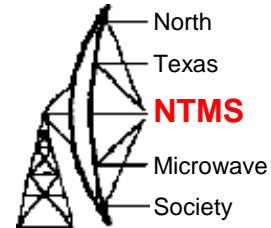


# Lunar Echoes from the Goldstone 34 meter dish (DSS24) and 20 kw on 2115 MHz

Al Ward W5LUA

March 3, 2015

# Original Email



S-band Moonbounce Update (March 3)

The frequency and schedule has changed slightly..

As before, we're going to aim at Tycho from DSS-24 (34m antenna)

We'll radiate at 2115 MHz (not 2401 MHz).. from 0630UTC to 0900 UTC

For the first hour (until 0730UTC) we'll just have a CW carrier, should be easy to see.

For the next hour, we'll be transmitting a JPL ranging code with the chip rate at 2115/2048 MHz (a bit more than 1 MHz)..

See the 810-005 handbook for details

<http://deepspace.jpl.nasa.gov/dsndocs/810-005/214/214-1.pdf>

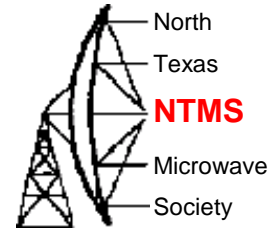
You can probably see not only the carrier but the +/-1 MHz ranging tones (and probably at +/-2 MHz, too), and also the PN sequence if you've got enough SNR (or post process.. the code period is about 1 second.. it's about a million chips long)

Then, at 0830UTC we'll stop using the PN ranging, and go to Doppler compensating the uplink so that the received signal at JPL will have zero Doppler.

This is all "we hope".. it's experimental and a sort of procedural shake out as well as giving me a chance to test my ground copy of a Software Defined Radio that is flying on ISS.

[ANS thanks Jim Lux, W6RMK for the above information]

# http://eyes.nasa.gov/dsn/dsn.html



DSN Now

eyes.nasa.gov/dsn/dsn.htm

Most Visited Getting Started From Internet Explorer From Internet Explorer

Jet Propulsion Laboratory | California Institute of Technology  
**DEEP SPACE NETWORK NOW** LAST UPDATED: MAR 7 3:30 PM (UTC) [DSN home](#)

<b>MADRID</b> MAR 7 4:30 PM	ROSE	LRO	MVN	MER1 M010	
	63	65	54	55	
<b>GOLDSTONE</b> MAR 7 7:30 AM	NHPC	SOHO	MOM	DAWN	
	14	15	24	25	26
<b>CANBERRA</b> MAR 8 2:30 AM	CAS			GBRA	
	43	45	34	35	

TARGET  
**SOHO**

[VIEW ANTENNA](#) [VIEW SPACECRAFT](#) [VIEW WORLD MAP](#)

SOHO

SPACECRAFT

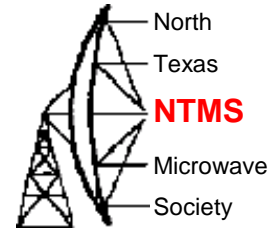
NAME  
**SOHO**

RANGE

+ more details [credits](#) [contact us](#)

9:30 AM 3/7/2015

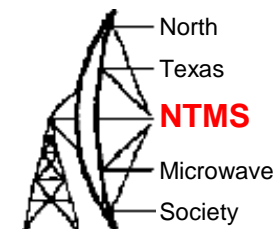
# 5m Dish at W5LUA used to Monitor Lunar Echoes from NASA on 2115 MHz



I use my EME system which consists of a circular polarized feed with septum polarizer optimized for an  $f/d$  of 0.375. The system receives LHCP. The LNAs are my own design LNAs using the ATF-36077 providing a nominal 0.5 dB system noise figure. To copy the 2115 MHz, I couple some of the 13 cm signal off to an Avantek DBM with an LO of 2087 MHz provided by an HP 83712A GPS locked signal generator. A tunable Farinon S band filter with a 5 MHz 3 dB bandwidth provides greater than 50 dB of image rejection. My IF is 28 MHz

The screenshots to follow are from my Flex-1500 while receiving the lunar signals. The resolution bandwidth is  $48 \text{ kHz} / 512 \text{ mB} = 93.75 \text{ Hz} \sim 100 \text{ Hz BW}$

# K5GW Tracking Program



KT07-5.EXE

TIME	DATE	TGT	A/T	AZ	EL	AZC	ELC	DEC	AZ ERROR	EL
07:19:03	03/03/15	MOON	OFF	246.73	49.69	5.3	0.2	12.0	-93.94	36.25

ANTENNA	AZIM	ELEV
1296	77.73	89.39
2304	152.80	85.94
3400	63.52	89.50
5760	235.86	88.67
10368	152.51	89.40
24048	243.20	44.11
47088	103.10	44.49
77184	85.50	43.41

Band: 2304MHZ  
Doppler: -3715.1  
Sky Tem: 2.8  
Loss dB: 2.21  
Tdeg dB: 2.22  
Pol: -38  
Lib: 44.8

MAR 03 2015 07:19:03

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

STATION B DATA

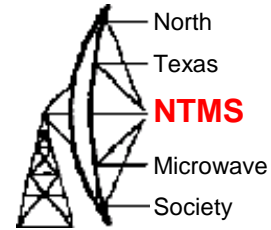
Call:	Grid: DM15NK
Lat: 35.437	Lon: 116.875
Az: 216.88	El: 61.75
Dop: -1872	Mdop: -2794
Pol: -60	Mpol: -22
Lib: 51	Mlib: 48

<esc> <E> <B> <T> <L> <M/m> <D/d> <Y/y> <W/w> <H/h> <N/n> <F/f> <O> ↑ --> -  
 reset exit bnd tgt lib month day year week hour 1min 5min stnB

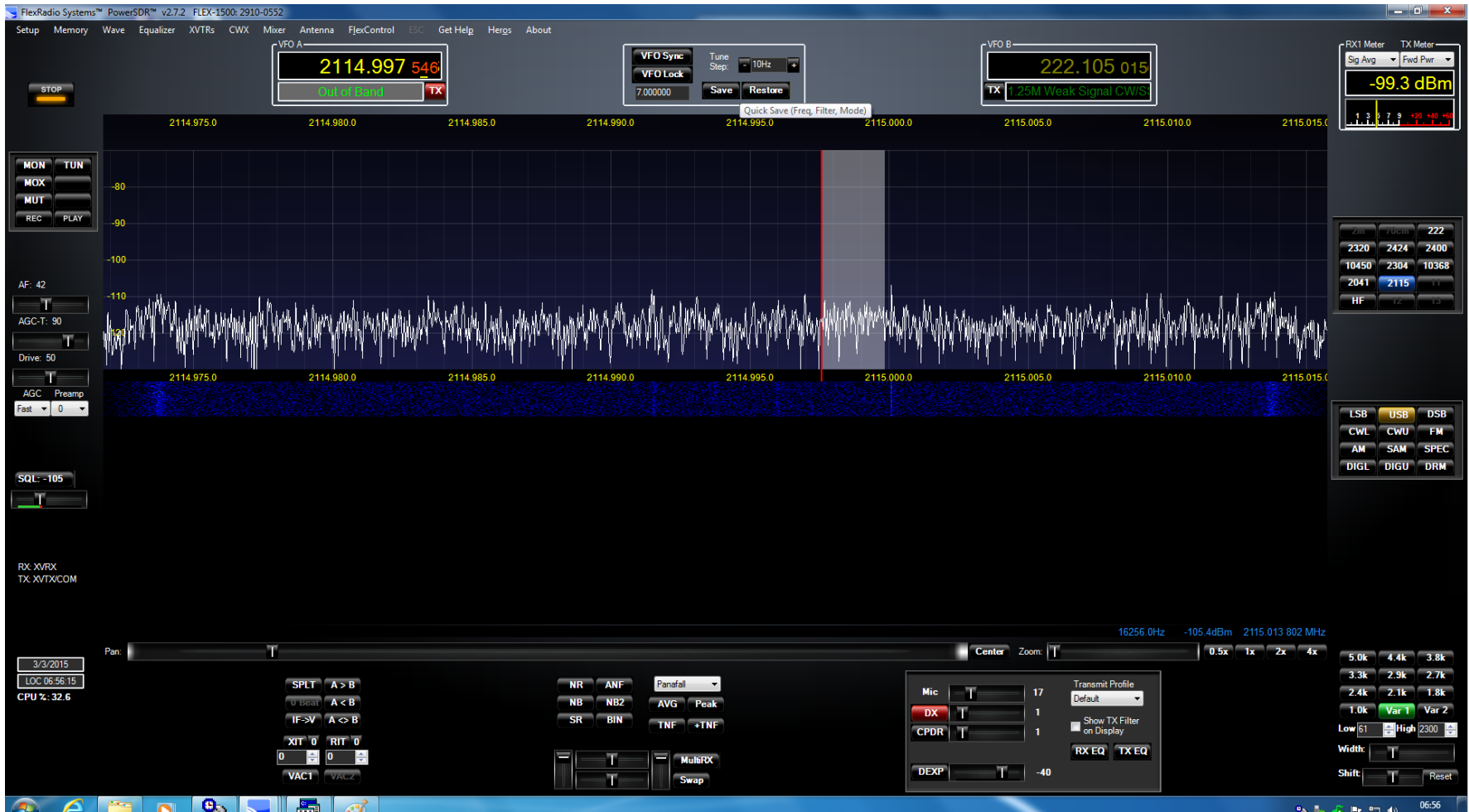
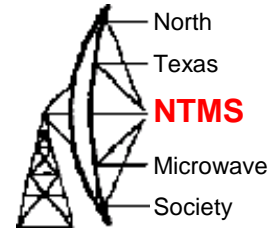
At 0719Z on March 3, 2015, my self-doppler to the moon was -3.715 kHz and the mutual doppler between Goldstone in DM15nk to me in EM13qc was -2794 Hz. It was starting to move rather quickly as the moon was passed zenith for both of us.

# Noise Floor at 2115 MHz

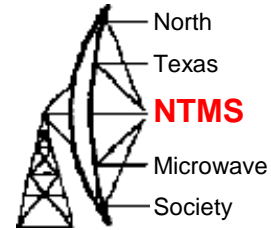


- 2115 MHz is in a very noisy part of the 13 cm band. My location in Allen, Texas in EM13qc is only 35 miles north of Dallas
- The next slide represents my relative noise floor with my receive system terminated in  $50 \Omega$ . Normally the cold sky is upwards of 6 dB below the equivalent noise floor in  $50\Omega$ .

# Noise Floor on 2115 MHz @0656Z – Receiver input 50 Ω



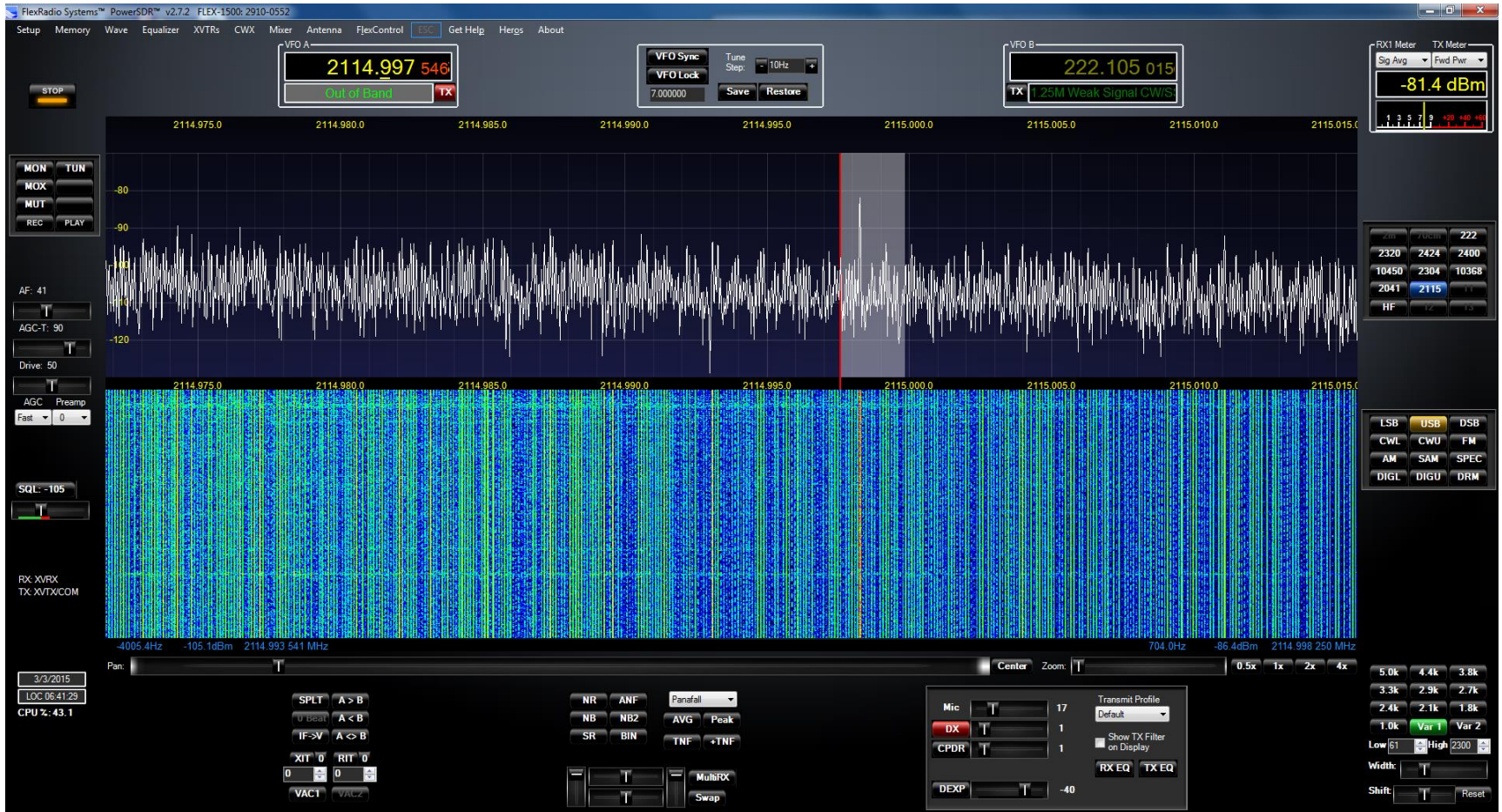
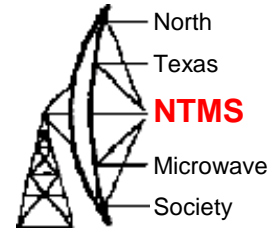
# Screenshots during the Lunar Pass



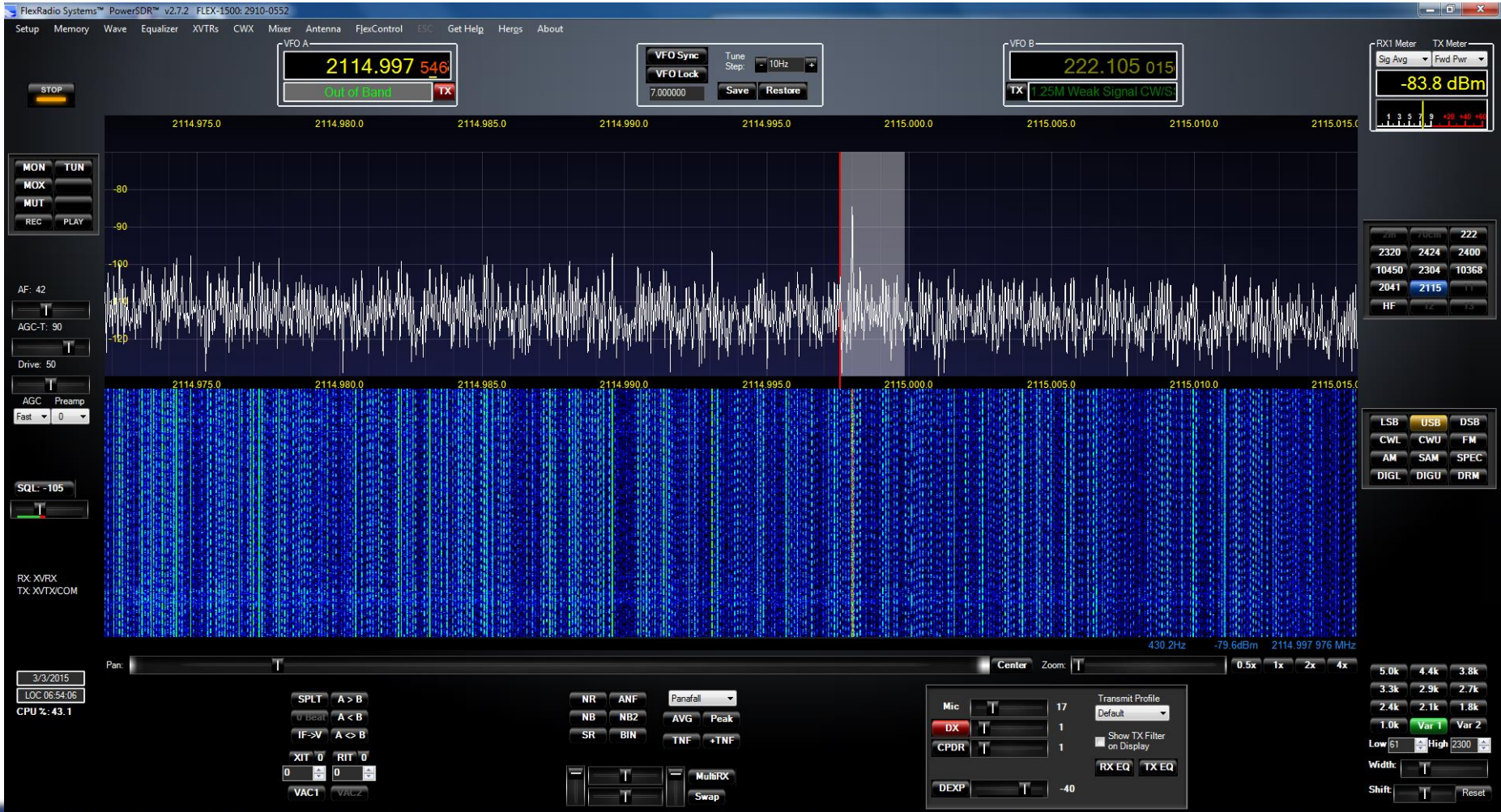
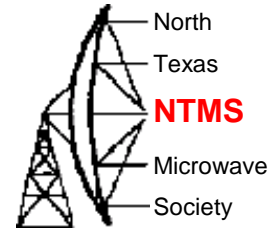
- The following slides were taken at various times throughout the lunar pass. It was difficult to get a good screen capture based on some fading and the refresh times in Power SDR.
- Note the high background level most likely based on my local 3G/4G interference.
- Assuming my relative noise floor (not calibrated against actual thermal noise level) the best signal to noise ratio seems to be about 40 plus dB based on slides 13 and 14.
- Slide 11 is in the “Peak” mode and slides 13 and 14 are with both “Average” and “Peak” active.
- Slide 12 shows the 100 Hz rate of my interfering signal.



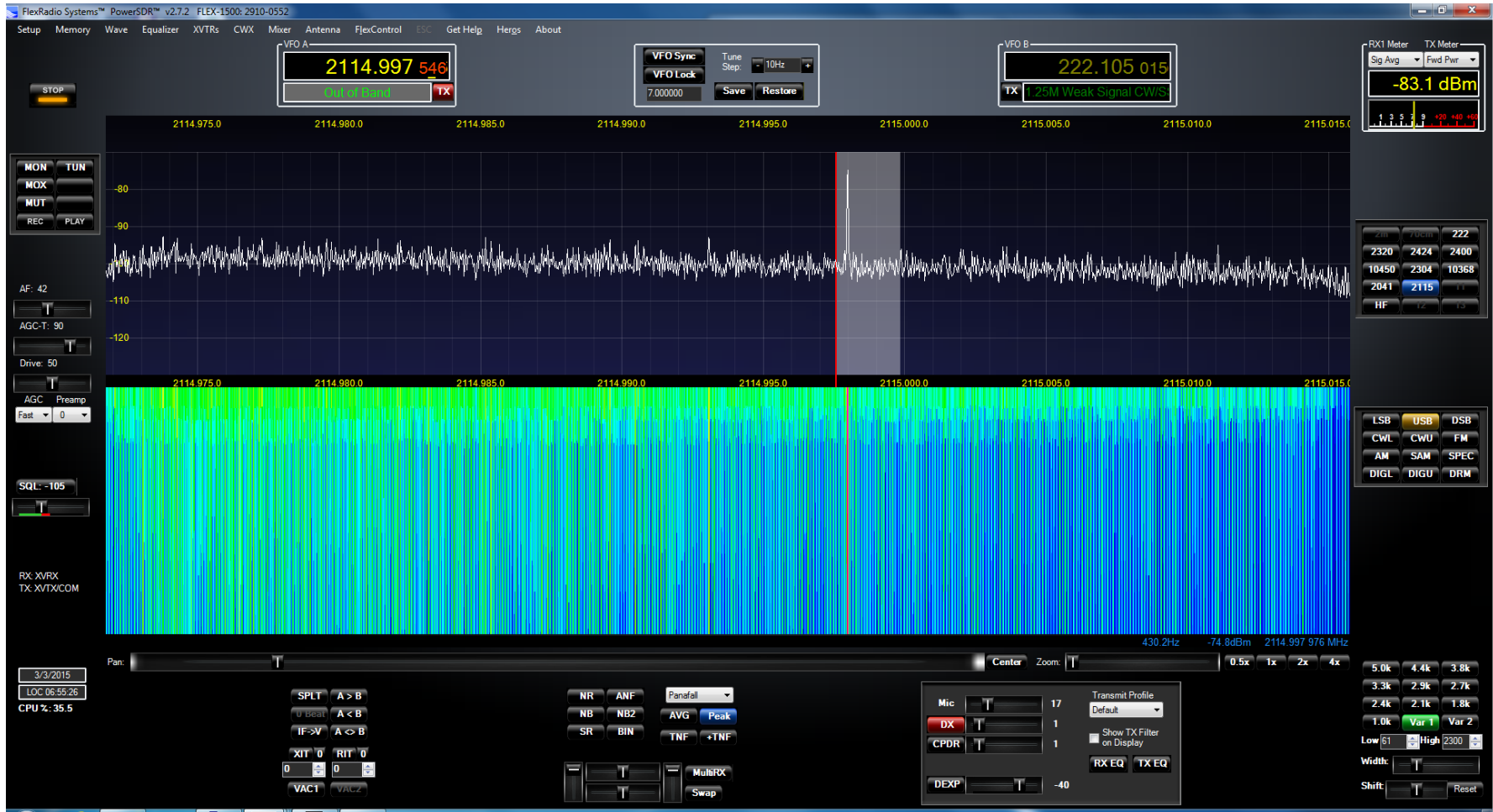
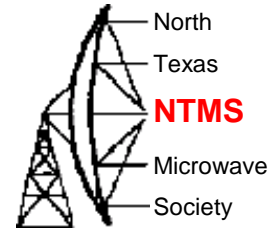
# Lunar Echoes from NASA on 2115 MHz @ 0641Z



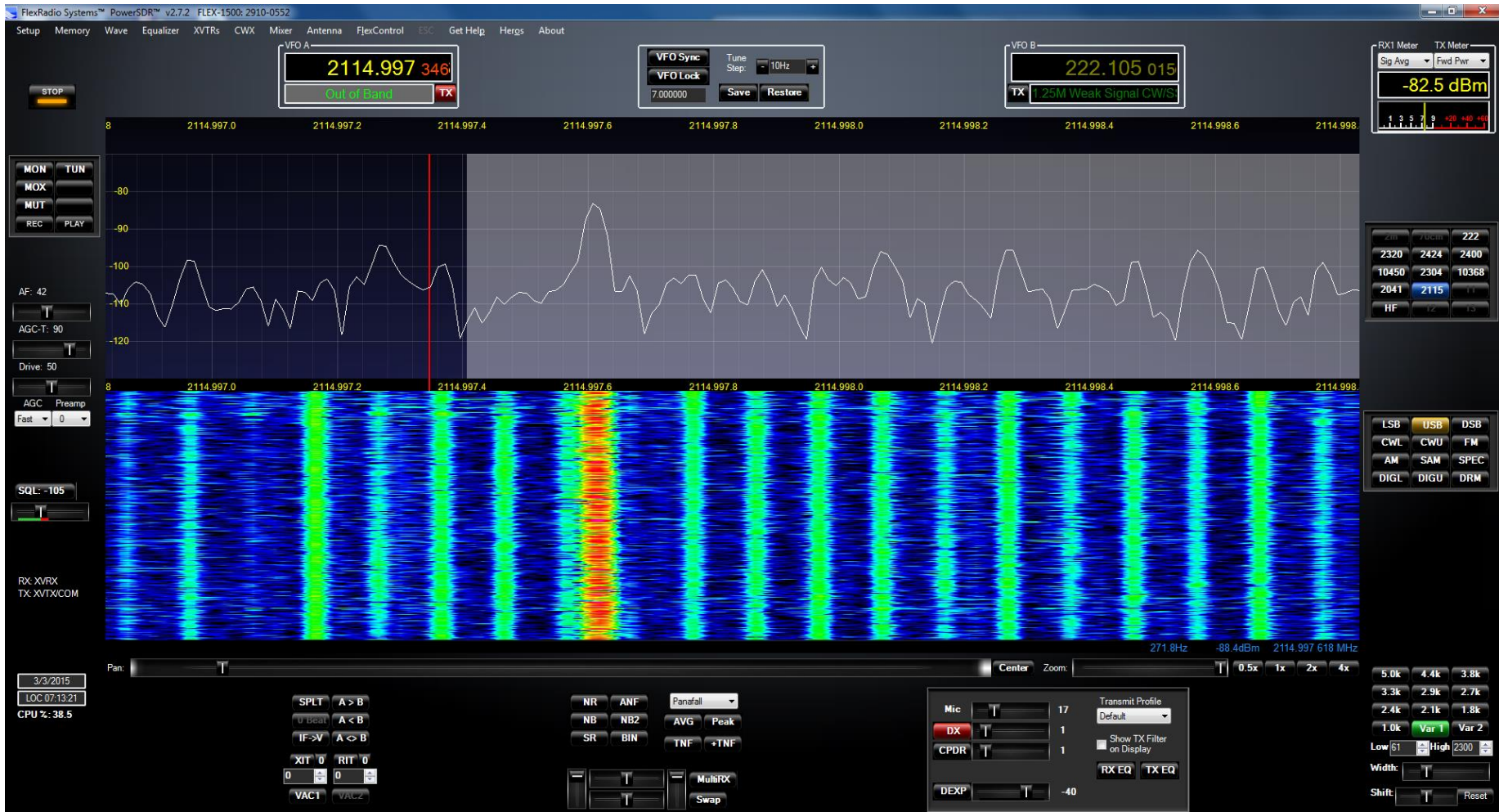
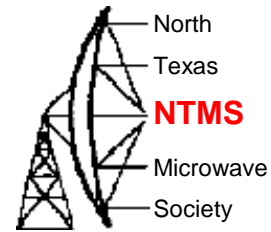
# Lunar Echoes from NASA on 2115 MHz @0654Z



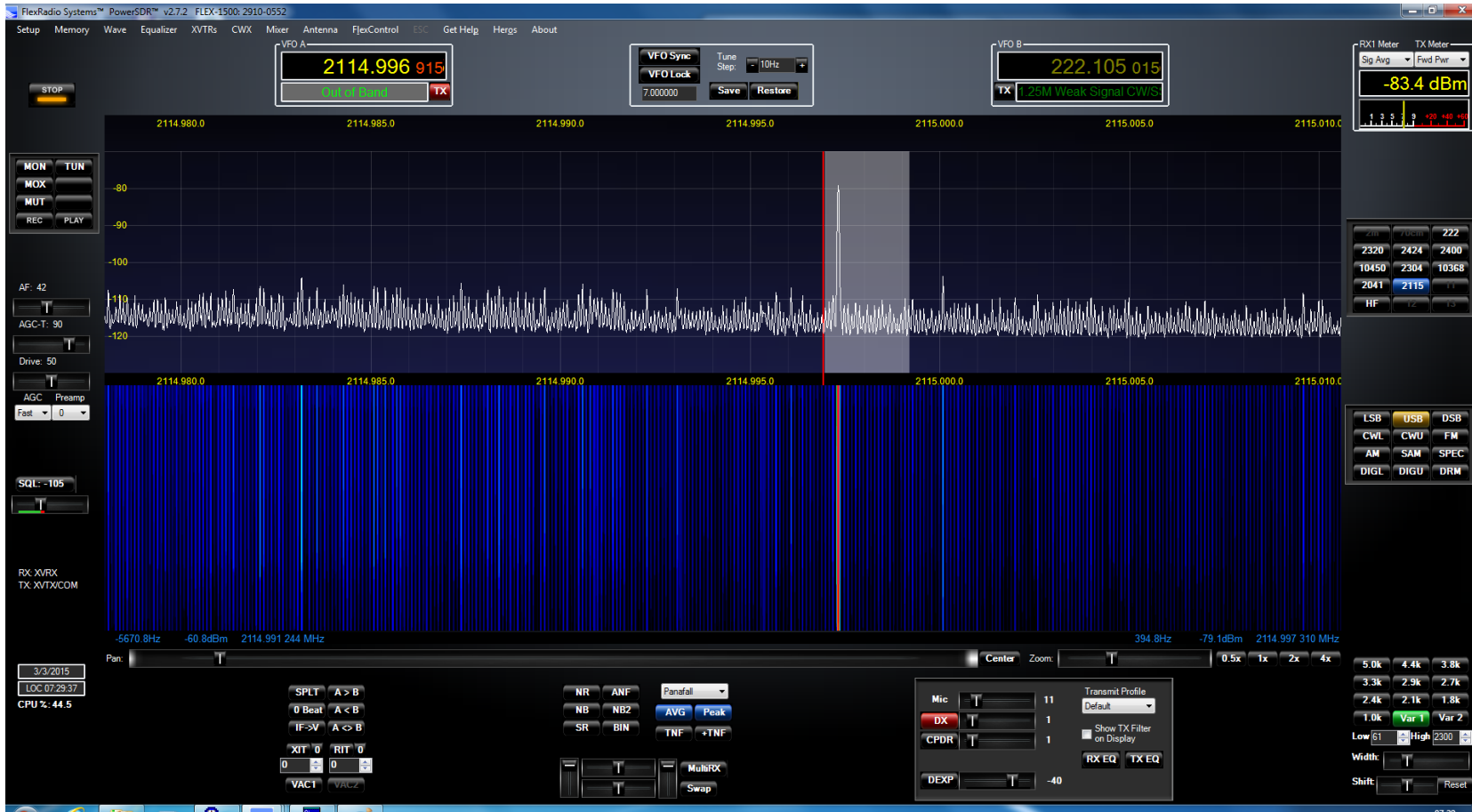
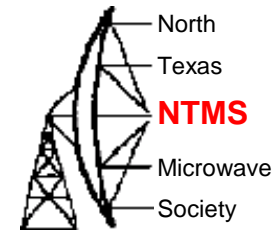
# Lunar Echoes from NASA on 2115 MHz @0655Z



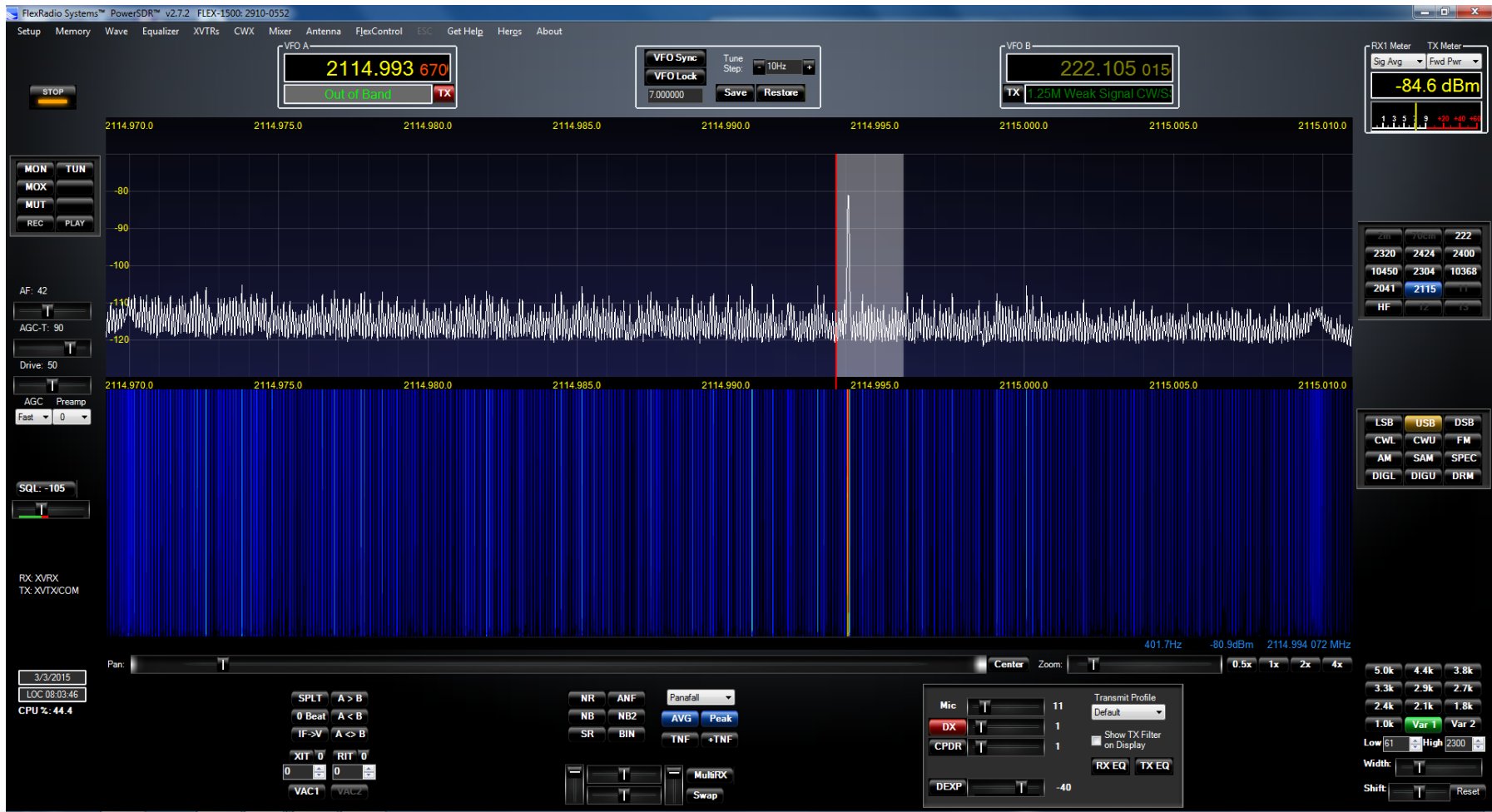
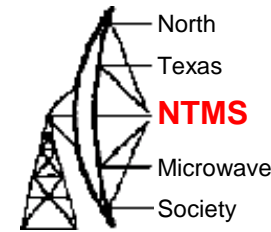
# Lunar Echoes from NASA on 2115 MHz @0713Z



# Lunar Echoes from NASA on 2115 MHz @0729Z



# Lunar Echoes from NASA on 2115 MHz @0803Z



# Lunar Echoes from NASA on 2115 MHz @0855Z

