

NATIONAL RADIO ASTRONOMY OBSERVATORY

MEMORANDUM

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To: W. Brundage
R. Thompson
S. Weinreb

From: C. Moore

Subj: VLBA IF/LO/MASER SUBGROUP:
Proposed Receiver Sky, LO, and Image Frequencies

In working with the new Oscilloquartz hydrogen maser I have become aware that a 180 MHz LO frequency internal to the maser receiver has spectral purity superior to that obtainable by multiplication from the 5 MHz VCXO output. Similarly, the 60 MHz VCXO output from the new Smithsonian masers (VLG-11) has higher spectral purity than that of the multiplied 5 MHz output. Consequently, I have looked at the VLBA LO scheme in an effort to use 180 MHz as the reference frequency for all microwave LO's. The attached listing is presented for comments and discussion.

The two low-frequency prime-focus receivers will feed directly into the IF system. The only frequency conversion for these bands will be in the single sideband mixers of the video converter units. The X-band geodetic frequency coverage has been lowered slightly to accommodate an LO with a 180 MHz multiple within the 300-1500 MHz IF band. This should not cause many complaints as the current geodesy band is 8.2-8.6 GHz.

In order to realize both a frequency overlap with the VLA at C-band and coverage of the excited OH line at 6.033 GHz, the use of a band dividing scheme with a diplexer and separate FET amplifiers for each band is being investigated. The proposed LO scheme utilizes both sidebands of the first mixer and probably a band selector switch ahead of the mixer. The 3 cm band has been lowered slightly due to comments about getting too close to the commercial satellite band of 11.7-12.2 GHz. The K and Q-band LO has been changed to accommodate an L-band IF for cooled mixers. This LO will probably be a phase locked loop (PLL) synthesizer with 80 MHz steps. I plan a future memo detailing the possible design of this LO.

In conclusion, I would like to encourage your thinking about the 3rd order intercept point and amount of image rejection likely to be needed through the first frequency conversion and also the 180 MHz spectral purity requirement in view of the N^2 noise enhancement indicated. Also, is there another LO/IF scheme which is more compatible with the VLA. This is important since current thinking is to have two VLBA sites connected to the VLA via microwave link for joint use as VLA "outriggers" or VLBA short baseline sites.

CRM/cjd

Enclosure

Table: VLBA Receive/LO Frequencies
using 180 MHz Reference

VLBA Receive/LO Frequencies using 180 MHz Reference

Sky Frequency	1st LO	180 MHz Multiplier	Phase Noise Degradation	1st Mixer Image	IF
312 - 345 MHz	None			First mixing in SSB mixer of video converter (20 + dB SB rejection)	
580 - 640 MHz	None				
1.35 - 1.75 GHz	900 MHz	X5	14 dB	50 - 450 MHz	450- 850 MHz
2.175- 2.425 GHz	1.8 GHz	X10	20 dB	1.175- 1.425 GHz	375- 625 MHz
8.0 - 8.7 GHz	7.2 GHz	X40	32 dB	5.7 - 6.4 GHz	800-1500 MHz
4.5 - 5.0* GHz	5.4 GHz	X30	30 dB	5.8 - 6.3 GHz	900- 400 MHz
5.8 - 6.2 GHz				4.6 - 5.0 GHz	400- 800 MHz
10.1 - 11.1 GHz	9.72 GHz	X54	35 dB	8.42 - 9.42	380-1380 MHz
14.9 - 15.9 GHz	14.4 GHz	X80	38 dB	12.9 - 13.9 GHz	500-1500 MHz
21.3 - 25.6 GHz	20.1-24.1 (80 MHz steps)	X112	41 dB	2.4 - 3.0 GHz Lower than sky frequency.	1200-1500 MHz
42.5 - 43.5 GHz	20.66-20.98 (160 MHz steps)	X224	47 dB		1200-1500 MHz

* Diplexer and separate FET amplifier for each frequency band.