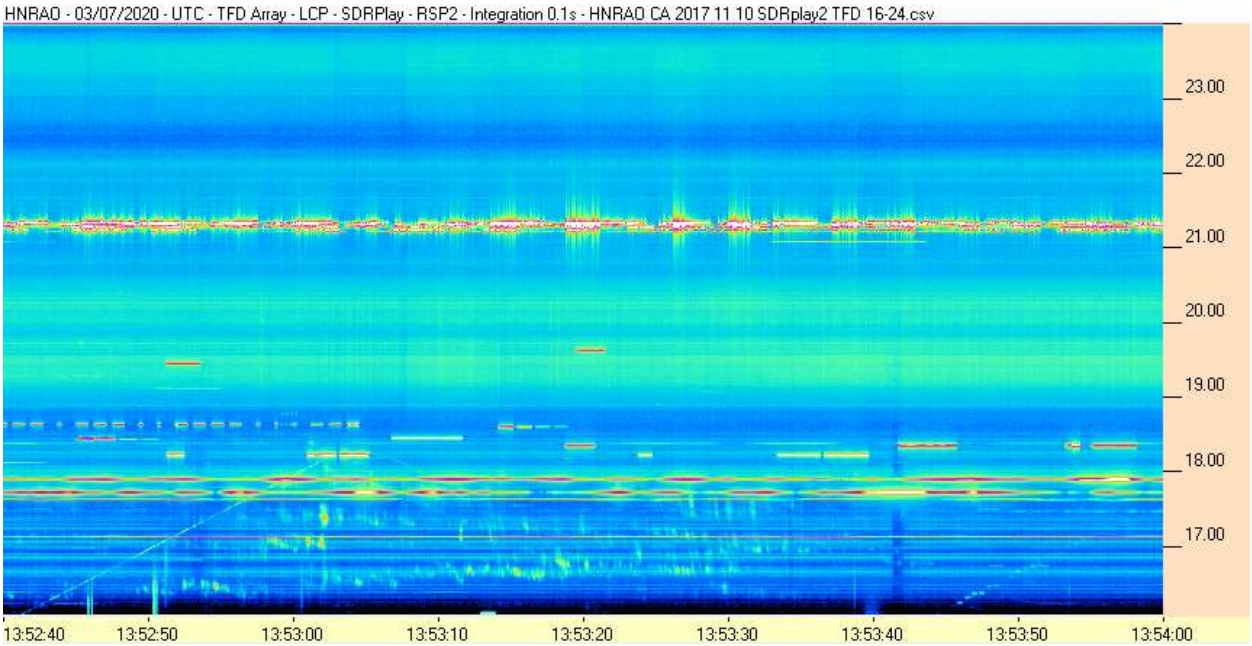
There were no observed RCP emissions from the Io-A pass preceding this storm in the FSX-2 spectrograph. There was no FSX-8S or SDRPlayRSP2/RCP data files to review.

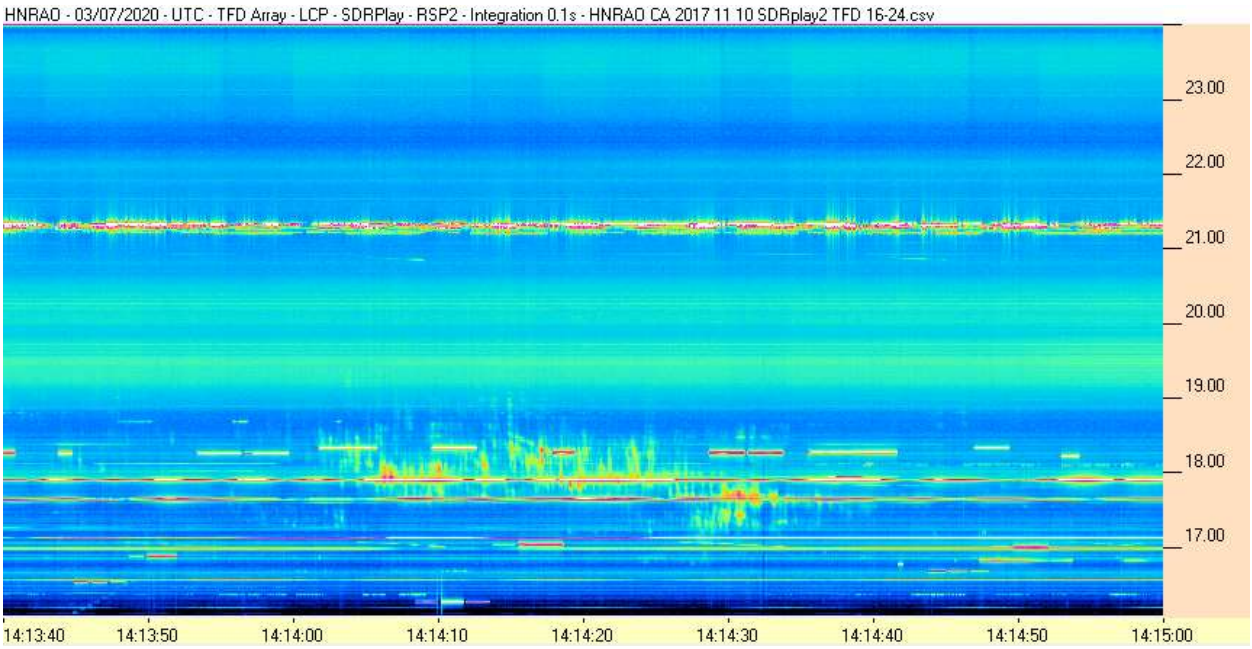
EOR

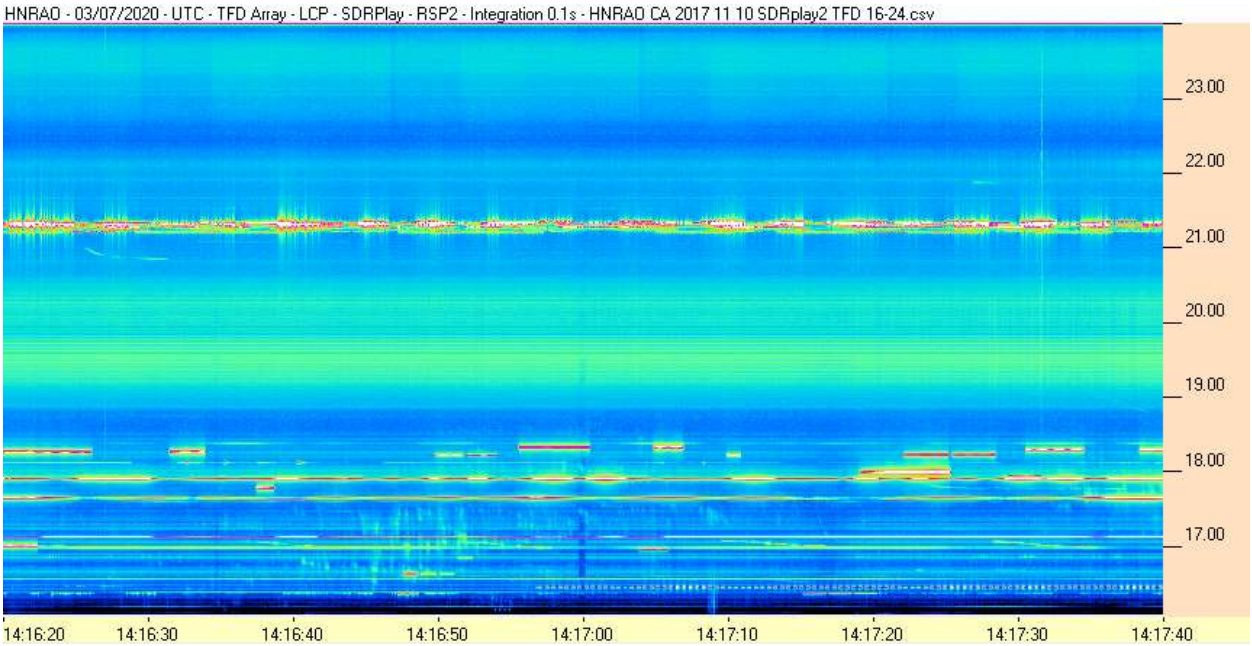
SDRPlay RSP2 / TFD Array

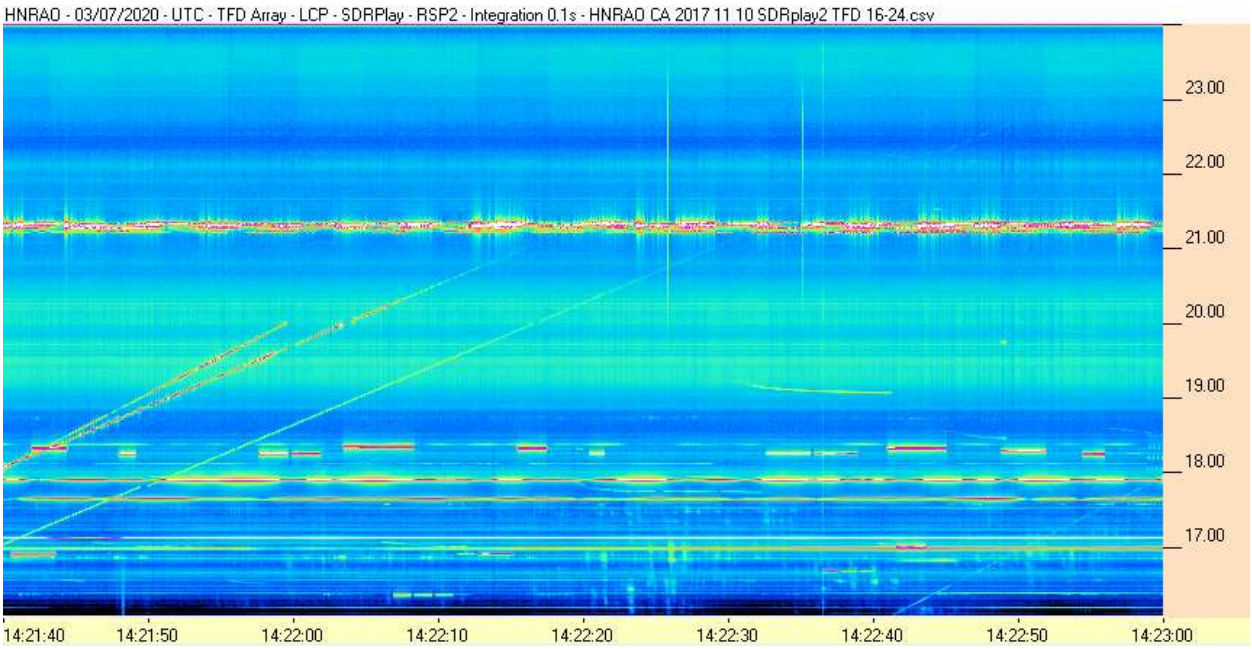


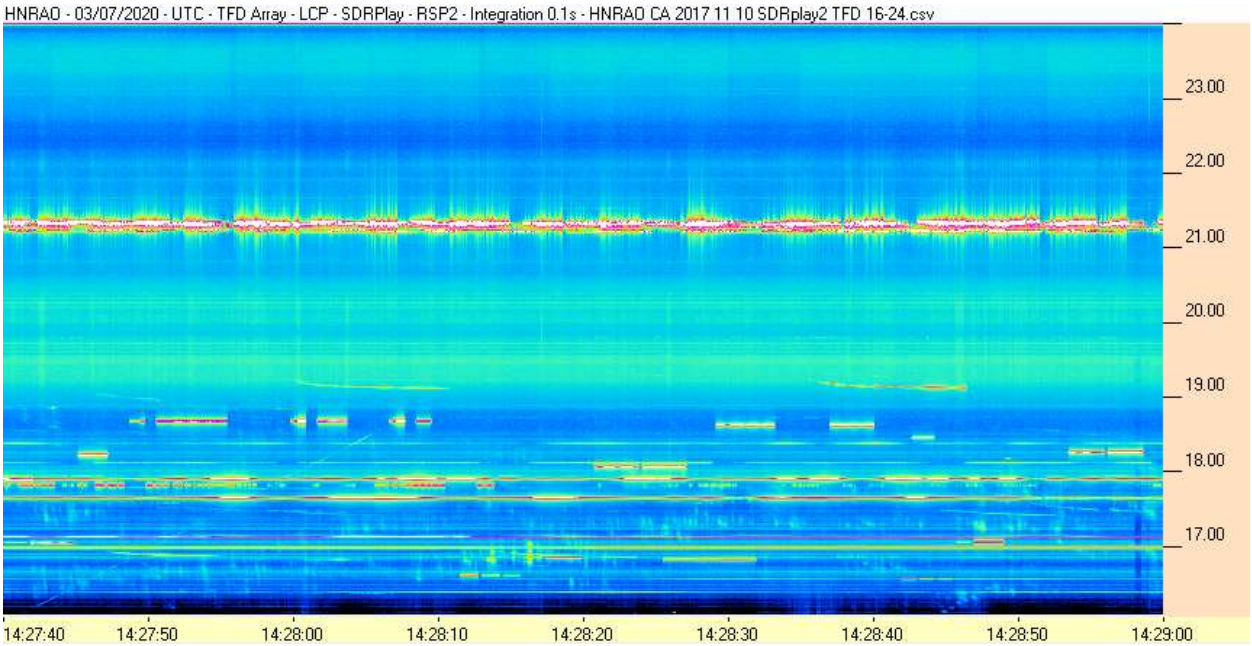


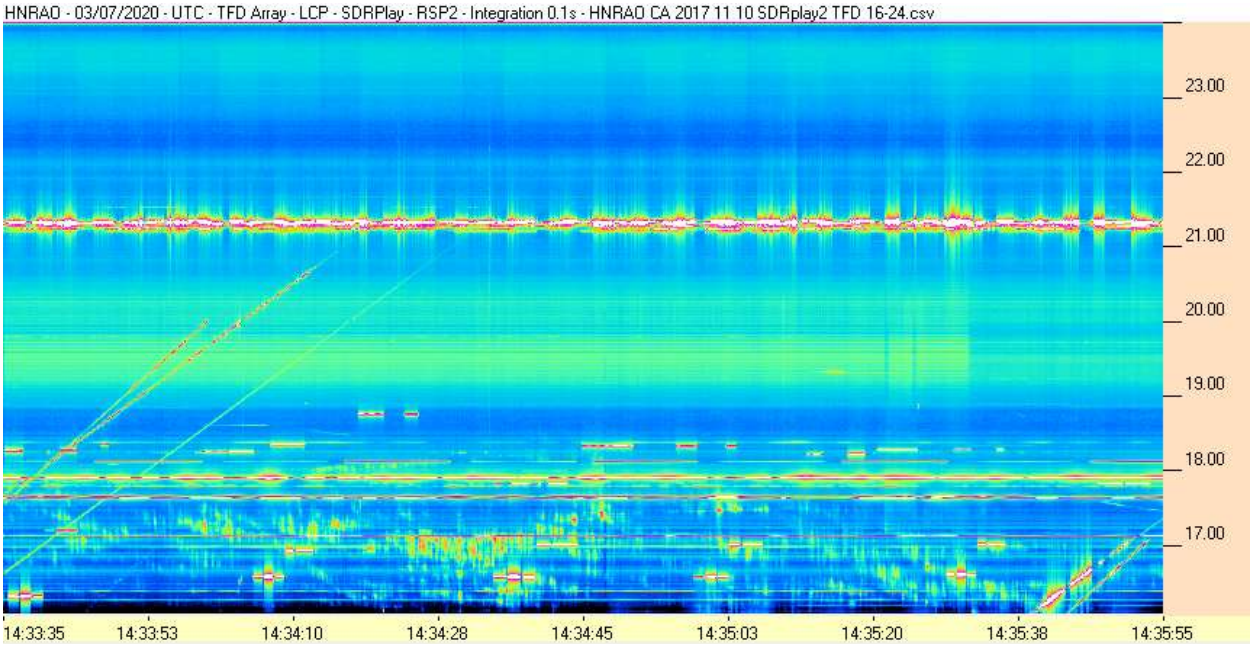

HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
13:52:40
13:52:50
13:53:00
13:53:10
13:53:20
13:53:30
13:53:40
13:53:50
13:54:00

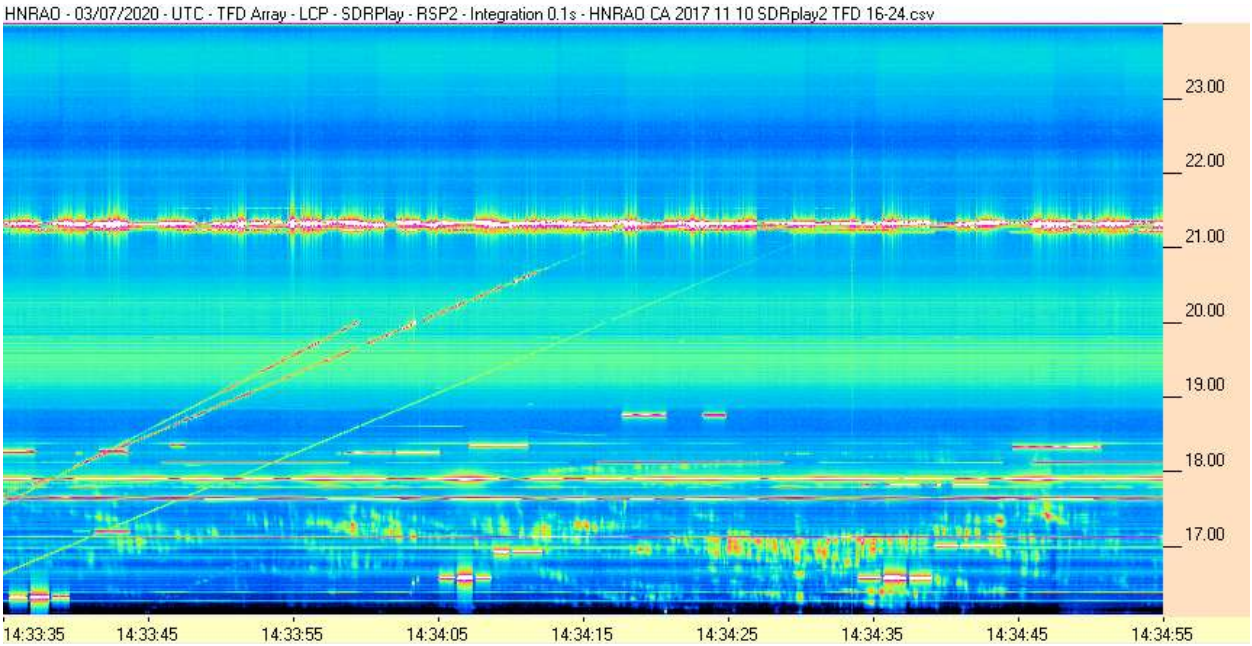

HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:13:40
14:13:50
14:14:00
14:14:10
14:14:20
14:14:30
14:14:40
14:14:50
14:15:00

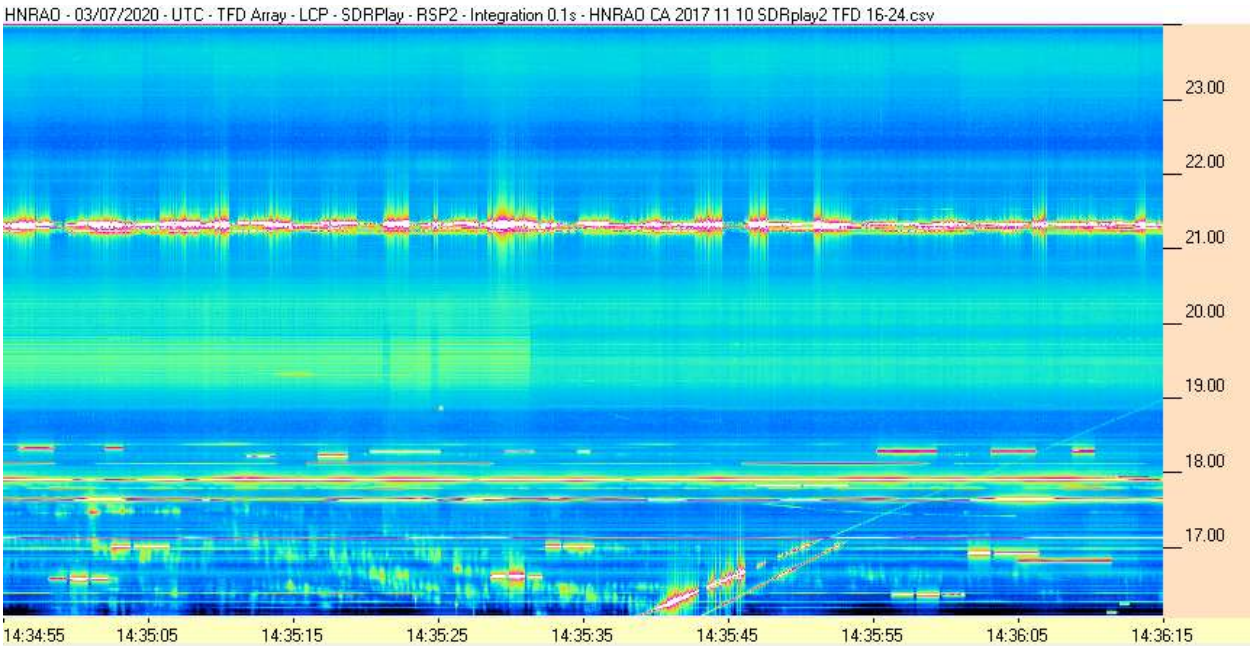

HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:16:20
14:16:30
14:16:40
14:16:50
14:17:00
14:17:10
14:17:20
14:17:30
14:17:40


HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:21:40
14:21:50
14:22:00
14:22:10
14:22:20
14:22:30
14:22:40
14:22:50
14:23:00


HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:27:40
14:27:50
14:28:00
14:28:10
14:28:20
14:28:30
14:28:40
14:28:50
14:29:00


HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:33:35
14:33:53
14:34:10
14:34:28
14:34:45
14:35:03
14:35:20
14:35:38
14:35:55


HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:33:35
14:33:45
14:33:55
14:34:05
14:34:15
14:34:25
14:34:35
14:34:45
14:34:55


HNRAO - 03/07/2020 - UTC - TFD Array - LCP - SDRPlay - RSP2 - Integration 0.1s - HNRAO CA 2017 11 10 SDRplay2 TFD 16-24.csv
23.00
22.00
21.00
20.00
19.00
18.00
17.00
14:34:55
14:35:05
14:35:15
14:35:25
14:35:35
14:35:45
14:35:55
14:36:05
14:36:15