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

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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

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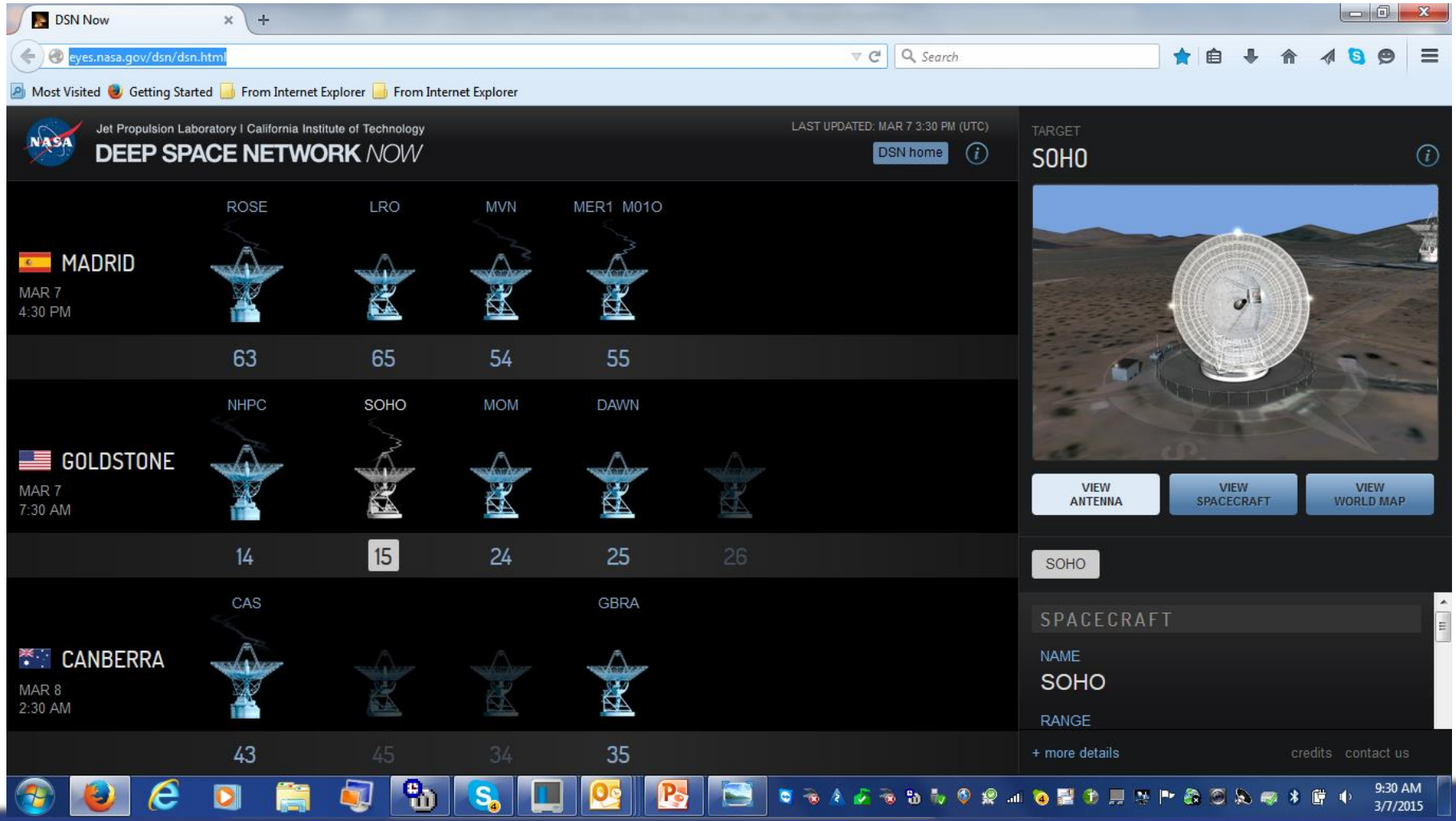

5m Dish at W5LUA used to Monitor Lunar Echoes from NASA on 2115 MHz

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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 kHz / 512mB = 93.75 Hz ~ 100 Hz BW

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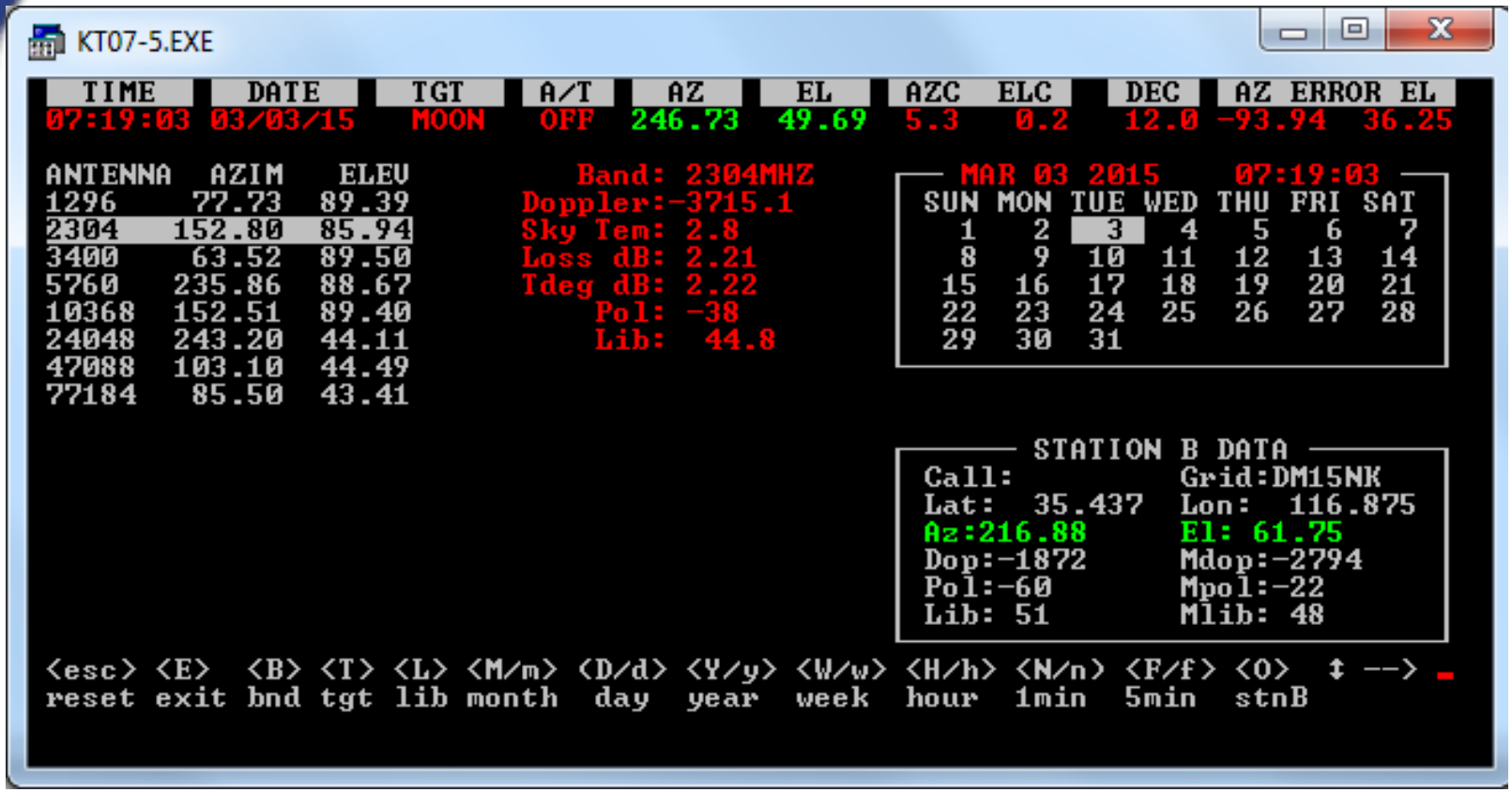
K5GW Tracking Program



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

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- 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 Ω. Normally the cold sky is upwards of 6 dB below the equivalent noise floor in 50Ω.

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

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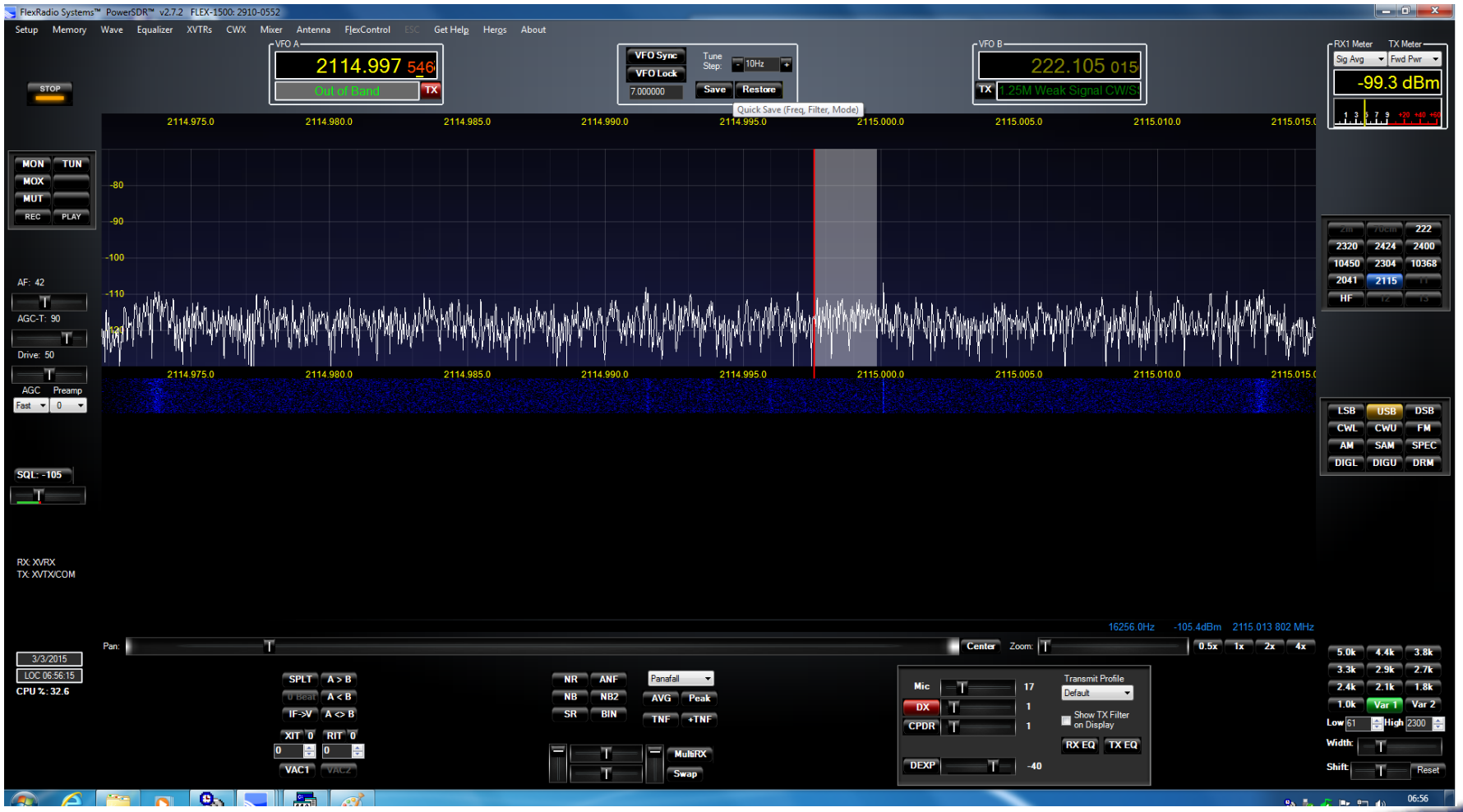

Screenshots during the Lunar Pass

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- 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

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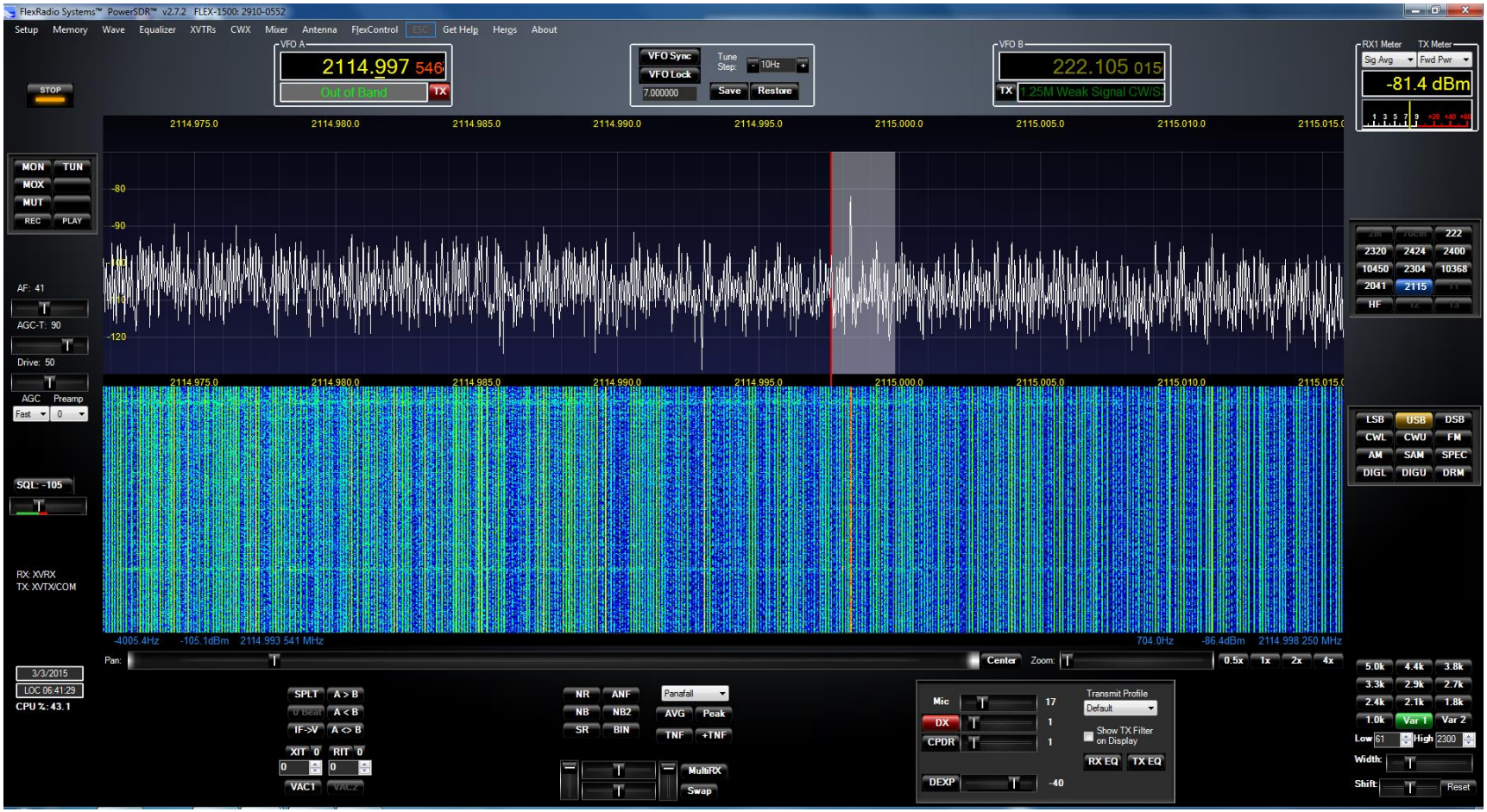

Lunar Echoes from NASA on 2115 MHz @0654Z

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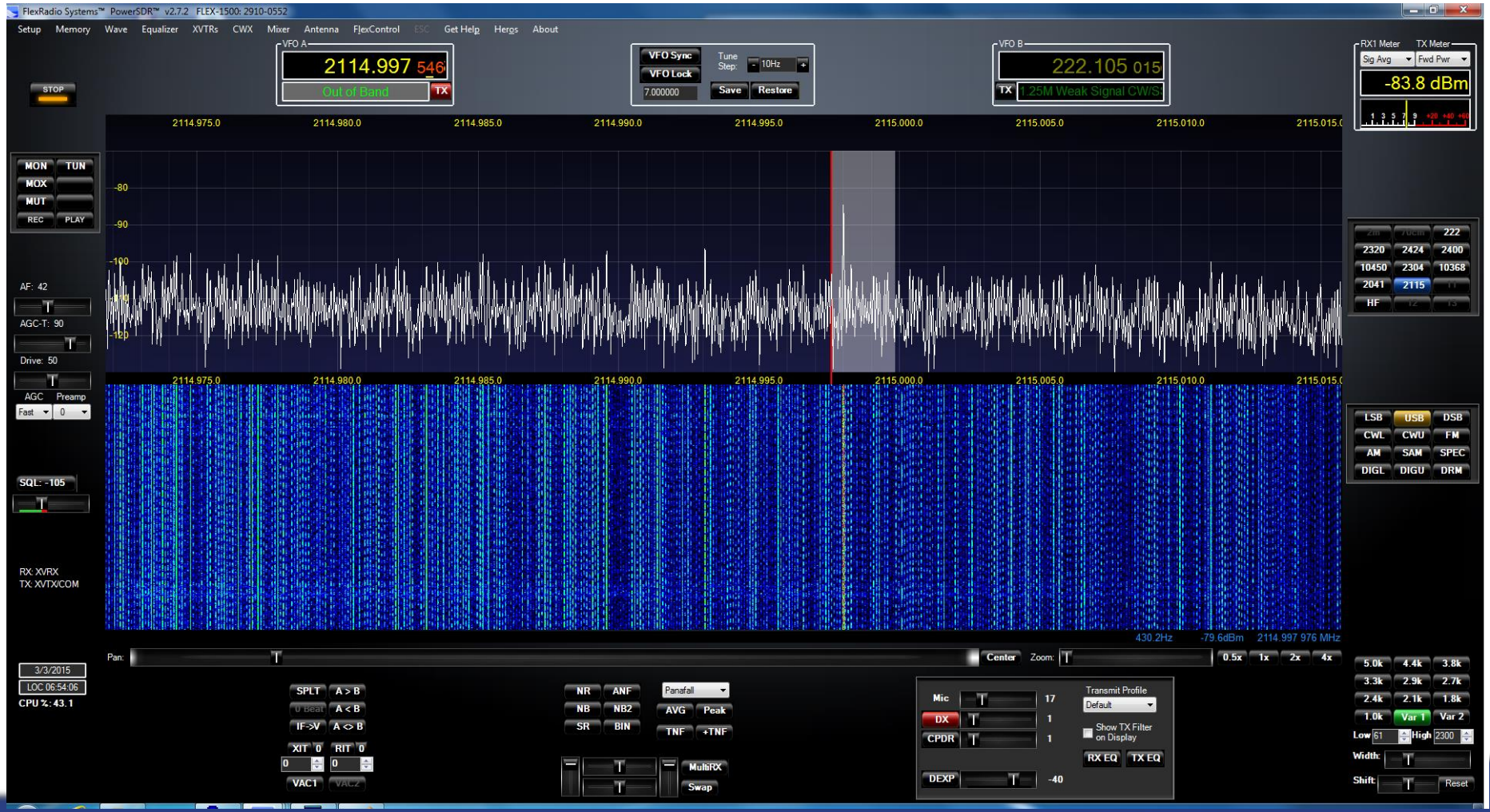

Lunar Echoes from NASA on 2115 MHz @0655Z

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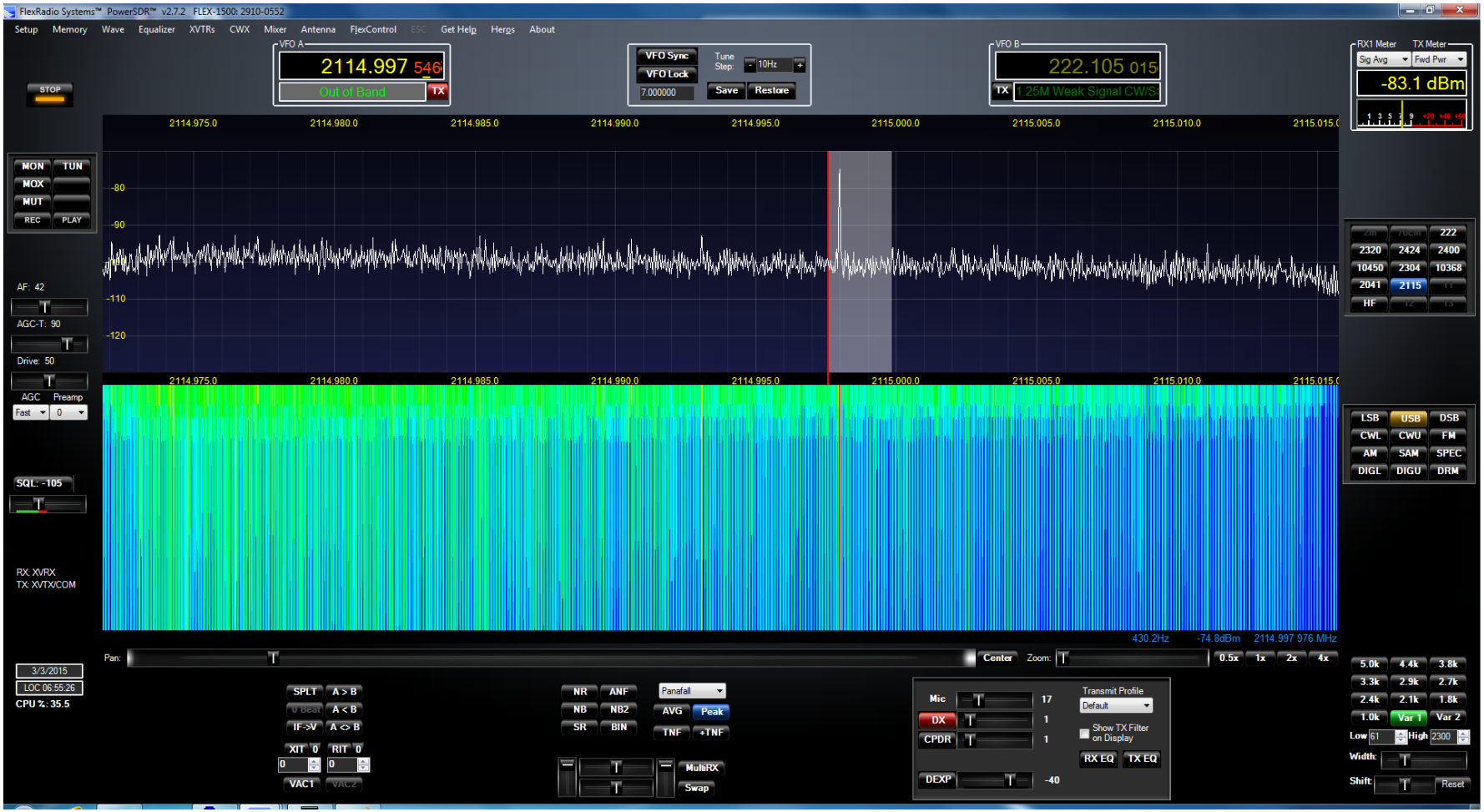

Lunar Echoes from NASA on 2115 MHz @0713Z

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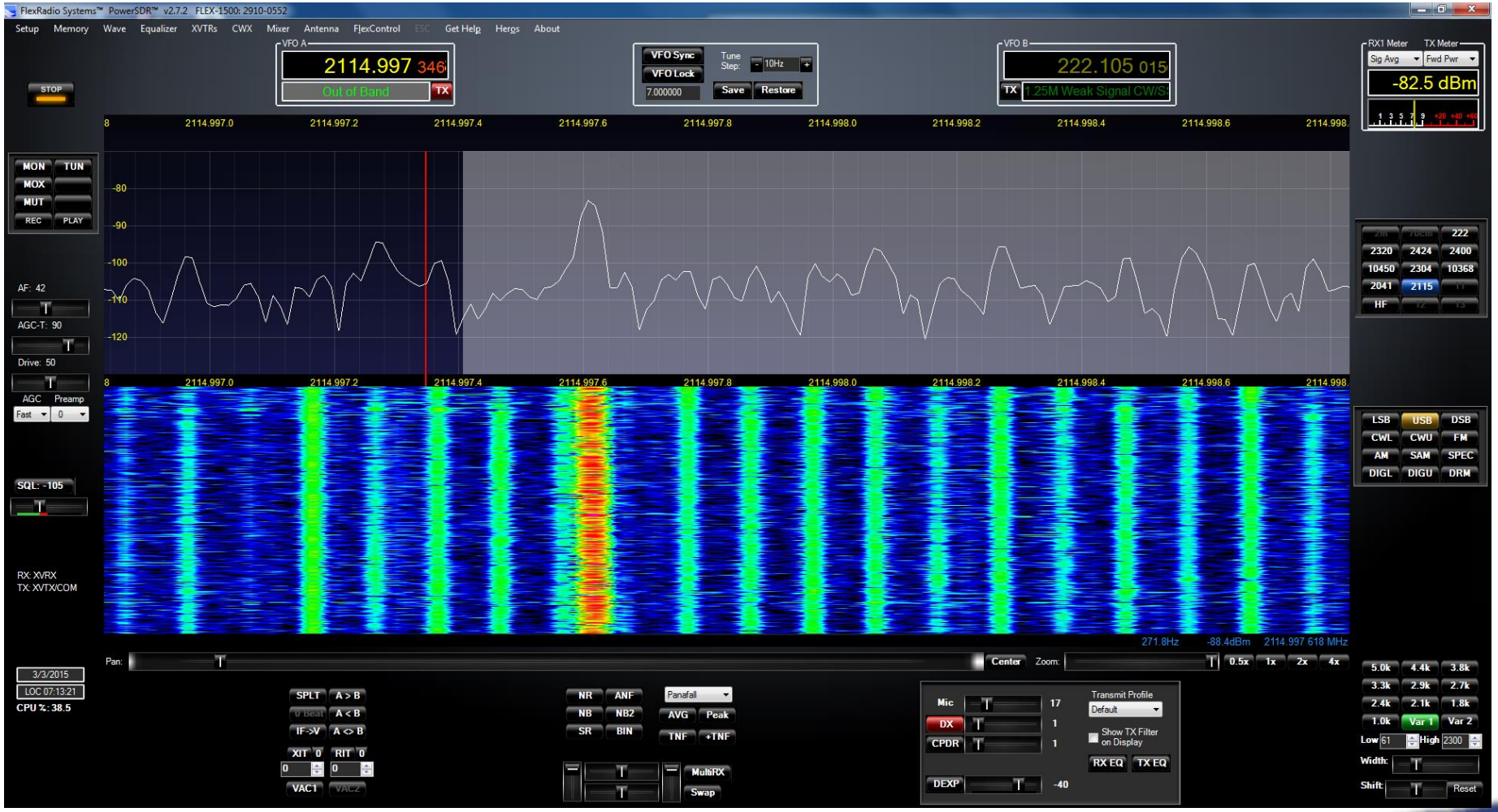

Lunar Echoes from NASA on 2115 MHz @0729Z

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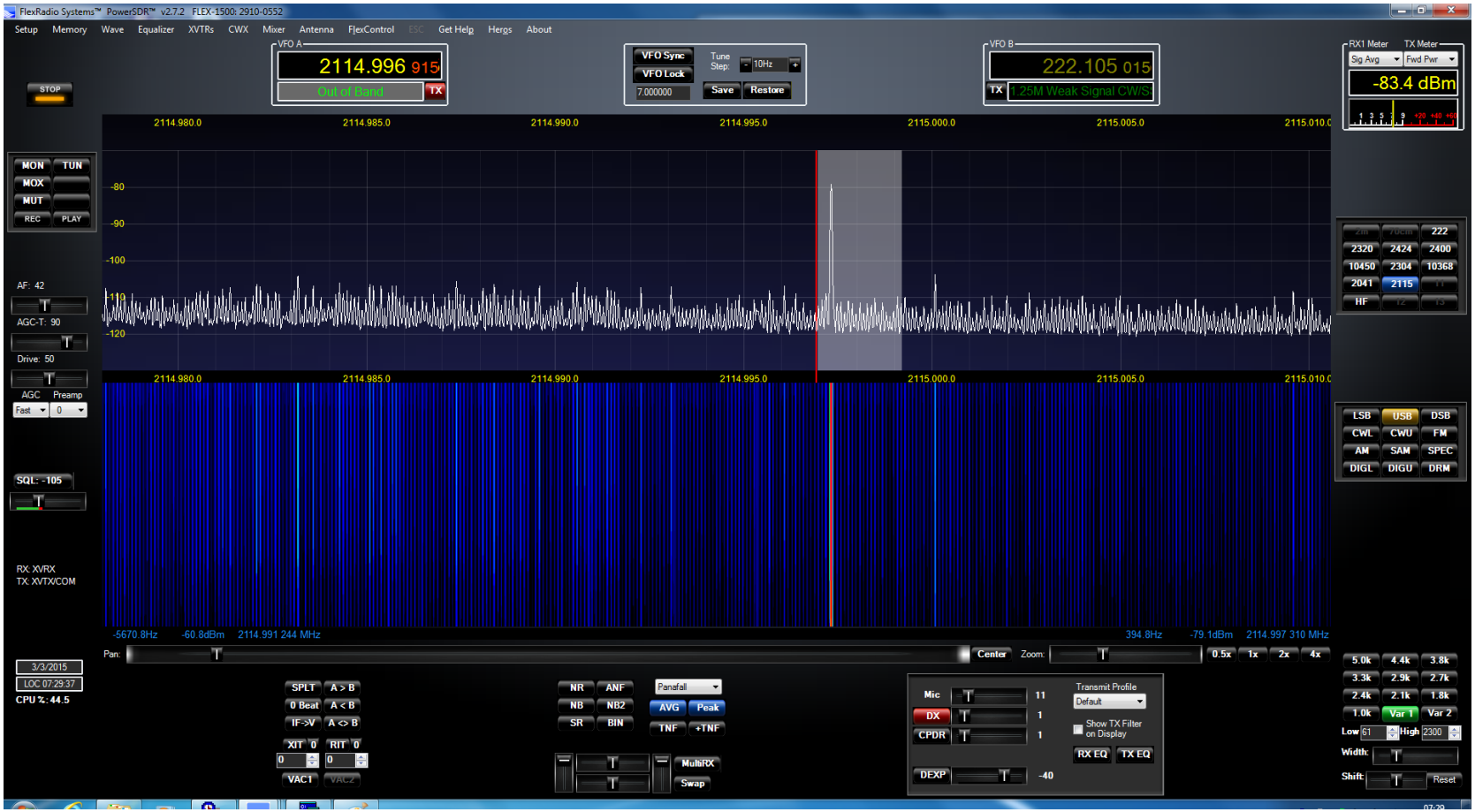

Lunar Echoes from NASA on 2115 MHz @0803Z

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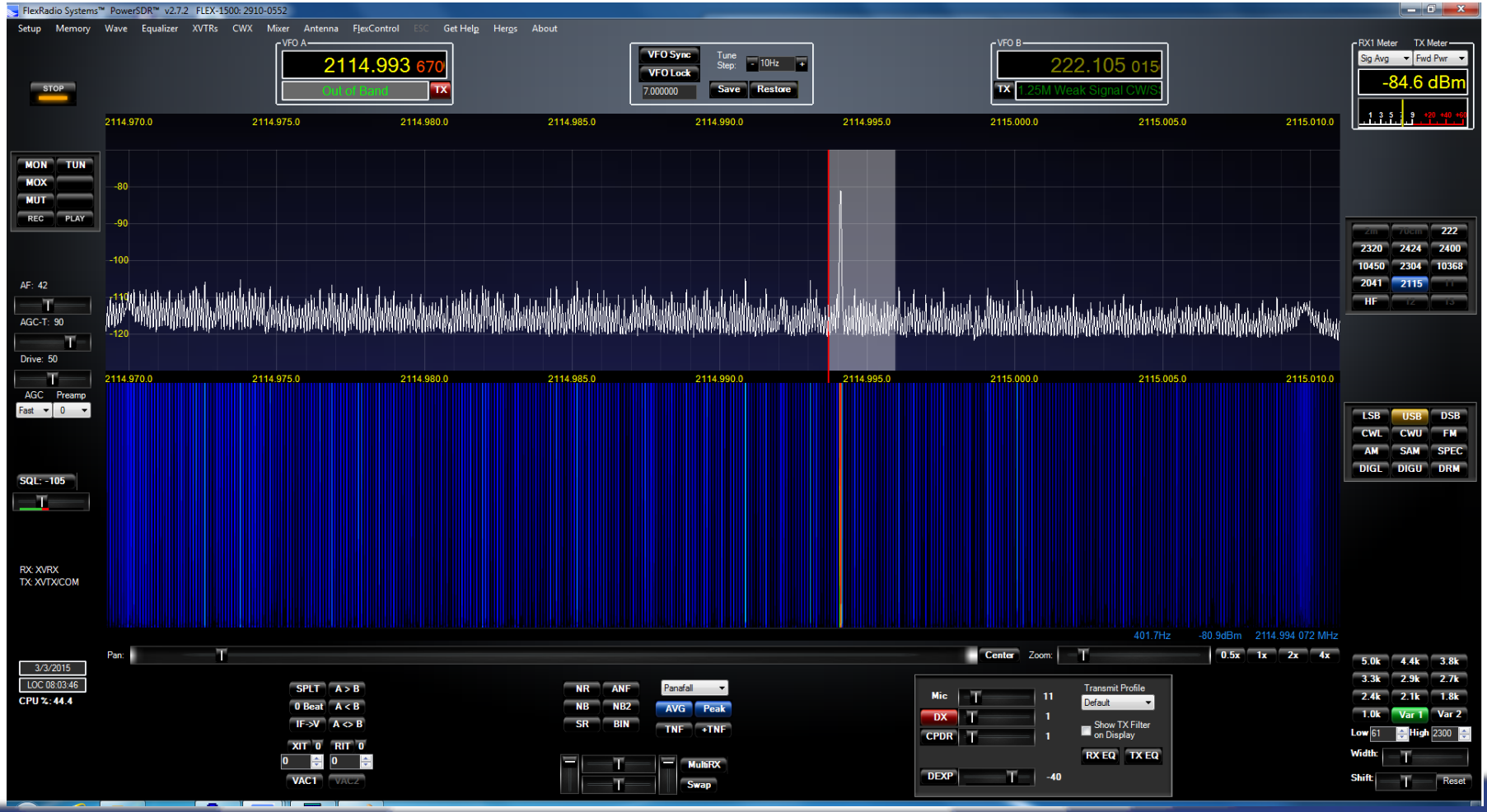

Lunar Echoes from NASA on 2115 MHz @0855Z

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