# VLBA ACQUISITION MEMO #370
# MARK IV MEMO #166

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY

16 September 1993

TO : VLBA Data Acquisition Group

FROM : Dan Smythe and Pete Bolis

SUBJECT : Test Procedure for R131 Read Modules and R132 Parallel Reproduce Modules

We have developed test fixtures and procedures for maintaining Mark IIIA Read Boards. Since these boards have circuits almost identical to the VLBA Read and Parallel Reproduce Modules, the same fixtures, equipment, and procedures could be used to maintain the VLBA modules. These procedures utilize a differential technique to compare the magnitude *and phase* of the frequency response of the modules, including the equalizers, to that of a known, good, unit. The only equipment required is a Hewlett Packard 3312A (or an equivalent) Function Generator and any oscilloscope with differential (A minus B) capability. This equipment can also be used to check the preamplifier power supplies, and the proper functioning of the selectable equalizers. A tape recorder and computer are not required.

The test fixture shown in Fig. 1 is used to supply the same input signal to all inputs of the module, differentiated by the 0.01 $\mu$f capacitor to compensate for the integrators in the equalizers. The LEDs indicate that power is available for the preamplifiers in the head assembly. The switches shown in Fig. 1 are used to select the track and equalizer for the Monitor A and Monitor B outputs, which are connected to two channels of an oscilloscope. Although toggle switches are shown for the monitor inputs, 5 or 6 hex switches could be used, and the equalizer select inputs could be connected together. (These switches are not used for the Parallel Reproduce Module.)

To set the HP3312A Function Generator for proper sweep operation, it is helpful to observe the sweep signal on an oscilloscope to set the proper start frequency and repetition rate. Set the 'scope to

1. 1ms/DIV
2. CHOP
3. CH 2 TRIGGER SOURCE
4. – SLOPE
5. AUTO MODE
6. CH 1: 50 mVOLTS/DIV
7. CH 2: 5 VOLTS/DIV

Connect the Monitor A output of a Read Module to Ch. 1 with a 50 $\Omega$ termination at the 'scope end of the cable, and the MOD output of the 3312A to Ch. 2, as shown in Fig. 2. Set the HP3312A as follows:

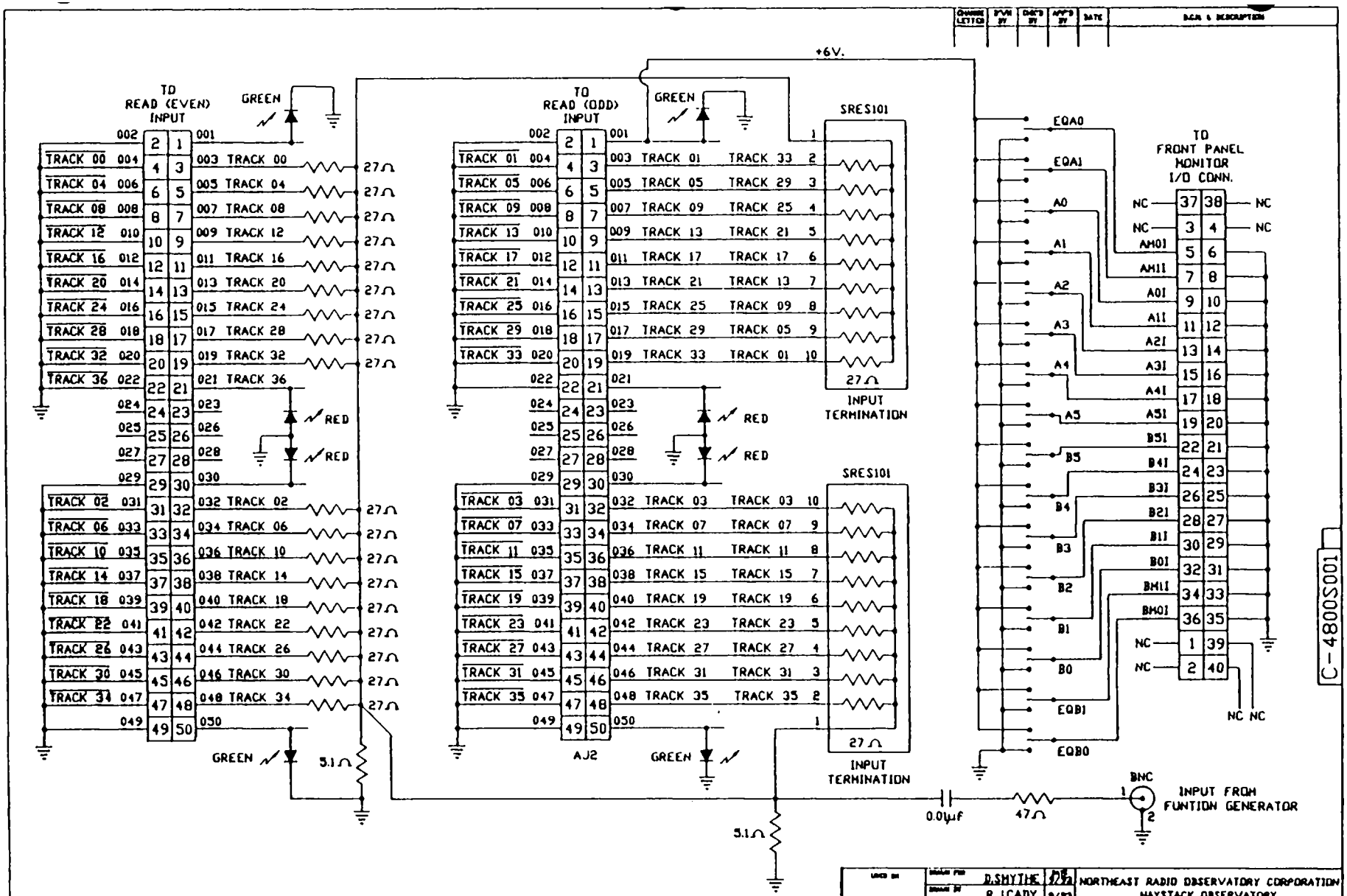
1. RANGE - 1MHz
2. FREQUENCY - 2.3 (or 4.5) MHz
3. OUTPUT OFFSET • CAL - in
4. OUTPUT AMPLITUDE - .1 Vp-p
5. OUTPUT SYM • CAL - in
6. FUNCTION - ~
7. MODULATION SWP - in
8. MODULATION RANGE - 10k Hz

Trigger on the bottom edge of the sawtooth, set the MODULATION RANGE VERNIER for one full sawtooth sweep, and adjust the MODULATION START frequency low enough to display the peak at the beginning of the CH 1 trace. After obtaining a display similar to that shown in Fig. 3, move the MOD output to the EXT TRIGGER INPUT on the 'scope, switch the TRIGGER SOURCE to EXT÷10, and the CH 1 display should be the same as before. (If your 'scope does not have an EXT÷10 setting, use the EXT setting and a 10 or 20 dB attenuator at the EXT TRIG INPUT.) Connect the MONITOR B output of the Read Module to CH 2, and set it to 50 mVOLTS/DIV, INVERTed. You should now have two traces similar to the upper trace in Fig. 2.

Proper functioning of the multiplexers can be verified by touching input pins 9-19 and 31-47 of AJ1 and AJ2 in sequence with an ungrounded probe and observing the added noise on the oscilloscope when the proper input is selected; a grounded probe risks shorting the power supplies connected to pins 1, 21, 30, and 50.

Frequency response is tested by setting the function generator to sweep from about 100 kHz to 2.3 MHz for the 135 ips equalizer, or 4.5 MHz for the 160 and 270 ips equalizers. With the oscilloscope set to 50 mV/div, adjust the amplitude of the function generator to give 2-3 divisions of deflection at the equalizer peak near 2 or 4 MHz. Then the oscilloscope is switched to ADD to display A−B and the variable VOLTS/DIV of one channel is adjusted to get as close to a straight line as possible. If a uniform null can be obtained, then the magnitude and phase of both signals is the same across the band; if not, the response of the two channels is different. The response of one channel of each of two different Read Modules can be compared in a similar fashion. This same technique can be used on a Parallel Reproduce Module by using a pair of oscilloscope probes to compare a reference channel to each of the others in sequence at pins 8 and 9 of the AM687 comparators. A DIP clip will facilitate connecting the reference probe to the chip when testing the Parallel Reproduce Module.

The AM687 comparators can be checked by setting the Function Generator to provide a minimum-amplitude sine wave at band edge (2.3 or 4.5 MHz) (SWP button on HP3312A out), with the CH 1 probe on any 687 input. Set the oscilloscope to trigger on CH 2 at .2 ms/div, and touch the CH 2 probe to each 687 output in sequence (pins 1, 2, 15, and 16 on each of 9 chips). If the 687 is working, then it will trigger the 'scope and stabilize the sine wave on CH 1.




## NOTES

1. RED LED'S ARE DIALIGHT #558-0102.
   GREEN LED'S ARE DIALIGHT #558-0202.
2. ALL RESISTORS 1/8 WATT.

| | | |
|---|---|---|
| DRAWN BY | D.SMYTHE | 9/93 |
| CHECKED BY | R.J.CADY | 9/93 |
| | D.FIELDS | 9/93 |
| | D.SMYTHE | 9/93 |
| | D.SMYTHE | 9/93 |
| SCALE | NONE | |

NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS

VLBA/MARK IV READ MODULE TEST FIXTURE

| | | |
|---|---|---|
| 4800S001 | C | 4800S001 |
| CAD FILE | | |

FIGURE 1.

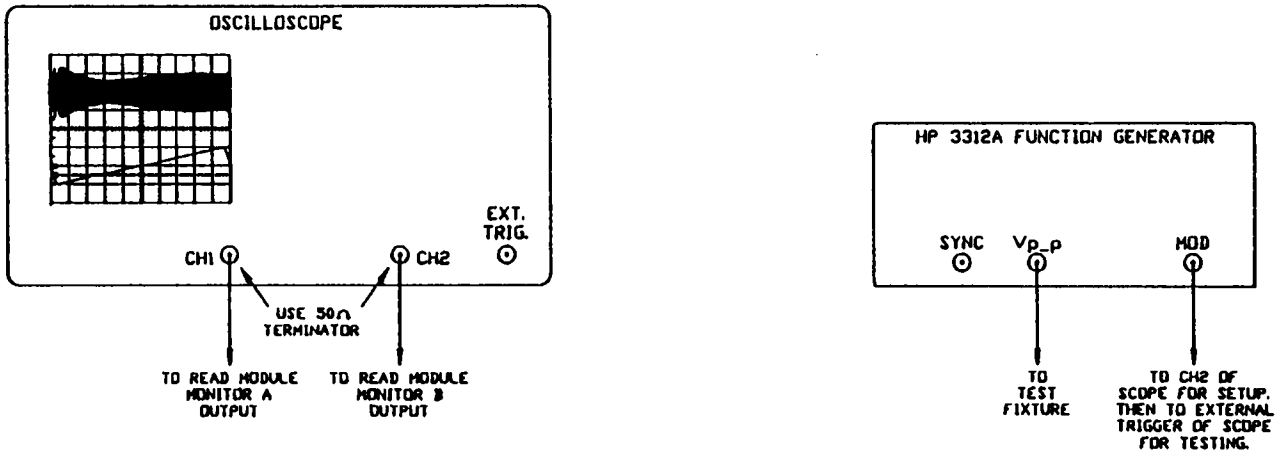



FIGURE 2. READ MODULE TEST SETUP

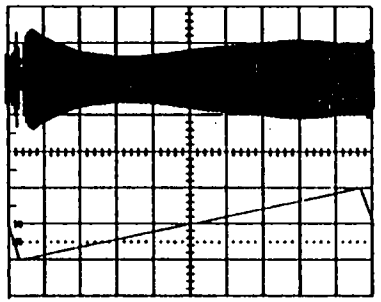


FIGURE 3. PROPER DISPLAY

NOTES

| | | | |
|---|---|---|---|
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| CHECKED BY | R.J.CADY | 9/93 | HAYSTACK OBSERVATORY |
| APPROVED BY | D.FIELDS | 9/93 | WESTFORD, MASSACHUSETTS |
| PROJECT ENGR | D.SMYTHE | 9/93 | VLBA/MARK IV |
| DRAWING | D.SMYTHE | 9/93 | READ MODULE TEST SETUP |
| NEXT ASSEMBLY | | | |
| MATERIAL | | | |
| SCALE | NONE | | 4800A001 C 4800A001 |
| CLASSIFICATION | | | CAD FILE |

C-4800A001

FIGURE 2.