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Lunar Orbiters

Al Ward W5LUA

December 1, 2007

Lunar Prospector

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- NASA launched the Lunar Prospector on Jan 6, 1998
- On Jan 12 it was orbiting the moon providing NASA with valuable information regarding the moon's surface
- The Lunar Prospector provided a nice S band beacon at 2273.000 MHz plus or minus doppler. Subcarriers at +/- 1.024 MHz with 3600bps data rate
- I was able to receive it at 30 dB over the noise with my 5 meter dish
- After 1 year it dropped out of orbit
- Now the moon has a few more visitors in orbit….

Japanese Lunar Explorer SELENE

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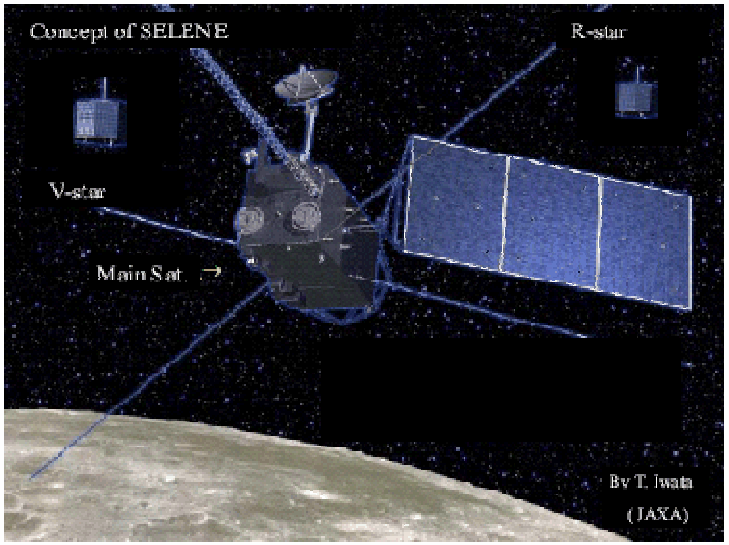
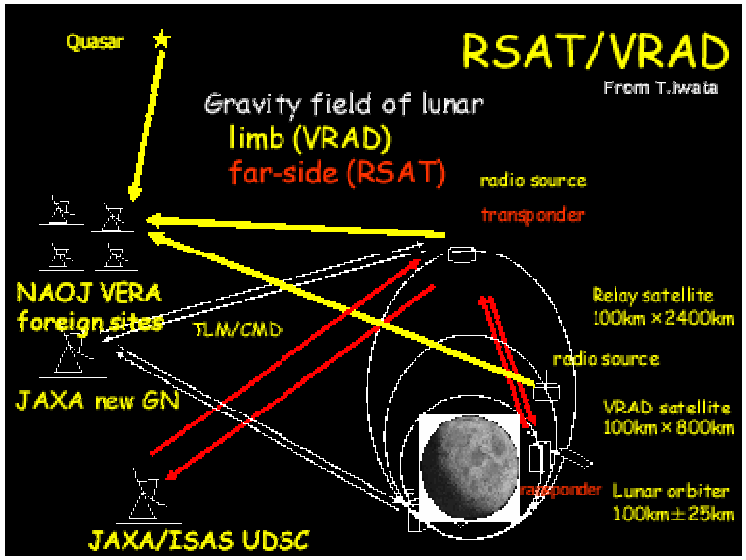
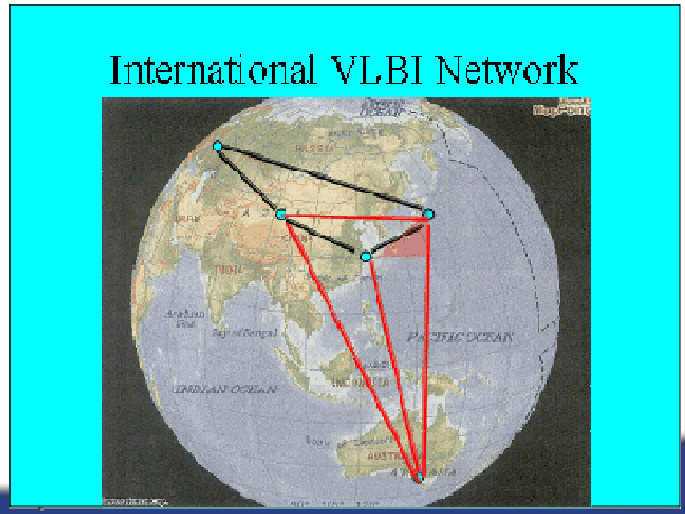




The Japanese lunar explorer SELENE was launched in October 2007. Two sub-satellites, Relay satellite and VLBI satellite, will transmit S and X band carrier signals for precisely measuring the lunar gravity field. It is expected that Wettzell, Shanghai, Urumqi, Hobart and the VERA stations take part in intensive international VLBI observations. The observation period will be 8 hours, 3 days a week in two separate months.



S and X band Frequencies

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Table 1: Characteristics of the transmitters onboard SELENE.

Center frequency	2212 MHz	2218MHz	2287 MHz	8456 MHz
Band width	CW	CW	CW	CW
Sampling rate	200 ksps	200 ksps	200 ksps	200 ksps
Recording	Hard disc drive			
EIRP	24 mW	24 mW	24 mW	250 mW (Rstar)
				38 mW (Vstar)
Polarization	RHCP	RHCP	RHCP	RHCP

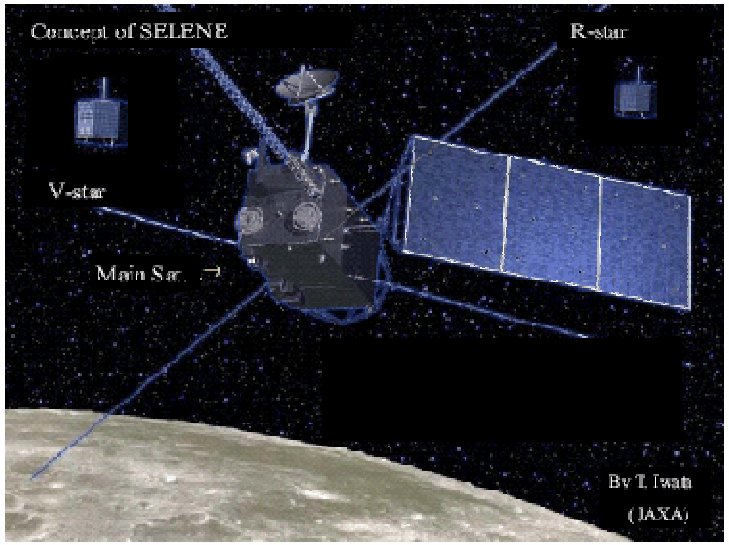

Table 2: Orbit characteristics of three spacecraft.

	Perilune	Apolune	Inclination	Period
Main orbiter	100 km	100 km	**90°**	120 min.
Vstar	100 km	800 km	**90°**	~153 min.
Rstar	100 km	2400 km	**90°**	~240 min.

http://ivs.nict.go.jp/mirror/publications/gm2006/kawano/

Lunar Orbiter Frequencies

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Frequency	Catalogue # / Satellite Name / last heard date dd/mm/yy and by who
2212.000	32054 KAGUYA R-Satellite
2212.000	32054 KAGUYA VRAD-Satellite
2218.000	32054 KAGUYA R-Satellite
2218.000	32054 KAGUYA VRAD-Satellite
2234.533	32274 Chang'e'1 Chinese lunar orbiter (27/10/07)
2241.579	32054 KAGUYA R-Satellite
2260.416	32054 KAGUYA R-Satellite
2260.416	32054 KAGUYA VRAD-Satellite
2263.602	32054 KAGUYA main spacecraft downlink (30/10/07)
2287.313	32054 KAGUYA R-Satellite
2287.313	32054 KAGUYA VRAD-Satellite

http://www.uhf-satcom.com/sband/

Setup at W5LUA

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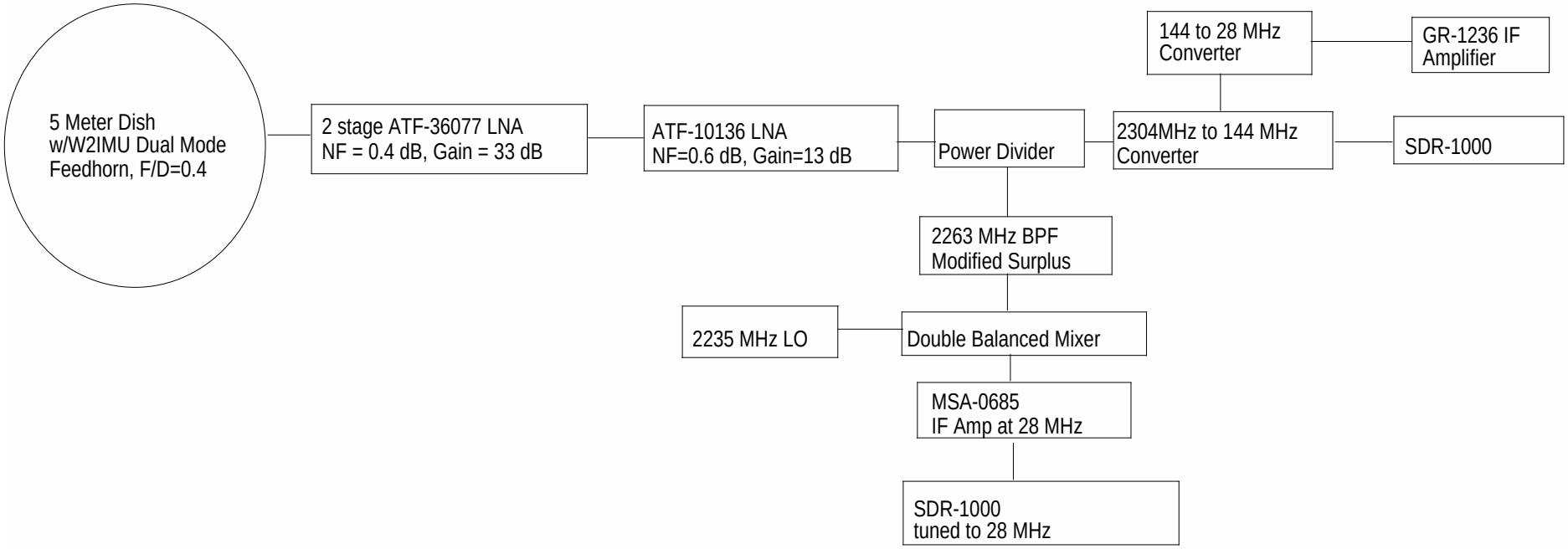

Reception Slides

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- The next several slides show a timeline of signals received from the lunar orbiters
- The SDR-1000 screenshots show frequency in VFO A and the date and time in GMT in the lower left hand corner. This helps give you an idea as to the drift in frequency due to doppler.
- The SDR-1000 is GPS frequency locked

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First Reception on Nov 25, 2007

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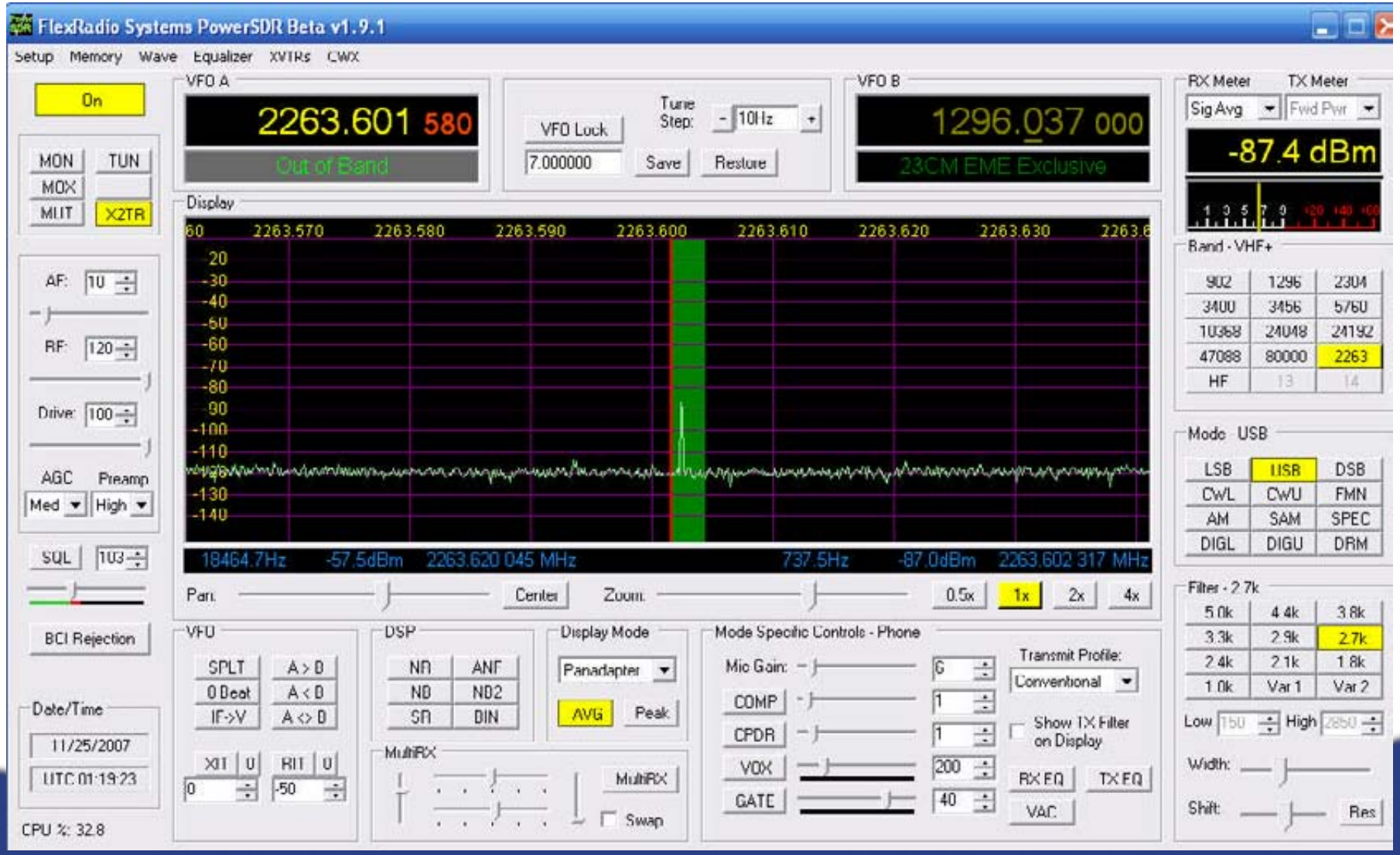

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8 Minutes later

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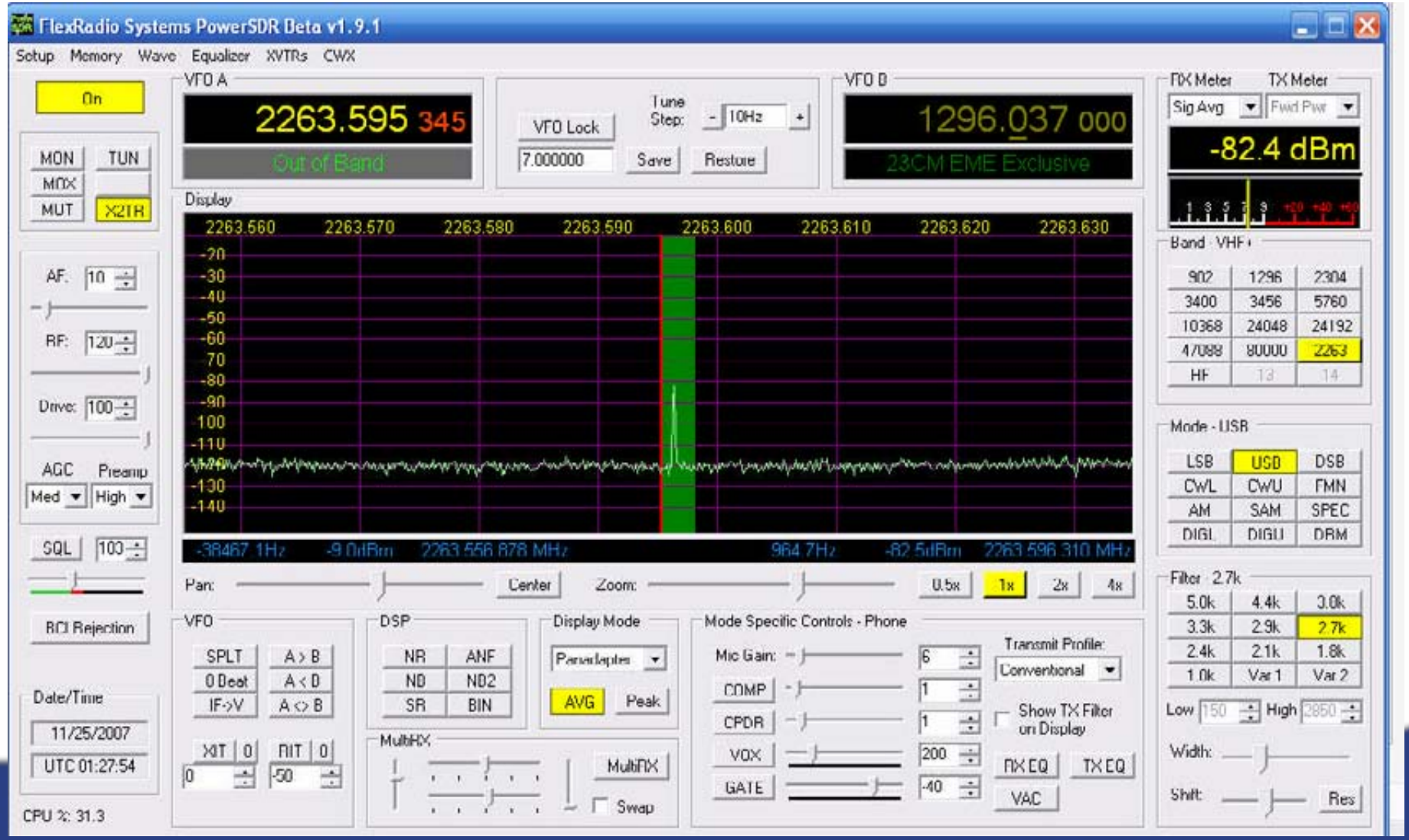

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Another 5 minutes Later

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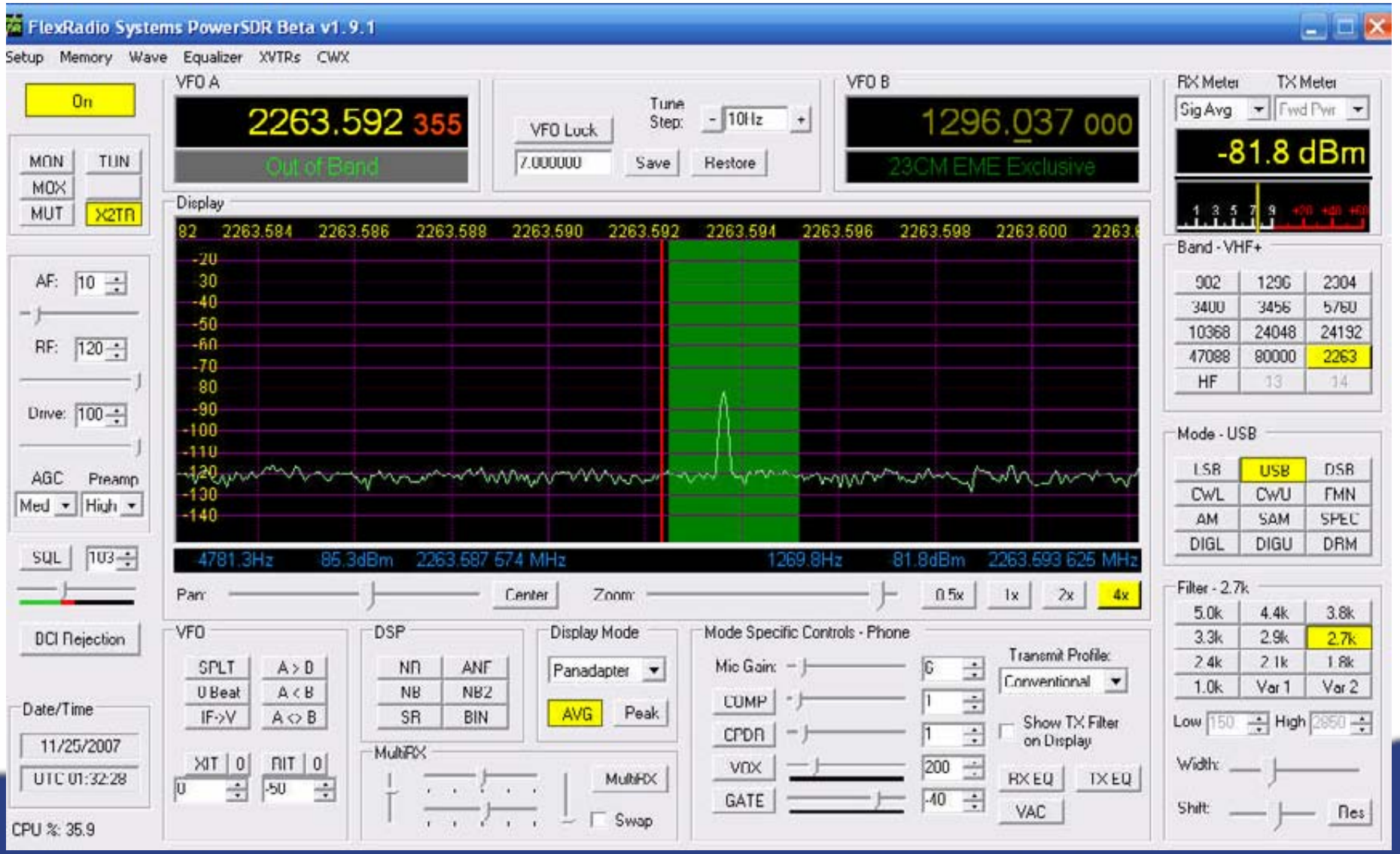

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Another 6 minutes later

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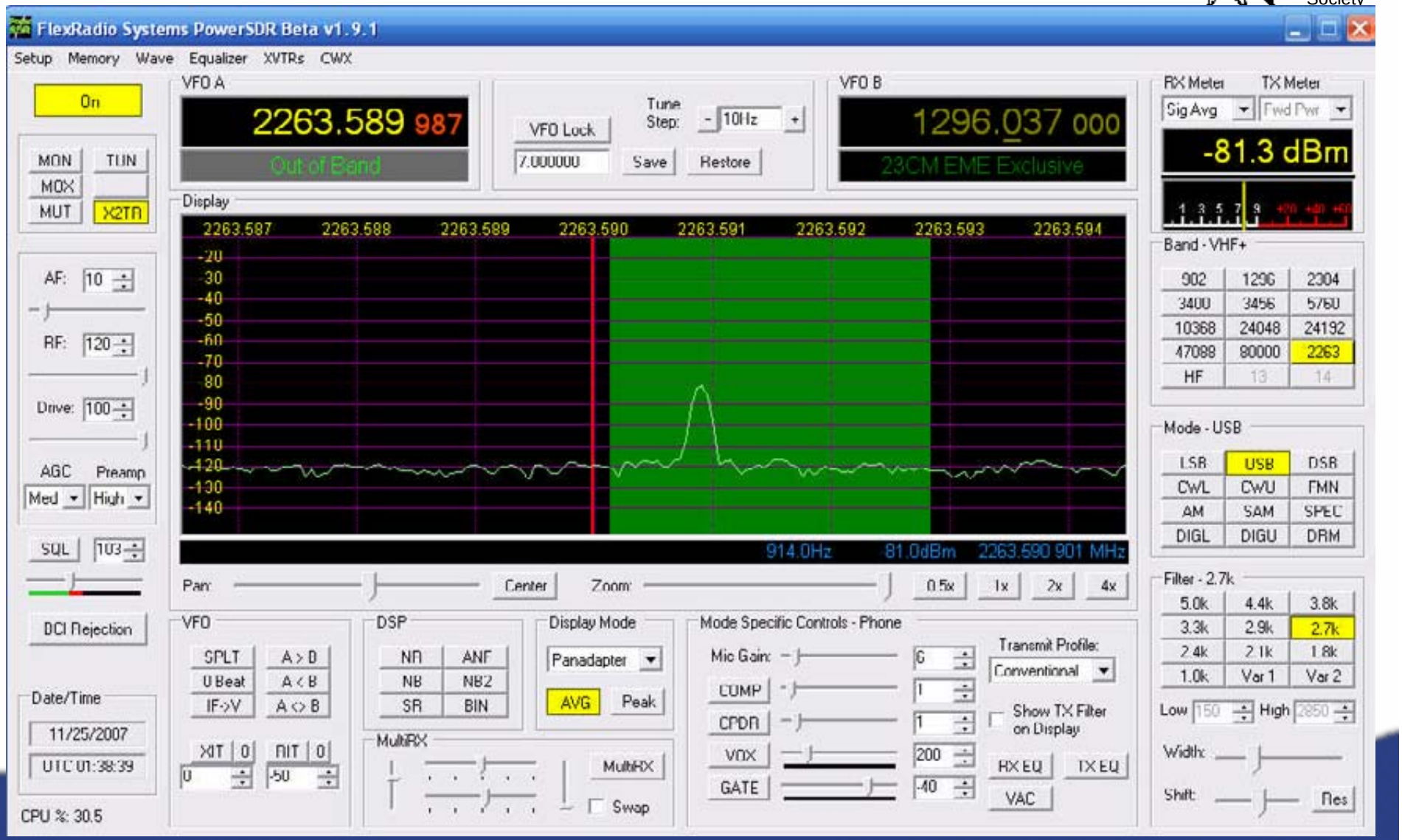

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Another 8 Minutes later

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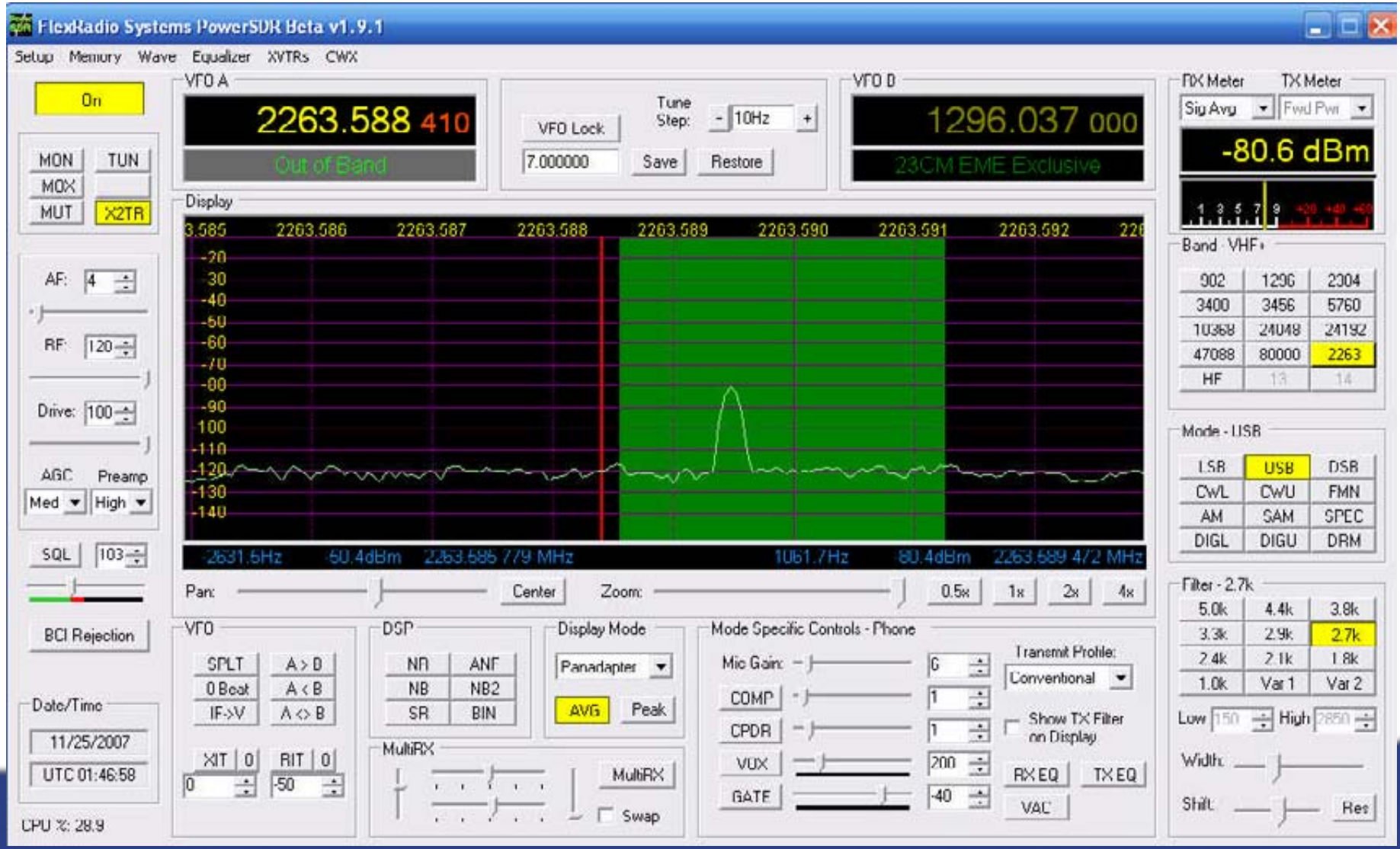

Subcarriers now in view

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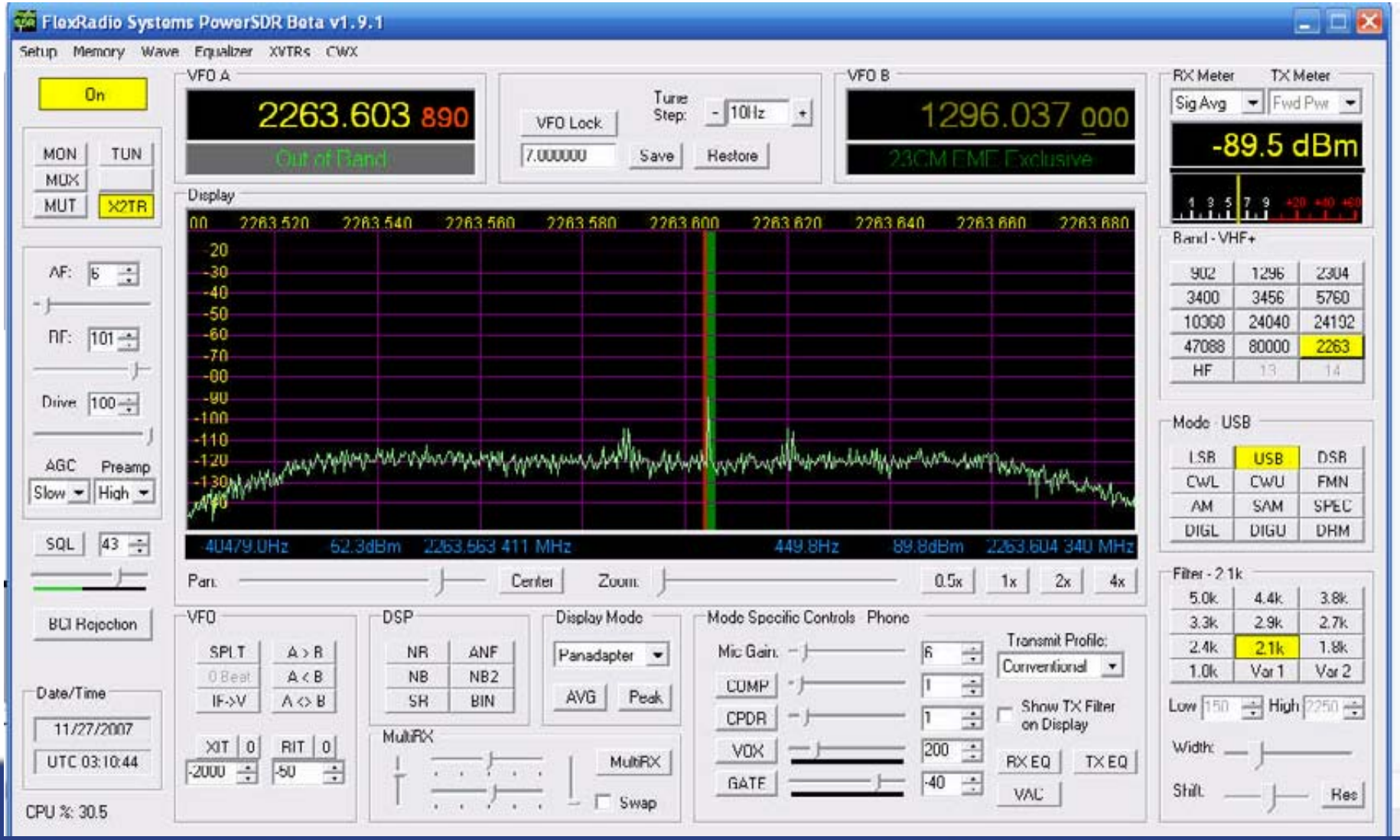

Subcarriers at +/- 16 kHz

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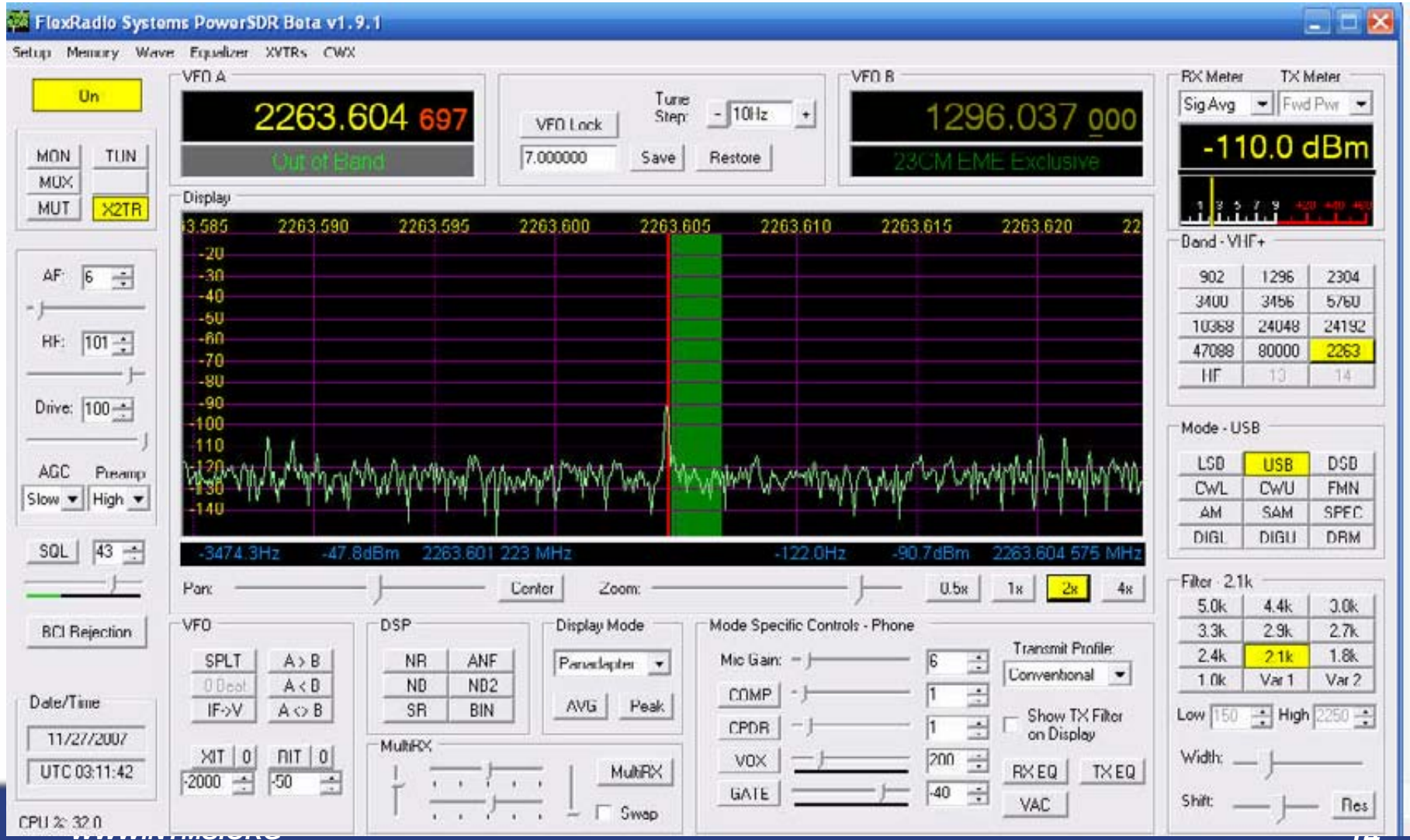

Subcarriers at +/- 16 and 32 kHz

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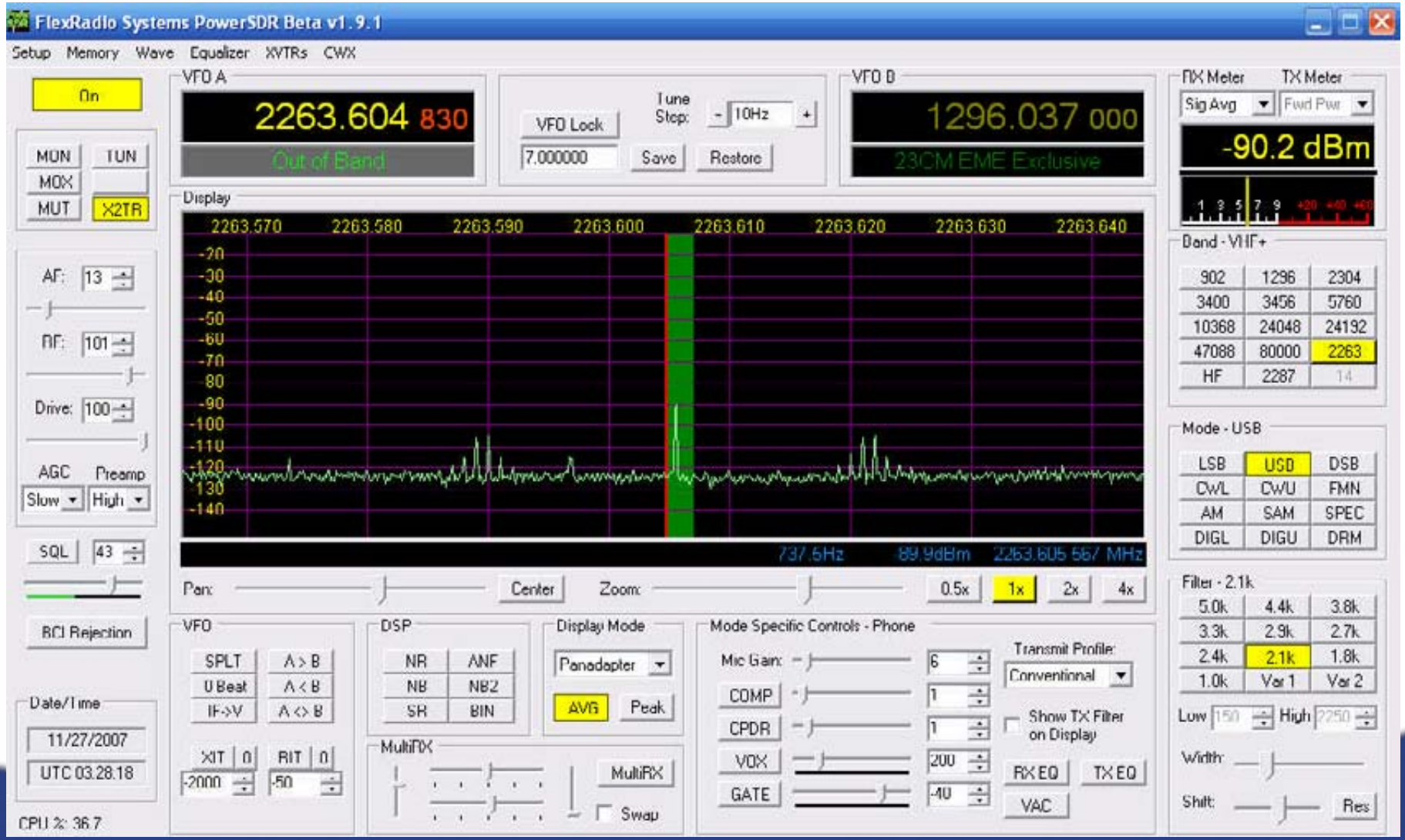

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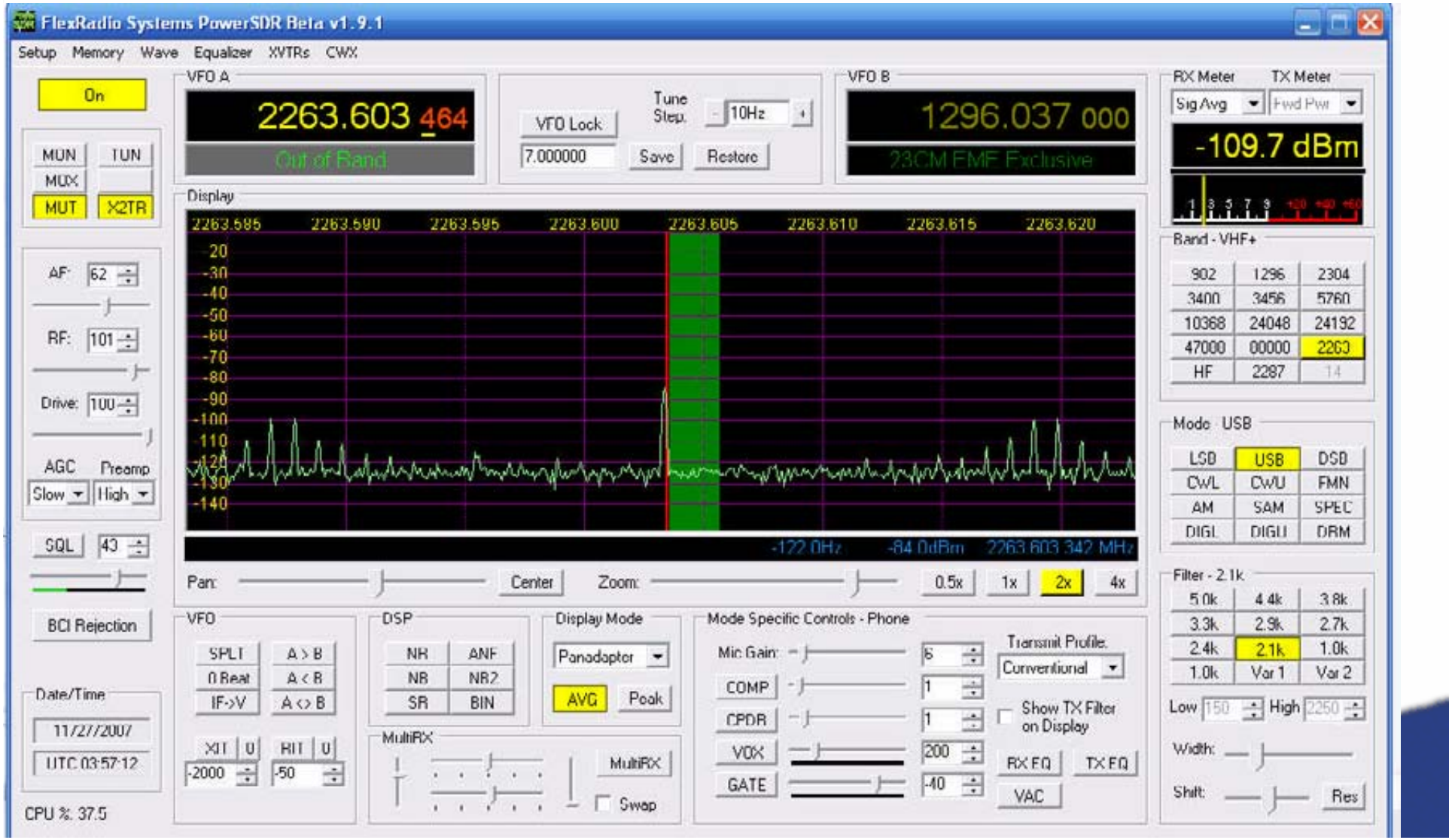

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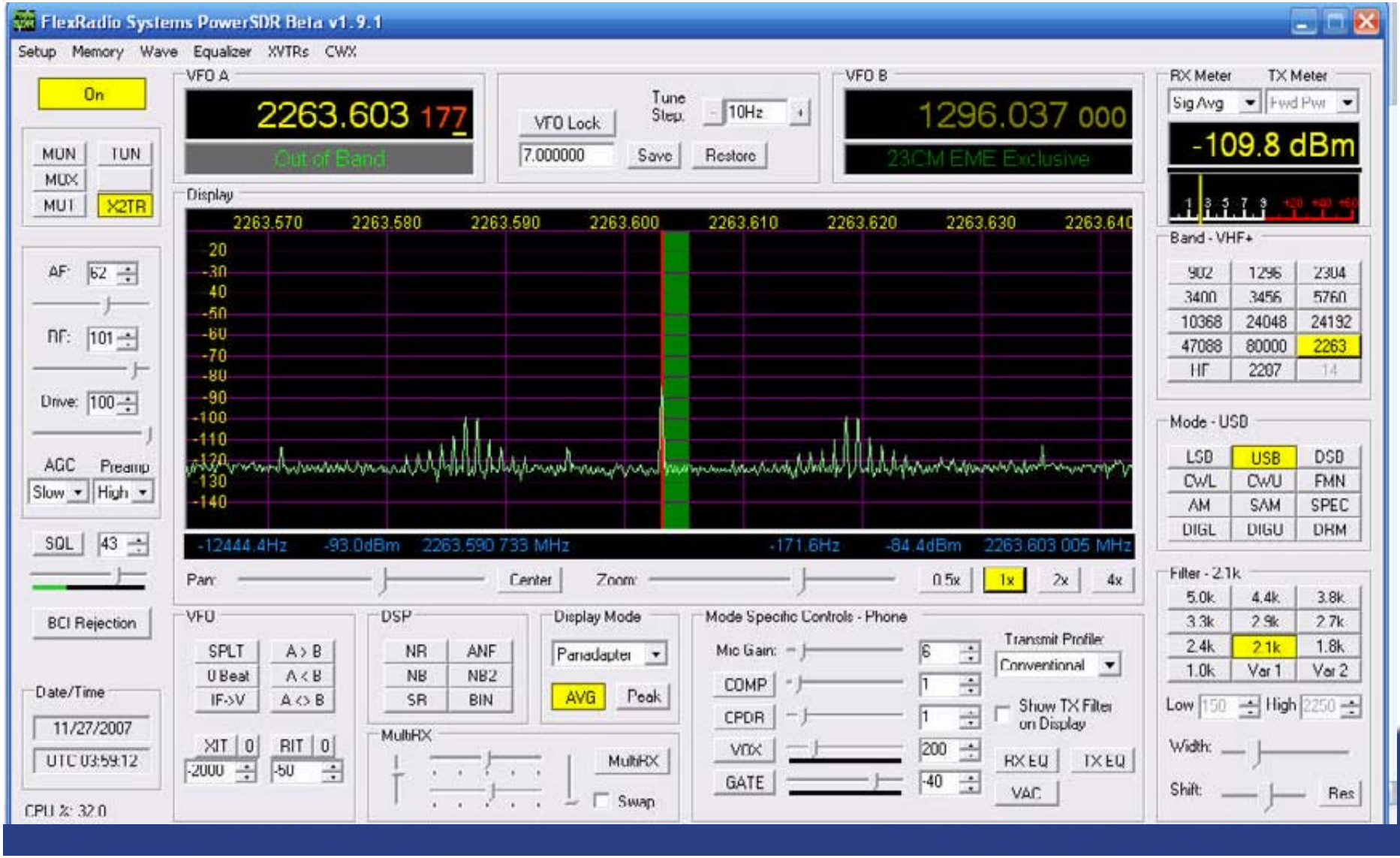

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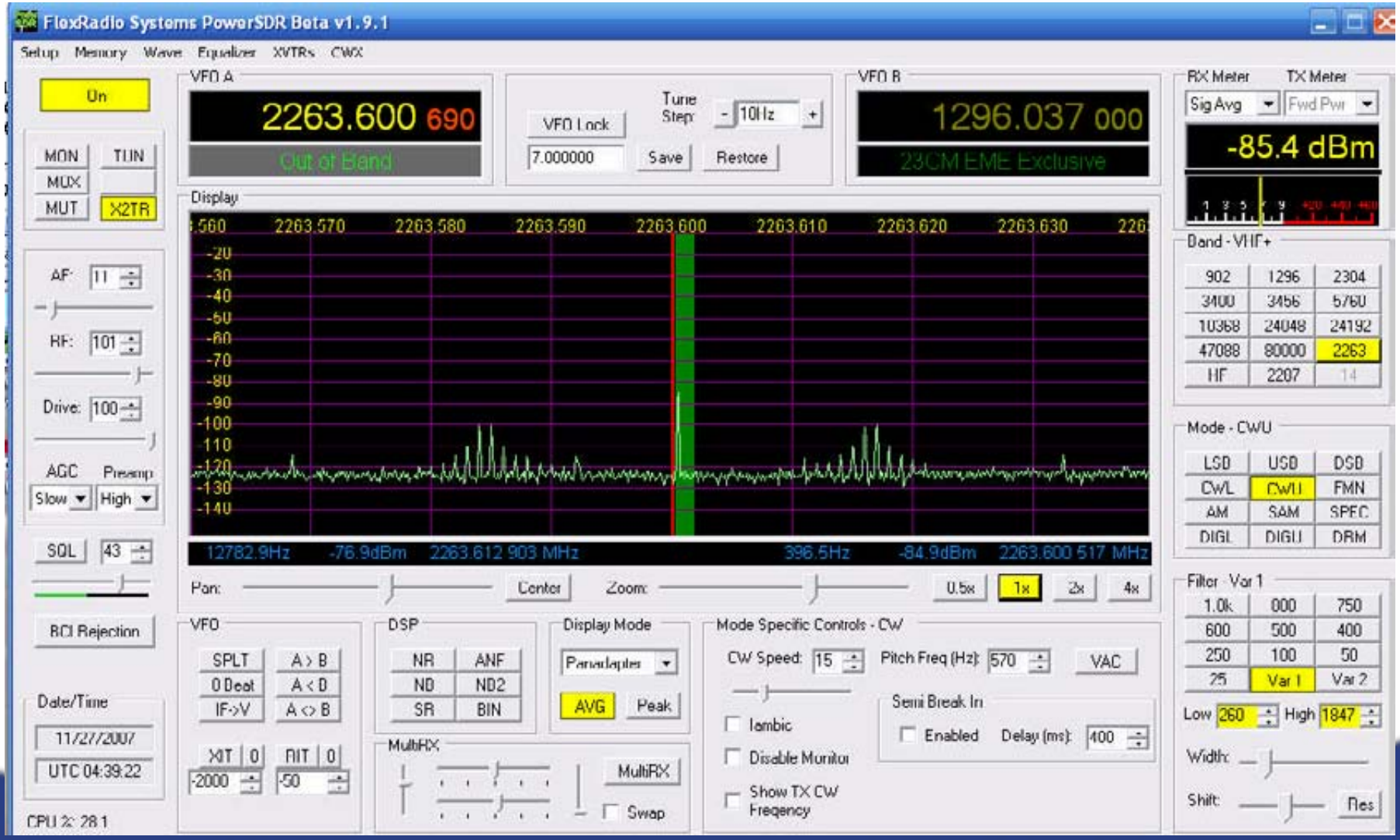

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100 Hz per minute

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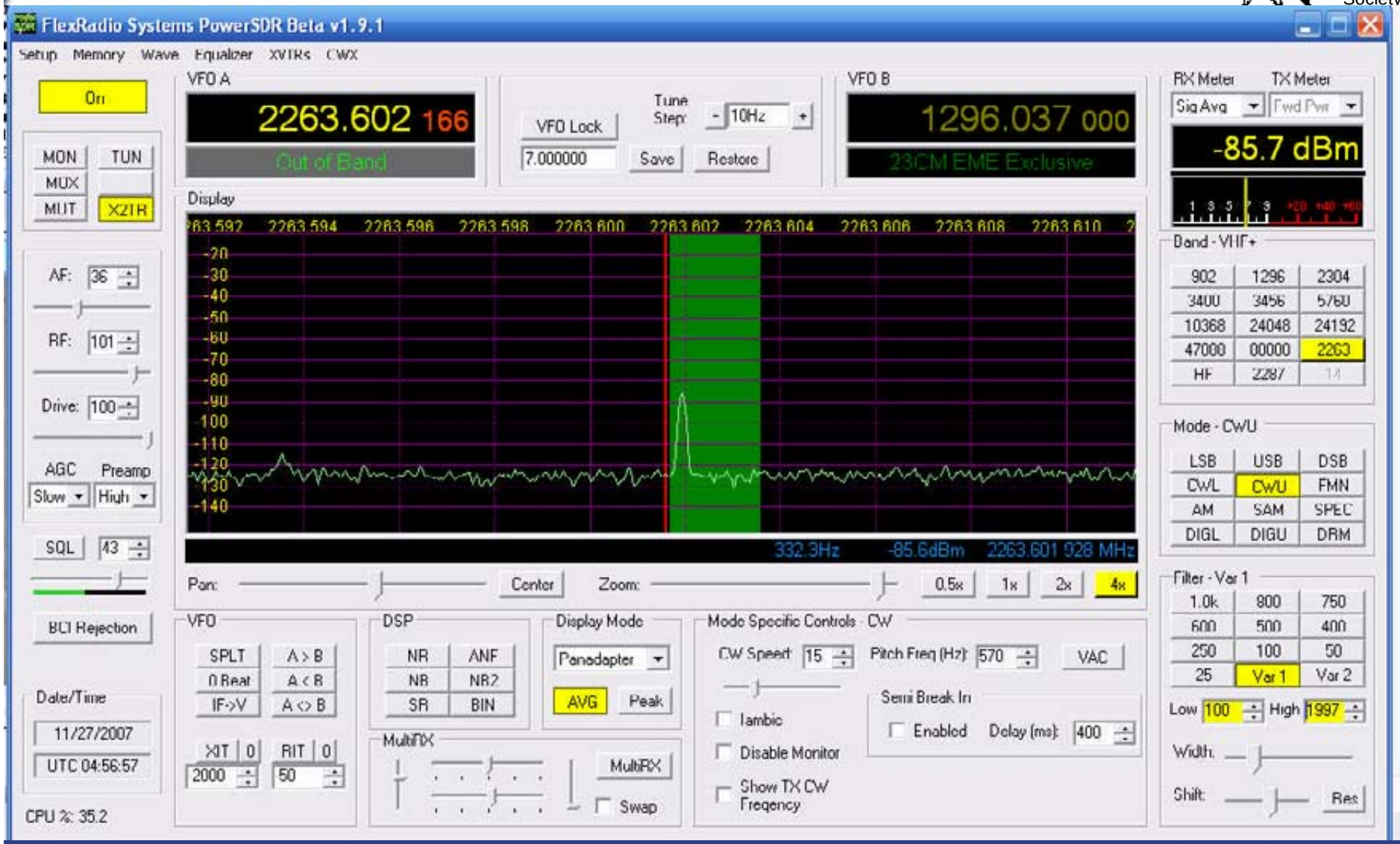

SELENE Sub Satellite on 2287 MHz

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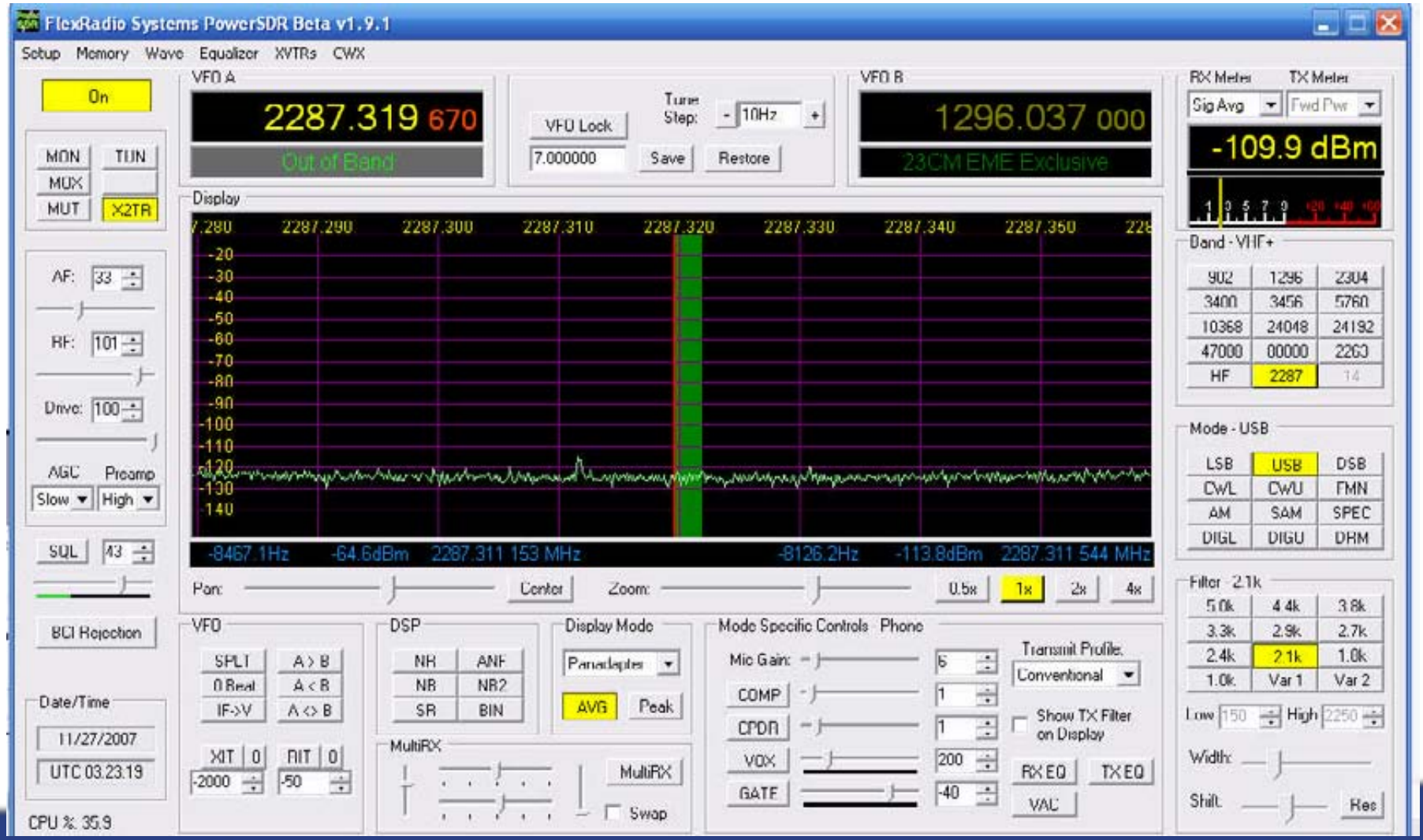

OH2AUE 90 cm dish with switchable LHCP/RHCP

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Signal strong enough that he can hear the sidebands at +/- 16 kHz

More Information

http://ivs.nict.go.jp/mirror/publications/gm2006/kawano/

http://www.aerospaceguide.net/spacecraft/selene.html

http://www.uhf-satcom.com/sband/

http://www.valinet.com/mailman/listinfo/microwave