Interoffice

VLBA Electronics Memo No. 7

National Radio Astronomy Observatory

Socorro, New Mexico

January 13, 1984

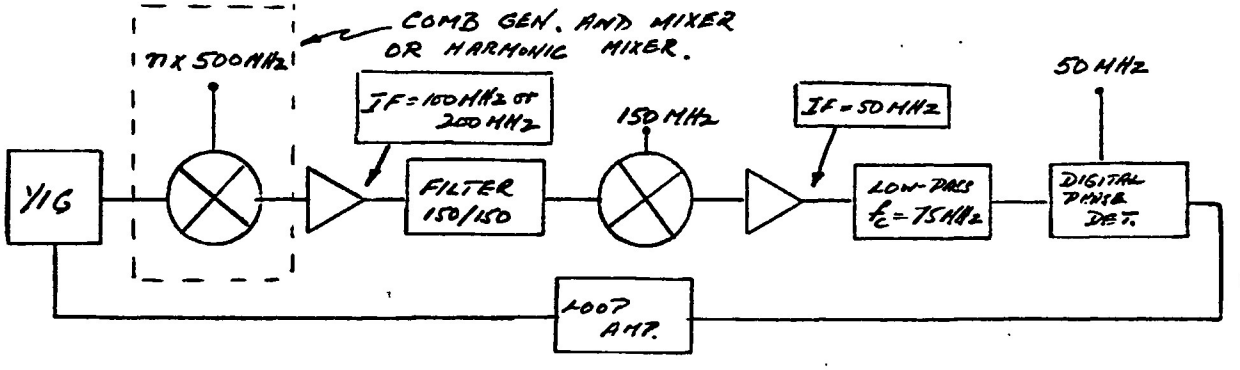
To: Larry D'Addario

From: Dick Thompson

Subject: Design of LO System in VLBA Memo No. 303.

Experience with LO modules at the VLA prompts me to make two comments concerning the design of the 2-16 GHz by 0.1, 0.2 GHz synthesizer and the LO scheme described in VLBA Memo 303.

1) From experience with the VLA L6 module I believe we have a good design of phase detector and lock detector. The phase detector uses the MC12040 digital circuit which has a maximum operating frequency of 80 MHz. A scheme like that outlined below, which uses a 50 MHz final IF, would allow use of very similar circuitry. It provides lock points at multiples of 100 MHz except for multiples of 500 MHz.



2) In the VLA F3 module (17-20 GHz LO) we had problems with the harmonic mixer that generates harmonics of 600 MHz, basically because the 600 MHz reference had sidebands which could produce spurious signals at the final loop IF of 100 MHz and 200 MHz. The 500 MHz reference in Fig. 3 of VLBA Memo 303 will play a similar role, feeding four oscillator modules. It will simplify the design of these modules if we make sure that the 500 MHz reference is very clean.

ART/bmg

NATIONAL RADIO ASTRONOMY OBSERVATORY

5-25 GHz 140-ft CASSEGRAIN RECEIVERS

CRYOGENICS HISTORY

Charles J. Brockway

November 29, 1983

1980

Jan.-May In lab. Establishing loading characteristics Run refrigerator tests. Refrigerator and compressor stable and reliable. About 30 cooldowns. Compressor hours $\approx$ 4000; refrigerator hours $\approx$ 3000. Stage 3 full load 1200-1300 mW.

June Start losing capacity. Varies 200-500 mW. Replace displacers with no improvement. Replace hydrogen switch with 2 spares.

Switch	$\Delta T/\Delta t$ ($80 \leq t \leq 70$ K)
Original (meshed plates)	10.0 K/hour
Spare 1 (meshed plates)	0.37 K/hour
Spare 2 (small cylindrical)	2.2 K/hour

Cannot use spares due to low $\Delta T/\Delta t$. Reinstall original.

June Mount on telescope. Cools o.k.

July
- Compressor 1 fails. Broken reed valve. Replace compressor. Cools down o.k.
- Compressor 2 fails. Thermal overload. Cools down o.k.
- Compressor 2 fails. Broken reed valve. Replace compressor. Cools down o.k.
- Compressor 1 fails. Broken reed valve. Replace compressor. Cools down o.k.
- Clean displacers. Bad contamination. Will not cool. Replace displacer seals. Cools down o.k.

Sept. Spontaneous warm-up. Replace displacer seals. Will not cool. Replace displacer seals. Cools down o.k.

Oct. He leak in telescope line. Vertex house manifold.

Nov.
- Power failure. Emergency generator won't start. Compressor off $\approx$ 2 hours. Cools down.
- Power failure. Emergency generator on o.k. Stays cold.

Dec. He leak in telescope line. Compressor shuts down. Recharge. Cools down.

1981

Feb.	Warm-up for RF work. Replace seals. Lots of dust. Cool down o.k.
	Spontaneous warm-up. Seals very dusty. Replace seals. Will not cool. Remove 300 mW loading (transitions). Cools down.
May	Warm-up for RF work. Inspect seals; look o.k.; replace anyway. Cools down o.k. Measure capacity. Missing $\approx$ 900 mW. Thermal measurements indicate capacity varying over large range (0-1000 mW). Suspect H_2 switch intermittent.
June	More measurements. Capacity still varies, but sometimes stays normal for days.
July	Warm-up for refrigerator work. Cools down o.k. Spontaneous warm-up. Measure capacity; very erratic. Will not cool. Remove receiver from scope to work on magnet problem. Run thermal tests in cryo lab. Capacity back to normal. Replace displacer seals. Reinstall on telescope.
Aug.	Cools down o.k. Spontaneous warm-up even with load $\approx$ 700 mW. Replace H_2 switch. Cools down o.k.
Sept.	Warm-up to replace transition. Cools down o.k.
Oct.	Run thermal tests. Capacity normal. T_1, T_2 start cycling bad. Replace displacer seals. Replace all thermal loads ($\approx$ 1300 mW). Cools o.k. Run thermal tests. Capacity normal.
Nov.	Power failure. Compressor off $\approx$ 2 hours. Cools down o.k.

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1982

Jan.-Apr.	No problems. T_1, T_2 gradually increase. Recovers o.k. from several power failures.
April	Warm-up for RF work. Cools down o.k.
June	Replace displacer seals. Will not cool. T_1, T_2 too high. Remove 400 mW load. Cools down o.k.
July	Measure capacity. Stable but reduced due to T_1, T_2 running high.

Continued --

1982 (continued):

Aug.	Replace displacers. All thermal loads. Cools down o.k. T_1, T_2 normal.
	Warm-up to work on magnet problem. Cools down o.k.
Nov.	T_2 cycling.
	Compressor 2 fails. Replace. Start cooldown.
	Compressor 1 fails. Bad regulator. Replace. Start cooldown.
	Will not cool. T_2 too high.
	Replace displacers. Will not cool. T_1, T_2 high.
	Replace displacers. Cools o.k. but T_1, T_2 still higher than normal.
Dec.	Compressor 3 regulator causing flow fluctuation. Replace.
	T_1, T_2 still high and cycling.
	Replace displacers. Cools o.k. T_1, T_2 normal.
	Intermittent He leak in lines. Not serious yet.

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1983

Feb.	Compressor 3 fails. Bad reed valve. Cools down o.k.
Feb.-Apr.	Gradual increase in T_1, T_2. Stabilities in late April.
June	Spontaneous warmup. Seals, displacers very dusty.
	Replace seals, clean displacers. Cools down o.k.
Sept.	Compressor down approximately 2 hours. Replace. Cools down o.k.

B Receiver

Sept.	Install on 140-ft. Approximately 2000 hours on seals. Cools down o.k.
	Compressor reed valve breaks. Replace compressor. Cools o.k.
Oct.	Compressor out. Motor wires worked loose. Cools o.k.
Nov.	Compressor motor windings bad. Replace compressor. Cools o.k.

CJB/cjd

Enclosure
140-ft Cassegrain Receiver
Cryogenics History:
Failures and Replacements

Copies to:
M. Balister
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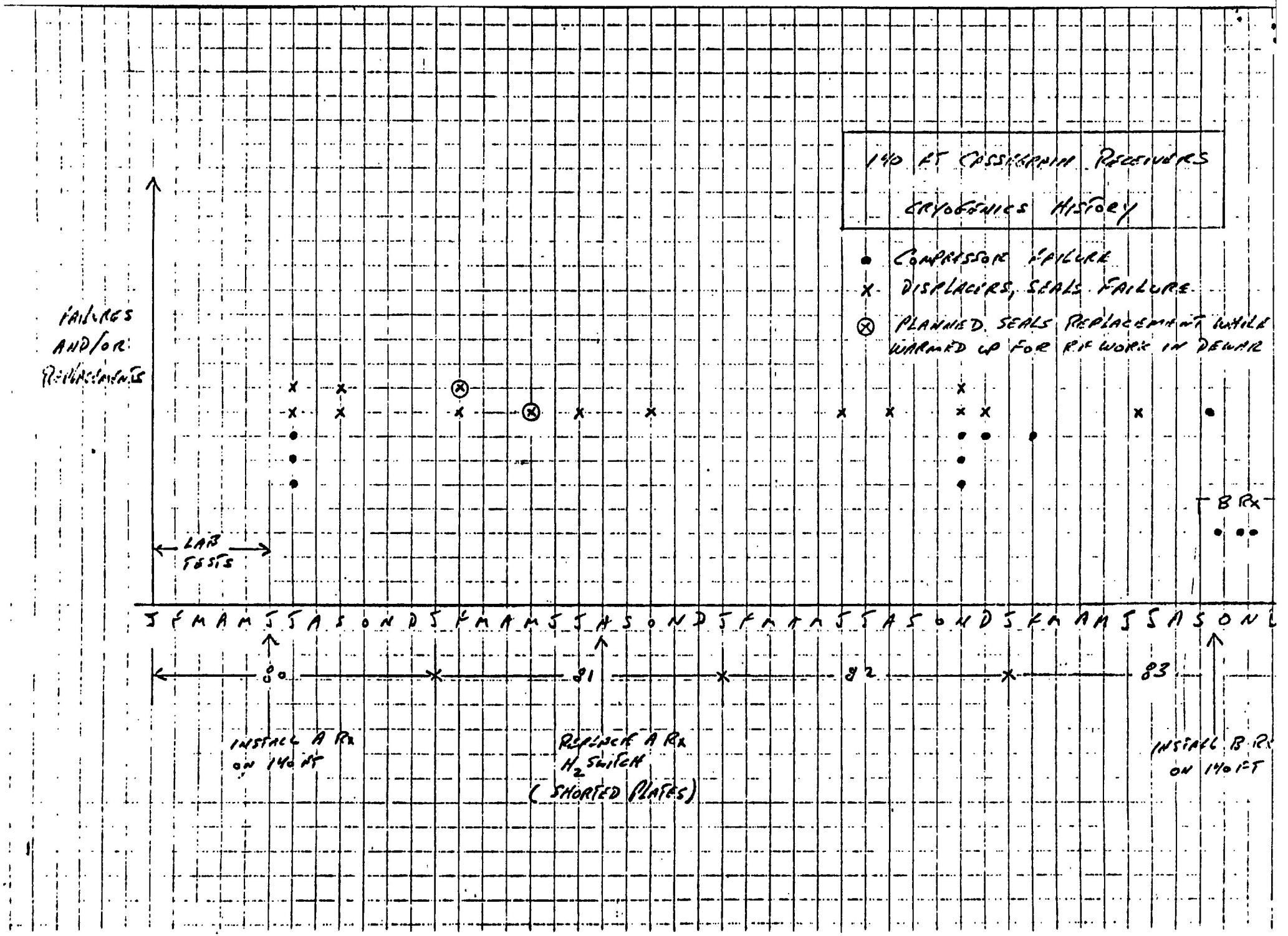
140 FT CASSEGRAIN RECEIVERS
CRYOGENICS HISTORY
COMPRESSOR FAILURE
DISPLACERS, SEALS FAILURE
PLANNED SEALS REPLACEMENT WHILE WARMED UP FOR RF WORK IN DEWAR
FAILURES AND/OR REPLACEMENTS
LAB TESTS
B Rx
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N
80
81
82
83
INSTALL A Rx ON 140 FT
REPLACE A Rx H2 SWITCH (SHORTED PLATES)
INSTALL B Rx ON 140 FT